

Ref : HZL/RA/ENV/MoEF&CC/2023-24/ 1860

28.11.2023

To,
The Deputy Director (S) /Scientist -C
Ministry of Environment, Forest & Climate Change,
Integrated Regional Office, A-209&218, Aranya Bhawan,
Jhalana Institutional area Jaipur-302004

Sub: Six monthly environmental compliance reports from April 2023 to Sep 2023.

Ref : Environment Clearances and Amendments

1.	Environment Clearance vide No. : J-11015/267/2008-IA.II (M) Dtd. 11.12.2009.
2.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 05.03.2012
3.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 22.08.2014
4.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 12.12.2014
5.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.12.2015
6.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.02.2020

Sir / Madam,

Please find enclosed herewith the compliance status report of above referred Environmental Clearance granted by the Ministry of Environment, Forest and Climate Change for the period April 2023 to Sep 2023. along with soft copy in a CD.

Hope you find this in order.

Thanking you,

Your faithfully



(Kishore Kumar S)
CEO - Agucha IBU

CEO - IBU Agucha
Hindustan Zinc Limited
Rampura Agucha Mines
PO - Agucha
Distt. - Bhilwara (Raj.)

Cc to:

1. In-Charge (Zonal office)
Central Pollution Control Board,
Vithal Market, Paryavaran Parisar , E-5, Arera Colony,
Bhopal, - 462 016 (MP)
3. The Regional officer
Rajasthan Pollution Control Board Regional Office,
18, Azad Nagar, Pannadhai Circle Mining Engineer Office Road
(Near Telephone Exc.) Bhilwara-311001

2. Member Secretary
Rajasthan Pollution Control Board
4 Institutional Area, Jhalana Doogri,
Jaipur (Raj) -302004

Hindustan Zinc Limited

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CIN No. L27204RJ1966PLC001208

HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE

MoEF Environmental Clearance for Expansion of Rampura Agucha Lead and Zinc Opencast and Underground Mining Project (from 5.00 to 6.15 mTPA) and Beneficiation Capacity of Beneficiation Plant (from 5.00 to 6.50mTPA) Env Clearance Vide No. J-11015/267/2008-IA.II (M) Dtd 11.12.2009

S. No.	Condition	Status
A. Specific Conditions		
i	The project proponent shall obtain Consent to Establish and Consent to Operate from the Rajasthan State Pollution Control Board and effectively implement all the conditions stipulated therein	Consent to establish obtained from RSPCB. Consent to Operate granted by RSPCB vide File F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117 dated 28/02/2023 for mining activity. RSPCB. Consent to Operate granted by RSPCB vide File F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631 dated 14/06/2023 for Beneficiation plant , and the conditions stipulated are implemented.
ii	The environmental clearance is subject to approval of the State Land use Department, Government of Rajasthan for diversion of agricultural land for non-agricultural use.	Land purchased within Mine Lease area and converted in name of HZL for mining.
iii	The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations.	No natural watercourse or water resources are obstructed due to mining operations.
iv	The top soil shall temporarily be stored at earmarked site(s) only and it should not be kept unutilized for long. The topsoil shall be used for land reclamation and plantation.	Top soil utilized on waste dump for its stabilization and plantation.
v	The over burden generated during the mining operation shall be stacked at earmarked dump site(s) only and it should not be kept active for a long period of time and its phase-wise stabilization shall be carried out. The maximum height of the dump should not exceed 100m having 5 terraces as recommended by the Central Institute of Mining and Fuel Research, Dhanbad. The recommendations made by the Central Institute of Mining and Fuel Research, Dhanbad shall be effectively implemented. The over burden dump shall be scientifically vegetated with suitable native species to prevent erosion and surface run off. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment & Forests and its Regional Office located at Lucknow on six monthly basis	Amendment in this condition was granted in EC vide letter No J-11015/267/ 2008-I-A.II (M) dated 22 nd August, 2014. The maximum height of the dump shall not exceed 140 m (in two lifts of 20m each). Waste dump vegetated phase manner. Waste dump are covered by application of geotextiles.
vi	The void left unfilled in an area of 25 ha shall be converted into water body. The higher benches of excavated void/mining pit shall be	Will be complied during the mine closure.

	terraced and plantation done to stabilize the slopes. The slope of higher benches shall be made gentler. Peripheral fencing shall be carried out along the excavated area.	
vii	<p>Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from mine working and over burden dump. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains should be regularly desilted particularly after monsoon and maintained properly.</p> <p>Garland drain (size, gradient and length) shall be constructed for both mine pit and over burden dump and sump capacity should be designed keeping 50% safety margin over and above peak sudden rainfall (based on 50 years data) and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Sedimentation pits should be constructed at the corners of the garland drains and desilted at regular intervals.</p>	<p>Garland drain of adequate size is constructed along the waste dump toe & mining pit, along with siltation pond that provides adequate retention time for settling of silts and rain water collection lined sumps of about 8.5 lakh CuM. The water collected is utilized for watering the mine area, roads, green belt development etc</p> <p>Annexure -VIII</p>
viii	Dimension of the retaining wall at the toe of dump and OB benches within the mine to check run-off and siltation should be based on the rain fall data.	The retaining wall at the toe of the OB dump is constructed along with garland drain. Annexure VIII
ix	Regular monitoring of subsidence movement on the surface over working area and impact on water bodies/vegetation/ structures/ surrounding shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil/suitable material.	A comprehensive assessment and monitoring of subsidence movement on the surface over working area is done by a dedicated team comprising of Rock mechanic engineers. There has been no subsidence or movement observed.
x	All the mine entries shall be above the highest flood level to avoid any anticipated flooding of mine from the surface water during the rainy season	The underground mine opening is at 392 mRL against highest flood level at Agucha reservoir of 391 mRL. Further, A peripheral bund is constructed around the mine pit for protection of the mine from flooding due to rain water.
xi	In areas where subsidence is anticipated in shallow mineral occurrence, such areas be identified and provided with garland drains to ensure draining of water and avoid ingress of the same in to the underground mine.	No subsidence is anticipated in the proposed area. Garland drain is already constructed as a safety measure to avoid ingress of water into underground mining.
xii	The project authorities shall check the possibility of existence of fault(s) before	Mining activities are carried out as per Mine plan as approved by IBM.

	deciding about the thickness of safe barrier required to be maintained between the working face and the water bodies, if any, in consultation with the Director General Mines & Safety (DGMS). De-pillaring should also be carried out after taking prior approval of the DGMS.	De-pillaring, if required shall be carried out after prior approval of the DGMS.
xiii	The project proponent shall carry out conditioning of the ore with water to mitigate fugitive dust emission, without affecting flow of ore in the ore processing and handling areas.	Water sprinklers are installed on conveyer belts, transfer points, and conditioning of ore is done during crushing to mitigate fugitive dust. Annexure- XXXII
xiv	The effluent from the ore beneficiation plant shall be treated to conform to the prescribed standards and the tailings slurry shall be transported through a closed pipeline to the tailing dam.	Tailings are being disposed through closed pipeline to the earmarked Tailing dam after necessary lime treatment. Annexure- XXXVI
xv	The decanted water from the tailing dam shall be re-circulated and there should be zero discharge from the tailing dam. Acid mine water, if any, shall be neutralized and reused within the plant.	Tailing dam water is completely reused in process plant and zero discharge is maintained. There is no acid mine drainage occurring in the mine.
xvi	Plantation shall be raised in an area of 670.7ha including a green belt of adequate width by planting the native species around ML area, OB dump, around tailing dam, around beneficiation plant, roads etc. in consultation with the local DFO / Agriculture Department. In addition, the township area shall also be adequately planted. The density of the trees should be around 1500 plants per ha. Green belt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.	Green belt developed all along the acquired mine lease area. Progressive plantation is being carried out on waste dump benches every year Seed spreading and geotextile laying is also carried out on waste dump slopes. As per SRSAC study conducted based on Nov 2021 satellite imagery, 694103 Nos of plants are existing with in 348 Ha area. Further FY 2022-23 and FY 2023-24, 15000 and 23000 Nos saplings planted as gap filling. Currently 732103 Nos of plants are exiting in 348 Ha. Detailed SRSAC report attached as Annexure XXXV. Plantation in remaining area will be completed by closure of mine. Additional plantation has been done in 37.70 ha in the township and along roadsides. Annexure -IX.
xvii	Regular water sprinkling should be carried out in critical areas prone to air pollution and having high levels of SPM and RPM such as haul road, loading, unloading and transfer points and other vulnerable areas. It should be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard.	Water sprinkling is carried out by 4 Nos. of 40 KL water sprinkler on Haul roads to mitigate air pollution in mine area. Dust extraction system and Water sprinkling nozzles are installed at the crusher, transfer points and coarse stockpiles for dust suppression. The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB. Annexure-X.
xviii	The project authority should implement suitable conservation measures to augment ground water resources in the area in consultation with the Regional Director, Central Ground Water Board.	Till date 3 Nos. of anicuts have been constructed for groundwater augmentation in consultation with the CGWB. 4 anicuts constructed in the area under MJSA. 8.72 MCM groundwater recharge work has been completed four blocks of Bhilwara district, (Annexure -XI). Detailed

		report shared in six monthly EC report of Oct-21 to Mar-22. Ref: HZL/RA/ENV/MoEF&CC/2022-23/463
xix	Regular monitoring of ground water level and quality shall be carried out in and around the project area (mine lease, beneficiation plant and tailing dam) by establishing a network of existing wells and installing new piezometers during the operation. The periodic monitoring [(at least four times in a year- pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January); once in each season)] shall be carried out in consultation with the State Ground Water Board/Central Ground Water Authority and the data thus collected may be sent regularly to the Ministry of Environment and Forests and its Regional Office Lucknow, the Central Ground Water Authority and the Regional Director, Central Ground Water Board. If at any stage, it is observed that the groundwater table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.	Regular groundwater monitoring is being done by piezometers and wells outside and inside the lease area. Report enclosed as Annexure -I Six monthly reports are submitted to MoEF & CPCB, Quarterly report being sent to RSPCB, CGWA and CGWB.
xx	The project proponent shall ensure that no additional water is drawn for the expansion project. The additional requirement of water will be met out of the water saved by adopting water conservation measures.	No additional water is drawn. The additional requirement of water if any in future will be met out by water conservation measures.
xxi	Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with the Regional Director, Central Ground Water Board.	Various rainwater-harvesting measures are implemented including the construction of rainwater collection pond of about 1.5 Lakh cum in the township, collection sumps of 8.5 lakh CuM capacity to collect and reuse the rain. Annexure XII
xxii	Regular monitoring of groundwater quality around the tailing dam shall be carried out in consultation with Central Ground Water Authority and records maintained. It shall be ensured that the groundwater quality is not adversely affected due to the project	Groundwater quality is regularly monitored around the tailing dam through piezometers within ML area and wells inside as well as outside the lease area. The groundwater quality report is being submitted to MoEF, CPCB RSPCB, CGWA and CGWB on regular basis.
xxiii	Groundwater and surface water in and around the mine shall be regularly monitored at strategic locations for heavy metals such as Ni, Co, Cu, Zn and Cd. The monitoring stations shall be established in consultation with the Regional Director, Central Ground Water Board and State Pollution Control Board	Ground and surface water is regularly monitoring for heavy metals. Report enclosed as in point no xix.
xxiv	Vehicular emissions should be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of	Periodic preventive maintenance of vehicles is part of our operations. All the trucks are covered with tarpaulin while transportation of concentrates to the smelters and no overloading

	mineral. The vehicles should be covered with a tarpaulin and shall not be overloaded	is allowed. Annexure -XIII
xxv	Blasting operation should be carried out only during the daytime. Controlled blasting should be practiced. The mitigative measures for control of ground vibrations and to arrest fly rocks and boulders should be implemented	Blasting operation is carried out with various mitigation measures as per DGMS guidelines to ensure the fly rocks are arrested. The vibrations monitored are well within the prescribed limits by DGMS.
xxvi	Drills shall either be operated with dust extractors or equipped with water injection system	Wet drilling system is adopted.
xxvii	Digital processing of the entire lease area using remote sensing technique should be done regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment and Forests and its Regional Office, Lucknow	Noted. The land use & land cover change study carried out in 2023. Copy attached. Annexure-XIV
xxviii	The tailing dam shall be lined by LDPE lining on the sides as the height of the dam is raised. The ultimate height of the dam shall be maintained to 51m and provided with garland drains. The disaster management plan for tailing dam shall be prepared and implemented	The sides of the tailing dam are lined with HDPE. As per letter No. Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.02. 2020 ultimate height shall be 74m. The present height of tailing dam is 60 meter. Garland drains are constructed around the tailing pond with pumping arrangement to collect any seepage and rainwater runoff back to tailing pond. Disaster management plan for the tailing pond is prepared and implemented. Annexure XV
xxix	The recommendations of the study report of NEERI, Nagpur on pollution vulnerability of aquifer shall be effectively implemented and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis	Complied on the recommendations of NEERI i.e. network of piezometer established and report submitted on six monthly basis. Report enclosed as point no xix.
xxx	The project proponent shall regularly analyse the waste generated from the mining (at least once a year) for heavy metals such as Ni, Co, Cu, Pb, Zn and Cd and the data thus collected may be sent regularly to Ministry of Environment and Forests and its Regional Office, Lucknow. It should be ensured that the parameters conform to the prescribed norms.	Being analyzed and report is submitted on six monthly basis. Annexure II
xxxi	The recommendations of the study report on blood lead levels of children to monitor levels of lead in human system carried out by National Institute of Occupational Health, Ahmedabad shall be effectively implement and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis.	As recommended by the NIOH, regular health checkups are carried out for the mine personnel and regular health checkup organized in nearby villages to keep a track of the health status. Annexure XX
xxxii	Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be carried out and	Pre-placement medical examination and periodical medical examination of the employees are being carried out at regular interval as per

	records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly	the Mine Act.
xxxiii	Sewage treatment plant shall be installed for the colony. ETP shall also be provided for the workshop and the wastewater generated during mining operation	Sewage treatment plant of 425 KLD capacity in colony and 300 KLD in mine area operating efficiently. Oil & Grease Traps installed and water reused in process. Annexure XVI
xxxiv	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project	No construction labour housing is proposed in mining area. However, the sanitation and drinking water facility is provided to the workers, working at site.
xxxv	Acid mine water, if any, has to be treated and disposed of after conforming to the standard prescribed by the competent authority	No acid mine water generated & mine pit water is used in process plant.
xxxvi	The critical parameters such as RSPM (Particulate matter with size less than 10µm i.e., PM ₁₀ and with size less than 2.5µm i.e., PM _{2.5}), NOX in the ambient air within the impact zone, peak particle velocity at 300m distance or within the nearest habitation, whichever is closer shall be monitored periodically. Further, quality of discharged water shall also be monitored [(TDS, DO, PH and Total Suspended Solids (TSS)). The monitored data shall be uploaded on the website of the company as well as displayed on a display board at the project site at a suitable location near the main gate of the Company in public domain. The circular No. J-20012/1/2006-IA.II(M) dated 27.05.2009 issued by Ministry of Environment and Forests, which is available on the website of the Ministry www.envfor.nic.in shall also be referred in this regard for its compliance	Monitoring of Ambient air at 3 locations inside mine and 3 locations outside the mine area is regularly carried out. Monitoring report is enclosed as Annexure III. Peak Particle velocity of blast vibration is being monitored for every blast & records are maintained. No effluent, treated or untreated, is discharged outside the project area as Zero discharge is maintained at all times. Monitoring data are displayed at Main Gate. Annexure XVII.
xxxvii	A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval	A Final Mine Closure Plan along with details of Corpus Fund will be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.


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HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE

MoEF Environmental Clearance Compliance to amendment in EC vide letter No J-11015/267/2008-I-A.II (M) dated 5 March, 2012

Sr. No	Condition	Status
i	In the environment clearance letter dated 11th December, 2009, in para number 1, the words "The mineral will be transported through the road." will be substituted by the words "The mineral will be transported through the rail".	Amendments granted by MoEF vide letter dated 28.12.2015 "The mineral will be transported both through road and rail". Railway line commissioned but not operative.
ii (a)	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.
ii (b)	The project affected people whose land will be acquired for laying of the railway track shall be compensated as per the National / State Policy in this regard.	Compensation given to land owners done by RIICO, GOR as per the norms.
ii (c)	The company shall submit within 3 months their policy towards Corporate Environment Responsibility which should inter alia provide for (i) Standard operating process / process to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions, (ii) Hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions and (iii) System of reporting of non-compliance s / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders.	Policy towards Corporate Environment Responsibility enclosed.


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HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE

MoEF Environmental Clearance Compliance to amendment in condition no (v) in EC vide letter

No J-11015/267/2008-I-A.II (M) dated 22nd August, 2014

Specific Condition		
S.No	Condition	Status
i	The Open crack, whenever developed in the partially consolidated new dump mass, should be consolidated with proper filling/ leveling with the help of dozer/ compactors.	In such case, we shall consolidate with proper filling/ leveling with the help of dozer.
ii	Dump foundation preparation should be done by excavating and removing soil before dumping, to improve the frictional resistance at the base of dump. It should be filled with over burden containing stones.	Complied mining rock waste dump on exiting waste dump.
iii	There should not be any dumping in pool water or on slushy ground.	No dumping is done in water pooled / slushy ground
iv	Discontinuous dumping should be avoided to check water accumulation between two isolated dumps.	Dumping is done at a single earmarked area.
v	During rainy season, an officer should be deputed to go in and around the dump site every morning to see the effectiveness of drain. If any blockage is observed, immediately steps should be taken to make it effective.	Mining officer is always deputed during rainy season to ensure smooth flow of runoff water.
vi	The dump should be surveyed periodically to produce up-to-date and accurate dump geometry.	Survey team survey the dump once in a month to produce up-to-date and accurate dump geometry.
vii	The slope and stability monitoring by Radar should be done and its report should be sent to MoEF and its Regional Office every six – months.	Stability monitoring by Radar Report enclosed as Annexure VII
viii	The dump design should be reviewed by CIMFR or any other scientific agency after reaching dump height of 120m and its report sent to MoEF and its Regional office.	Complied. Waste dump design and slope stability is being reviewed yearly by CIMFR and report being submitted to MoEF Regional Office. Latest report is attached as Annexure XXI. Recommendations of current 3 quarters also attached.
ix	Waste dump has to be managed as per the guidelines of DGMS and quarterly monitoring report to be submitted to DGMS and regional office.	Waste dump is being managed as per the DGMS guidelines and quarterly monitoring report shall be submitted to DGMS and regional office.
x	On stabilized dumps, more species such as Pongamia, Bombax ceiba, Tamarind, Arjun, Gravillea robusta and Amla to be planted.	Plantation of Pongamia, Bombax ceiba, Tamarind, Arjun, Gravillea robusta, Amla and other species has been done on stabilized dumps.

xi	The Radar monitoring system should satisfactorily sub- serve the dual objectives viz.(a) Investigative monitoring to provide an understanding of the slope behavior over time and typical response to external events (e.g. Precipitation and seasonal fluctuations) and (b). Predictive Monitoring: To provide a warning of a change in behavior, enabling the possibility of limiting or intervening to prevent hazardous sliding. The data so analyzed should be provided with reference to the above.	The analyzed data is enclosed Annexure - VII
xii	Paved drains are to be provided to protect the slope surface against rain-cuts and seepage during rains to make a safe way to discharge top and surface water to the bottom of the dump. Constant vigilance on the condition of dumps with special reference to accumulation of water and development of cracks.	Paved drains are provided. Constant vigilance shall be given on the dump condition with special reference to water accumulation and development of cracks.
xiii	Regular Monitoring of above mentioned specific conditions shall be included in the monitoring plan and report submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office located at Lucknow on six monthly basis.	Regular monitoring of the above mention conditions conducted and report is enclosed. Annexure - XXI. Recommendations of current quarters also attached.



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HINDUSTAN ZINC LIMITED, RAMPURA AGUCHA MINE

MoEF Environmental Clearance Compliance to amendment in EC vide letter No. J-11015/267/2008-I-A-II (M)
dated 28th February, 2020

A) Additional Specific Conditions		
S.No.	Condition	Status
1.	PP shall ensure that the recommendation provided in study conducted by Indian Institute of Science, Bangalore shall be complied for increasing the height of the tailing dam.	Height raising of the tailing dam is done as per the recommendations of Indian Institute of Science, Bangalore study.
2.	The risk arising due to surface runoff during rainy season or otherwise, from the tailing area/heap, shall be assessed on regular basis and corrective measures shall be undertaken and reported to SPCBs.	Tailing Dam is always having freeboard and there is no risk of surface runoff from the area.
3.	PP shall engage suitable agency for conducting subsidence study for increasing the depth of working from 1000 mbgl to 1500mbg. The report shall be submitted to Ministry within 6 months.	Study conducted by Central Institute of Mining & Fuel Research (CSIR- CIMFER). Copy of the study report "Numerical Modelling Studies for Subsidence predication at Rampura Agucha Mine, HZL" is submitted vide letter No. HZL/RAM/ENV/2020-2021/789 dated 28.08.2020. Report cover page – XXXIII
4.	No waste to be transported outside the mining lease area.	No waste is transported outside the lease area. If required to be done in future, necessary approvals will be taken.
B) Standard Conditions: (As Ministry's O.M No 22-34/2018-IA.III dated 8.01.2019 and Ministry's O.M No 22-34/2018-IA.III dated 16.01.2020)		
1. Statutory compliance		
1.	This Environmental Clearance (EC) is subject to orders/ judgment of Hon'ble Supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	All applicable orders/ and Judgment will be complied.
2.	The Project Proponent complies with all the statutory requirements and judgment of Hon'ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors before commencing the mining operations.	Till date no liability raised by state government. If raised any in future, same will be complied.
3.	The State Government concerned shall ensure that mining operation shall not be commenced till the entire compensation levied, if any, for illegal mining paid by the Project Proponent through their respective Department of Mining & Geology in strict compliance of Judgment of Hon'ble Supreme Court dated 2 nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors.	Till date no liability raised by state government. If raised any in future, same will be complied.
4.	This Environmental Clearance shall become	Not Applicable for our operations.

	operational only after receiving formal NBWL Clearance from MoEF&CC subsequent to the recommendations of the Standing Committee of National Board for Wildlife, if applicable to the Project.	
5.	This Environmental Clearance shall become operational only after receiving formal Forest Clearance (FC) under the provision of Forest Conservation Act, 1980, if applicable to the Project.	Forest clearance not applicable as there is no forest land in Mine Lease area.
6.	Project Proponent (PP) shall obtain Consent to Operate after grant of EC and effectively implement all the conditions stipulated therein. The mining activity shall not commence prior to obtaining Consent to Establish/ Consent to Operate from the concerned State Pollution Control Board/Committee.	Consent to Establish was granted by RSPCB vide letter No. F(Mines)/Bhilwara(Hurda)/1(1)2009-2010/4792 dtd 21/01/2010 (Copy attached as Annexure - XXXII). Consent to Operate granted by RSPCB vide File F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117 dated 28/02/2023 for mining activity. RSPCB. Consent to Operate granted by RSPCB vide File F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631 dated 14/06/2023 for Beneficiation plant , and the conditions stipulated are implemented. (Copies attached as Annexure -XXXIII) There is no requirement of obtaining CTE & CTO afresh as this is an amendment in existing EC.
7.	The PP shall adhere to the provision of the Mines Act, 1952, Mines and Mineral (Development & Regulation), Act, 2015 and rules & regulations made there under. PP shall adhere to various circulars issued by Directorate General Mines Safety (DGMS) and Indian Bureau of Mines from time to time.	Adherence to all provisions of Mines Act, MMDR Act and circulars of DGMS & IBM is ensured.
8.	The Project Proponent shall obtain consents from all the concerned land owners, before start of mining operations, as per the provisions of MMDR Act,1957 and rules made there under in respect of lands which are not owned by it.	All the land is owned by HZL. Operations were started in the year 1991.
9.	The Project Proponent shall follow the mitigation measures provided in MoEF&CC's Office Memorandum No. Z-11013/57/2014-IA, II (M), dated 29 th October, 2014, titled "Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and villages are the part of mine lease areas or Habitations and villages are surrounded by the mine lease area"	No village and Habitation are part of mining lease area.
10.	The Project Proponent shall obtain necessary prior permission of the competent authorities	Permission for mine dewatering issued by CGWA vide NOC No. CGWA/NOC/MIN/REN/2/2022/7143

	for drawl of requisite quantity of surface water and from CGWA for withdrawal of ground water for the project.	valid till 07.07.2024. (Annexure XXIV).NOC of water withdrawal from Banas radial well has been renewed vide no. CGWA/NOC/MIN/REN/3/2023/7399 same is valid till 07/07/2024 (Annexure XXV).
11	A copy of EC letter will be marked to concerned Panchayat / local NGO etc. if any, from whom suggestion/ representation has been received while processing the proposal.	Copy of EC letter was submitted to Panchayat in 2009.
12.	State Pollution Control Board/Committee shall be responsible for display of this EC letter at its Regional office, District Industries Centre and Collector's office/ Tehsildar's Office for 30 days.	Copy is marked to Rajasthan State Pollution Control Board.
13	The Project Authorities should widely advertise about the grant of this EC letter by printing the same in at least two local newspapers, one of which shall be in vernacular language of the concerned area. The advertisement shall be done within 7 days of the issue of the clearance letter mentioning that the instant project has been accorded EC and copy of the EC letter is available with the State Pollution Control Board/Committee and web site of the Ministry of Environment, Forest and Climate Change (www.parivesh.nic.in). A copy of the advertisement may be forwarded to the concerned MoEFCC Regional Office for compliance and record.	Copy of the advertisement was sent to MoEF &CC, Lucknow vide letter No HZL/RAM/Env/Exp/2009 Advertised in two News papers on 03.01.2010.
14	The Project Proponent shall inform the MoEF&CC for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred than mining operation shall only be carried out after transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time.	Will inform as per EIA notification in case of any change in ownership or transfer of the mining lease.
15	In pursuant to Ministry's O.M. No 22-34/2018-IA.III dated 16.01.2020 to comply with the direction made by Hon'ble Supreme Court on 8.01.2020 in W.P. (Civil) No 114/2014 in the matter Common Cause vs Union of India, the mining lease holder shall after ceasing mining operations, undertake re-grassing the mining area and any other area which may have been disturbed due to other mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna	Reclamation is carried out progressively for growth of flora and fauna,

	etc.	
II. Air quality monitoring and preservation		
16	<p>The Project Proponent shall install a minimum of 3 (three) online Ambient Air Quality Monitoring Stations with 1 (one) in upwind and 2 (two) in downwind direction based on long term climatological data about wind direction such that an angle of 120° is made between the monitoring locations to monitor critical parameters, relevant for mining operations, of air pollution viz. PM10, PM2.5, NO2, CO and SO2 etc. as per the methodology mentioned in NAAQS Notification No. B-29016/20/90/PCI/I, dated 18.11.2009 covering the aspects of transportation and use of heavy machinery in the impact zone. The ambient air quality shall also be monitored at prominent places like office building, canteen etc. as per the site condition to ascertain the exposure characteristics at specific places. The above data shall be digitally displayed within 03 months in front of the main Gate of the mine site.</p>	<p>Three Online Ambient Air Quality Monitoring Stations are in place, 1 in upwind and 2 in downwind direction.</p> <p>Six Ambient air monitoring locations, three each in core and buffer zone each are selected in consultation with the SPCB. AAQ monitoring is carried out every fortnightly</p> <p>Data digitally displayed at main gate. Attached as Annexure-XXVI.</p>
17	<p>Effective safeguard measures for prevention of dust generation and subsequent suppression (like regular water sprinkling, metalled road construction etc.) shall be carried out in areas prone to air pollution wherein high levels of PM 10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from all sources shall be regularly controlled by installation of required equipment's/ machineries and preventive maintenance. Use of suitable water-soluble chemical dust suppressing agents may be explored for better effectiveness of dust control system. It shall be ensured that air pollution level conform to the standards prescribed by the MoEFCC/ Central Pollution Control Board.</p>	<p>Water sprinkling is carried out by 4 Nos. of 40 KL water sprinkler on Haul roads to mitigate air pollution in mine area Annexure-X. Dust extraction system and Water sprinkling nozzles are installed at the crushers, transfer points and coarse stockpiles for dust suppression. Industrial roads are cleaned by using Truck mounted vacuum road sweepers. (Annexure-XXII) The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB.</p>
III. Water quality monitoring and preservation		
18	<p>In case, immediate mining scheme envisages intersection of ground water table, then Environmental Clearance shall become operational only after receiving formal clearance from CGWA. In case, mining operation involves intersection of ground water table at a later stage, then PP shall ensure that prior approval from CGWA and MoEFCC is in place before such mining operations. The</p>	<p>Permission for mine dewatering issued by CGWA vide NOC No. CGWA/NOC/MIN/REN/2/2022/7143 valid till 07.07.2024. (Annexure XXIV). NOC of water withdrawal from Banas radial well has been renewed vide no. CGWA/NOC/MIN/REN/3/2023/7399 same is valid till 07/07/2024 (Annexure XXV).</p>

	permission for intersection of ground water table shall essentially be based on detailed hydro-geological study of the area.	
19	Regular monitoring of the flow rate of the springs and perennial nallahs flowing in and around the mine lease shall be carried out and records maintain. The natural water bodies and or streams which are flowing in an around the village, should not be disturbed. The Water Table should be nurtured so as not to go down below the pre-mining period. In case of any water scarcity in the area, the Project Proponent has to provide water to the villagers for their use. A provision for regular monitoring of water table in open dug wall located in village should be incorporated to ascertain the impact of mining over ground water table. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry, CGWA and State Groundwater Department/ State Pollution Control Board.	There is no perennial nallahs in and around mine lease. Not disturbed any village's natural water bodies or streams. Regular water monitoring carried out for open dug well / piezometers near mining area and water level and water quality report Quarterly to CGWA, GCWB & State Pollution Control Board. Drinking water is provided to the nearby villages through tankers. Report Submitted to MoEF&CC on six monthly basis. Attached as Annexure -I
20	Project Proponent shall regularly monitor and maintain records w.r.t. ground water level and quality in and around the mine lease by establishing a network of existing wells as well as new piezo-meter installations during the mining operation in consultation with Central Ground Water Authority/ State Ground Water Department. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry, CGWA and State Groundwater Department/ State Pollution Control Board	Ground water level and water quality monitoring done regular basis and report submitted to CGWA, State Pollution Control Board and MoEF&CC on quarterly basis and six- monthly basis.
21	The Project Proponent shall undertake regular monitoring of natural water course/ water resources/ springs and perennial nallahs existing/ flowing in and around the mine lease and maintain its records. The project proponent shall undertake regular monitoring of water quality upstream and downstream of water bodies passing within and nearby/ adjacent to the mine lease and maintain its records. Sufficient number of gullies shall be provided at appropriate places within the lease for management of water. PP shall carryout regular monitoring w.r.t. pH and included the same in monitoring plan. The parameters to be monitored shall include their water quality vis-a-vis suitability for usage as per CPCB criteria	There is no perennial nallahs in and around mine lease. Regular Monitoring of natural water resources around mining lease is carried out. Regular water monitoring carried out for open dug well / piezometers near mining area and water level and water quality report Quarterly to CGWA, GCWB & State Pollution Control Board. (Annexure- I (1, 2 & 3).

	and flow rate. It shall be ensured that no obstruction and/ or alteration be made to water bodies during mining operations without justification and prior approval of MoEFCC. The monitoring of water courses/ bodies existing in lease area shall be carried out four times in a year viz. pre- monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the record of monitored data may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority and Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board. Clearly showing the trend analysis on six-monthly basis.	
22	Quality of polluted water generated from mining operations which include Chemical Oxygen Demand (COD) in mines run-off; acid mine drainage and metal contamination in runoff shall be monitored along with Total Suspended Solids (TDS), Dissolved Oxygen (DO), pH and Total Suspended Solids (TSS). The monitored data shall be uploaded on the website of the company as well as displayed at the project site in public domain, on a display board, at a suitable location near the main gate of the Company. The circular No. J- 20012/1 /2006-IA. II (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change may also be referred in this regard.	Water generated from mining operations is utilized in Beneficiation Plant and zero discharge is maintained. There is no acid mine drainage occurring in the mine. Garland drains are constructed around the tailing dam and waste dump with collection sumps.
23	Project Proponent shall plan, develop and implement rainwater harvesting measures on long term basis to augment ground water resources in the area in consultation with Central Ground Water Board/ State Groundwater Department. A report on amount of water recharged needs to be submitted to Regional Office MoEFCC annually.	Garland drains are constructed around the tailing dam and waste dump with collection sumps of 8.5 lakh CuM capacity to collect and reuse the rain water. Collection pond of 1.5 lakh CuM has been constructed in the township. 3 Nos. of anicuts have been constructed for groundwater augmentation in consultation with CGWB. 4 anicuts constructed in the area under MJSA. 8.7 MCM groundwater recharge work has been completed in four blocks of Bhilwara district.
24	Industrial waste water (workshop and waste water from the mine) should be properly collected and treated so as to conform to the notified standards prescribed from time to time. The standards shall be prescribed through Consent to Operate (CTO) issued by concerned State Pollution Control Board (SPCB). The workshop effluent shall be treated after its initial passage through Oil and grease trap	No waste water generation from mining. Water generated during mining intersection is used in sprinkling and beneficiation process. Water from tailing dam is recycled back to the Beneficiation Plant and zero discharge is maintained. Annexure-V. Oil & Grease traps are installed near work shop and water reused in beneficiation process. Annexure XVIII
25	The water balance/water auditing shall be carried out and measure for reducing the	Water balance attached as annexure XXVII

	consumption of water shall be taken up and reported to the Regional Office of the MoEF&CC and State Pollution Control Board/Committee.	
IV. Noise and vibration monitoring and prevention		
26	The peak particle velocity at 500m distance or within the nearest habitation, whichever is closer shall be monitored periodically as per applicable DGMS guidelines	Peak particle velocity monitoring done as per guidelines. Annexure-XXIII
27	The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day /night hours.	Lights are installed in a manner so that no disturbance to the villagers. Noise levels are also within prescribed limits. Annexure- IV
28	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment. The workers engaged in operations of HEMM, etc. should be provided with ear plugs /muffs. All personnel including laborers working in dusty areas shall be provided with protective respiratory devices along with adequate training, awareness and information on safety and health aspects. The PP shall be held responsible in case it has been found that workers/ personals/ laborers are working without personal protective equipment.	PPEs like ear plugs / muffs, dust masks, safety goggles, safety shoes etc. provided to all workers/ personals/ laborers. Adequate trainings provided to all concerned and toolbox talks are carried out before starting work. Noise monitoring done as per guideline report attached as per Annexure –IV
V. Mining plan		
29	The Project Proponent shall adhere to the working parameters of mining plan which was submitted at the time of EC appraisal wherein year-wise plan was mentioned for total excavation i.e. quantum of mineral, waste, over burden, inter burden and top soil etc.. No change in basic mining proposal like mining technology, total excavation, mineral & waste production, lease area and scope of working (viz. method of mining, overburden & dump management, OB & dump mining, mineral transportation mode, ultimate depth of mining etc.) shall not be carried out without prior approval of the Ministry of Environment, Forest and Climate Change, which entail adverse environmental impacts, even if it is a part of	Working as per mining plan. There is no changes in mining technology scope of work, method of mining, overburden & dump management, OB & dump mining, mineral transportation mode, ultimate depth of mining. As per the latest MoEF&CC O.M. No. 22-44/2018-IA.III dated 14.05.2020, production will not be extended beyond EC approved quantity.

	approved mining plan modified after grant of EC or granted by State Govt. in the form to Short Term Permit (STP), Query license or any other name.	
30	The Project Proponent shall get the Final Mine Closure Plan along with Financial Assurance approved from Indian Bureau of Mines/Department of Mining & Geology as required under the Provision of the MMDR Act, 1957 and Rules/ Guidelines made there under. A copy of approved final mine closure plan shall be submitted within 2 months of the approval of the same from the competent authority to the concerned Regional Office of the Ministry of Environment, Forest and Climate Change for record and verification.	Progressive Mine Closure Plan is part of approved Mining Plan. Final Mine Closure Plan along with details of Corpus Fund will be got approved from IBM and copy of the same will be submitted to MoEF&CC well in advance of final mine closure.
31	The land-use of the mine lease area at various stages of mining scheme as well as at the end-of-life shall be governed as per the approved Mining Plan. The excavation vis-a-vis backfilling in the mine lease area and corresponding afforestation to be raised in the reclaimed area shall be governed as per approved mining plan. PP shall ensure the monitoring and management of rehabilitated areas until the vegetation becomes self-sustaining. The compliance status shall be submitted half-yearly to the MoEFCC and its concerned Regional Office.	Land use of mine lease area, excavation and afforestation and reclamation are done as per approved mining plan.
VI. Land reclamation		
32	The Overburden (OB) generated during the mining operations shall be stacked at earmarked OB dump site(s) only and it should not be kept active for a long period of time. The physical parameters of the OB dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of top soil/OB dumps. The topsoil shall be used for land reclamation and plantation.	Overburden burden is stacked at earmarked Waste Dump site. Physical parameters maintain as per mining plan and DGMS guidelines and circulars. The topsoil is used for land reclamation and plantation. In current FY there is no top soil generation.
33	The reject/waste generated during the mining operations shall be stacked at earmarked waste dump site(s) only. The physical parameters of the waste dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	Overburden burden is stacked at earmarked Waste Dump site. Physical parameters maintain as per mining plan and DGMS guidelines and circulars. stability monitoring by Radar Report enclosed as Annexure -VII

34	The reclamation of waste dump sites shall be done in scientific manner as per the Approved Mining Plan cum Progressive Mine Closure Plan.	Reclamation of waste dump site as per mining plan.
35	The slope of dumps shall be vegetated in scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface run off. The selection of local species regulates local climatic parameters and help in adaptation of plant species to the microclimate. The gullies formed on slopes should be adequately taken care of as it impacts the overall stability of dumps. The dump mass should be consolidated with the help of dozer/ compactors thereby ensuring proper filling/ leveling of dump mass. In critical areas, use of geo textiles/ gee-membranes / clay liners / Bentonite etc. shall be undertaken for stabilization of the dump.	Slopes of waste dumps are stabilized and vegetated in scientific manner using geotextile and with native and arid zone seeds (like <u>Acacia nitalica</u> , <u>Ziziphus Jojoba</u> , <u>Prosopis cineraria</u> , <u>Alkanna Tinctoria</u> , <u>Capparis decidua</u> , <u>Gundi</u> , <u>Salvadorapersica</u> spread on waste dump slopes. Aloe Vera and Vetiver grass planted during laying of geotextiles Annexure XXVIII
36	The Project Proponent shall carry out slope stability study in case the dump height is more than 30 meters. The slope stability report shall be submitted to concerned regional office of MoEF&CC.	Waste dump design and slope stability is being reviewed yearly by CIMFR and report being submitted to MoEF&CC Regional Office. Latest report enclosed as Annexure XXI.
37	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and Top Soil/OB/Waste dumps to prevent run off of water and flow of sediments directly into the water bodies (Nallah/ River/ Pond etc.). The collected water should be utilized for watering the mine area, roads, green belt development, plantation etc. The drains/ sedimentation sumps etc. shall be de-silted regularly, particularly after monsoon season, and maintained properly	Garland drains of adequate size are constructed along the waste dump toe & mining pit, along with lined collection sumps of about 8.5 lakh CuM . The water collected is utilized for various purposes. De-silting sump and drains are de-silted on regular basis. Annexure -VIII
38	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent storm run-off and sediment flow into adjoining water bodies. A safety margin of 50% shall be kept for designing of sump structures over and above peak rainfall (based on 50 years data) and maximum discharge in the mine and its adjoining area which shall also help in providing adequate retention time period thereby allowing proper settling of sediments/ silt material. The sedimentation pits/ sumps shall be constructed at the corners of the garland drains.	Garland drains of adequate size are constructed along the waste dump toe & mining pit, along with lined collection sumps of about 8.5 lakh CuM . The water collected is utilized for various purposes. De-silting sump and drains are de-silted on regular basis. Annexure -VIII
39	The top soil, if any, shall temporarily be stored at earmarked site(s) within the mine lease only	The topsoil has been utilized for land reclamation and plantation. At present no top soil dump at site.

	and should not be kept unutilized for long. The physical parameters of the top soil dumps like height, width and angle of slope shall be governed as per the approved Mining Plan and as per the guidelines framed by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of dumps. The topsoil shall be used for land reclamation and plantation purpose.	
VII. Transportation		
40	No Transportation of the minerals shall be allowed in case of roads passing through villages/ habitations. In such cases, PP shall construct a 'bypass' road for the purpose of transportation of the minerals leaving an adequate gap (say at least 200 meters) so that the adverse impact of sound and dust along with chances of accidents could be mitigated. All costs resulting from widening and strengthening of existing public road network shall be borne by the PP in consultation with nodal State Govt. Department. Transportation of minerals through road movement in case of existing village/ rural roads shall be allowed in consultation with nodal State Govt. Department only after required strengthening such that the carrying capacity of roads is increased to handle the traffic load. The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly. Vehicular emissions shall be kept under control and regularly monitored. Project should obtain Pollution Under Control (PUC) certificate for all the vehicles from authorized pollution testing centers.	Ore transportation is being done within acquired land and not passing through any village / habitation. Regular water sprinkling is done on haul roads (Annexure X). Industrial roads are cleaned using truck mounted vacuum Road Sweepers(Annexure-XXII). Periodic preventive maintenance of vehicles is part of our operations. All the trucks are covered with tarpaulin while transportation of concentrates to the smelters. PUC certificate is ensured for every truck prior to entry in the premises. Annexure XIII
41	The Main haulage road within the mine lease should be provided with a permanent water sprinkling arrangement for dust suppression. Other roads within the mine lease should be wetted regularly with tanker-mounted water sprinkling system. The other areas of dust generation like crushing zone, material transfer points, material yards etc. should invariably be provided with dust suppression arrangements. The air pollution control equipments like bag filters, vacuum suction hoods, dry fogging system etc. shall be installed at Crushers, belt-conveyors and other areas prone to air pollution. The belt conveyor should be fully covered to avoid generation of dust while	Regular water sprinkling is done on haul roads (Annexure X). Dust extraction system and Water sprinkling nozzles are installed at the crushers, transfer points and coarse stockpiles for dust suppression. Industrial roads are cleaned by using Truck mounted vacuum road sweepers. (Annexure-XXII) The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB.

	transportation. PP shall take necessary measures to avoid generation of fugitive dust emissions.	
VIII. Green Belt		
42	The Project Proponent shall develop greenbelt in 7.5m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole Green belt shall be developed within first 5 years starting from windward side of the active mining area. The development of greenbelt shall be governed as per the EC granted by the Ministry irrespective of the stipulation made in approved mine plan.	Green belt developed all along the acquired area.
43	The Project Proponent shall carryout plantation/ afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by planting the native species in consultation with the State Forest Department/ Agriculture Department/ Rural development department/ Tribal Welfare Department/ Gram Panchayat such that only those species be selected which are of use to the local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 saplings per Hectare. Adequate budgetary provision shall be made for protection and care of trees,	Green belt developed all along the acquired area. Progressive plantation is being carried out on waste dump benches every year. Seed spearing and geotextile laying is also carried out on waste dump slopes. As per SRSAC study conducted based on Nov 2021 satellite imagery, 694103 Nos of plants are existing with in 348 Ha area. Further FY 2022-23 and FY 2023-24, 15000 and 23000 Nos saplings planted as gap filling. Currently 732103 Nos of plants are exiting in 348 Ha. Detailed SRSAC report attached as Annexure XXXV. Additional plantation has been done in 37.70 ha in the township and along roadside. Density of the plantation will be increased in phase manner. (Annexure -IX)
44	The Project Proponent shall make necessary alternative arrangements for livestock feed by developing grazing land with a view to compensate those areas which are coming within the mine lease. The development of such grazing land shall be done in consultation with the State Government. In this regard, Project Proponent should essentially implement the directions of the Hon'ble Supreme Court with regard to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded/ protected against felling and plantation of such trees should be promoted.	Hindustan Zinc Ltd. is carrying out various work for livestock and agriculture development under its flagship project named "Samadhan" in collaboration with BAIF (National level Origination)
45	The Project Proponent shall undertake all precautionary measures for conservation and protection of endangered flora and fauna and Schedule-I species during mining operation. A Wildlife Conservation Plan shall be prepared for the same clearly delineating action to be taken	Not applicable there is no Shedule-1 species in mining area

	for conservation of flora and fauna. The Plan shall be approved by Chief Wild Life Warden of the State Govt.	
46	And implemented in consultation with the State Forest and Wildlife Department. A copy of Wildlife Conservation Plan and its implementation status (annual) shall be submitted to the Regional Office of the Ministry.	Not applicable There is no Shedule-1 species in mining area
IX. Public hearing and human health issues		
47	The Project Proponent shall appoint an Occupational Health Specialist for Regular as well as Periodical medical examination of the workers engaged in the mining activities, as per the DGMS guidelines. The records shall be maintained properly. PP shall also carryout Occupational health check-ups in respect of workers which are having ailments like BP, diabetes, habitual smoking, etc. The check-ups shall be undertaken once in six months and necessary remedial/ preventive measures be taken. A status report on the same may be sent to MoEFCC Regional Office and DGMS on half-yearly basis.	Appointed Occupational Health Specialist. Regular as well as Periodical medical examination of the workers are carried out as per Mines Act. Copy of the return submitted to DGMS is attached as annexure –XXIX
48	The Project Proponent must demonstrate commitment to work towards 'Zero Harm' from their mining activities and carry out Health Risk Assessment (HRA) for identification workplace hazards and assess their potential risks to health and determine appropriate control measures to protect the health and wellbeing of workers and nearby community. The proponent shall maintain accurate and systematic records of the HRA. The HRA for neighborhood has to focus on Public Health Problems like Malaria, Tuberculosis, HIV, Anaemia, Diarrhoea in children under five, respiratory infections due to bio mass cooking. The proponent shall also create awareness and educate the nearby community and workers for Sanitation, Personal Hygiene, Hand washing, not to defecate in open, Women Health and Hygiene (Providing Sanitary Napkins), hazard of tobacco and alcohol use. The Proponent shall carryout base line HRA for all the category of workers and there after every five years.	We are committed for Zero Harm from our mining activities. Various studies have been done for health risk assessment regarding identification and control measures for work place hazards. Regular health check-ups of nearby community are done through "Deepak Foundation" (Annexure-XX) and awareness sessions are also conducted.
49	The Proponent shall carry out Occupational health surveillance which be a part of HRA and include Biological Monitoring where practical and feasible, and the tests and investigations relevant to the exposure (e.g. for Dust a X-Ray	Biological monitoring and tests and investigations relevant to the exposure are carried out and record maintain by Occupational health team. No manganese and chromium mining so Mn & Cr monitoring not applicable. Blood lead monitoring is

	<p>chest; For Noise Audiometric; for Lead Exposure Blood Lead, For Welders Full Ophthalmologic Assessment; for Manganese Miners a complete Neurological Assessment by a Certified Neurologist, and Manganese (Mn) Estimation in Blood; For Inorganic Chromium-Fortnightly skin inspection of hands and forearms by a responsible person. Except routine tests all tests would be carried out in a Lab accredited by NABH. Records of Health Surveillance must be kept for 30 years, including the results of and the records of Physical examination and tests. The record of exposure due to materials like Asbestos, Hard Rock Mining, Silica, Gold, Kaolin, Aluminium, Iron, Manganese, Chromium, Lead, Uranium need to be handed over to the Mining Department of the State in case the life of the mine is less than 30 years. It would be obligatory for the State Mines Departments to make arrangements for the safe and secure storage of the records including X-Ray. Only conventional X-Ray will be accepted for record purposes and not the digital one). X-Ray must meet ILO criteria (17 x14 inches and of good quality).</p>	<p>done on regular basis.</p>
50	<p>The Proponent shall maintained a record of performance indicators for workers which includes (a) there should not be a significant decline in their Body Mass Index and it should stay between 18.5 -24.9, (b) the Final Chest X-Ray compared with the base line X-Ray should not show any capacities ,(c) At the end of their leaving job there should be no Diminution in their Lung Functions Forced Expiratory Volume in one second (FEV1),Forced Vital Capacity (FVC), and the ratio) unless they are smokers which has to be adjusted, and the effect of age, (d) their hearing should not be affected. As a proof an Audiogram (first and last need to be presented), (e) they should not have developed any Persistent Back Pain, Neck Pain, and the movement of their Hip, Knee and other joints should have normal range of movement, (f) they should not have suffered loss of any body part. The record of the same should be submitted to the Regional Office, MoEF&CC annually along with details of the relief and compensation paid to workers having above indications.</p>	<p>Periodical medical examination of the workers are carried out as per DGMS guidelines and records are maintained.</p>
51	<p>The Project Proponent shall ensure that</p>	<p>Dust masks are provided to all workers/ personals/</p>

	Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.	laborers. Adequate trainings provided to all concerned and toolbox talks are carried out before starting of work.
52	Project Proponent shall make provision for the housing for workers/ labors or shall construct labor camps within/ outside (company owned land) with necessary basic infrastructure/ facilities like fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche for kids etc. The housing may be provided in the form of temporary structures which can be removed after the completion of the project related infrastructure. The domestic waste water should be treated with STP in order to avoid contamination of underground water.	No construction labor housing is proposed in mining area. However, the sanitation and drinking water facility is provided to the workers, working at site. Sewage Treatment Plants are also installed at mining area and township.
53	The activities proposed in Action plan prepared for addressing the issues raised during the Public Hearing shall be completed as per the budgetary provisions mentioned in the Action Plan and within the stipulated time frame. The Status Report on implementation of Action Plan shall be submitted to the concerned Regional Office of the Ministry along with District Administration.	All the issues raised during Public Hearing in the year 2009 were addressed.
X. Corporate Environment Responsibility (CER)		
54	The activities and budget earmarked for Corporate Environmental Responsibility (CER) as per Ministry's O.M No 22-65/2017-IA. II (M) dated 01.05.2018 or as proposed by EAC should be kept in a separate bank account. The activities proposed for CER shall be implemented in a time bound manner and annual report of implementation of the same along with documentary proof viz. photographs, purchase documents, latitude & longitude of infrastructure developed & road constructed needs to be submitted to Regional Office MoEF&CC annually along with audited statement.	Separate Cost center and GL account are maintained. Activities proposed for CER will be implemented in time bound manner.
55	Project Proponent shall keep the funds earmarked for environmental protection measures in a separate account and refrain from diverting the same for other purposes. The Year wise expenditure of such funds should be reported to the MoEF&CC and its concerned Regional Office.	Environmental funds are earmarked for environment work only. Separate Cost center and GL account are maintained. Environmental expenditure is reported on six monthly basis enclosed as Annexure -VI
XI. Miscellaneous		

56	The Project Proponent shall prepare digital map (land use & land cover) of the entire lease area once in five years purpose of monitoring land use pattern and submit a report to concerned Regional Office of the MoEFCC.	The land use & land cover change study carried out in 2023. Copy attached Annexure-XIV
57	The Project Authorities should inform to the Regional Office regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Being operational unit, condition is not applicable.
58	The Project Proponent shall submit six monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MOEFCC & its concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	Compliances report submitted to MOEF&CC & Regional Office, Central Pollution Control Board and State Pollution Control Board. Environment statement submitted on 28th September 2023. Annexure-XIX.
59	A separate 'Environmental Management Cell' with suitable qualified manpower should be set-up under the control of a Senior Executive. The Senior Executive shall directly report to Head of the Organization. Adequate number of qualified Environmental Scientists and Mining Engineers shall be appointed and submit a report to RO, MoEF&CC.	Environment Management Cell has been set up having adequate qualified Executives and a Senior executive who reports to IBU CEO directly. Adequate number of mining engineers are appointed for mine planning, execution, Geotech etc.
60	The concerned Regional Office of the MoEF&CC shall randomly monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the MoEF&CC officer(s) by furnishing the requisite data / information / monitoring reports.	Noted


CEO - IBU Agucha
Hindustan Zinc Limited
Rampura Agucha Mines
PO - Agucha
Distt. - Bhilwara (Raj.)

Mechanism for addressing Environmental Issues

HZL has a Health Safety and Environment Policy, given below, signed by its CEO and forms the guidelines for the entire organization. A well laid mechanism is implemented uniformly across all units of HZL for the implementation of the policy.

All operating units of Hindustan Zinc Limited are certified for ISO-14001 Environmental Management system (EMS). The Management Representative (MR) of the certification system is an experienced environmental officer with due authority to implement and drive a responsible EMS. The MR is duly supported by a committee constituting the operations and maintenance officers of the unit. The system has a well laid documented procedure for identification of all environmental aspect, Impacts and implementation of suitable mitigation measures.

The company has three level monitoring mechanism for addressing environmental concerns starting at unit level, HZL corporate level and Vedanta group company level. Depending on the scale and nature of the issue, the concern is escalated to different level right up to the Board of the company and also the shareholders of the company in the general body meetings.

The compliances to Environment Clearance and all environmental licenses are reviewed and monitored regularly and reports are submitted to the respective regulatory authorities at every unit, by a dedicated environmental professional, who reports directly to the unit head. The compliance is periodically reviewed and audited by Corporate Environment Department, which reports to the top management of the company. A Corporate Sustainability Committee, chaired by the CEO of the company, oversees all sustainability issues including Environment, Safety and Health and also reviewing any policy matters.

Any non-compliances/show cause/notices/complaints received from regulatory authority or any stakeholder is addressed jointly by the unit and corporate environment department. Such issues are also reported and the actions taken are reviewed by the top management every month. Further, all show cause, complaint letters and notices from any stakeholder, along with the action taken report is submitted to the Board Of Directors of the company every quarterly. All major concerns are reported to the stakeholders through the annual general body meetings of the company.

HINDUSTAN ZINC

Environmental Policy

Purpose

Hindustan Zinc Limited is committed to achieving excellence in environmental management. Our goal is to minimise environmental impacts of our business across the entire lifecycle by implementing pollution prevention and natural resource conservation actions either on site or off site.

This policy is forward looking and sets a vision for businesses across the Hindustan Zinc Limited.

Scope

This policy is applicable to all Hindustan Zinc Limited business units, including subsidiaries, joint ventures, and acquisitions, managed sites, licensees, outsourcing partners, corporate offices, and research facilities. This policy is also applicable to all Hindustan Zinc Limited employees, contractor employees, business partners, suppliers, and others with whom Hindustan Zinc does business.

In addition, this policy is applicable throughout the operational lifecycle of the projects and mines, covering stages from exploration and planning to evaluation, operation, and closure. Furthermore, it extends to activities in our upstream and downstream value chain, limited to distribution, logistics, and sale of products and services to the customer.

Objectives of the Environmental Policy

Hindustan Zinc will strive to:

- ✦ Comply with applicable national, regional, and local environmental regulations and statutory obligations, in the absence or lack of appropriate legislation, industry best practices and applicable international standards will be used.
- ✦ Develop, implement, and improve environmental management systems, consistent with world-class standards.
- ✦ Set targets and objectives to avoid, reduce or mitigate Environmental impacts on people and planet.
- ✦ Consistently assess our environmental risks, manage our impacts, take appropriate mitigation and adaptation measures, and communicate our environmental strategy to our stakeholders.
- ✦ Incorporate appropriate environmental criteria for all business decisions including the planning, operationalization, and closure of the projects.
- ✦ Conduct regular environmental review and due diligence of the projects (including for mergers & acquisitions) to identify, prioritize, assess, and take effective actions for mitigating the potential environmental risks.
- ✦ Drive continuous environmental performance improvement by implementing appropriate available practices and technology.
- ✦ Conserve natural resources by adopting environment-friendly and energy-efficient technologies through process improvements.
- ✦ Apply mitigation hierarchy (avoid, reduce, reuse, recycle, disposal) to environmental impacts and adopt the principles of circular economy.
- ✦ Manage impact related to energy, carbon emissions, waste, nature, air emissions, land-use & biodiversity, and water.
- ✦ Raise awareness of internal and external stakeholders including business partners, suppliers, and other stakeholders on adoption of practices in alignment with our policies, thereby fostering a collective commitment to managing environmental impacts.
- ✦ Provide appropriate training to all employees and emphasise the importance of minimising risks to environment, while also understanding the impacts of their work activities on the environment.
- ✦ Communicate with all our stakeholders on the progress and performance of Environment management.
- ✦ Review the performance against the policy on a periodic basis to ensure management of environmental impacts as per our objectives, including the sharing of good practices throughout the organization and stakeholders.

Responsibility & Review

This policy is part of the Vedanta Sustainability Framework, and each Hindustan Zinc Limited business unit shall implement this policy. Our CEO will be accountable for controlling and setting the policy, and the Executive Committee are responsible for the full implementation of the policy and associated standards. The Board ESG committee will review this policy annually and recommend appropriate revisions to the Board as may deem necessary.

Related additional policies: Energy & Climate Change Policy, Biodiversity Policy, Water Policy, Tailings Management Policy.

Date: 1st September, 2023

Arun Misra

Arun Misra

CEO & Whole Time Director, HZL



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हिन्दुस्तान जिंक जैवविविधता नीति

प्रयोजन

जैवविविधता की रक्षा और संवर्धन हिन्दुस्तान जिंक की सतत विकास की प्रतिबद्धता का एक अभिन्न अंग है। हमारे व्यवसाय के सामान्य पर्यावरण एवं जैवविविधता पर पहले वाले समर्पित प्रयास और निवेशों की ज़रूरत हमें स्पष्ट है। जैवविविधता की व्यवस्थापकता को एकीकृत कर हमारे प्रयासों में निरंतरता को बढ़ा देने वाले प्रयासों की योजना बनाने के लिए प्रकृति साक्षात्कार (नैचर पैरिडिग) जोरों की अनुपम समय उपान बन गया हमारे मूलभूत प्रतिबद्धता है।

जैवविविधता एक वैश्वीय असाध्य है, जिसे जैविक एवं सामाजिक (अर्थात पारिस्थितिक तंत्र दोनों) के परस्परिभूत प्रभावों, संरक्षण और महत्व देने की आवश्यकता है, और अपने सामान्य रूप से कार्यरत पर हमारे संरक्षित प्रजातियों और निर्मल के प्रति संवेदनशील है। विशेष रूप से जैवविविधता के प्रति। यह जैवविविधता नीति हमें आवश्यक संवेदन, मान्यता और कार्यप्रणाली को परिभाषित करने, लागू करने, योजना बनाने और निगरानी रखने को प्राप्त करने की दिशा में मदद करेगी।

यह नीति दृष्टान्त है और हिन्दुस्तान जिंक समूह के व्यवसायों के लिए एक दृष्टिकोण निर्धारित करती है।

लाभकारी

यह नीति हिन्दुस्तान जिंक लिमिटेड की सभी व्यवसायिक इकाइयों पर लागू है, जिसमें सहयोगी कंपनियाँ, संयुक्त संप्रदाय और अधिग्रहण प्रकृतित सहाय, स्वयंसेवक, आउटसोर्सिंग प्रदाता, वितरित कार्यालय और अनुसंधान क्षेत्र शामिल हैं। यह नीति हिन्दुस्तान जिंक लिमिटेड के सभी कार्यकारी, निदेशक, कार्यकारी, व्यवसायिक प्रदाता, आपूर्तिकर्ता, और अन्य जिन्हें यह हिन्दुस्तान जिंक व्यापार करता है पर भी लागू है।

इसके अलावा, यह नीति परियोजनाओं और छात्रों के भी पर्यावरण जीवनसाथ में लागू होती है, जिसमें अन्वेषण और योजना से लेकर मुद्रांकन, संरक्षण और सम्पन्न तक के सारण शामिल होते हैं। इसकी अवधि, यह हमारे अपराधी मूल्य श्रृंखला में पर्यावरण तक विस्तारित है।

जैवविविधता नीति के उद्देश्य

हिन्दुस्तान जिंक प्रकाशित है:

- साइट पर या साइट के अंदर रहने प्रवेश करने की लागू करने जैवविविधता मूल्यों पर प्रकृति के सकारात्मक प्रभाव प्राप्त करना, खाते में यही लायीय या प्रजाती / समूह प्रजातियों या अधिवास और खाते वाले पर्यावरणों तक के उच्च मूल्यों के लिए राष्ट्रीय या अंतर्राष्ट्रीय स्तर पर मायाय प्राप्त क्षेत्रों के किसी भी परियोजना के प्रभाव की प्रतिपूर्ति करें।
- जहाँ भी हम काम करते हैं, हम सभी व्यवसायों में भूमि प्रकल्प और जैवविविधता संरक्षण के संबंधित स्वयंसेवक, क्षेत्रीय और राष्ट्रीय विधायी आवश्यकताओं को साथ-साथ प्रासंगिक अंतर्राष्ट्रीय समझौतों का पालन करें और जब भी संभव हो, उससे आगे बढ़ें।
- विषय प्रवेश करने और EIA परीक्षा के प्रकल्प परीक्षा 14 वीं और 2 वीं अंतर्राष्ट्रीय स्तर पर सम्मेलन प्राप्त क्षेत्रों में बनी की सहाई और अवसीत इति क्षेत्रों।
- विविध में बनी की सहाई (कोई मुद्रांकन की सहाई नहीं) के साथ अधिनियम-सहाई या अधिनियम-सहाई आवश्यकताओं द्वारा प्रतिपूर्ति करें।
- हमारे परियोजना संरक्षण में नै-नेट जोन प्राप्त करने और सुनिश्चित करें कि हम स्वतंत्रता अक्षांश के लिए गैर जीवविविधता प्रकल्प के विधायी पर लागू करें (जब भी जैवविविधता होटस्पॉट क्षेत्रों, पारिस्थितिक रूप से संवेदनशील क्षेत्रों, अंतर्राष्ट्रीय स्तर पर पर्यावरण क्षेत्रों में या उसके निकट काम करते हैं, साथ के लिए प्रकृति का संरक्षण EIA परीक्षा 14 वीं परीक्षा क्षेत्रों, विषय के आवश्यकताओं प्रवेश करने की सहाई क्षेत्रों में काम करें।
- पर्यावरण में प्रजाती पर जैवविविधता और प्रकृति-आधारित प्रजातियों से बनने, उन्हें कम करने या कम करने के लिए स्वयंसेवक और उद्देश्य निर्धारित करें।
- हमारे रणनीतिक दृष्टिकोण के अनुसार विविध योजना में जैवविविधता और प्रकृति संबंधी विधायी को एकीकृत करें और परियोजना के पूरे जीवनचक्र में प्रकृति से संबंधित जोखिमों और अवसरों का विश्लेषण करने जिसमें डिस्कवरी, सम्पन्न और पुनर्वास सम्मिलित हैं।
- जैवविविधता जोखिम मूल्यांकन का संरक्षण करें और प्रकृति-आधारित जोखिमों से बनने या कम करने के लिए संपूर्णकाल परामर्शक लागू करें।
- प्रजातियों प्रकल्प और कार्य योजनाओं के कार्यान्वयन के मध्यम से जैवविविधता प्रकल्प में निरंतर सुचारु सुनिश्चित कर "प्रकृति-आधारित सम्पन्न" दृष्टिकोण को सुनिश्चित करें।
- समस्त संरक्षण और विधायी क्षेत्रों में अवसर प्रजातियों को संरक्षण करने सहित हमारे क्षेत्रप्रमुख जैवविविधता के प्रकल्प को सुनिश्चित करने के लिए सार्वजनिक अक्षांश पर नीति की समीक्षा एवं सुधार करें।
- क्षेत्रीय, राष्ट्रीय और वैश्विक संरक्षण की पहल कर संरक्षण विशेषज्ञों और संगठनों के साथ जुड़ें। किसी और सार्वजनिक क्षेत्रों द्वारा संयुक्त प्रजातियों का संरक्षण करें, और संपूर्णकाल रूप से कार्यपरिणत सहाई प्रासंगिक विधायी क्षेत्रों के बीच आग का सुचारु कर जानकारी और मायायों को बढ़ावा देना एवं जैवविविधता और प्रकृति संबंधी मुनीषियों का सम्मान करें।
- जैवविविधता और पारिस्थितिकी तंत्र प्रकल्प प्रजातियों के बारे में उच्चतम ज्ञान और समझ को बढ़ावा के लिए हमारे कार्यकारी, व्यवसायिक प्रदाता, आपूर्ति श्रृंखला और अन्य विधायी क्षेत्रों के बीच जानकारी बढ़ाएं।
- सुपरमिड श्रृंखला मायायों और आपूर्तिकर्ताओं को इस नीति के साथ जुड़ने के लिए सक्रिय रूप से जोरप्रकृतित करें और वैश्विक या राष्ट्रीय स्तर पर महाप्रकार जैवविविधता खाते बनाने के पास पर्यावरण पर्यावरणों से बनने।

निष्कर्ष एवं समीक्षा

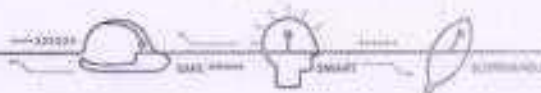
यह नीति वेदाता सहयोगीविधि प्रकल्पों का रूप है और हिन्दुस्तान जिंक की आर्थिक व्यवसायिक इकाई इसे लागू करेगी। समूह सहयोगी इस नीति को नियंत्रित करने और निर्धारित करने लिए निष्कर्षक होने और समूह कार्यकारी समिति नीति के पूर्ण कार्यप्रणाली के लिए निष्कर्षक होती और संयुक्त मानक बोर्ड द्वारा ही सहाई सातवें इस नीति की समीक्षा करेगा और बोर्ड को आवश्यक समझे जाने वाले उचित संशोधन की सिफारिश करेगा।

दिनांक : 01 मिनम्बर, 2023

Anam Mishra

अरुण मिश्रा

मुख्य कार्यकारी अधिकारी एवं पारिस्थितिक निदेशक, हिन्दुस्तान जिंक



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Annexures Table

S. No.	Descriptions	Annexure No.
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HINDUSTAN ZINC LIMITED
RAMPURA AGUCHA MINE

WELL WATER ANALYSIS REPORT-April-2023 to Sep-2023

S.No Code	1		2		3		4		5		6		7		8		9		10		11	
	WW-10		ww-22		GWD		WW-13		TIP-1		WW-15		WW-16		WW-23		PRK-1		KOT-1		WW-14	
Month	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23
pH	7.61	6.91	8.10	7.96	7.66	7.68	8.19	8.14	7.81	7.59	7.85	7.89	8.14	7.72	8.06	7.93	8.05	7.99	7.99	7.90	8.12	7.59
Alkalinity	370	242	270	242	410	290	260	245	440	403	390	302	440	523	350	427	390	378	360	261	480	507
Chlorides	83.9	123.8	87.97	50.6	203.9	244.3	63.98	64.5	103.9	119.7	83.97	106.92	137.9	186.64	71.97	76.5	207.9	191.4	223.9	230.43	109.9	97.7
Sulphate	370	386	89	33	182	176	154	31	203	226.6	86	78	184	192	78	95	182	183	249	248	81	100
CN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zn	0.02	1.65	0.120	0.23	0.110	0.08	0.160	BDL	0.180	0.08	0.090	0.18	0.070	BDL	0.100	BDL	0.130	0.07	0.110	0.09	0.060	0.28
Fe	0.08	0.12	0.010	BDL	0.006	0.05	0.050	BDL	0.050	0.03	0.060	BDL	0.080	BDL	0.040	BDL	0.080	0.03	0.060	BDL	0.060	BDL
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001	BDL
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

All figures are in mg/l except pH

Qadim

HINDUSTAN ZINC LIMITED
RAMPURA AGUCHA MINES
PIEZOMETER WATER ANALYSIS REPORT - April-2023 to Sep-2023

S. No.	Code	1		2		3		4		5		6		7		8	
		P		H		EI		GI		II		K		A		Adm	
		May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23	May-23	Aug-23
Months		8.02	8.23	7.68	7.67	8.01	7.66	7.63	7.92	8.02	7.55	8.02	7.88	8.16	7.47	7.89	7.88
pH		310	314	410	427	320	219	370	380	510	370	250	274	300	370	400	429
Alkalinity		165.94	194.76	219.93	239.64	359.88	364.07	197.94	194.76	209.93	225.82	89.97	119.82	213.93	179.73	239.93	256.52
Chlorides		249.00	235.00	351.00	366.00	368.00	380.00	368.00	368.00	373	350	108	100	343	358	353	365
Sulphate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CN		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb		0.160	0.150	0.090	0.080	0.100	0.020	0.100	0.120	0.120	0.090	0.150	BDL	0.180	BDL	0.050	0.080
Zn		0.050	BDL	0.120	0.040	0.120	0.030	0.050	BDL	0.060	0.060	0.030	BDL	0.120	0.050	0.020	BDL
Fe		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001	BDL	BDL	BDL	BDL	BDL
Cd		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	BDL	BDL	0.02	BDL	BDL	BDL
Cu		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ca		8.02	8.23	7.68	7.67	8.01	7.66	7.63	7.92	8.02	7.55	8.02	7.88	8.16	7.47	7.89	7.88
Mg		310	314	410	427	320	219	370	380	510	370	250	274	300	370	400	429

Palvi

Annexure I (3/3)

HINDUSTAN ZINC LTD
RAMPURA AGUCHA MINE
WELL WATER LEVEL MONITORING
(Below the ground level in meters)

Months	W-10	W-22	W-13	W-14	W-15	W-16	W-23	GWD	PRK-1	KOT-1
Apr-23	6.3	6.2	6.4	7.9	8.1	16.5	6.9	8.1	6.9	8.9
May-23	6.3	6.4	6.5	8.2	8.2	16.6	6.9	8.2	7.1	8.9
Jun-23	6.0	6.1	6.3	8.0	7.9	16.1	6.5	8.0	6.8	8.7
Jul-23	5.9	6.2	6.2	7.9	7.8	16.1	6.4	8.0	6.8	8.6
Aug-23	5.8	6.1	6.0	7.8	7.8	16.0	6.3	7.9	6.7	8.5
Sep-23	5.8	6.1	6.1	7.6	7.7	16.1	6.1	7.7	6.7	8.3

Original

Annexure - II

Analysis of Waste Dump Rocks

Location : Waste Dump

Element	Range
Pb	0.0002% - 0.0005%
Zn	0.0700% - 0.0815%
Cu	0.0005% - 0.0027%
Cd	0.0001% - 0.0005%
Ni	0.0020% - 0.0042%
Co	0.0010% - 0.0025%

Wahid

**HINDUSTAN ZINC LIMITED
HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE
AIR MONITORING: AMBIENT AIR & STACK : April 2023 to Sep 2023**

Annexure- III

Location month/ year	Fortnight	Mine Site										Main Gate										Mine Tower									
		SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)
Apr-23	I st	146.26	67.05	29.08	6.61	15.12	450.00	130.01	68.69	29.49	6.40	15.00	420.00	139.32	70.58	31.18	6.87	15.15	440.00	146.26	67.05	29.08	6.61	15.12	450.00	130.01	68.69	29.49	6.40	15.00	420.00
	II nd	162.08	81.87	30.45	5.09	15.14	390.00	148.89	84.06	35.24	4.82	15.67	380.00	153.23	76.71	30.85	4.48	15.47	360.00	162.08	81.87	30.45	5.09	15.14	390.00	148.89	84.06	35.24	4.82	15.67	380.00
	I st	141.62	70.12	30.85	6.67	14.91	350.00	149.74	70.95	28.24	6.37	15.07	380.00	150.26	73.04	29.69	6.85	14.99	410	141.62	70.12	30.85	6.67	14.91	350.00	149.74	70.95	28.24	6.37	15.07	380.00
	II nd	153.21	71.40	38.02	4.37	14.97	360.00	148.49	77.53	34.37	5.29	15.04	370.00	152.73	74.86	40.37	4.19	14.95	350.00	153.21	71.40	38.02	4.37	14.97	360.00	148.49	77.53	34.37	5.29	15.04	370.00
May-23	I st	166.26	80.75	31.01	5.40	14.83	410.00	169.34	79.99	35.56	5.90	15.01	410.00	158.41	78.28	32.83	4.87	14.60	390.00	166.26	80.75	31.01	5.40	14.83	410.00	169.34	79.99	35.56	5.90	15.01	410.00
	II nd	156.64	77.18	27.98	4.66	14.86	370.00	132.15	65.76	30.98	5.27	14.70	410.00	134.40	71.60	31.09	5.84	14.29	380.00	156.64	77.18	27.98	4.66	14.86	370.00	132.15	65.76	30.98	5.27	14.70	410.00
	I st	120.80	62.83	24.00	4.75	14.04	290.00	116.09	59.16	23.00	7.13	15.58	290.00	117.55	63.74	25.24	4.78	15.05	280.00	120.80	62.83	24.00	4.75	14.04	290.00	116.09	59.16	23.00	7.13	15.58	290.00
	II nd	120.92	59.33	25.88	6.17	13.50	240.00	120.51	61.31	25.56	11.72	14.19	240.00	130.25	74.37	25.88	8.31	13.55	280	120.92	59.33	25.88	6.17	13.50	240.00	120.51	61.31	25.56	11.72	14.19	240.00
Jun-23	I st	125.45	68.93	26.70	6.01	14.03	310.00	125.89	73.06	25.35	6.14	13.69	310.00	123.37	62.21	26.70	5.94	13.91	310.00	125.45	68.93	26.70	6.01	14.03	310.00	125.89	73.06	25.35	6.14	13.69	310.00
	II nd	118.44	58.95	32.20	6.22	14.20	320.00	123.05	63.32	30.44	7.08	16.92	290.00	123.37	62.21	26.70	5.94	13.91	310.00	118.44	58.95	32.20	6.22	14.20	320.00	123.05	63.32	30.44	7.08	16.92	290.00
	I st	143.44	63.53	27.01	6.34	15.53	350.00	105.17	87.13	30.63	6.10	15.12	330.00	142.34	71.90	30.19	6.41	15.40	370.00	143.44	63.53	27.01	6.34	15.53	350.00	105.17	87.13	30.63	6.10	15.12	330.00
	II nd	116.23	65.82	33.66	6.38	15.92	370.00	116.84	77.77	30.17	5.72	14.19	310.00	142.11	78.76	29.64	7.46	15.17	380.00	116.23	65.82	33.66	6.38	15.92	370.00	116.84	77.77	30.17	5.72	14.19	310.00
Location month/ year	Fortnight	Agucha village										Kotahia village										Bharukhara village									
		SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (µg/m ³)
Apr-23	I st	126.11	65.89	25.85	4.53	13.05	270.00	117.11	60.20	23.27	3.68	11.24	260.00	118.79	65.27	21.28	3.94	12.13	250.00	126.11	65.89	25.85	4.53	13.05	270.00	117.11	60.20	23.27	3.68	11.24	260.00
	II nd	121.60	61.54	24.18	5.59	12.40	210.00	121.34	63.49	21.80	6.71	11.94	260.00	128.33	64.99	25.89	5.92	13.84	270.00	121.60	61.54	24.18	5.59	12.40	210.00	121.34	63.49	21.80	6.71	11.94	260.00
	I st	121.99	66.12	27.90	4.31	14.88	270.00	117.91	56.95	27.26	4.94	15.02	210.00	116.51	54.36	21.15	5.82	13.82	310.00	121.99	66.12	27.90	4.31	14.88	270.00	117.91	56.95	27.26	4.94	15.02	210.00
	II nd	127.47	70.72	26.15	3.27	13.30	250.00	117.55	58.23	27.15	4.91	12.97	260.00	132.13	56.44	24.13	4.48	13.59	270.00	127.47	70.72	26.15	3.27	13.30	250.00	117.55	58.23	27.15	4.91	12.97	260.00
May-23	I st	137.23	63.69	28.88	4.78	13.27	330.00	123.62	61.75	23.18	4.38	12.95	310.00	106.19	60.01	28.05	5.48	13.36	280.00	137.23	63.69	28.88	4.78	13.27	330.00	123.62	61.75	23.18	4.38	12.95	310.00
	II nd	114.72	59.34	27.16	3.34	14.93	260.00	120.44	64.82	27.13	8.15	10.31	260.00	125.19	60.66	25.41	5.89	15.15	270.00	114.72	59.34	27.16	3.34	14.93	260.00	120.44	64.82	27.13	8.15	10.31	260.00
	I st	104.94	35.88	19.46	4.87	10.64	210.00	96.43	48.28	20.83	3.65	12.89	300.00	127.67	59.54	24.66	7.55	11.72	250.00	104.94	35.88	19.46	4.87	10.64	210.00	96.43	48.28	20.83	3.65	12.89	300.00
	II nd	95.63	33.32	23.56	4.34	14.19	260.00	94.00	55.69	27.47	4.78	13.87	240.00	118.79	58.02	21.09	4.28	13.50	260.00	95.63	33.32	23.56	4.34	14.19	260.00	94.00	55.69	27.47	4.78	13.87	240.00
Jun-23	I st	121.62	61.36	23.18	4.81	15.55	240.00	123.47	67.82	27.22	4.96	13.08	280.00	112.49	48.86	20.75	6.96	13.13	250.00	121.62	61.36	23.18	4.81	15.55	240.00	123.47	67.82	27.22	4.96	13.08	280.00
	II nd	124.74	62.36	24.03	6.33	12.42	260.00	107.33	49.34	23.06	5.24	12.84	270.00	114.28	51.76	19.66	5.85	10.20	310.00	124.74	62.36	24.03	6.33	12.42	260.00	107.33	49.34	23.06	5.24	12.84	270.00
	I st	140.04	60.19	28.26	6.22	16.00	360.00	103.35	50.16	23.64	6.17	14.95	340.00	101.57	50.40	26.56	6.46	13.00	310.00	140.04	60.19	28.26	6.22	16.00	360.00	103.35	50.16	23.64	6.17	14.95	340.00
	II nd	138.78	75.63	28.75	6.42	15.73	280.00	110.24	63.04	24.85	6.11	13.87	260.00	125.20	67.69	21.00	5.61	12.16	230.00	138.78	75.63	28.75	6.42	15.73	280.00	110.24	63.04	24.85	6.11	13.87	260.00

All figures are in (µg/m³)

STACK MONITORING SPM

Month-Yr	Fortnight	Crusher (SPM)	New Py Crusher (SPM)	All figures are in (mg/m ³)
Apr-23	I st	10.40	16.12	
	II nd	20.14	15.78	
May-23	I st	29.49	31.05	
	II nd	24.58	30.65	
Jun-23	I st	26.58	28.98	
	II nd	31.26	26.47	
Jul-23	I st	24.64	26.45	
	II nd	30.85	32.95	
Aug-23	I st	27.35	31.20	
	II nd	30.66	36.05	
Sep-23	I st	30.69	35.17	
	II nd	21.50	35.52	

Adil

Annexure-IV

Slno.	Area of Monitoring	NOISE LEVEL AT WORK ENVIRONMENT IN (dBA)						Equipment Condition
		Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	
1	BENEFICIATION PLANT a. Mill Ambient b. Mill Grinding Area c. Operators cabin mill area d. Flotation cell area e. AFM's cabin cell area f. Shift engineer's room g. Control room h. Work Shop i. Mine Tower	71.3/65.8	70.5/63.8	71.3/65.3	71.3/61.9	72.1/61.5	76.30/63.90	Day/ Night Plant is in running condition.
		80.7	81.3	80.5	81.50	80.30	81.20	-do-
		71.8	70.9	71.3	72.60	71.50	78.50	-do-
		71.3	71.2	70.8	71.70	72.30	79.30	-do-
		75.4	74.3	71.5	73.50	71.60	78.30	-do-
		73.9	71.8	70.9	74.50	73.20	76.40	-do-
		73.8	72.9	70.9	71.80	70.70	78.20	-do-
		72.7	71.5	72.3	72.30	70.90	77.20	-do-
		72.3/62.9	71.3/62.1	70.3/65.4	70.5/63.8	70.5/61.9	74.10/64.90	-do-
2	PRIMARY CRUSHER a. Primary Crusher I Control Room b. Primary Crusher II Control Room	73.9/62.8	74.9/63.9	74.1/63.1	71.9/62.1	70.9/63.5	73.10/63.40	Day/ Night Day/ Night
		71.9/64.8	72.4/63.3	72.1/65.1	70.3/61.8	70.1/60.3	72.10/66.20	
3	SEC/TERT. CRUSHER a. Shift Room Sec. Crusher b. Secondary crusher control room Ambient Mine Pit	70.9/62.7	70.1/63.8	76.81/63.1	70.7/62.1	70.5/62.3	73.20/65.20	Day/ Night Plant is in running condition.
		71.4	72.8	72.1	71.30	70.50	78.20	Day/ Night
		70.4/63.5	70.1/63.1	70.5/63.9	70.8/63.3	70.4/62.3	79.00/73.90	
4	Ambient Noise Main Gate Agucha Bharukhara Village monitoring	61.9/63.4	62.8/63.9	60.1/63.1	61.8/59.6	62.5/59.3	65.60/68.40	Day/ Night
		62.8/44.9	62.1/41.6	62.8/43.4	60.8/44.1	60.4/43.2	59.30/45.30	Day/ Night
		55.4/53.8	55.4/53.1	55.1/53.9	51.5/47.8	51.1/45.8	56.40/56.70	Day/ Night
5	Agucha Bharukhara Kathiya	50.1/41.3	50.5/40.8	50.1/40.3	50.1/40.3	50.3/40.1	50.10/41.20	Day/ Night
		49.8/40.3	41.8/40.1	41.9/40.5	48.6/40.1	48.1/40.1	47.30/40.10	Day/ Night
		50.5/41.6	50.1/43.8	50.6/45.9	50.8/38.3	50.5/38.1	50.90/41.20	Day/ Night

UG set Noise Monitoring		
Month	Location	Noise level (dB)
May-23	DG set Operator's room	71.3
	DG set Hall	99.2
	DG set Operator's room	69.4
Aug-23	DG set Hall	94.5

Radim

Annexure - V

Env. Sump water analysis (April-23 to Sep-23)

Parameter	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
pH	7.3	7.2	7.1	7.3	7.2	7.3
Oil & Grease	BDL	BDL	BDL	BDL	BDL	BDL
Alkalinity	610	640	650	630	620	605
Chlorides	730	745	760	710	715	700
Hardness	940	965	975	930	910	903
TDS	1420	1440	1470	1440	1405	1410
Pb	0.01	0.01	0.01	0.01	0.01	0.01
Zn	2.4	2.6	2.7	2.5	2.5	2.4
Fe	0.6	0.7	0.8	0.7	0.5	0.4
Cd	0.01	0.01	0.01	0.01	0.01	0.01

All value are in mg/l except pH

Remarks: Collected Water is pumped to reclaim reservoir and recycled back to plant for reuse. Zero discharge is maintained.

Aditya

Annexure -VI

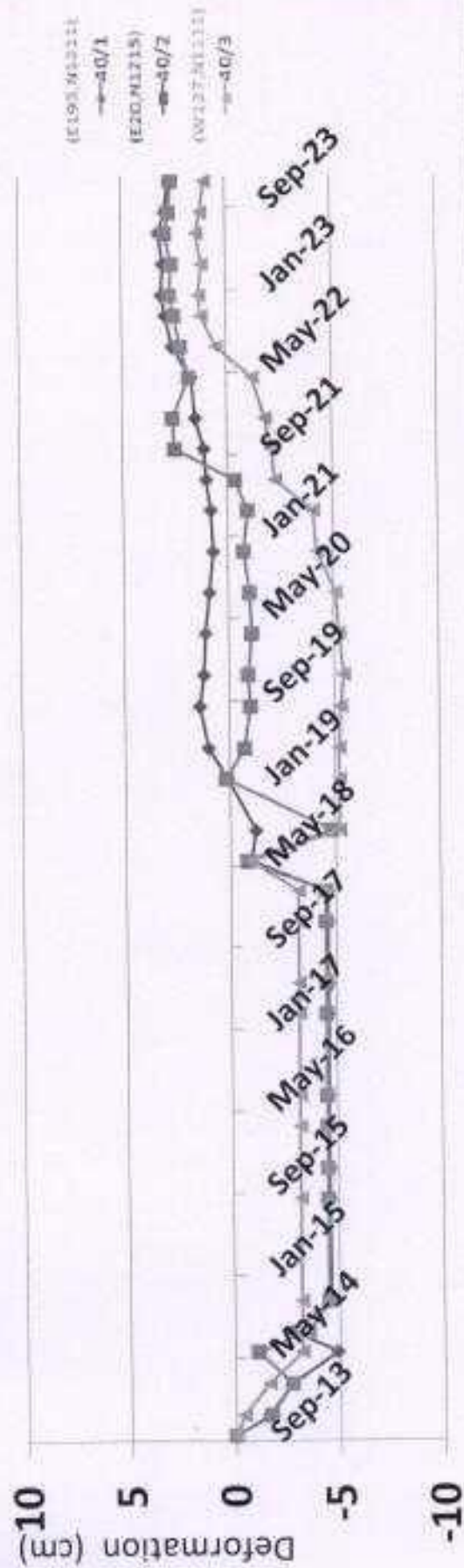
ENVIRONMENTAL EXPENDITURE DETAILS

Particulars	2023-24					
	April 2023 to Sep 2023					
Expenditure	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
	13.16	6.09	10.80	28.57	21.59	27.28
TOTAL Rs (Lacs)	107.49					

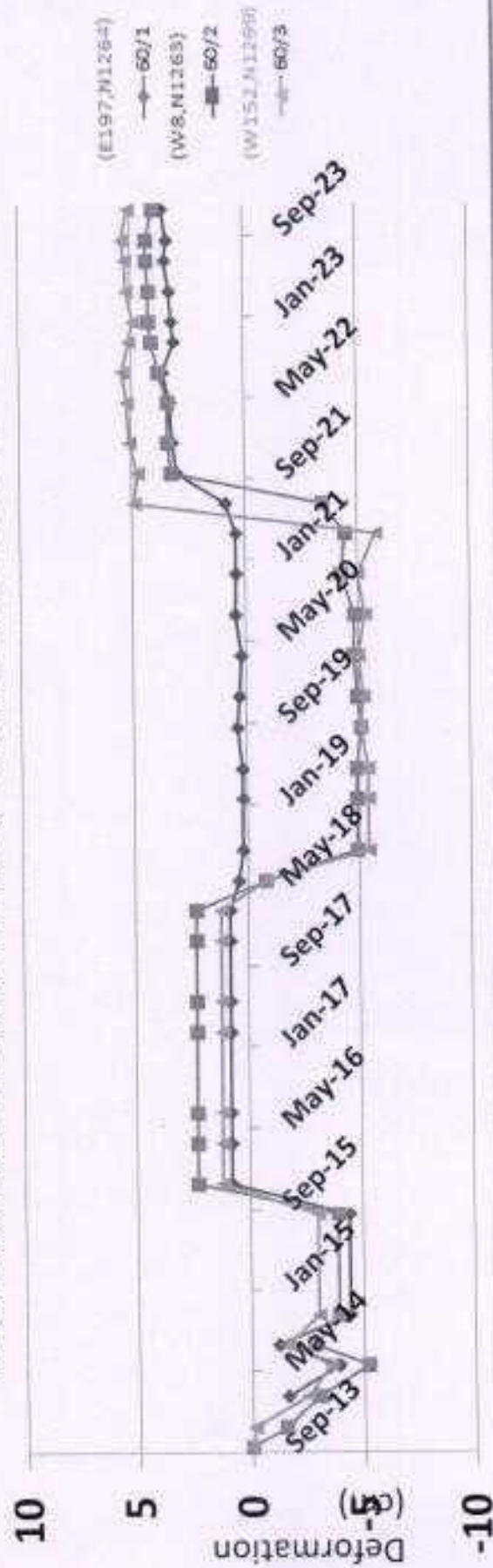
Radhika

Dump Slope monitoring Data: Radar & pillar-prism Monitoring data for MOEF _ NOV 2023

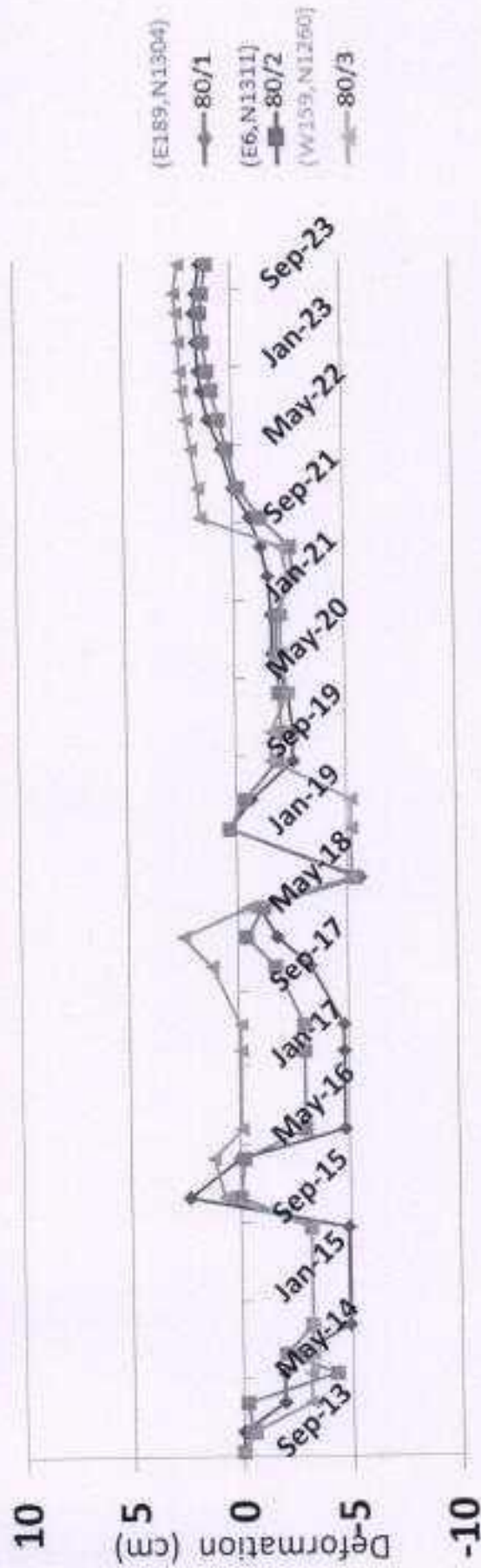
MOVEMENT: MONITORING TREND OF WASTE DUMP AT 40m LIFT BY PRISMS



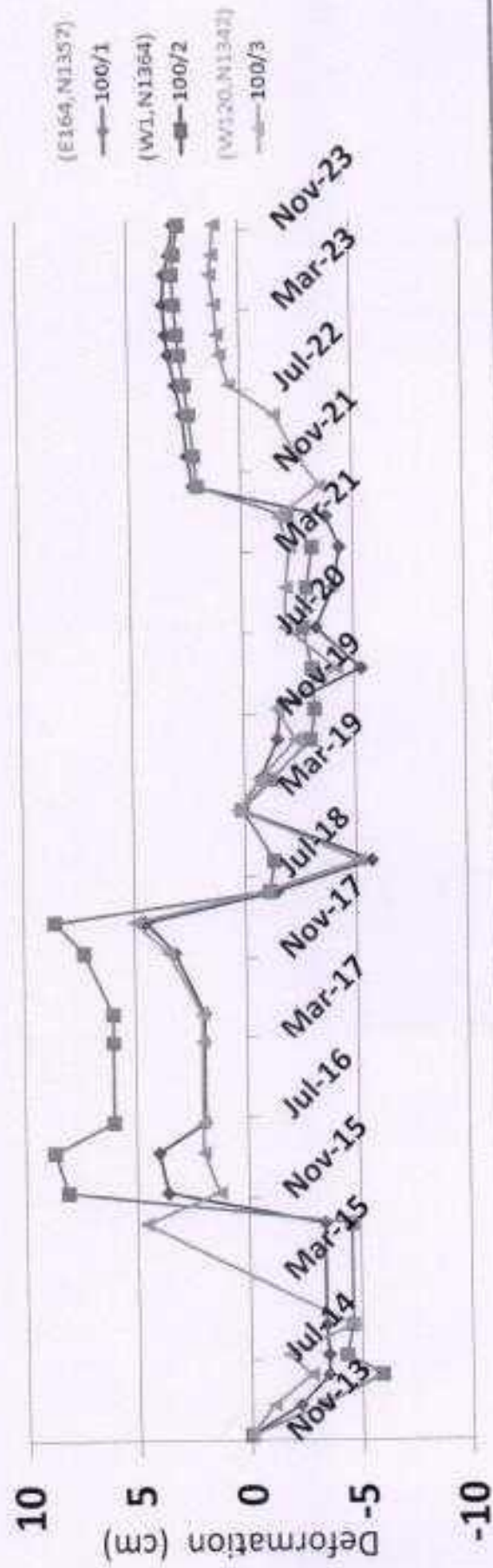
MOVEMENT: MONITORING TREND OF WASTE DUMP AT 60m LIFT BY PRISMS



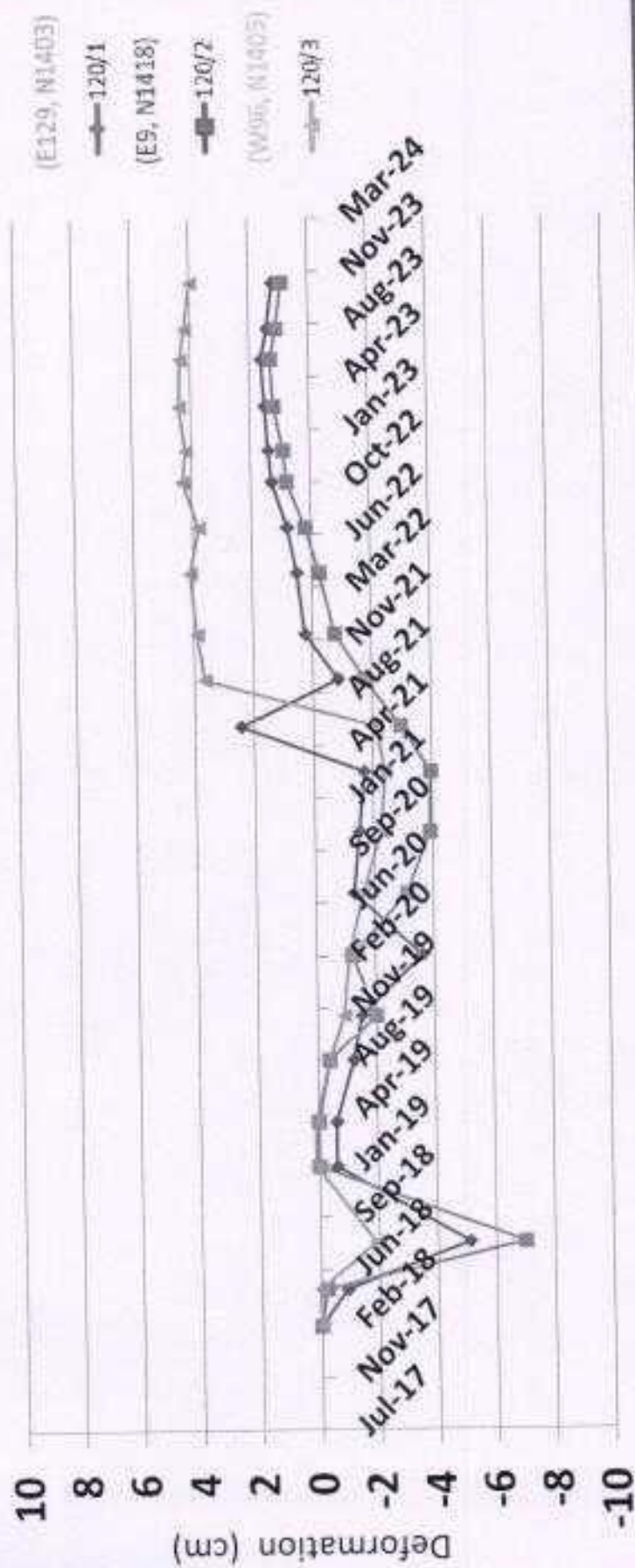
MOVEMENT: MONITORING TREND OF WASTE DUMP AT 80m LIFT BY PRISMS



MOVEMENT : MONITORING TREND OF WASTE DUMP AT 100m LIFT BY PRISMS



MOVEMENT : MONITORING TREND OF WASTE DUMP AT 120m LIFT BY PRISMS



Slope Stability Radar monitoring on waste Dump Area

D H C A R ΔC ΔA ΔR SRA DSR EDM EDP 12/11/2023 15:42



X: 1.000 Y: 16.000 D: 0.2 mm A: 51.265 R: 449.30 m C: 0.996 (3.85x3.81)m

FIGURES Enhanced Deformation



Slope Stability Radar monitoring on waste Dump Area

12/11/2023 15:42



X: 4.000 | Y: 18.000 | D: 115.1 mm | A: 49.033 | R: 474.53 m | C: 0.342 | (4.07x4.03)m

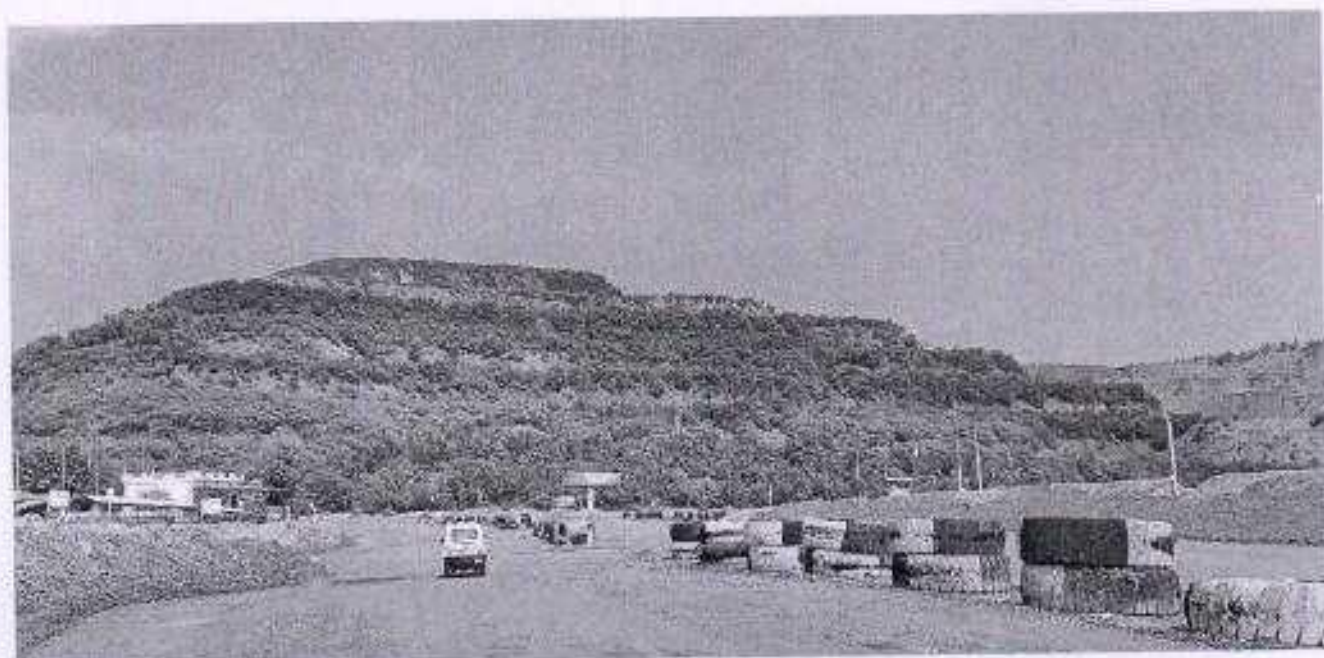
FIGURES Enhanced Deformation





Garland Drain Photo





Plantation

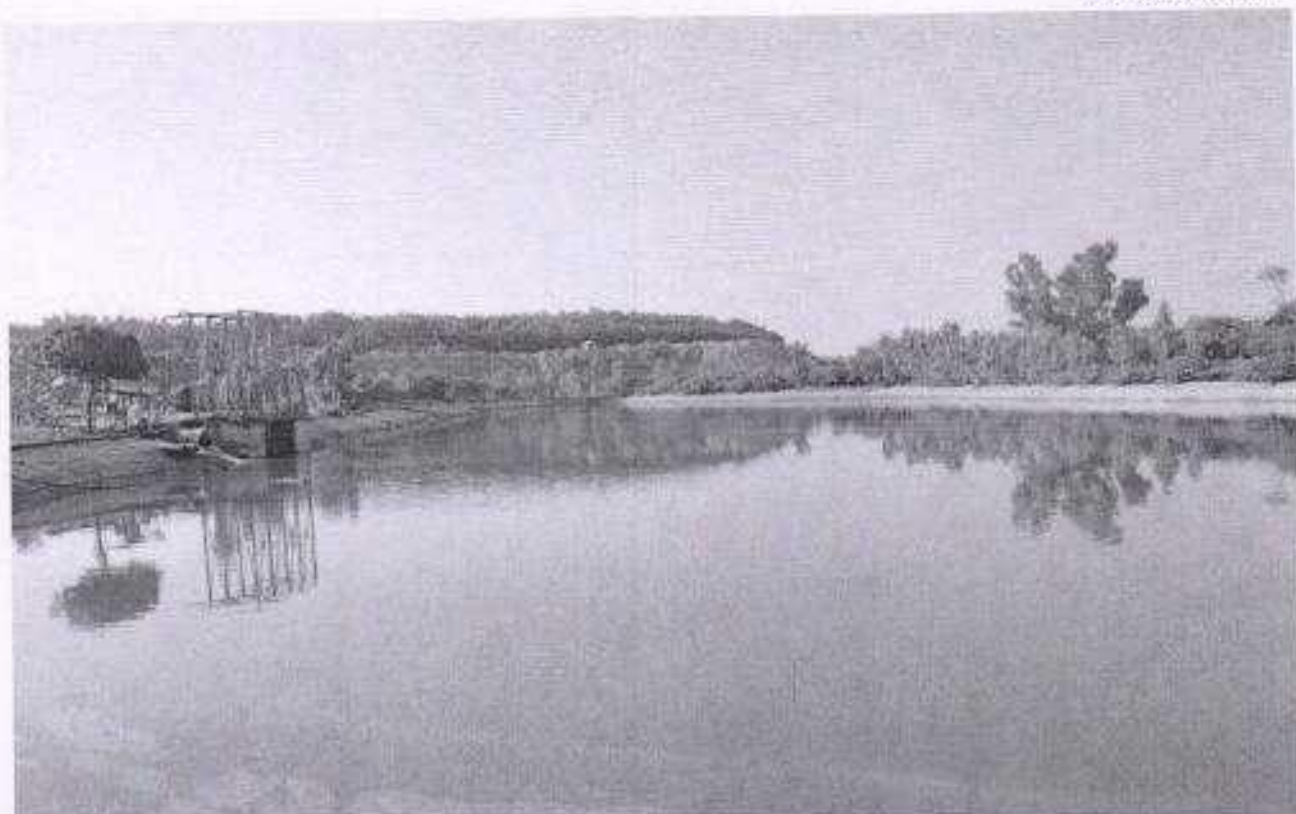


40KL Water sprinkler

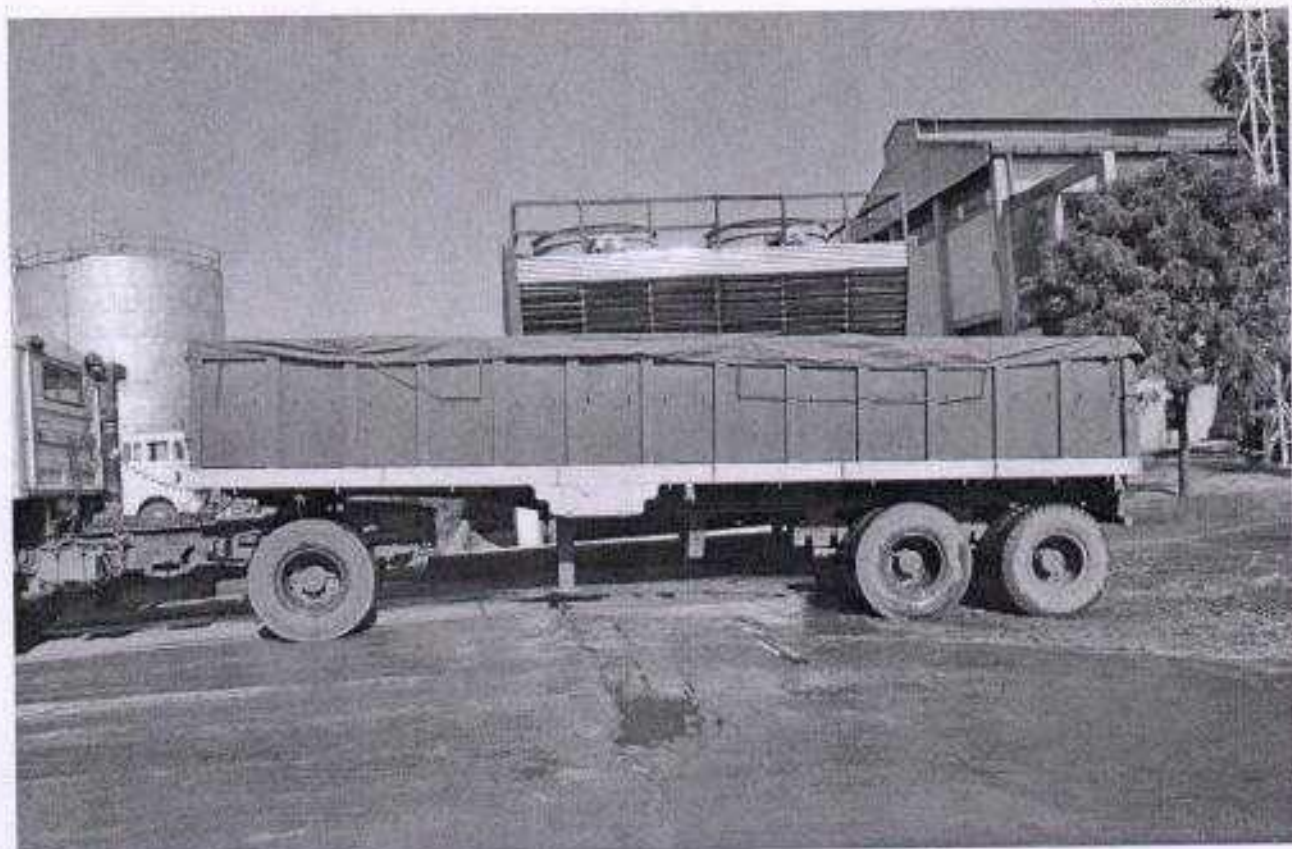
Annexure XI



Anicut Photos



Pond Photo



Truck covered with tarpaulin

**Land use mapping of 15 km radius area of Rampura-Agucha mine
of the year 2023 using remote sensing techniques and
showing the changes in land use in the last five years**



Sponsor: Hindustan Zinc Limited, Rampura-Agucha Mine, Bhilwara

Studied by:



Estb: 1988

Studied for:



Hydro-Geosurvey Consultants Private Limited



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June, 2023

**Land use mapping of 15 km radius area of Rampura-Agucha mine
of the year 2023 using remote sensing techniques and showing the changes
in land use in the last five years**

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1.0 INTRODUCTION

After discovering Lead and Zinc mineral deposit near villages Rampura and Agucha, tehsil Hurda, district Bhilwara in the year 1977, the Hindustan Zinc Ltd., (HZL) commenced the mining operations in the year 1991 in the lease area of 1200 hectares with a capacity of 3000 TPD of ore production and treatment. The mine and mill capacity was expanded to 4500 TPD day during 1998-99. After expanding the capacity to 6100 TPD, it is now producing 6.15 MTPA along with its beneficiation.

The open cast mine has now been shut down leaving an open mine pit with ultimate depth of 420 metres (-30 mRL) while underground mining is continuing after leaving a barrier of 60 metres. Although, a barrier of 60 metres has been provided between open cast mine pit and underground mine, there will be inflow of ground water in the underground mine through the mineralized zone which is highly sheared and fractured and behaves as a good conduit of water from the bottom of the open cast mine to the underground mine.

The mining lease area covers an area of 1200 hectares and lies between the latitudes $25^{\circ} 49' 9.79''$ North to $25^{\circ} 5' 1.58''$ and longitude $74^{\circ} 34' 3.95''$ to $74^{\circ} 46' 0.72''$ East and lease area falls in Survey of India toposheet Nos. 45 K/9 and 45 K/13 on 1: 50,000 scale and forms a part of Hurda tehsil of Bhilwara district.

For fulfilling the compliance of the condition of the Ministry of Environment and Forests to submit land use maps once in five years by digital processing of 15 km radius area of Rampura- Agucha mine using remote sensing techniques, the HZL has been getting the land use studies done by Hydro-Geosurvey Consultants Pvt. Ltd. The earlier Land use /Land cover was done in the year 2018 and indicated the changes which had taken place during the period of five years.

The HZL decided to award the land use /land cover studies of 15 km radius of Rampura-Agucha mine for the year 2023 to Hydro-Geosurvey Consultants Private Limited (HCPL), who has been preparing the land use maps by digital processing of other mines like





Rajpura- Dariba, Zawar group of mines, Sindesar Khurd, Maton mine etc, and to find out the changes in the land use as compared to the earlier years..

HCPL procured the IRS-R2A digitized satellite imagery of the area from National Remote Sensing Agency, Hyderabad to prepare the land use maps of 15 km radius area covering 706.23 km² (the same area as covered under previous study by HCPL) by identifying the different land use units and the area of each land use unit of the total area. Thematic layer on the drainage showing, major and minor drainage with surface water bodies have been prepared and are submitted with integrated land use/cover map.

The present report contains the land use/land cover map of the area as required by the MoE&F and shows the area of each land use unit and its percentage within the area. Each land use unit has been discussed with respect to its nature, composition etc. The change in the land use during the last five years has also been indicated.

2.0 HYDROLOGY

2.1 Physiography of Banas river basin

The lease area lies in Banas river basin while it is drained by ephemeral rivers, Khari in the north and Mansi river in the south of the lease area. The lease area is located in the water shed divide of both the rivers (**Figure-4**) like Mansi, Sameilya Nadi and Khari which are tributaries of river Banas. Mansi river originates in hills western part of the district and after flowing for 50 km in northeast, it meets Khari river near village Phuliya in Bhilwara district. Khari river originates in the hills near Deogarh in Rajsamand district. It flows northeast for 192 km through Rajsamand, Bhilwara and Ajmer districts before joining Banas river near village Chosla in Ajmer district. Sameliya Nadi, just flowing parallel to Mansi river, originates in Raila area and after flowing for 42 km, joins Khari river near village Bisundi in Bhilwara district.

All these rivers are tributaries of river Banas which originates in the eastern slopes of the Aravali ranges near Kumbhalgarh and after flowing eastwards for about 512 km through districts of Rajsamand, Chittorgarh, Bhilwara, Tonk, and Sawai Madhopur meets Chambal



river near Rameshar village in Sawai Madhopur district. The Banas river basin covers an area of 47,052 sq.km.

Rampura-Agucha mine is located 52 km NNE of Bhilwara having 25° 50' North latitude and 74° 44' 15" East longitude. The general elevation of the land is about 390 metres above MSL and the mine falls in Survey of India toposheet Nos. 45 K/9 and 45 K/13 and forms a part of Hurda tehsil of Bhilwara district.

The area in general has alluvial soils of fluvial origin with varying depths from shallow to moderate with weathered rock in the sub-stratum.

2.2 Mansi and Khari river sub-basins

Rampura-Agucha mine area is drained by river Mansi which flows on its southern side. Northern area is drained by river Khari and both meet near village Phuliya about 25 km down stream from Rampura-Agucha mine. The catchment area of Mansi river is around 1750 sq.km before joining Khari river while the catchment area of Khari river is around 1845 sq.km. Both these rivers have been harnessed by minor and medium irrigation projects, details of which have been provided in **Table-1**.

Two dams, Sareri and Arwar have been constructed on Mansi river while Nahar Sagar has been constructed on Sameliya Nadi. Agucha pond gets water from local catchment area. Only Arwar dam and Agucha ponds are located in the buffer zone while Sareri and Nahar Sagar dams are located just outside the buffer zone. However, a part of the command area of Sareri dam is located in the buffer zone while entire command area of Agucha pond lies in this buffer zone.

2.3 Surface water reservoir of Mansi-Khari river sub-basin

Table-1. Minor and medium irrigation projects in the area

S. No.	Project Name	DSB No.	Catchment Area (km ²)			Live Storage	CCA Ha.
			Total	Intercepted	Free		





						Mm ³	
1.	Agucha	4	89.3	36.3	53.1	4.5	633
2.	Arwar	4	1145	565	580	47.8	7391
3.	Nahar Sagar	4	539	195	344	24.5	3310
4.	Sareri	4	1652	603	1049	83.5	9712

DSB - Differential Sub-Basin

CCA- Culturable Command Area

Source - Irrigation department, 1996

2.4 Drainage pattern

Although there is a well- defined drainage system having dendritic drainage pattern in the buffer zone, a major part of drainage has been harnessed by constructing medium and minor irrigation projects. Whatever runoff is produced by the annual rainfall of 400 mm in the buffer zone, major part goes as surface runoff after meeting the evapo-transpiration losses and part percolates to the zone of saturation.

2.5 Run-off

Average annual rainfall in the catchment area of Mansi-Khari river sub-basin is 557 mm out of which 516 mm happens to be during monsoon period from June to October. Winter monsoon is low, hardly contributing any surface runoff. The surface run-off in the river sub-basin has been computed as 15 to 18% based on the storage of medium irrigation dams.

2.6 Climate

There is no IMD meteorological station in Mansi-Khari river sub-basin, the nearest station being at Ajmer which is 80 km in north. However, the climatic conditions excluding the rainfall, are not much different in the sub-basin than recorded at Ajmer.

The Indian Meteorological Department (IMD) has divided Rajasthan in two meteorological sub-divisions, i.e. west Rajasthan and east Rajasthan and the sub-basin falls in east Rajasthan sub-division.



Based on Koppen classification of climatic pattern, the sub-basin may be classified as tropical steppe, semi-arid and hot. The year is divided into four seasons. The winter season is from mid-December to February and is followed by the hot summer season from March to mid-July including the pre-monsoon season from April to June. The period from July to mid-September constitutes the southwest monsoon season and the period from the latter half of September to mid-December as post monsoon season.

2.6.1 Temperature

Temperature records from Ajmer observatory are available for 60 years. The period from April to June is marked by a continuous increase in the temperatures. May is the hottest month of the year with a mean daily maximum and minimum temperature (in May) of 39.5°C and 27.3°C, respectively. Night temperatures in June are relatively higher than the May. With the onset of southwest monsoon by about mid-June, the temperatures go down considerably. From November onwards, both the day and night temperature decrease and January, the coldest month, with daily maximum and minimum temperatures of 22.2°C and 7.3 °C. The range in temperature i.e. the difference between extreme maximum and minimum temperature, may be over 45°C. The highest temperature for the period for which data are available was 45.6°C recorded on 11th June 1901 while the lowest temperature -2.8°C recorded on 16th January 1935.

2.6.2 Rainfall

Average annual rainfall based on rainfall data recorded at the mine for the last 36 years has been observed as 535.03 mm. The rainfall recorded from the year 2010 to the year 2014 at the mine was higher than the average annual rainfall of 535.03 mm. During the year 2011, it was measured as 1017 mm, which created water logging conditions over a major part of the area, down stream side of the tailing pond and around the plant.

Of the annual rainfall, about 90% fall during four monsoon months (June to September) with July and August getting the maximum rains. The following table gives the annual rainfall recorded at the mine, since 1987.



Table-2. Rainfall in mm recorded at Rampura-Agucha mine

Year	Rainfall (mm)	Year	Rainfall (mm)
1987	440.00	2005	418.00
1988	508.00	2006	792.00
1989	455.00	2007	721.00
1990	806.00	2008	472.00
1991	315.40	2009	289.00
1992	288.40	2010	951.00
1993	294.50	2011	1017.00
1994	457.00	2012	747.00
1995	308.50	2013	749.00
1996	480.60	2014	709.50
1997	453.00	2015	471.00
1998	309.00	2016	814.00
1999	180.00	2017	491.00
2000	352.00	2018	611.80
2001	428.00	2019	847.50
2002	153.00	2020	504.00
2003	575.00	2021	791.00
2004	604.00	2022	457.80
Average rainfall for the last 36 years			535.03

Source: RA Mine

2.6.3 Humidity

Relative humidity during the southwest monsoon is generally over 60%. During the rest of the year air is normally dry. Relative humidity during summer afternoons is as low as 20% while during monsoon, it does not go more than 80%. The mean annual humidity values in the morning are 65.4% and in the evening 37.6%.

2.6.4 Winds

Winds are generally light to moderate, except during the southwest monsoon season, when these are moderate to strong. From May to September, winds blow mostly from the direction from northwest to southwest. In the post monsoon and winter months, winds are mostly from the direction lying between northeast and northwest. Mean wind speed is highest in June (14.6 km/hour) and lowest in November (2.3 km/hour).

2.6.5 Cloudiness



Skies are generally moderately to heavily clouded during southwest monsoon season, being overcast on some days. During the rest of the year, the skies are normally clear to lightly cloud. During the months of July-August, the mean cloudiness (in Oktas) is usually more than 5, being generally higher in the evenings than the mornings.

Table-3. Meteorological data as recorded at Ajmer

Month	Temperature		Relative Humidity		Mean Wind Speed	Mean Cloudiness	
	Mean Daily Max °C	Mean Daily Min °C	08:30 %	17:30 %	Km/hr	08:30 Oktas	17:30 Oktas
Jan.	22.2	7.3	65	36	3.4	1.5	1.5
Feb.	25.3	9.9	53	25	4.4	1.7	2.0
Mar.	30.7	15.7	40	20	6.3	1.6	2.0
Apr.	35.9	21.9	31	17	8.4	1.4	2.2
May	39.5	27.3	39	20	13.1	1.1	2.0
Jun.	38.1	27.7	56	34	14.6	2.4	3.3
Jul.	33.2	25.6	75	59	11.6	5.0	5.5
Aug.	33.2	24.3	80	66	9.5	5.1	5.4
Sep.	32.1	23.7	70	52	8.4	2.9	3.5
Oct.	32.9	17.8	53	29	4.0	1.1	1.6
Nov.	28.9	10.9	54	28	2.3	1.1	1.3
Dec.	24.4	7.7	62	33	2.5	1.5	1.5
Annual Mean	33.6	19.8	65.4	37.6	7.0	2.2	2.7

3.0 HYDROGEOLOGY

3.1 Physiography of lease area

Physiography of the lease area is characterized by plain area with isolated low raised hill. The general slope of the area is towards the southwest and towards the Agucha village tank. The general elevation of the lease area ranges from 384 metres, amsl (above mean sea level) to 391 m amsl. But after the mining, the topography has changed considerably due to dumps, mining, and tailing pond.

3.2 Regional geology

The geology of the area is mainly composed of thin alluvial cover, belonging to Sub-Recent to Recent period of Quaternary Era followed by Banded Gneissic Complex (BGC) of Bhilwara Group of Lower Proterozoic Era. The geological succession can be



summarized as under:

Table-4. Geological succession of the area

Era	Age	Super Group	Group /Formations	Rock Types
Quaternary	Sub-Recent to Recent	Fluvial & Colluvium	Alluvium	Sand, silt, clays gravel etc.
Unconformity				
Proterozoic		Aravali	Devda	Quarzites, phyllites, dolomites etc.
Lower Archaeans Proterozoics		Bhilwara		Banded Gneissic Granites, Gneisses, Schists, migmatites

3.3 Hydrogeology of lease area

Of all the rocks exposed in the area, only banded gneissic complex forms very poor aquifer while alluvium generally thin, remains above water table. It is only during the post monsoon period that basal part of alluvium gets saturated in the area along river courses.

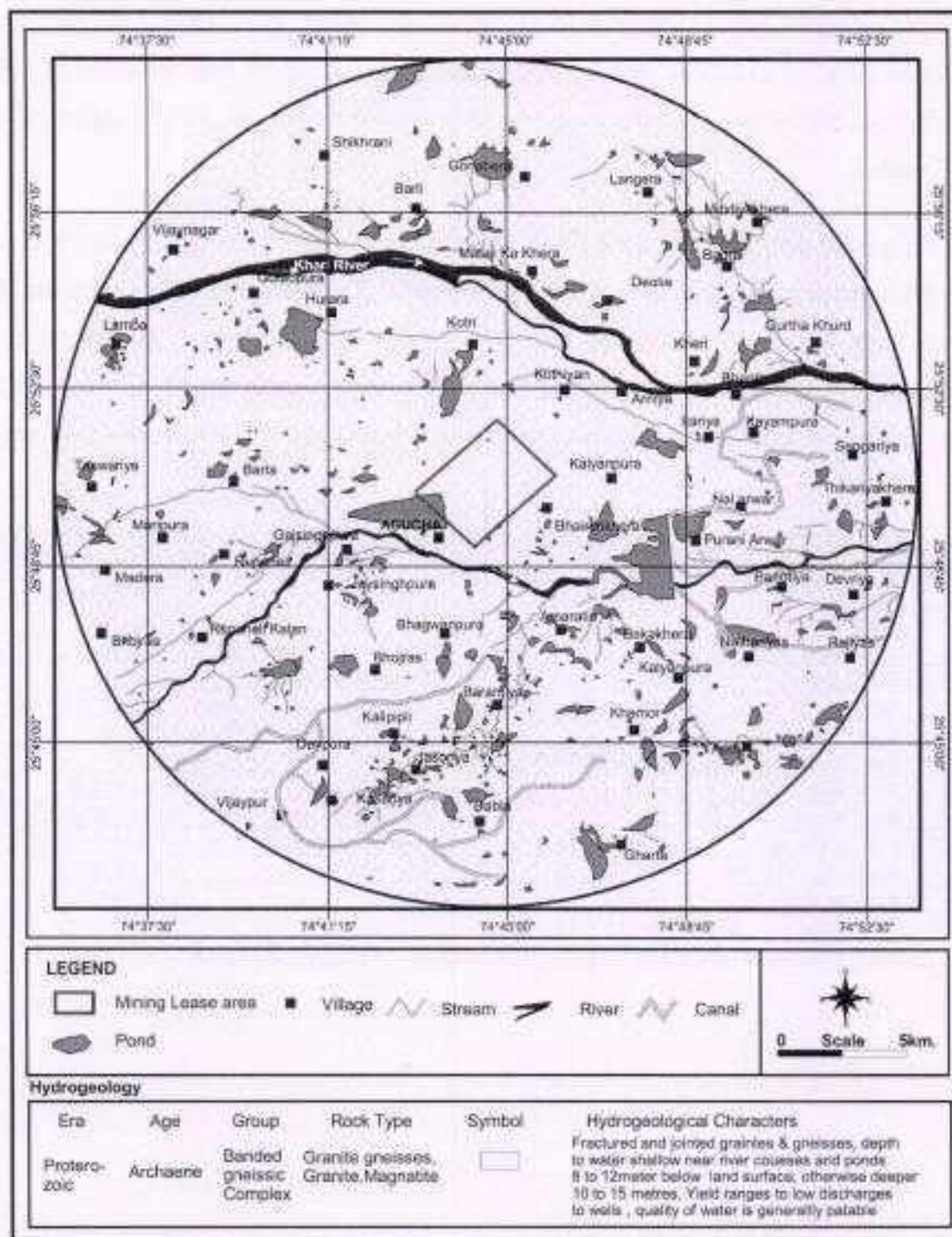
3.3.1 Nature of occurrence of ground water in lease area

Ground water occurs under water table conditions and is transmitted through fractures, joints and foliations. BGC rocks are impervious in nature and have developed secondary porosity only due to joints and fractures. There is very limited thickness of weathered BGC rocks and generally it lies above the zone of saturation.

The depth of water table in BGC rocks ranges from 8 to 10 metres below the land surface near the river courses, surface water reservoirs and ponds during post monsoon period while it is deeper in the area from 10 to 20 metres below the land surface. The fluctuations due to rainfall and ground water withdrawal are significant as the rocks have very low fracture porosity and hydraulic conductivity.

Figure-1: Hydrogeological map of the buffer zone of lease area





4.0 METHODOLOGY

4.1 Data source



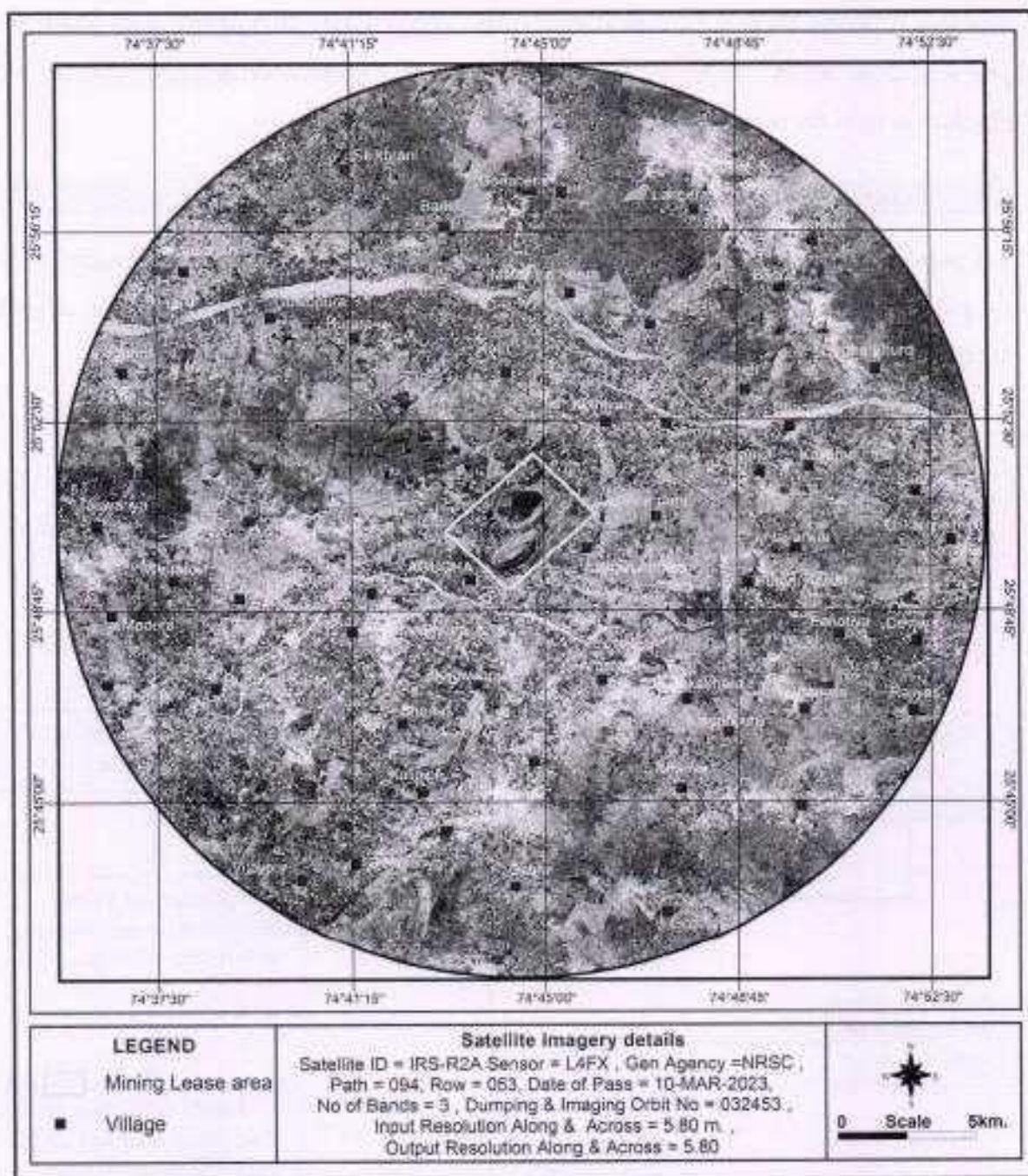
For preparing the land use map of 15 km radius area along with different thematic layers, satellite data for cloudless day for pre monsoon period, 2023 was asked from NRSC, Hyderabad. NRSC provided the imagery available with it. The details of imagery as given in **Table-5**.

This digitized data has been used for preparing the Land use /Land cover map of the area. Satellite imagery of the area is shown as **Figure-2**. The base map information has been noted from Survey of India Toposheet Nos. 45 K/9 & K45/13 on 1: 50,000 scale. The collateral information on hydrogeology was used, collected earlier by HCPL while carrying out hydro-geological investigations of the core and buffer zones of Rampura-Agucha mine.

Table-5. Imagery specifications

S. No.	Specification:		S. No.	Specification:	
1.	Satellite ID	IRS-R2A	14.	Prod Code	STUC00GTD
2.	Sensor	L4FX	15.	Prod Type	ORTHO
3.	Sub Scene	D	16.	Input Resolution Along	5.80 m.
4.	Gen Agency	NRSC	17.	Input Resolution Across	5.80 m.
5.	Path	094	18.	Output Resolution Along	5.00 m.
6.	Row	053	19.	Output Resolution Across	5.00 m.
7.	Date of Pass	10-MAR-2023	20.	Season	MAR
8.	No of Bands	3	21.	Image Format	GEOTIFF
9.	Band Numbers	234	22.	Processing Level	ORTHORECTIFIED
10.	Date of Dump	10-MAR-2023	23.	Map Projection	UTM
11.	Dumping Orbit No	032453	24.	Ellipsoid	WGS 84
12.	Imaging Orbit No	032453	25.	Datum	WGS 84
13.	Generation Date Time	04-MAY-2023 10:38:26			

Figure-2. Satellite imagery of buffer zone of lease area



4.2 Approach for preparing different themes

The base map of the area, covering 706.23 km² (15 km radius) was prepared, which included all the important features like lease area, villages, main roads collected from the toposheet of the area keeping common marks for each theme. This base map was used for

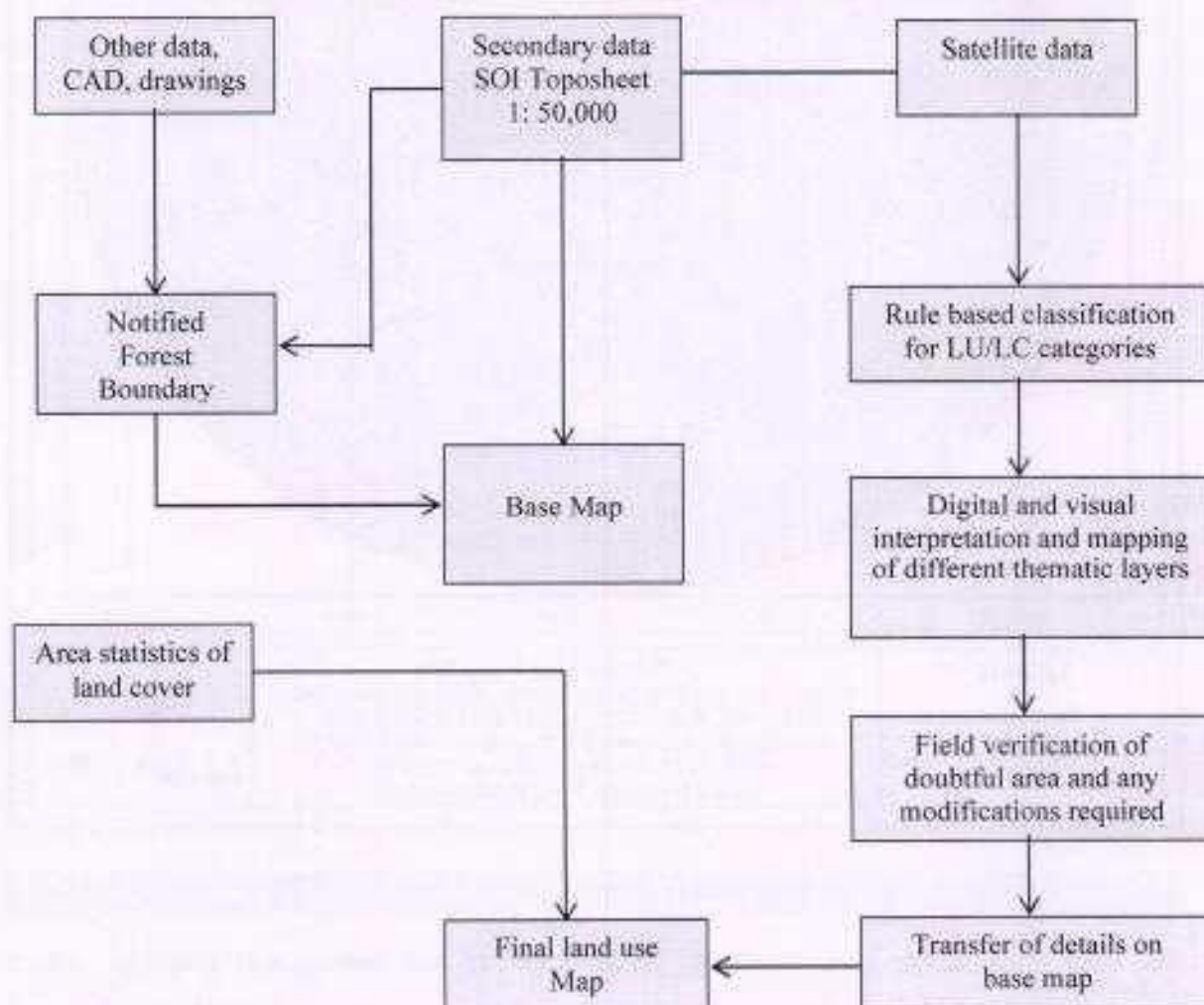


mapping different themes by digital and visual interpretation of satellite data which was procured from NRSC. These maps were converted to digital mode in GIS form and then checked in field for respective details and finalized.

4.3 Procedure followed

For preparing land use/ land cover map of study area and its respective thematic layers, the procedure as shown in the following Flow diagram was adopted. The procedure adopted for preparing each thematic layer is discussed as below.

Flow diagram showing the methodology adopted for land use mapping



4.4 Land use / Land cover map





After proper registration of satellite data, the satellite data was digitally interpreted and different categories of land use units were marked using standard digital techniques.

4.5 Thematic mapping

By adopting the methodology as mentioned above, thematic layers on land use and drainage along with estimation of area of each unit and its percentage in the study area covering 706.23 km² have been prepared. Each thematic layer is discussed as below.

4.6 Land use-Land cover classification

Land use refers to man's activities on land utilitarian in nature, whereas land cover denotes vegetation and artificial constructions.

The land use/land cover classification system standardized by Department of Space, Govt. of India for mapping different agro-climatic zones has been adopted for the classification. This classification has 6 major land use classes at level I and 25 at level II. The six major classes at level I are further enunciated below (**Table-6**):

- Built-up land- This comprises areas of land covered by structures
- Agricultural land- land used for production of food, fiber, crops and plantation
- Forest- This includes land such as dense or sparse evergreen forests, deciduous forests and degraded forests.
- Wastelands- Land having potential for development of vegetative cover but not being used due to constraints including salt affected land, eroded land water logged areas.
- Water bodies-Areas persistently covered by water such as river/streams, reservoirs/tanks, lakes/ ponds and canals.
- Others- Grassland and snow covered land are included in this category
- Using the above classification system and digital analysis techniques with restricted field checks, land use/land cover distribution in the study area has been estimated.





Table-6. Land use/Land cover classification standardized

S. No.	Level-I	Level-II	
1.	Built up land	1.1	Built up land
		1.2	Road
		1.3	Railway
2.	Agriculture land	2.1	Crop land
		2.2	Fallow (Residual) land
3.	Forest	3.1	Evergreen Forest
		3.2	Deciduous Forest
		3.3	Degraded forests
		3.4	Forest Plantations
		3.5	Mangroves
		3.6	Cropland is forest
		3.7	Forest Blank
4.	Wastelands	4.1	Salt affected land
		4.2	Waterlogged land
		4.3	Marshy/Swampy Land
		4.4	Gullied/Ravenous Land
		4.5	Land with or without scrub
		4.6	Sandy Area (Coastal and Desertic)
		4.7	Barren rocky/Stony Waste/Sheetrock area
5.	Water Bodies	5.1	Rivers/Streams
		5.2	Lake/Reservoir
		5.3	Tank/Canal
6.	Others	6.1	Grassland/grazing land
		6.2	shifting Cultivation
		6.3	Snow cover/Glacial area

4.7 Approach for preparing different themes

The spatial resolution and the spectral bands in which the sensors collect the remotely sensed data are two important parameters for any land use survey. Appropriate remote sensing data were processed to investigate land use patterns through digital image processing techniques. SOI toposheets were geo-referenced to superimpose on orthorectified satellite image. Mosaicing was performed for the geo-referenced toposheets to form a continuous frame. A base map was generated from the mosaic of SOI toposheet comprising features such as administrative boundaries major roads, railways and river drainage. IRS-R2A, L4FX data offer spatial resolution of 5m x 5m. The shapes, sizes and colors of several geomorphic features are visible in the IRS data. Three spectral bands





provide a high degree of measurability through band combinations including False Colour Composites (FCC) generation, bands ratioing, classification etc. These features of the IRS data are particularly important for better comprehension and delineation of the land use classes. Hence IRS-R2, L4FX data has been used for land use mapping. The standard FCC is generated by assigning blue, green and red colours to visible green, visible red and near Infrared bands respectively. Image processing and Ortho rectifications was done in ERDAS IMAGINE (V.8.5) software and spatial data was created in Arc view GIS (Ver.3.2a) software. Area of interest comprising the study area was then selected and extracted from the satellite image. Suitable image enhancements were the applied on the extracted area on interest. A visual interpretation followed by supervised classification (digital image processing approach) was adopted to classify areas land use-cover features. Several training sets/signatures for classification were collected prior to applying supervised classification.

After evaluating the statistical parameters of trainings sets, the training areas were rectified by deleting non-congruous training sets and creating new ones. Mask of mine area was superimposed on the final output to generated area statistics for different land use categories. Classification accuracy estimation was done on the supervised classified image for further rectification. Based on this, the final estimation and results for a land use-land cover features existing in the study area were derived.

5.0 THEMATIC MAPPING

By adopting the methodology as mentioned above, thematic layers on land use and drainage (water sheds) along with estimation of area of each unit and its percentage in the study area of 706.23 km² hectares have been prepared. Each thematic layer is discussed as below.

5.1 Base map showing the settlements, villages and rural roads

There are several villages in the buffer zone and main rural roads and railway line are seen in toposheet (Figure-3) which were marked in base map and were then updated using



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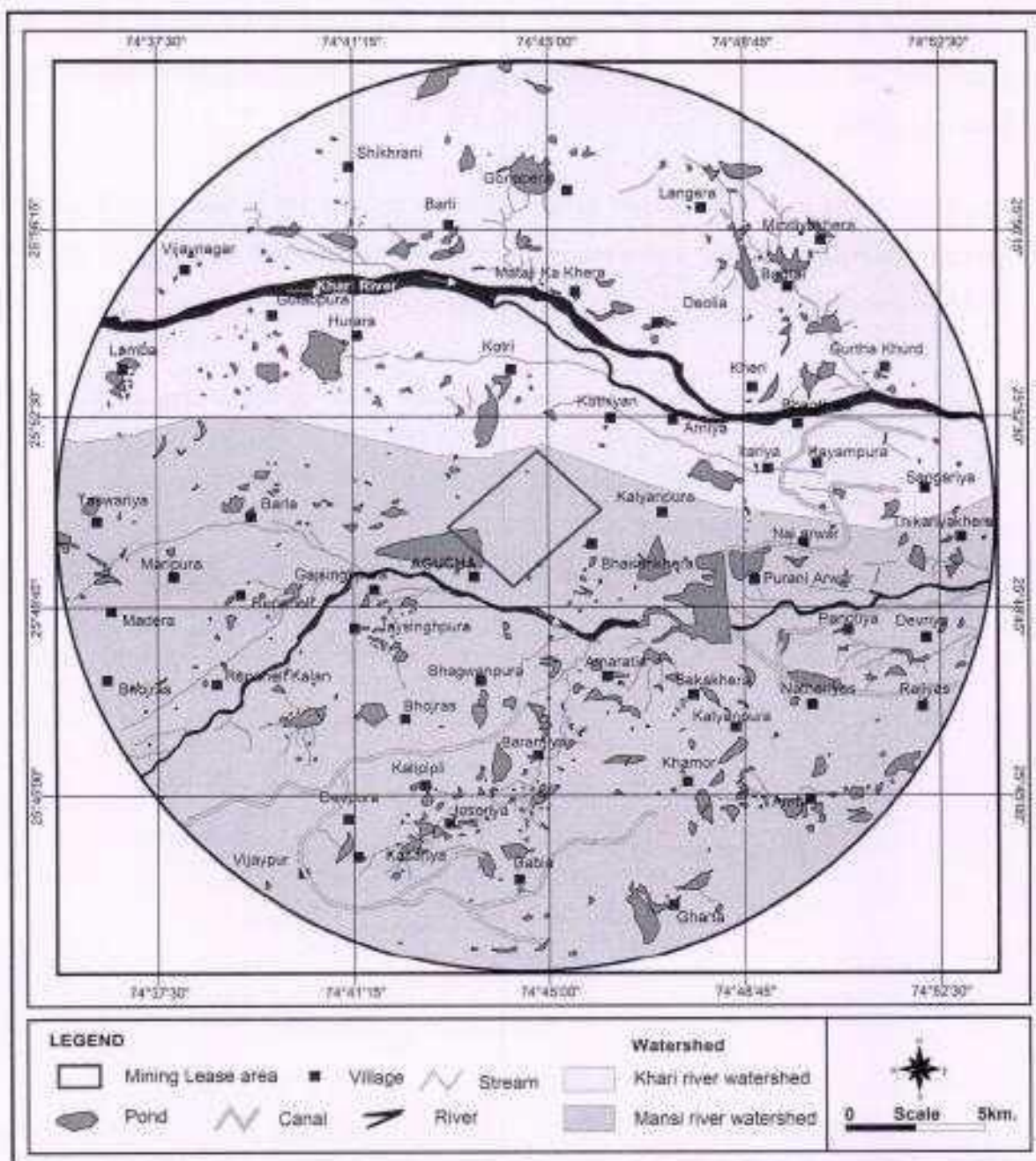
dam while a village tank near village Agucha and many other small village tanks, distributed all over the study area. Two water sheds have been demarcated and its area has been calculated.

The water sheds have been shown in two different colours for proper identification. The thematic layer for drainage and water shed is shown as **Figure-4** and area of each water shed is shown in **Table-7**.

Table-7. Area under different water sheds in study area

S. No.	Water shed name	Area (hectare)	% of the total area
1.	Khari river watershed	30110	42.63
2.	Mansi river watershed	40513	57.37
Total		70623	100.00

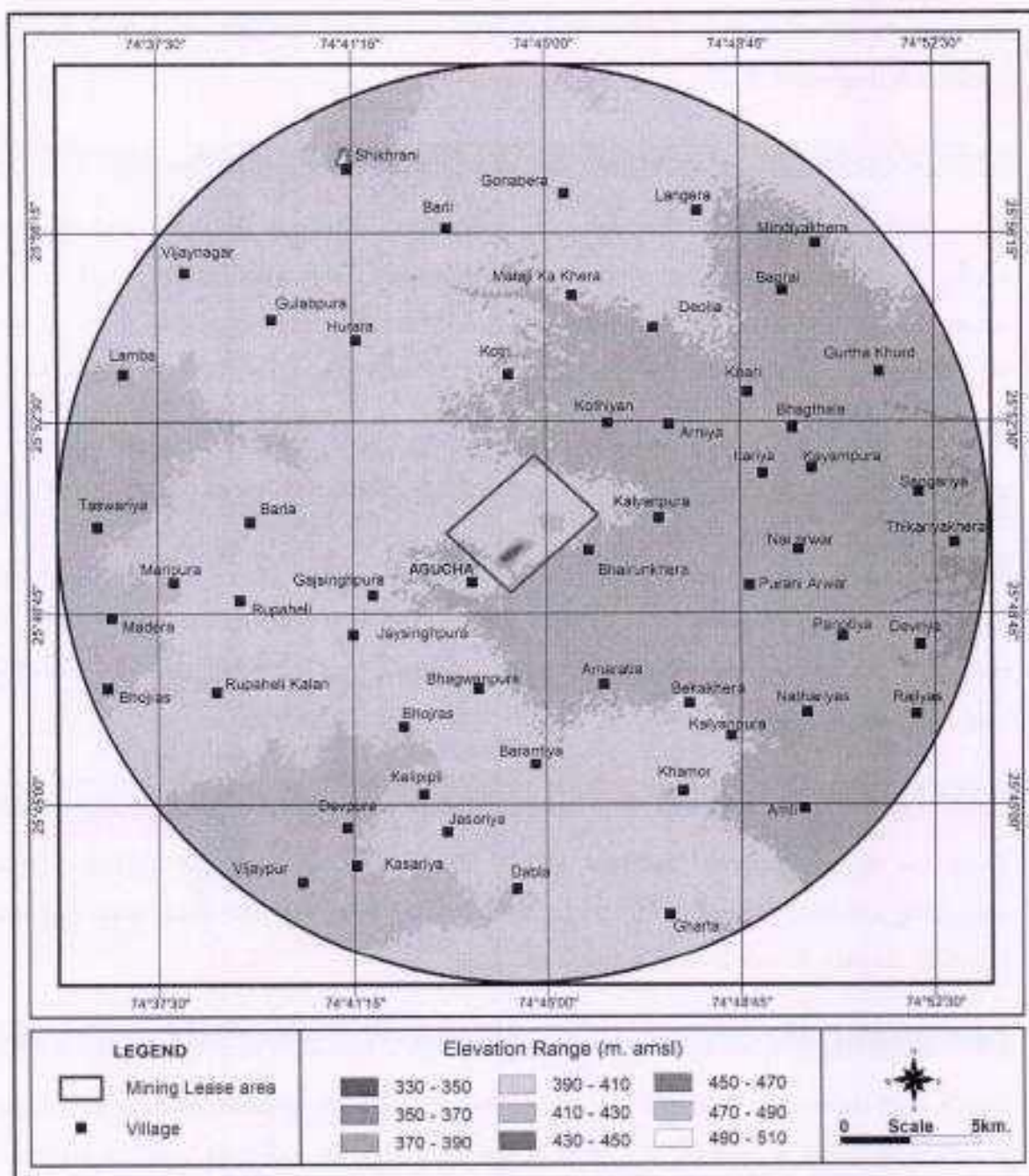
Figure-4. Drainage map of buffer zone of lease area



5.3 Digital Elevation Model

The study area (Buffer zone of 15 km.) is mainly a flat to slightly undulating area slopping towards east. The elevation ranges from 330 m asml (above mean sea level) to 510 m asml (Figure-5).

Figure-5. Digital Elevation Model (DEM) of buffer zone of lease area



5.4 Agriculture land

The study area has a large percentage of agriculture land. Out of the total land of 70,623 hectares, 46081 hectares (65.25 %) is cropping land where winter crops like Barley, wheat, gram etc. are grown during Rabi season. Only 1308 hectares (1.85 %) is fallow land where





no crops are grown. A part of the total Rabi land is irrigated by open wells, tube wells and canals (**Photoplate-1 & 2**).

5.5 Waste land

Waste land is mostly uncultivable land and is mainly classified as degraded land, land with scrubs and without scrubs, stony land, brick mud area, land with natural vegetation and barren land (**Photoplate-3**). It has been found that out of 70,623 hectares of the study area, the total waste land covering five land units covers 16,636 hectares which forms 23.56 % of the total study area.

5.6 Built up land

The built up land comprises the main urban towns like Gulabpura and Vijaynagar while there are many villages within 15 km radius area. Urban two municipal towns occupy 955 hectares (1.35 % while the rural villages and colony occupy 1765 hectares (2.50 % of the total study area) (**Photoplate-4, 5, & 6**).

5.7 Forests

There are no reserved or protected forests in the study area except degraded forests occupying a limited area of hardly 91 hectares or 0.13 % of the total study area. These are scattered all over the study area in small patches.

5.8 Water bodies

Due to well developed drainage system and two main rivers of Khari and Arwar, the area occupied by rivers is 2008 ha or 2.84 % of the study area. In addition, there is Arwar dam on Mansi river having 47.8 Mm³ of live storage of water, its canals, many village ponds and all these occupy the area of 546 hectares or 0.77 % of the total study area (**Photoplate-7, 8 & 9**).

5.9 Rampura-Agucha mine





Rampura-Agucha mine is one of the most well developed open cast base metal mine of India having a large size mine pit having 202 hectares (**Photoplate-10**), a tailing pond of 132 hectares (**Photoplate-11**), few main mine dumps having total area of 326 hectares (**Photoplate-12**) out of which 22 MW solar plant is installed on 250 hectares (**Photoplate-13**) and plantation of 348 hectares within the lease area (**Photoplate-14 to 16**). In addition, there are plant and its buildings occupying 106 hectares. The total area occupied by Rampura-Agucha mine amounts to 1056 hectares of 1200 hectares of the mining lease area. The total area occupied by Rampura-Agucha mine happens to be 1.50 % of the total study area of 70, 623 hectares.

5.10 Other industries in the study area

As the study area has two urban municipal towns of Gulabpura and Vijaynagar, there are many small scale industries which occupy 155 hectares of the land which happens to be 0.22 % of the total study area.

5.11 Integrated land use/ Land cover map

Land use /land cover mapping of the study area has been done as per standard classification. The land use units as identified are indicated in **Table-9** along with area of each unit in hectares and its percentage in the study occupying an area of 70,623 hectares as covered by HCPL, Jodhpur. The major features identified from the satellite data are discussed as under:

After integrating the different thematic layers of land use units of drainage and settlements etc., an integrated map has been prepared which is shown as **Figure-6**.

Figure-6. Integrated land use /land cover map of 15 km radius area indicating different land units



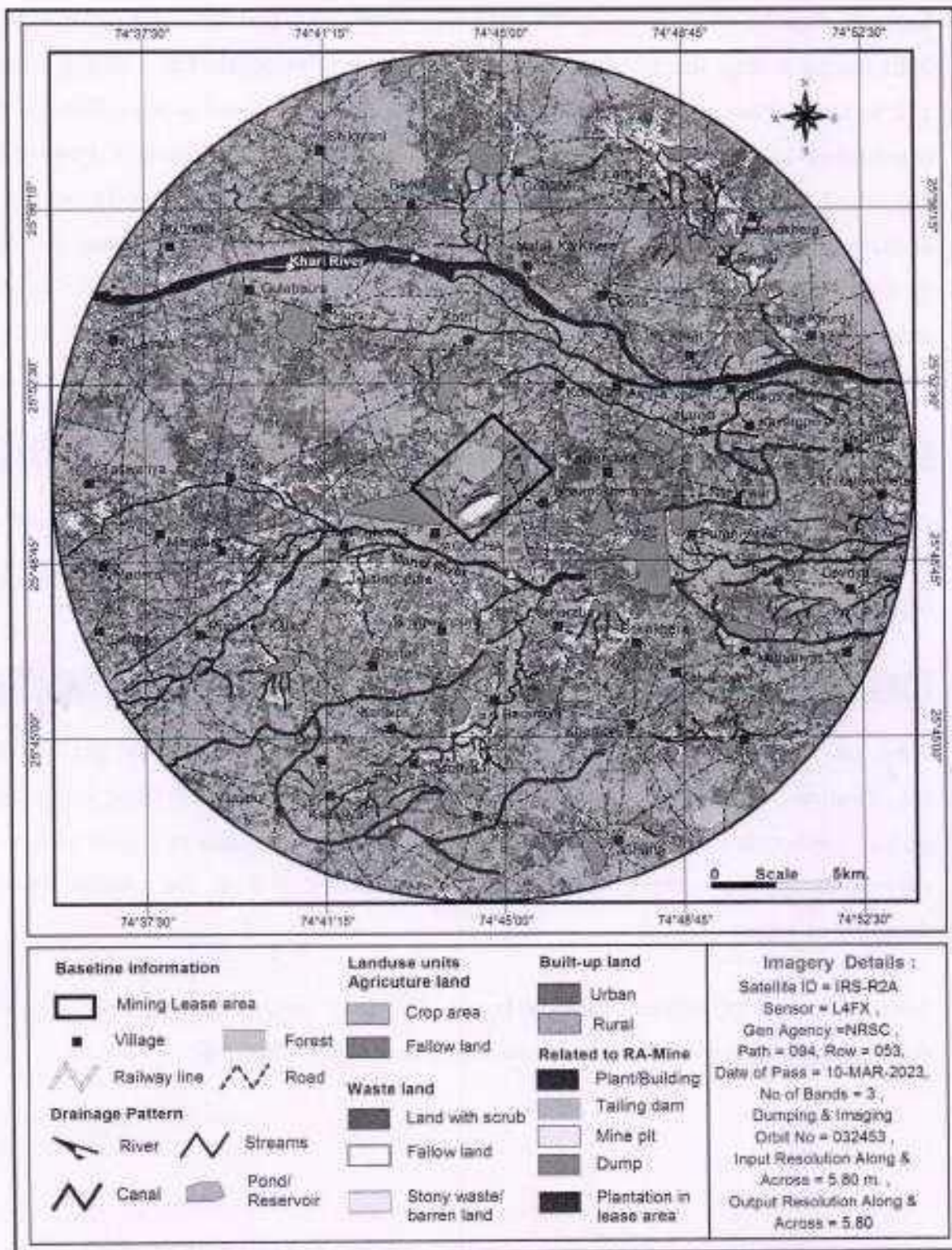


Table-8. Area under different land use classes in the study area during year 2017



S. No.	Category Level-I	Level - II	Area (In ha.)	% of the total area
1.	Agriculture land	Crop land	49358	69.89
		Fallow land	950	1.35
2.	Waste land	Land without scrub	4050	5.73
		Land with scrub	8710	12.33
		Brick mud area	490	0.69
		Natural vegetation	248	0.35
		Stony waster/Barren stony land	326	0.46
3.	Built-up land	Urban	905	1.28
		Rural	1740	2.46
4.	Forest	Scrub/Degraded forest	91	0.13
5.	Water body	River	1992	2.82
		Pond/Reservoir/Canal	560	0.79
6.	Related to R-A Mines	Plant and Buildings	106	0.15
		Tailing dam	132	0.19
		Mining pit	166	0.24
		Mine dump	371	0.53
		Plantation in lease area	282	0.40
7.	Others	Other industries in the buffer zone	146	0.21
			70623	100 %

Table-9. Area under different land use classes in the study area during year 2023

S. No.	Category Level-I	Level - II	Area (In ha.)	% of total area
1	Agriculture land	Crop land	46081	65.25
		Fallow land	1308	1.85
2	Waste land	Land without scrub	5768	8.17
		Land with scrub	9855	13.95
		Brick mud area	457	0.65
		Natural vegetation	236	0.33
		Stony waster/Barren stony land	320	0.45
3	Built-up land	Urban	955	1.35
		Rural	1765	2.50
4	Forest	Scrub/Degraded forest	91	0.13
5	Water body	River	2008	2.84
		Pond/Reservoir/Canal	546	0.77
6	Related to RA-Mines	Plant and Buildings	106	0.15
		Tailing dam	132	0.19
		Mining pit	166	0.24
		Mine dump	326	0.46
		Plantation in lease area	348	0.49
7	Others	Other industries in the buffer zone	155	0.22
			70623	100.00

6.0 CHANGES IN THE LAND USE DURING LAST FIVE YEARS



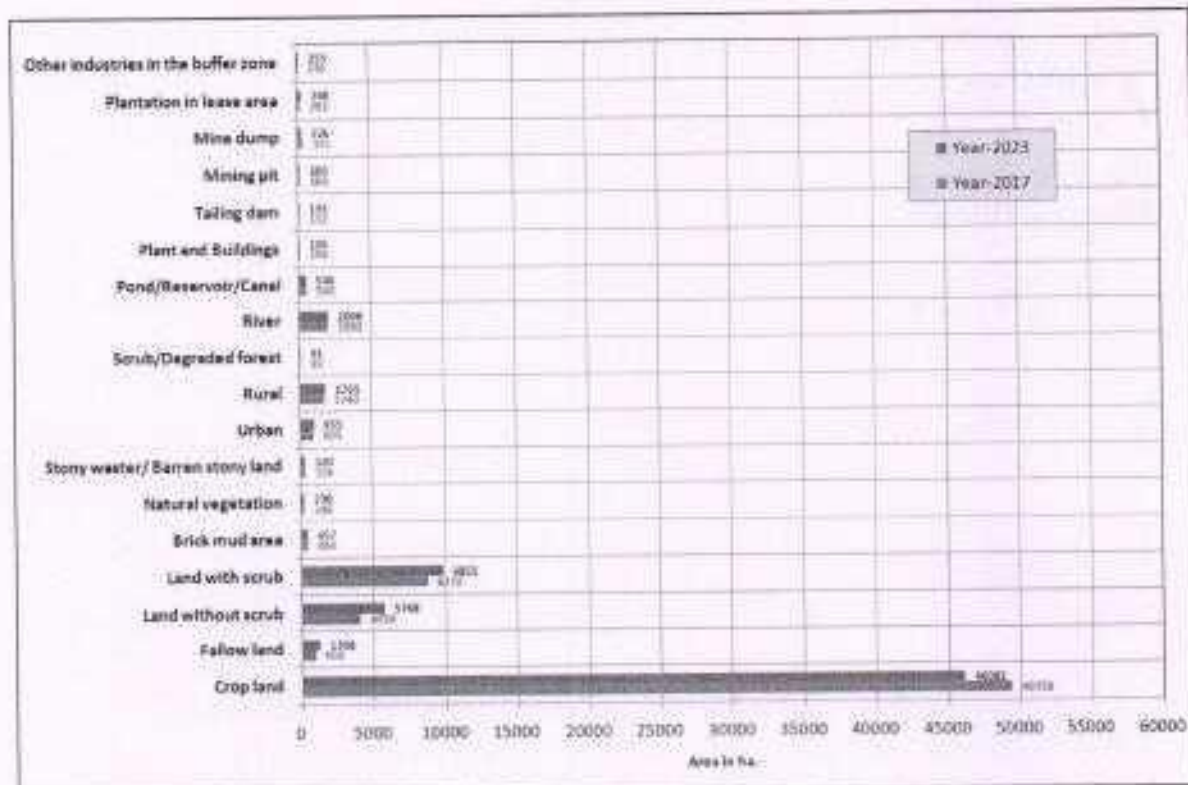
The major changes during the period of last five years in the study area can be determined while comparing the land use /land cover map prepared by HCPL, Jodhpur during the year 2017 (based on the satellite imagery of October, 2017). The land use classification is shown in **Table-10**.

While comparing the area delineated for different units of satellite imagery of October, 2017 and the satellite imagery of March, 2023 it is observed that during last five years, there has been minor changes in some land units while some units have shown significant change in land use pattern of the study area. HCPL has to covering 70,623 hectares against the area of 15 km radius from the lease comparison to find out the change in area of 70, 623 hectares.

Table-10. Changes in land unit during the period of Five years (October, 2017 to March, 2023)

S. No.	Category Level-I	Level - II	Area (In ha. 2017)	Area (In ha. 2023)	Changes in area (ha.)	Net changes in land units in %
1	Agriculture land	Crop land	49358	46081	-3277	-6.64
		Fallow land	950	1308	+358	+37.68
2	Waste land	Land without scrub	4050	5768	+1718	+42.42
		Land with scrub	8710	9855	+1145	+13.15
		Brick mud area	490	457	-33	-6.73
		Natural vegetation	248	236	-12	-4.84
		Stony waster/ Barren stony land	326	320	-6	-1.84
3	Built-up land	Urban	905	955	+50	+5.52
		Rural	1740	1765	+25	+1.44
4	Forest	Scrub/Degraded forest	91	91	0	0.00
5	Water body	River	1992	2008	+16	+0.80
		Pond/Reservoir/Canal	560	546	-14	-2.50
6	Related to RA-Mines	Plant and Buildings	106	106	0	0.00
		Tailing dam	132	132	0	0.00
		Mining pit	166	166	0	0.00
		Mine dump	371	326	-45	-12.13
		Plantation in lease area	282	348	+66	+23.40
7	Others	Other industries in the buffer zone	146	155	+9	+6.16
			70623	70623		

Figure-7: Changes in land unit (in ha.) during the period of Five years (October, 2017 to March, 2023)



7.0 CONCLUSIONS

While comparing the area occupied by different land units, it is observed from the Table-10 that there has been minor or insignificant changes in the land units of crop land, waste land, except natural vegetation, built-up land and forests and other units of water bodies and Rampura-Agucha mine except mine pit and mine dumps. The increase in the mine pit and mine dump is obvious as there has been regular mining activity during five three years with the dumps getting more waste rock to be stored. There are no changes in mine pit its 166 ha because its underground working from year, 2017. The plantation are done by HZL and its increased by 23.40 % from 282 to 348 hectares.

However, the changes during last five years do not indicate any adverse impact on the land environment due to mining activity being carried out in Rampura-Agucha mine.

for Hydro-Geosurvey Consultants Pvt. Ltd.,



Land use mapping of 15 km radius area of Rampura-Agucha mine
of the year 2023 using remote sensing techniques and
showing the changes in land use in the last five years



Hindustan Zinc Limited

(Dr. V.B. Khilnani)
Managing Director

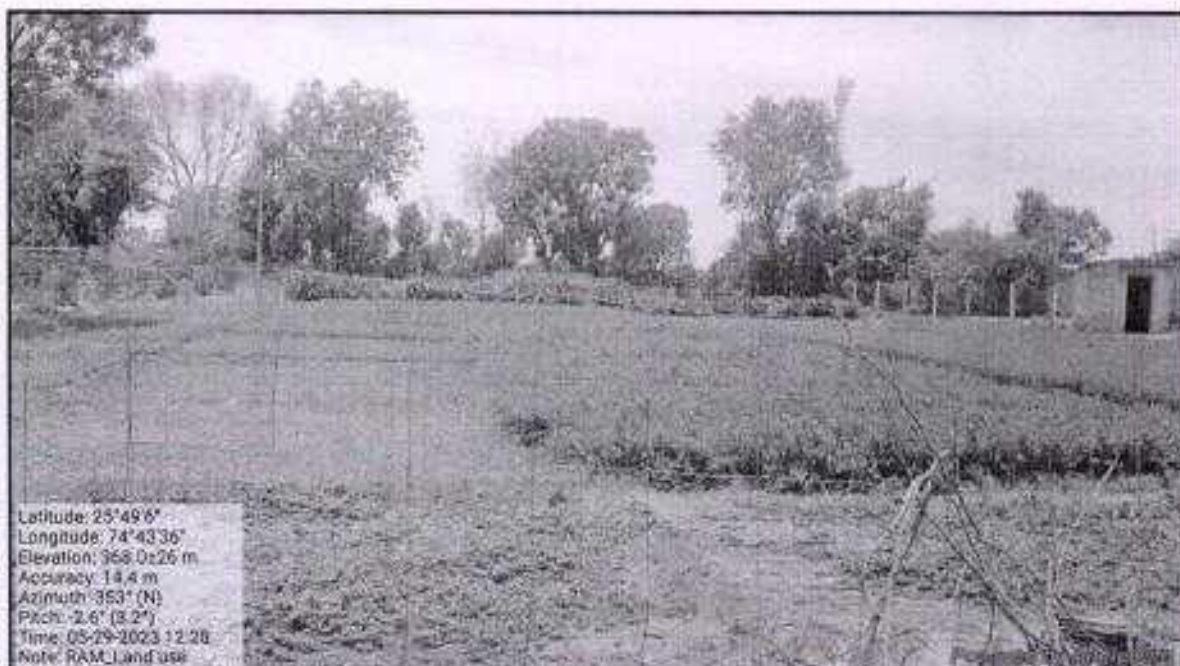
Photoplate-1. Agriculture land



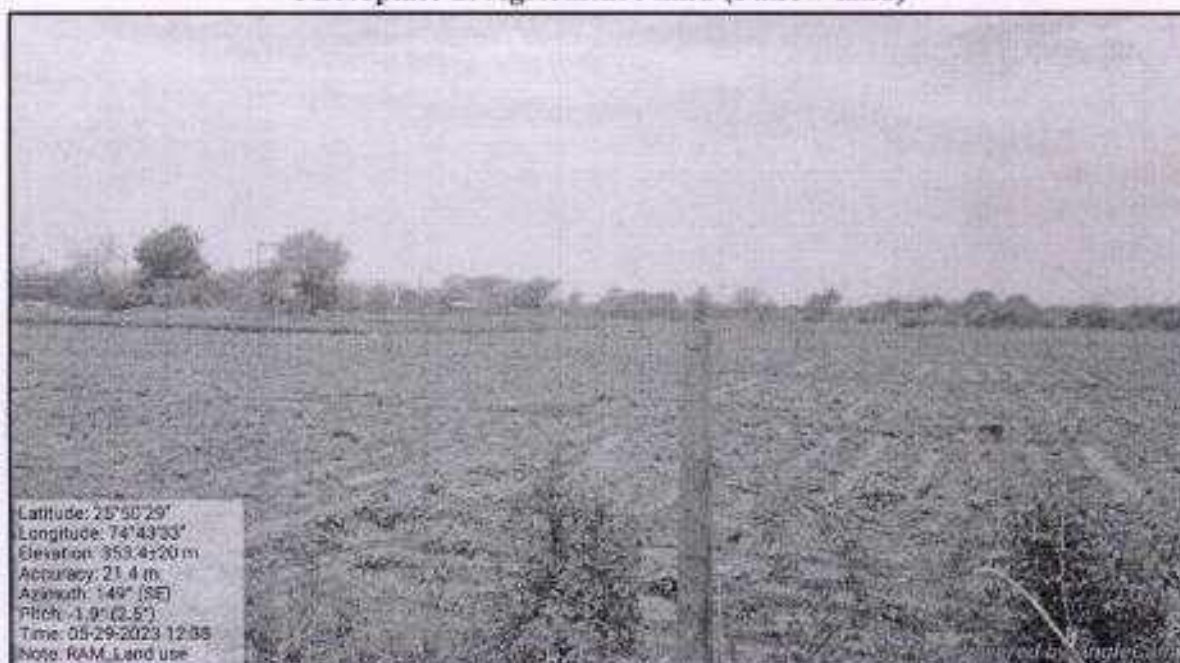
Hydro-Geosurvey Consultants Private Limited
(CERTIFICATE NO.: NABET/GWCO/IA/GW003)

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Photoplate-2. Agriculture land (Fallow land)



Photoplate- 3, Waste Land



Photoplate-4. NH-148-D within buffer zone

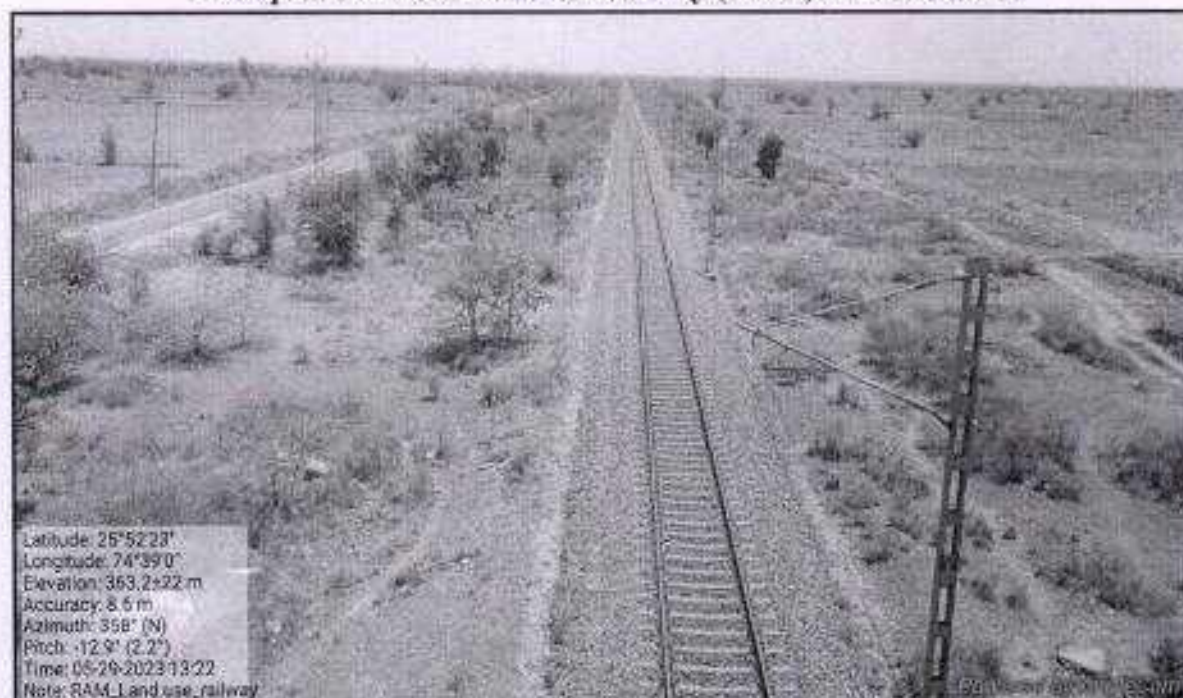


Photoplate-5. SH-39-A within buffer zone





Photoplate-6. North Western Railway (NWR) in buffer zone



Photoplate-7. Agucha pond



Photoplate- 8. Pond in buffer zone



Photoplate- 9. Mansi river in buffer zone





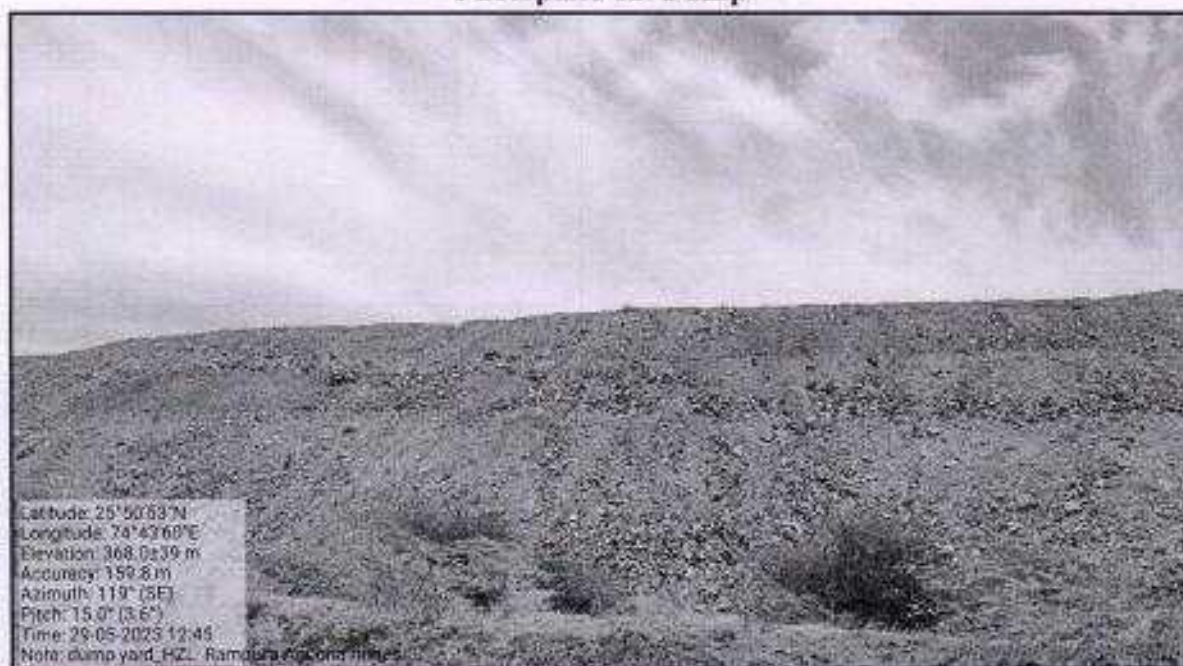
Photoplate-10. Mining pit overview



Photoplate-11. Tailing pond



Photoplate-12. Dump



Photoplate-13. 22 MW Solar plant on waste dump





Photoplate-14. Plantation towards Agucha side



Photoplate-15. Plantation on waste dump



Photoplate-16. Plantation on waste dump





HDPE laying in tailing dam



STP (300KLD) in plant premises

SEWAGE TREATMENT PLANT AT COLONY.

A black and white photograph showing a sewage treatment plant. In the center is a large rectangular aeration tank with a circular structure in the middle. To the left is a smaller circular tank. Behind the main tank is a large cylindrical storage tank. The plant is surrounded by trees and vegetation. A set of stairs leads up to the right side of the main tank. The text "SEWAGE TREATMENT PLANT AT COLONY." is printed in bold capital letters at the top left of the image.

STP (425KLD) in plant premises

Annexure -XVII

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Display board at Main-gate



Oil trap



HZL/RAM/Env/2023-2024/1443

HINDUSTAN ZINC
Zinc & Silver of India

September 28, 2023

Member secretary
Rajasthan State Pollution Control Board
4, Institutional Area
Jhalan Doongri
JAIPUR

Sub: Environment Statement of Rampura Agucha Mine for year 2022-2023

Ref: CTO granted vide order No 2022-2023/Mines/10762 dated 28/02/2023.
CTO granted vide order No 2023-2024/HDF/9370 dated 14/06/2023.
CTO granted vide order No 2019-2020/Mines/9959 dated 25/06/2019.
CTO granted vide order No 2019-2020/CPM/5547 dated 22/10/2019.
EC granted vide letter No J-11015/267/2008-LA.II (M) dated 11.12.2009.

Sir/Madam,

Please find enclosed herewith the environmental statement for financial year ending on 31st March 2023.

Thanking you

Yours truly,


(Kishore Kumar S)
CEO Agucha IBU

CEO - IBU Agucha
Hindustan Zinc Limited
Rampura Agucha Mines
PO - Agucha
Distt. - Bhilwara (Raj.)

cc to: Regional Officer
Rajasthan State Pollution Control Board
18, Azad Nagar, Pannadhy Circle,
Mining Engineer Office Road (Near Telephone Exchange)
Bhilwara (Raj.)


The Joint Director (S)

Ministry of Environment, Forest & Climate Change,
Integrated Regional Office, A-209&218, Aranya Bhawan,
Jhalana Institutional area Jaipur-302004

Hindustan Zinc Limited

Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
M +91-9001294956-57 www.hztindia.com

Registered Office : Yashad Bhawan, Udaipur (Rajasthan) 313 004
CIN No. L27204RJ1945PLC001208



SWASTHYA SEWA

Quarterly Report

July '22 to September '22



Submitted to:
HINDUSTAN ZINC LTD.

Submitted By:
Deepak Foundation



REV:00



F/CS/Quarterly Rep/02

Abbreviations

ASHA	Accredited Social Health Activist
ANC	Ante-Natal Care
AWW	Anganwadi Workers
BHO	Block Health Officer
BMI	Body Mass Index
BPL	Below Poverty Line
CHC	Community Health Center
HH	House Hold
HB	Hemoglobin
IEC	Information, Education and Communication
IFA	Iron-folic acid tablet
MHU	Mobile Health Unit
NCD	Non-Communicable Disease
OPD	Out-Patient Services
PHC	Primary Health Center
RBS	Random Blood Sugar

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F/CS/Quarterly Rep/02

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1.2	Location:	4
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3.0	Telemedicine	8
4.0	Special Days Celebration and Awareness Sessions	9
5.0	Case Studies	10
	Case Study 1: Gokul Bhil, Case from Agucha MHU	Error! Bookmark not defined.
6.0	Glimpses of the Activities Undertaken in three months	11
	Awareness Sessions and Group Counselling	Error! Bookmark not defined.



Project: Mobile Health Services to improve the Health and Nutritional profile of underprivileged communities -A Corporate Social Responsibility Initiative

1.0 Introduction:

Hindustan Zinc Limited is committed to contributing to the quality of life and social well-being of the communities where it operates. The business model clearly states that "our social license to operate come not only from the Government but from the communities surrounding our operations. Our growth has true meaning when it creates betterment opportunities for the people around us.

Hindustan Zinc Ltd is already running its Zinc smelter plant at Zawar, Chanderiya, and Rampura Agucha Mines in Rajasthan. To support the healthcare of people in the villages around the plant, Hindustan Zinc Initiated the provision of quality healthcare services in selected villages. Mobile Health Units have been envisaged to provide preventive, promotive, and curative health care in inaccessible areas and difficult terrains. Taking health care to the doorsteps is the principle behind this initiative and is intended to reach underserved areas. The Mobile Health units not only look after the curative and referral aspects but also render behavioral changes and awareness to promote healthy lifestyles by supporting existing healthcare programs, improving access to essential health services, providing a link for referral services, community health education, and health promotion, identification and referral of severely malnourished children among others.

Based on the needs assessed on the 'health' portfolio in the villages and experience of healthcare service provision in these selected regions, it is planned to extend the project in partnership with Deepak Foundation to provide basic healthcare facilities through Mobile Medical Unit that will cater to all the needs mapped.

1.1 Objective: To improve the health care service accessibility and awareness of key health and nutrition issues through a Mobile Health Unit in the underserved population of selected villages.

1.2 Location: The Mobile Health Unit is currently providing medical services in 26 selected villages nearby Rampura Agucha Mines.

1.3 Methodology:

1. Monthly plans are made to cover villages twice a month.
2. Daily counseling is conducted as per the emerging needs of the community.
3. Awareness Session on key topics
4. Weight monitoring of children aged of 5 years



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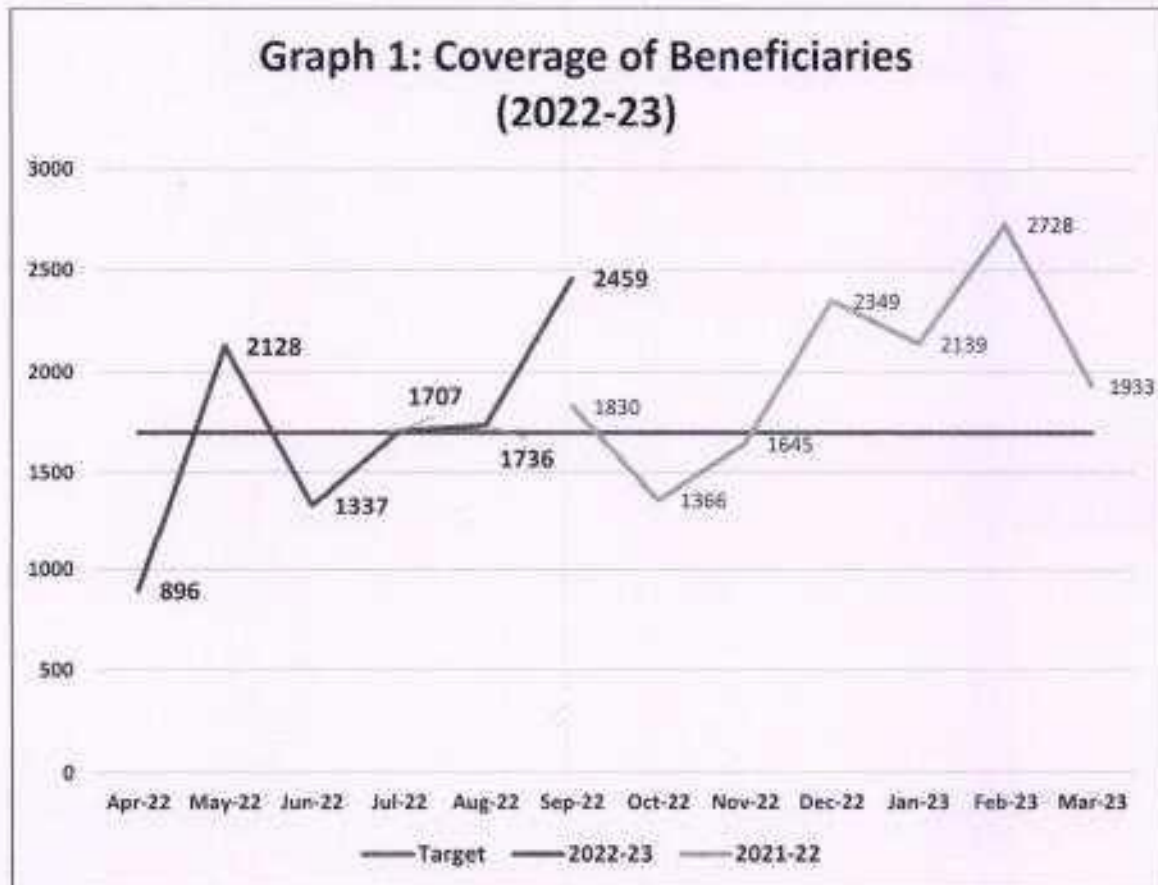


F/CS/Quarterly Rep/02

2.0 Activity report

The activities undertaken in three months – July 2022 to September 2022 are as follows

- **Total Beneficiaries:** The mobile health unit covered a total of 5902 beneficiaries during regular OPD, health camp, awareness sessions and daily counseling.
- **Household Coverage:** MHU services reached to new 604 households
- **Unique Patients:** Total 1919 new unique patients we treated in current quarter
- **OPDs:** The unit attended 4024 patients from July 2022 to Sept. 2022 (Graph 2, 3 & 4)
- **IEC/Counseling:** A total of 170 beneficiaries were counseled individually as well as in group, on topics related to personal hygiene and non-communicable diseases.
- **Awareness Session:** Counseled 1708 beneficiaries under different sessions



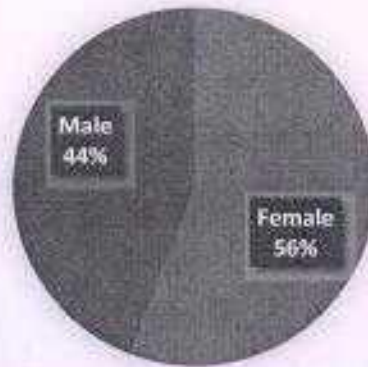


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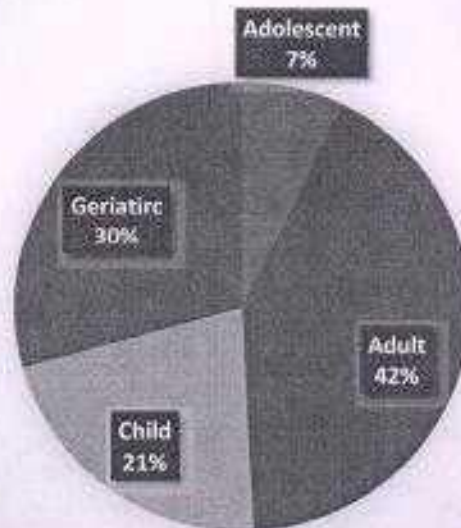


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**Graph 2: Gender wise distribution of beneficiaries
(n= 4024)**



**Graph 3: Age wise distribution of beneficiaries
(n= 4024)**





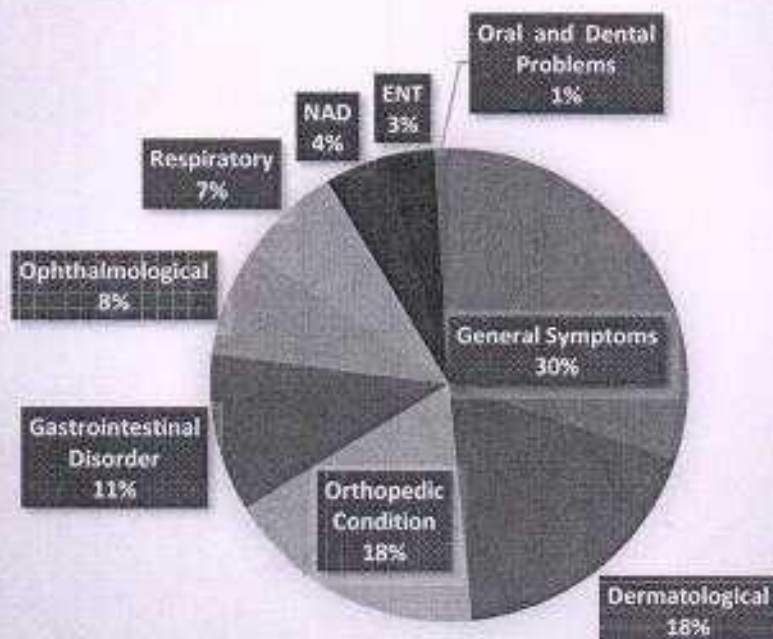
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Looking at the disease load (Graph 4) over a period of three months, General Symptoms were found to be very common (30%), followed by Dermatological problems (18%), Orthopedic Condition (18%) and Gastrointestinal disorder (11%).

**Graph 4: Major Type of illness among beneficiaries
(n= 4024)**



Note: ENT is ear, nose, and throat & NAD – No abnormality detected



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F/CS/Quarterly Rep/02

3.0 Telemedicine

Total patients screened in second quarter, through the system are 171. This includes 71 students from Siksha Sambhaal Schools.





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F/CS/Quarterly Rep/02

4.0 Special Days Celebration and Awareness Sessions

Sr. No.	Topic	Beneficiary	Remarks
1.	Skin Diseases (Fungal Infection)	24	2 villages
2.	Handwash and Hygiene Practices	170	6 villages
3.	Safety Training	110	2 villages
4.	National Nutrition Month	189	12 villages
5.	Tuberculosis	20	
6.	World First Aid Day	237	





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5.0 Case Study

Javed Mohammad Rafik

Name: Javed Mohamad Rafik

Age: 18 Years

Gender: Male

Village: Khatikheda

For the last one and a half months, the patient was suffering from boils and pain. He visited the nearest hospital and followed the instructions given by the practitioner but was not able to get relief from the same. Meanwhile, the community mobilizer informed the patient about the services provided by Mobile Health Unit. He visited the van on 26th August 2022 and described the issue in detail to the medical officer.

He started the treatment provided by the unit and got relief from the boils. The counselor was in regular touch with the patient to get his exact status of him.

Complaints at the time of 1st visit: The patient had boils on the skin, the affected area was inflated and was complaining of pain and itching.

Medical reports: Hb reports 10.7, BP Normal, Sugar Normal.

Diagnosis: Boils.

Counseling and other support provided:

MHU continuously connected with the patient from 26th August 2022 and gave him proper tests, treatment, and counseling for a cure.

Remark and Feedback from the patient: He like the services are given by MHU and its staff.

BEFORE TREATMENT



AFTER TREATMENT





REV'00



F/CS/Quarterly Rep/02

6.0 Glimpses



CSIR-CENTRAL INSTITUTE OF MINING AND FUEL RESEARCH,
BARWA ROAD, DHANBAD
(Council of Scientific and Industrial Research)



FINAL REPORT

PROJECT TITLE:

**Assessment of Open Pit Slope Stability, Waste dump Stability and
Ground Surface Movement through Monitoring and
Data Analysis at Rampura Agucha Mine of HZL.**



SPONSORED BY:

HINDUSTAN ZINC LIMITED

MAY, 2023

PROJECT NO.: SSP/585/2021-22



CSIR-Central Institute of Mining and Fuel Research, Dhanbad
(Council of Scientific and Industrial Research)

Project Title : Assessment of open pit slope stability, waste dump stability, ground surface movement through monitoring and data analysis at Rampura Agucha mine of HZL.

CIMFR Project No. : SSP/585/2021-22

Sponsor : M/s Hindustan Zinc Limited

Project Co-ordinator : Mr. Ajit Kumar, Ex-Chief Scientist

Project Leader : Mr. J. K. Singh, Chief Scientist

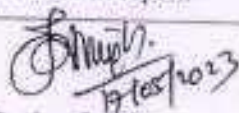
Project Collaborator : Dr. S. K. Roy, Chief Scientist
Mr. Kartik Varwade, Scientist
Mr. Rakesh Kumar Singh, Sr. Technical Officer (I)
Mr. Manish Kumar, Sr. Technical Officer (I)
Mr. Prince Kumar, Technical Assistant, and
Mr. Swapan Mahato, Technician.

May, 2023

DISCLAIMER

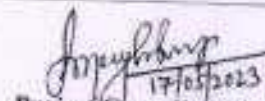
The report is meant only for the internal use of the sponsor and it should not be published in full or part by the sponsor or any of its staff members. It should not be communicated or circulated to outside parties except concerned Government departments. CIMFR reserves the right to publish the results in a general way for the benefit of the industry without disclosing the name of the sponsor. Recommendations stipulated in the report should be implemented in letter and spirit under the supervision of competent persons/agencies.

Conclusions and recommendations mentioned in the report are based on the geo-mining conditions specified in the report. Moreover, CSIR-CIMFR has no control in implementation of the recommendations stipulated in the report, research team will not be held responsible for any untoward incidences caused by changes in geo-mining conditions as well as due to non-compliance to recommendations of the report.


17/05/2023

Project Leader
(J K Singh)

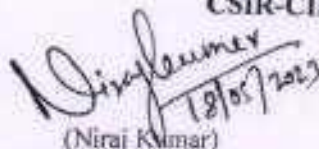
Chief Scientist & HORG
Slope Stabilisation & Landslide Management


17/05/2023

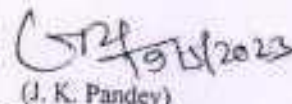
Project Co-ordinator
(S K Roy)

Chief Scientist
Slope Stabilisation & Landslide Management

CSIR-CIMFR Authorised Signatories


18/05/2023

(Niraj Kumar)
Principal Scientist & HOS
Project Planning and Monitoring


18/05/2023

(J. K. Pandey)
Chief Scientist & Coordinator
Project Planning & Industry Interface



INTRODUCTION

The importance of safe, properly designed and scientifically engineered slope is well known. The benefit of an openpit operation largely depends on the use of the steepest slopes possible, which should not fail during the life of the mine. So, the design engineer is faced with the two opposite requirements, stability and steepness, in designing the deep openpit slopes. Steepening the slopes, thereby reducing the amount of material to be excavated, can save a vast sum of money. At the same time excessive steepening may result into slope failure leading to loss of production, extra stripping costs to remove failed material, reforming of benches, rerouting of haul roads and production delays. The Directorate of Mines Safety may even close the mine, in case unsafe conditions are created. Therefore, it is necessary that a balance between economics and safety should be achieved.

Mine management of Agucha Mine entrusted the slope stability and slope monitoring studies to CSIR-CIMFR, in consultation with DGMS, along with the slope steepening for years. This report is for assessment of open pit slope stability, waste dump stability and ground surface movement through monitoring and data analysis at Rampura Agucha Mine of HZL for the year 2021-2022.

Rampura Agucha mining complex is situated in Tehsil Hurda, District Bhilwara in Rajasthan and connected by road from Gulabpura railway station on Delhi-Udaipur railway line.

The orebody has been proved for a strike length of 1.7 km. with 109.34 million tonnes of ore reserve and resource. The deposit is being mined with Shovel dumper combination. The overall pit slope is currently planned with 35° on footwall side and 42° on the hanging wall. The current pit depth is 390 m with bottom bench of zero mRL. Presently there is no mining operation in open pit, however pit slope monitoring is being continued in order to take care of safety of opencast as well as underground mining and other operations nearby.

The rock discontinuities were mapped by the resident geologist and validated by CIMFR at the freshly exposed benches of the pit as per the norms of International Society of Rock Mechanics (ISRM 1978). Geotechnical mapping was undertaken to determine the critical orientation of structural discontinuities. The freshly exposed slope materials were tested at CIMFR to determine any significant changes in the properties because any significant change will influence the slope steepening exercise. The slope monitoring was done to determine any movement in and around the mine and dump.

INTRODUCTION OF PRESENT MINING AT RAMPURA AGUCHA MINE

Rampura Agucha mine belonging to Hindustan Zinc Limited has a stratiform, sediment-hosted, high-grade zinc and lead deposit. The ore body is massive and lens shaped. The Lead-Zinc deposit is currently being extracted by underground stopping methods at a deeper horizon below the exhausted open pit mine. The open pit operated from 1991 to March 2018, has reached a depth of about 400m from the surface. The underground stopping operations are being carried out since June 2013. The lowest point of the exhausted open pit floor at -10mRL and underground stopping areas are separated by a 60m crown pillar. Figure 1 shows the transverse section of the orebody, including different rocks in the hangwall. The underground mining is being carried out by Long Hole Open Stopping (LHOS) with the paste fill method. Initially, the overhand (Bottom-up) LHOS method was followed for the production. After obtaining permission from the Directorate General of Mines Safety (DGMS), the orebody is being extracted between -230mRL and -255mRL (S640 to N607 Grid), between -255mRL and -280mRL (S640 to N590 Grid), and between -280mRL and -330mRL (S640 to N570 Grid) by underhand (Top-down) LHOS method with paste fill.

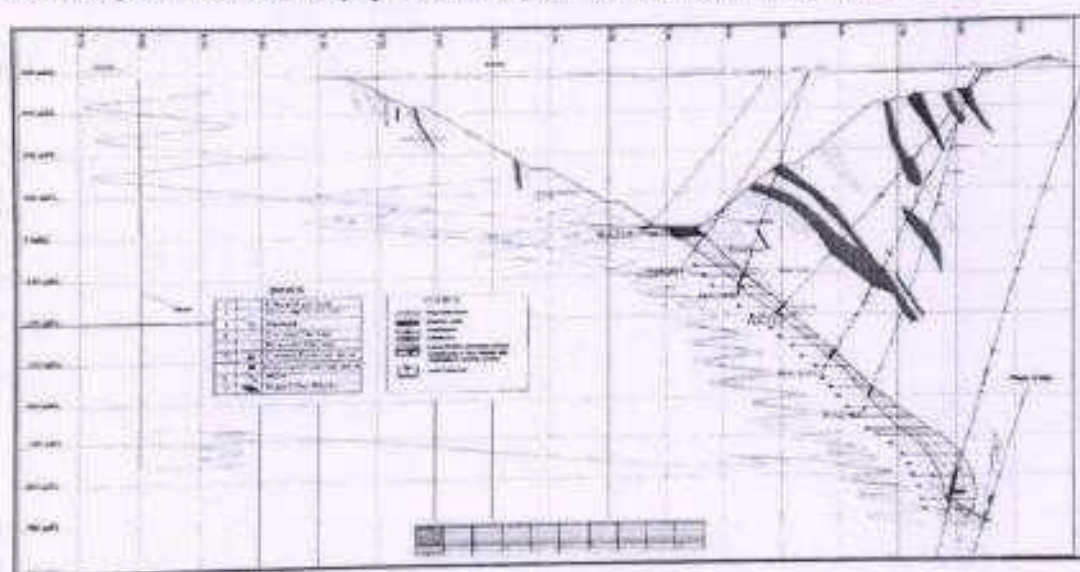


Figure 1: Transverse section of the geological plan showing the orebody, and different types of rocks



METHOD OF MINING

In Rampura Agucha mine, the orebody was extracted by the open pit working which had been discontinued as it reached around 400m depth of cover. Presently, underground mining operations are going on below the open pit working by keeping a 60m crown pillar between the open pit and underground mines. The underground mining is carried out by Long Hole Open Stopping (LHOS) with paste fill. Initially, the production from the underground was started by the overhand LHOS method with paste fill. In the overhand method, stopping is commenced from the lower level and is progressing upwards. Presently, both underhand (Top-down) and overhand (Bottom-up) LHOS methods are going on for production. Figure 2 shows the schematic diagram of the underhand method of mining.

The strike length of the orebody is divided into stopping panels. The stopping panels are divided into primary and secondary. Following the permission from DGMS, the ore body is divided into stopes of 15m wide (along strike), 25m high (the distance between the two levels), and the length depending on the thickness of the orebody, the maximum length allowed is 30m in a stope/panel. The stope dimensions are usually: 25m (H) \times 15m (W) \times up to 30m (L) with an average stope volume of 6000 – 7000m³. The stopes are extracted by the transverse stopping method. The primary and secondary stopes are extracted and backfilled sequentially. The secondary stopes are developed and extracted after completion and backfilling of two adjacent primary stopes. The LHOS with paste fill method in the Top-down approach at Rampura Agucha underground mine was designed by M/s BECK Engineering, Australia.

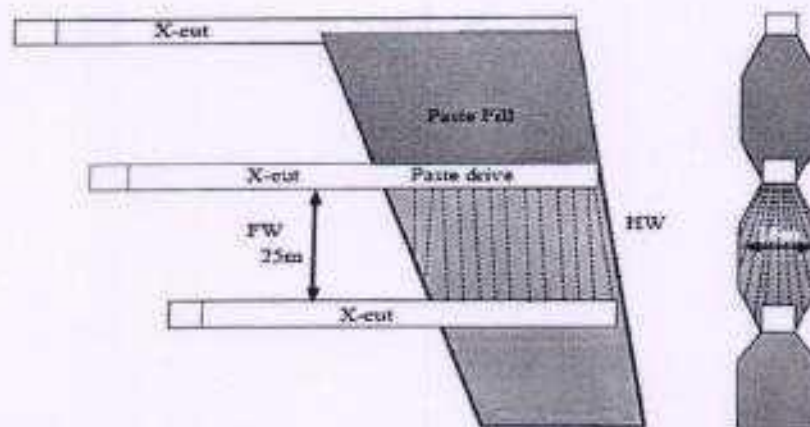


Figure 2: Schematic diagram of the underhand method of mining.

Stope development



The footwall drive of 5.6m (width) x 5.3m (height) was driven along the strike of the orebody by keeping at least 30m distance from the orebody. From the footwall drive, the x-cuts of 4.8m x 4.8m are driven at an interval of 15m. The footwall drive of the top level is used for drilling and the footwall drive of the bottom level is used for mucking.

Drilling and blasting

The diameter of the production drill ranges from 89mm to 127mm. The toe burden between holes is 2.0-3.5m and ring spacing is 2.0-3.0m. Multiple electronic delays are used to fire individual holes and between the rings. The ore is mucked by the remote Load Haul Dumper (LHD) and transported by the low-profile dump truck (LPDT).

Backfill

After completion of the stope, a barricade is made at the lower level x-cut. Then, the open stope is backfilled by the paste and cured to gain sufficient strength before mining of lower stope. For underhand stopping, there would always be 2-3m void above and below the filled stopes throughout the level.

Excavation sequencing for mining near paste-filled stopes

Stopes are extracted in a transverse manner. The sequence of mining is a combination of Primary-Secondary and Continuous stopping with oblique/inclined multiple fronts along the strike of the orebody. After filling the primary stope, the development of the roadways or stopping operation adjacent to the filled primary stope does not start immediately. The paste fill material is given sufficient time to gain the required strength. The development of the secondary x-cuts in rock mass adjacent to the filled primary stope is started after gaining 0.1-0.2MPa required strength of the paste. The first secondary stope adjacent to the filled primary stopes is taken place after attaining the required strength of 0.4-0.45MPa. The second secondary stope adjacent to the filled primary stope is not blasted without filling until attaining the required strength by the first filled secondary stope. The development through the paste fill can only be started after attaining the required strength of 0.75MPa. Extraction of primary stope below paste-filled stope can be done after gaining the fill material strength of 1.2MPa. Depending on the area of exposure, the required strength can be varied.

The stopping level was -305mRL at Feb. 2021 and currently the stopping depth is -405mRL as on Oct. 2022.

Physical Characterisation of the Discontinuities

The geotechnical mapping was done by the resident geologist on the exposed benches. CIMFR validated the collected data in the field. The objective was to detect any



unfavourably oriented persistent discontinuity in the freshly exposed slope mass, which can influence the stability of the slope standing after slope steepening exercise. The mapping did not reveal any advance geotechnical structure in the freshly exposed slope mass.

Mine and Dump Drainage

The pit benches should be properly levelled. The heap of muck should not be left on the benches. The rainwater will collect between the toe of the bench and the muck. The water will seep to deeper levels through cracks. The hydrostatic pressure will increase behind the slope, which may cause slope failure in due course of time. The muck should be cleaned and the gradient of the bench should be such that the rainwater flows to lower level in a planned way.

The mine management has made garland drains/ bunds and bench collector drains in the mine. However, the drains/ bunds are planned to be constructed with special care to the weak and weathered lithological units of the mine. These drains in weak and weathered zone must be kept effective.

The drainage must always be directed away from the excavated pit. All the benches or at least alternate benches should have an effective toe drains. These drains should be interconnected to drain out the rainwater into the mine sump. This is necessary to avoid the flow of rainwater on the benches of the precarious litho units, which affect their slope stability. All the drains should be kept clear of soil debris and effective for the free flow of water. The discontinuance of the pre- monsoon preparation at any location will jeopardise the whole effort of maintaining designed slopes.

There should not be unplanned water flowing channels on the benches of the mines, which may run across few benches. The benches should be provided with bench drains to collect the rainwater. It will help to arrest the momentum of fast moving water as soon as it meets the garland drain or drain of other bench. It should not be allowed to flow down to lower benches in an uncontrolled manner. The slope of the upper most benches should be well graded so that the rainwater goes to the valley side and not in the mine.

The entry of the rainwater from the northern end of the footwall of the pit has been checked by making a bund at the mouth / entry point/ start point of the haul road. The entry of rainwater of the adjacent catchment area should be checked by garland drain/ bund depending up the topography of the area.

At few locations it may not be possible to divert the rain/ seepage water away from the pit, in that case a proper drain pattern should be developed to divert the water into the pit sump. The water should not be allowed to enter into the pit from many channels or left



uncontrolled. By guiding the flow of water in a fixed channel erosion/ failure of soil/ clays can be checked. The unchecked erosion may lead to failure in these soil slopes in due course of time.

Sub-horizontal drain holes drilled into the slope face are effective in reducing water pressures near the seepage zone. It should be inclined at an angle of five deg. to facilitate free flow of water. The holes may be drilled at the interval of 5m or even closer in the area of requirement. A pipe should be inserted into the hole to prevent caving. The pipe is perforated or slotted to allow water to drain into it. This water will freely flow out of the slope under the gravity. It will improve the stability condition of slopes. The following sub-horizontal holes already available are effective in the bench slope.

Sl No	Month	Area	HW/FW	mRL	No of Holes	N/S	E/W	Z/mRL	Hole Depth
5	NOV-2015	S-5 (S)	HW	360mRL	1	S-451.32	E-721.46	360.30	100.77
					1	S-450.65	E-721.53	360.32	100.29
					1	S-449.28	E-720.84	360.34	100.69
					1	S-555.48	E-614.22	361.18	100.34
					1	S-558.92	E-614.45	361.21	101.17
					1	S-559.86	E-614.38	361.14	97.26
9	MAR-2016	S4	HW	210mRL	1	S-651.95	E-325.88	209.81	100.00
		Ramp	FW	180mRL	1	N-647.00	E-159.02	180.80	100.00
		Ramp	FW	180mRL	1	N-648.13	E-159.52	180.80	100.00
		Ramp	FW	180mRL	1	N-649.40	E-159.76	180.40	100.00

**HORIZONTAL HOLE DETAILS in 2017-18**

HOLE NO	DEPTH	CASING	N/S	E/W	RL	DATE OF DRILLING
1	100.9458	3.6	N-587.57	E-569.78	320.13 mRL	11 April 2017
2	100.514	3.5	N-478.54	E-644.28	320.10mRL	11 April 2017
3	100.2346	3.7	N-475.26	E-646.04	319.79mRL	11 April 2017
4	100.641	3.5	N-615.45	E-541.49	310.26mRL	14 May 2017
5	97.5422	3.6	N-615.30	E-541.32	310.14mRL	14 May 2017
46	101.022	3.6	N 639.2201	E 576.9097	331.00mRL	04 October 2017
47	100.9966	3.5	N 554.8813	E 664.578	331.17 mRL	05 October 2017
48	100.26	3.6	N 538.5584	E 671.3667	330.97mRL	06 October 2017
57	100.7934	3.6	N 654.4727	E 481.3891	291.87 mRL	14 November 2017
58	100.26	3.6	N 629.9021	E 503.4513	291.42mRL	15 November 2017
73	100.1838	3.6	N 669.2445	E 453.9323	278.42 mRL	19 December 2017
74	97.847	3.7	N 584.8226	E 527.2184	279.91mRL	20 December 2017
75	96.704	3.3	N 624.9913	E 496.0597	281.10mRL	21 December 2017
76	100.9204	3.5	N 640.2306	E 482.2159	281.43mRL	23 December 2017
77	101.276	3.6	N 652.7714	E 469.6828	281.21 mRL	24 December 2017

The groundwater is likely to be present at various stages of pit development. 200 mm dia depressurization holes are drilled at surface, on footwall side, Hanging wall side, south across of pit and in-pit at 240 mRL and at footwall 366 mRL., The following depressurisation holes are available in the field. As soon as benches are taking final shape, advance-pumping boreholes should be located on lower benches for more effective advance pit dewatering.



Depressurize hole details at RAM Open pit							
Serial No	Area	Hole Diameter (mm)	Hole Coordinate			Hole Depth (m)	Pump Depth (m)
			East	North	Level		
1	North Across (South Toe of Waste Dump)	200	459.9	855.2	393.8	300	Dry Hole; No pump
2		200	303.7	956.3	395.3	300	Dry Hole; No pump
3		200	200.7	979.9	397.3	300	Dry Hole; No pump
4		200	155.0	1033.2	398.1	300	Dry Hole; No pump
5		300	99.3	1000.5	398.2	300	Dry Hole; No pump
6		200	-37.9	1030.7	400.0	300	Dry Hole; No pump
7		200	44.7	1036.2	399.2	300	Dry Hole; No pump
8	Footwall North	300	-271.4	523.6	397.1	300	200
9		300	-268.2	475.5	396.0	300	150
10		200	-283.6	432.5	395.6	300	150
11		300	-288.5	406.6	394.6	300	150
12		200	-290.7	389.2	395.3	300	150
13		300	-292.0	363.0	394.5	300	150
14		200	-293.1	334.6	394.8	300	150
15		200	-293.1	297.9	394.3	300	220
16		200	-297.1	260.1	394.2	300	150
17		200	-299.8	232.2	393.9	300	150
18	Footwall South	200	-268.3	-33.0	392.8	300	Dry Hole; No pump
19		300	-268.4	-32.9	392.8	300	Dry Hole; No pump
20		200	-351.0	-200.5	392.1	300	Dry Hole; No pump
21		200	-283.3	-260.3	392.0	300	180
22		200	-292.5	-290.0	392.0	300	160
23		200	-285.3	-318.0	391.4	300	270
24		200	-228.2	-741.4	388.6	300	280
25		200	-222.4	-779.5	389.2	300	150
26		200	-211.2	-813.3	389.0	300	100



27		200	-194.4	-875.1	389.1	300	150
28		200	-183.2	-892.3	389.2	300	100
29		200	-156.5	-906.9	388.2	300	170
30		200	-122.0	-903.2	387.8	300	180
31	South Across	200	563.6	-810.6	388.1	300	220
32		200	536.0	-835.3	387.8	300	280
33		200	508.6	-860.2	388.2	300	280
34		200	453.9	-892.4	389.1	300	150
35		200	280.0	-986.8	388.1	300	150
36		200	103.5	-1005.9	388.9	300	250
37		200	26.6	-996.7	389.3	300	100
38		200	-	South-901	-	300	Dry Hole; No pump
39		200	West-120	-	-	300	Dry Hole; No pump
40	Hangwall North	200	865.7	-31.8	383.0	300	190
41		200	870.2	-61.5	381.8	300	180
42		300	866.7	-99.2	381.5	200	150
43		300	866.2	-183.6	380.2	200	150
44		300	864.2	-261.1	380.6	300	250
45		200	788.2	-396.9	382.0	300	180
46		200	770.8	-439.6	382.1	300	190
47		200	736.4	-505.3	381.5	300	180
48		200	719.5	-549.1	381.7	300	180
49		200	634.3	-702.7	384.1	300	200
50		300	623.6	789.6	390.3	300	270
51		300	654.9	758.6	389.3	300	260
52		300	675.6	743.4	388.9	300	275
53		300	698.0	722.5	388.0	300	290
54		300	720.9	702.7	386.9	300	280
55		300	733.4	678.4	386.3	300	290
56		300	760.2	631.5	386.7	300	290
57		300	770.3	602.6	386.4	300	180
58		300	779.3	584.3	386.2	300	280
59		300	789.3	562.6	386.4	300	280
60		300	800.8	533.3	385.7	300	270
61		300	809.5	510.9	385.5	300	280
62		300	820.1	483.7	385.9	300	290
63		300	828.4	458.9	385.8	300	290
64		300	834.3	426.9	386.0	300	290



65		300	823.8	405.1	386.2	300	150
66		300	826.0	367.6	385.5	300	150
67		200	842.7	321.6	384.6	300	150
68		300	851.3	294.6	384.6	300	170
69		200	865.1	256.9	384.2	300	190
70		300	870.6	227.1	384.2	300	200
71		200	875.6	187.4	384.2	300	200
72		200	883.4	162.6	384.0	300	200
73		200	875.8	95.7	383.8	300	200
74		200	874.1	44.3	383.3	300	195
75		300	869.4	13.2	383.5	300	210
76	Hangwall	200	504.1	-781.4	361.0	300	Dry Hole; No pump
77	360mRL	200	478.6	-806.4	360.5	300	Dry Hole; No pump
78	Hangwall	200	688.3	123.6	319.2	300	Dry Hole; No pump
79	320mRL	200	263.1	-792.7	242.8	300	150
80	South Across	200	205.9	-807.1	242.0	300	150
81	240mRL	200	972.4	293.8	384.7	300	150
82		300	977.2	323.2	384.5	300	150
83		200	965.1	356.2	385.0	300	270
84		200	953.1	408.5	384.9	300	150
85		200	958.2	424.2	384.5	300	170
86		300	963.2	455.2	384.7	300	175
87		200	942.8	465.9	386.4	300	150
88		200	934.1	513.8	385.5	300	180
89	Hangwall	300	944.1	533.0	385.4	300	250
90	(Beyond	200	929.8	561.3	385.7	300	270
91	Waste	300	943.6	572.6	385.9	300	150
92	Dump)	200	927.1	615.1	385.6	300	200
93		300	957.1	649.8	385.4	300	270
94		300	949.9	675.4	385.6	300	270
95		200	923.3	650.9	385.8	300	200
96		300	941.8	707.2	385.8	300	200
97		200	913.9	730.7	386.4	300	170
98		300	903.0	823.6	386.1	300	290
99		300	839.7	843.7	386.1	300	290



100		200	804.3	848.7	386.8	300	250
101		300	884.7	875.6	386.4	300	270
102		300	880.0	893.2	386.2	300	270
103		300	872.0	912.1	386.3	300	280
104		300	854.5	943.1	386.5	300	220

The following piezometers are installed towards footwall side only to measure the water level in different geo-mining conditions.

Piezometer Details at RAM HZL				
Serial No	Piezometer No	Location	Depth (m)	mRL (m)
1	PZ 1	Hangwall Surface N250	65	384.5
2	PZ 2	Hangwall Surface N250	95	384.5
3	PZ 3	Hangwall 310mRL N300	70	309.2
4	PZ 4	Hangwall 310mRL N300	120	309.2
5	PZ 5	North Across Mine tower N900	65	389.2
6	PZ 6	Footwall 366mRL Bench N500	90	365.9
7	PZ 7	Footwall Surface RMC Plant S300	80	392.7
8	PZ 8	Hangwall 360mRL S750	75	360.9

It should regularly be measured by piezometers to know the changes in the groundwater condition during different phases of the mine development. The mine management is taking observation of the water level fluctuation in a few boreholes dug for this purpose. It gives information about the water level at any point of time. It helps in keeping the working benches dry and adverse effect of the ground water pressure can be minimised. The number of deep boreholes should be increased for advance pit dewatering. More sub-horizontal drain holes should be drilled to depressurise the slope mass, especially near the seepage zones.

All around the periphery of dump, a collector drain/ bund should be formed to divert the rainwater away from the dump. The dump top should be properly levelled with a slope to avoid water retention on dump top/ dump benches and to prevent the rainwater flowing along slope. The drains should be kept clear of soil debris and effective for the free flow of water. It should be done well before the onset of monsoon. The discontinuance of the pre- monsoon preparation at any location will jeopardise the whole effort of maintaining the designed slopes.



The gradient along the floor of the dump should be properly maintained for free flow of water. The rainwater blocked on different levels and different portions of the dumps will percolate at the bottom of the dump. So, every attempt should be made to make a proper gradient of the dump floor. It will facilitate an effective seepage/ flow of water retained in dumps as well as run-off of rainwater to the drains. The drains should be effectively maintained to divert the drained water away from the dump. If this drainage system is not effectively achieved then the dumps may fail due to increase in saturation at the bottom of the dumps and subsequently cause a failure.

The dump floor of soil which forms the base of the external dump should be excavated and removed before dumping to improve the frictional resistance at the base of the dump. It should be filled with OB consisting of stones. It will facilitate the passage of water through the dump floor, thus preventing accumulation of water at the base of dump. Alternatively, the dump floor of hard rock, which forms the base of dump, should be ripped or blasted to a depth of one to two metres, before dumping to improve the frictional resistance at the base of the dump. It will also facilitate the passage of water through the dump floor down to the competent rock strata, thus preventing accumulation of water at the base of dump.

The presence of any well compacted elevated road or any other civil structure near the (external) dump acts as a barrier. It checks the flow of the collected water, near the dump toe, across the road. It is advisable not to construct the road near the dump toe. If it is unavoidable then the road should be located at a minimum distance of 100m from the existing effectively stabilised toe of the dump. The Hume pipes/ culvert should be provided at an interval of each 50m for effective drainage of water across it. The Hume pipes/ culverts should be regularly cleaned to keep them effective. Otherwise the dump would get saturated and may lead to a failure. Alternatively the level of the road should be lower than the toe of the dump.

Mining & Dump Condition and Few Suggestions

The dump mass should be maintained in drained condition. These dumps are likely to be safe with good drainage. Water entry should be checked from entering in to the toe of the dump by providing suitable drainage. The foundation of the external dump should be gneiss. The top soil should be removed and spread at the top of dump for plantation.



Attention must be paid to avoid entry of rain/ surface water in the slope by providing suitable drainage in and around the dump, failing which the slope can become unstable. It should be taken up well before the onset of monsoon.

The importance of the method of construction of dumps is considered to be an important factor in spoil pile stability. Controlled placement of spoil is required to ensure that weak top layer is not dumped at the base of the dump. The clay contains a lot of swelling minerals. It swells too much after coming in contact of water, which may cause failure of slope material lying over them. The top soil of overburden can be selectively dumped separately and should not be put within dumps or at base of dumps. There should not be any dumping in water bodies/ ponds.

Whenever any crack is detected on the existing dump, dozing should be done for proper leveling of the dump. It will consolidate the dump material also and the cracks would also be filled up. The entry of rainwater to the open cracks would also be checked due to closure of the cracks.

The crest of any pit and any civil construction/ installation should be located at a minimum distance equal to the dump height from the effectively stabilized toe of the dump. The distance should be considered in the direction through which it is the minimum.

Proper cleaning/ de-silting and leveling of the drains would be necessary to keep the drains effective. The drains at critical locations may be cemented. It would make the drain more effective. The cleaning would be easy. It would also check the rain water seepage through the drain itself.

The discontinuous dumping should be avoided for better dump slope stability. These depressions/ gaps between the dumps will get filled with rainwater. It may surcharge/liquefy the foundation of the dump, which may result in to failure of the overlying dump material.

The rainwater may percolate through the interspaces between the loose dumped soils, if the slope of the dumps is not proper. The uncontrolled entry of water in the dumps may cause liquefaction of the dumps. It is very difficult to make high dumps with steep slopes because the spoil starts flowing like a liquid under its own weight. With continued dumping the dump height increases and with excess addition of water, slope deformation occurs. The dump slope will quickly flatten to relatively low slope angle.

Proper leveling and compaction of the dumped material should be done with the help of dozer and compactor. It will help to consolidate the dumped material and will minimise the infiltration of water inside the dumps. The upper slope surface, immediately behind the crest, is an area of considerable potential danger. The water, which is allowed to pond in this area;



will almost certainly find its way into the slope through cracks and fissures. Grading of this surface will enhance run-off of any collected water.

The vegetation is certainly the best method of slope surface protection, as they will bind the surface together. In turn, it will reduce surface erosion considerably and will tend to inhibit the entry of water into the slope. The biological reclamation of the dumps should also be done by planting the local self-sustaining plants on the final dumps. It increases the stability of dumps.

The ground profile between the toe of dump (towards south across side) and road (near water reservoir) leading to Agucha village has been properly levelled for quick run-off of the rain water away from the dump foundation. Improper drainage at the dump foundation level towards south across would result in to yielding of the foundation due to liquefaction by the stagnant water between dump toe and road.

The In-house (HZL) geotechnical team should be consulted by the production team for their suggestion to meet the safety requirement of the mine.

Slope Monitoring

The monitoring information is used for variety of crucial functions including safety control, evaluation of current mining plans and future slope design. With the precise nature of the monitoring system at Agucha mine, it provides an active input into mine planning. The early identification of movement zones allows steps to be taken to minimise the impact of mining on stability by the implementation of corrective measures and at the same time provides for optimum ore extraction. The system contrasts strongly with more common 'passive' systems that frequently only record the occurrence of an event for subsequent post-mortem examination. The active monitoring system permits early and confident decision making by management both for safety purposes and for optimum excavation sequencing.

Objectives and Importance of Slope Monitoring

The main objective of slope monitoring study is to detect any instability well in advance so that any damage to men and machineries can be avoided. If the failure is unavoidable then it can be brought down in a predictable manner. If any instability is detected in the early stage then it can be stabilised by applying the suitable remedial measure. If the instability is detected at a later stage then it will be very difficult to check the instability.



The relevance of slope monitoring is recognised considering the increasing trend of steeper slopes and deeper mines. All geotechnical investigations aimed at collecting input design parameters, however complete, involve an inherent risk of inaccuracy. Furthermore, the overall design being based mainly on experience, empirical methods such as rock mass classifications or limit equilibrium stability analyses don't take into account the time dependent behaviour (stability) of slopes. Hence, any attempt of slope stability analyses and evaluation need to be supported by a sound slope monitoring programme in order to ensure the safe and smooth mining operations.

The slope failure never occurs suddenly. It gives sufficient signs to understand that the slope is unstable and it can fail. Generally, the first obvious sign of instability is exhibited by the formation of tension cracks on the crest of the slopes. It must be treated as warning of instability (Barton, 1971).

It should be noted that the order of movement near failure are large, of the orders of metres, and not millimeters (Kennedy, 1971). The real hazard is not only the detection of movement in the slope, but it is the accelerated rate movement which causes failure.

As soon as any movement is detected generally a question is asked regarding the rate of movement at which men and machinery should be removed. Actually the rate of movement near failure will depend on many factors including rock soil type, water pressure behind the slope, type of discontinuity along which failure is occurring etc. For each specific condition an empirical norm has to be established and then only it is possible to have an exact idea of rate of movement during failure which is not so easy. So, it is only the rate of acceleration of the movement, which can clearly tell the time to remove the men and machinery (Brawner, 1970).

Brawner (1970) from studies on over 200 slides in soil and rock concluded that complete failure has not occurred in less than 24 hours when the rate of movement was less than 25 mm per day with the exception of slides triggered by earthquake.



Monitoring Systems

The slope monitoring techniques vary widely ranging from simple visual observations of signs of potential instability such as slope bulging, surface fretting and the formation of tension cracks to the use of somewhat complex instrumentation. The scale of the mining operation, ore transport system and the nature and location of the potential slope failure decides the application of a particular technique.

Survey based methods can be used for absolute monitoring, that is determining the movement of a point or points relative to some datum believed to be outside the zone of potential deformation. These include:

- (a) Total station – Precise level based monitoring.
- (b) Tension crack monitors.

Other monitoring methods that may find future and more widespread application include:

- (a) Global Positioning Systems.
- (b) Computerised Total station monitoring.
- (c) 3D Terrestrial Laser Scanner Method
- (d) Slope stability radar.

Whichever is the technique used for slope monitoring, the objective is to predict future slope instability by appropriate interpretation of Displacement - Time data and analyses of failure mechanism. The slope monitoring based on standard surveying techniques have found wide acceptance because of the ability to remotely monitor a wall following the establishment of targets. Use of Total Station techniques along with angular measurements have become most popular because of the perceived advantage of only having to monitor from one location.

The slope stability radar technology provides complete slope face coverage from a remote location without need of reflective prisms. This mobile system can easily be moved into a pit to provide high-precision monitoring of a slope face up to 850 m away. Customized software processes the radar data to display slope movement and acceleration on a high-resolution CCD camera image. The unit can provide continuous coverage in all weather conditions, including dust and fog, and can be monitored via radio link and the Internet from remote locations. The SSR is deployed at Rampura Agucha mine. It is being used for slope monitoring by the mine management.



Monitoring observation

The slope materials are inherently weak in the mine. The consequences of slope failures can be very devastating when men or heavy earth moving machines come/ work close to an unstable zone. The slope failure can cause severe disruption to the complete mining operations.

The objective of monitoring is to detect possible slope instability so that appropriate remedial measures can be taken in time. The main concern is the protection of men and equipment.

Over the last few years, the technology for monitoring has improved considerably both in precision and cost effectiveness. Survey based monitoring systems are by far the most widely applied methods of pit slope monitoring. Effective monitoring based on survey methods require meticulous planning, a recognition of instrument precision, measurement repeatability.

The principal monitoring activity is measuring movement. The precise monitoring instrument used at Agucha mine is Total Station.

The slope monitoring study was conducted on quarterly basis, i.e. four times in a year by CIMFR. The changes of two monitoring observations give the data related with movement on the installed stations. The slope monitoring was conducted on the monitoring stations erected along the crest of the footwall. The base station is located in the stable zone of the hangwall side of the mine for setting the instrument.

Open pit mine:

- Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of October 2022 is 272. 99 stations are located towards hangwall side and 173 stations are towards footwall side of the mine.
- The following changes were observed among the stations made available for the monitoring purpose.
- The overall maximum cumulative change of 42.3 cm has been observed at S/100 of 30mRL bench, (Initial observation April 2019), towards hangwall side. During past one and half year (February 2021 to October 2022). The change in horizontal distance 23.1 cm. However, the rate of movement during period (from 2021 to October 2022) was 0.41 mm/day, which may be considered safe.
- 98 numbers stations are showing cumulative changes between 2.2 cm to 39.3 cm in hangwall side during the observed period.



- The overall maximum cumulative change of 37.8 cm has been observed at S/50 of 366mRL bench, (Initial observation October 2018), towards footwall side. During past one and half year (February 2021 to October 2022). The change in horizontal distance 14.6 cm. however, the rate of movement period (from February 2021 to October 2022) was 0.26 mm /day.
- 172 numbers stations are showing cumulative changes between 2.1 cm to 21.9 cm in footwall side during the observed period.
- The monitoring should be done departmentally on daily basis in the zone of movement to check any impending failure. It should also be supplemented by SSR.
- **Dump:**
 - Total 26 stations were made available for the monitoring purpose. The overall maximum cumulative change of 16.2 cm has been observed at W/125 during the observation of October 2022. (Initial observation October 2018) during past six month (April 2022 to October 2022). The change in horizontal distance 1.3 cm. However the rate of movement period (from April 2022 to October 2022) was 0.075 mm /day
 - 25 numbers stations are showing cumulative changes between 0.1 cm to 15.1 cm, during the observed period.
- **Subsidence Monitoring**
 - Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of October 2022 is 34. 22 stations are located towards hangwall side (Surface/ Inpit) and 12 stations are located towards footwall side (Surface/ Inpit) of the mine.
 - The overall maximum cumulative change of 3.9 cm has been observed at H/W in pit S-70 (Initial observation February 2021) to till the date of observation.
 - The overall maximum cumulative change of 1.6 cm has been observed at F/W surface N-725 (Initial observation February 2021) to till the date of observation.

More movement may occur in near future on the monitoring stations and/ or on rest part of the pit. It may get momentum any time and may cause a big failure. The continuous mining operation, blasting and changes in groundwater conditions continuously disturb the existing stress condition in the field. The whole system tries to come into equilibrium by stress redistribution and adjustment, which may result into movement of the slope any time.

The development of any tension crack on different benches formed in weak slope material should be observed. The iron rods (with serial numbers) should be installed across the crack to measure the movement with the help of tape, if possible daily/ weekly. If the



persistence of the crack is in two or more benches and the trend of the movement is continuously increasing, i.e. accelerating, then it is a matter of concern because it may cause large scale failure. The tension cracks should be filled with weathered rockmass and sealed with clay to prevent the entry of water, which may cause failure.

It is prudent to continue the monitoring of the slope regularly. It will be helpful to make use of remedial measures as soon as any movement is detected to check the impending failure. If the movement is continued for a year, it will be very difficult to control the instability by applying any remedial measure thereafter. World over, the scientists recommend that remedial measures should be adopted as soon as movement starts or even before. The monitoring should be continued to detect the on-set of any major movement, which in-turn will be helpful in applying a suitable remedial measure for the critical slope timely. A long-term association between HZL and CIMFR can only achieve it.

Conclusion and Recommendations

Open pit mine:

- Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of October 2022 is 272. 99 stations are located towards hangwall side and 173 stations are towards footwall side of the mine.
- The following changes were observed among the stations made available for the monitoring purpose.
- The overall maximum cumulative change of 42.3 cm has been observed at S/100 of 30mRL bench, (Initial observation April 2019), towards hangwall side. During past one and half year (February 2021 to October 2022). The change in horizontal distance 23.1 cm. However, the rate of movement period (from 2021 to October 2022) was 0.41 mm/day, which may considered safe.
- 98 numbers stations are showing commulative changes between 2.2 cm to 39.3 cm in hangwall side during the observed period. However rate of movement is within safe limit.
- The overall maximum commulative change of 37.8 cm has been observed at S/50 of 366mRL bench, (Initial observation October 2018), towards footwall side. During past one and half year (February 2021 to October 2022). The change in horizontal distance 14.6 cm. however, the rate of movement period (from February 2021 to October 2022) was 0.26 mm /day.
- 172 numbers stations are showing commulative changes between 2.1 cm to 21.9 cm in footwall side during the observed period.



- It may be concluded that the average observed values of movement of monitoring points for the open pit mine is within the safe limit. Considering the dimension and depth of mine, the first trigger point may be considered for the open pit as average 1mm/day movement over a period of 3 months for the majority of pillars in a zone of mine. Therefore it may be concluded that the condition of pit slope of the mine is under safe condition till the last monitoring observation of the mine during October 2022.

Dump:

- Total 26 stations were made available for the monitoring purpose. The overall maximum cumulative change of 16.2 cm has been observed at W/125 during the observation of October 2022. (Initial observation October 2018) during past six month (April 2022 to October 2022). The change in horizontal distance 1.3 cm. However the rate of movement period (from April 2022 to October 2022) was 0.075 mm /day
- 25 numbers stations are showing cumulative changes between 0.1 cm to 15.1 cm, during the observed period.

Subsidence Monitoring

- Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of October 2022 is 34. 22 stations are located towards hangwall side (Surface/ Inpit) and 12 stations are located towards footwall side(Surface/ Inpit) of the mine.
- The overall maximum cumulative change of 3.9 cm has been observed at H/W in pit S-70 (Initial observation February 2021) to till the date of observation.
- The overall maximum cumulative change of 1.6 cm has been observed at F/W surface N-725 (Initial observation February 2021) to till the date of observation.
- The external dump, placed towards South Across zone, is a dead weight over standing slope mass. Cracks were present along the crest of first tier of this dump before the recent dozing operation. The reopening of cracks should be regularly observed, especially during rainy season.
- The level of the ground between the toe of dump (south across side) and road (near water reservoir) leading to Agucha village should be regularly maintained for quick run-off of the rain water away from the dump foundation. Poor drainage at the dump foundation level would result in to yielding of the foundation due to liquefaction by stagnant water between dump toe and road.
- The monitoring should be done departmentally on daily basis in the zone of movement to check any impending failure. It should also be supplemented by SSR.



- The rock mass is weak, weathered and fractured. Constant vigil should be kept in these parts of the pit. It is advisable to continue slope monitoring to detect the onset of failure so that early and effective stabilisation measures can be taken at the earliest. If the instability is unavoidable then it can be brought down in a predictable manner. The iron pegs should be installed along old and new cracks to monitor opening of the crack.
- The lithology is highly weathered and fractured towards southern part, especially southwest part, of the footwall. The monitoring has revealed progressive change in data. It indicates impending failure.
- Location of monitoring stations should be shown on working plan and made available to CIMFR.
- The broken station should be reinstalled. The stations should be installed in such a way that it cover the whole pit and dump.
- The monitoring stations are installed only towards footwall side at different levels. Stations should also be installed towards hangwall side.
- No heap of muck should be left on the benches. The muck should be cleaned and the gradient of the bench should be such that the rainwater flows to lower level in a planned way.
- The mine and dump should have an effective garland drain/ bund, all around, to collect run-off rainwater before it reaches the mine slopes and dump toe. The drains should be steeply graded to promote rapid water movement and minimise the chances of ponding. It is essential that these drains should be kept clear of silt and debris. The benches should have toe drains. These drains should be again interconnected to drain out the rainwater into the mine sump.

The mine management should continue advance pit dewatering. Besides the existing boreholes for pumping, more boreholes should be drilled for dewatering.

- More sub-horizontal drainage and advance pit dewatering holes should be installed for depressurisation of adverse groundwater pressure, especially where seepage has been observed.
- The groundwater regime is likely to be present at various stages of pit development. Its measurement should be continued by installing piezometers. It is also recommended that the grid of piezometer stations should be expanded.
- During the rainy season, one person should be deputed to go in and around the mine in the morning to see any development of tension crack.
- The observations and analysis of slope monitoring data of the dump indicates an average of less than 1mm/day movement for the majority of monitoring pillars in a zone of dump. Hence it may be concluded that the condition of the dump is safe as per observed data by CSIR-CIMFR till October 2022.



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Bibliography

- Barton, N. R., 1971. A model study of the behaviour of steep excavated slopes, Ph.D. Thesis, Imperial College, London.
- Brawner, C.O., 1970. Stability investigations of rock slopes in Canadian mining projects, Proc. 2nd Int. Cong. Rock Mech., Belgrade.
- Coates, D.F., 1977. Pit Slope Manual, Chapter-5, Design, CANMET (Canada Centre for Mineral & Energy Technology, formerly Mines Branch, Energy, Mines and Resources, Canada).
- Hoek, E. and Bray J.W., 1977. Rock Slope Engineering, Inst. of Mining & Metallurgy, London.
- Hoek, E. and Londe, P., 1974. The design of rock slopes and foundations, 3rd Congress ISRM, Denver.
- ISRM, 1978. Suggested methods for the quantitative description of discontinuities in rock masses, Commission on the standardization of laboratory and field tests in rock mech.
- Kennedy, B.A., 1971. Methods of monitoring open pit slopes, Rock Mech., pp. 537-572.
- Larocque, G, 1977. Pit Slope Manual, Chapter-8, Monitoring, CANMET.
- Norton, P. J., 1986. Monitoring of ground movements in surface mining,
- Walker, B, and R. Fell, Soil slope instability and stabilisation, A.A. Balkema, Rotterdam, 1987.

PIT

Table 1: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 390 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/675	1286.281	-1.5	-2.4	-2.8	-3.0
N/650	1279.263	-1.5	-2.4	-3.0	-2.9
N/600	1260.210	-3.5	-4.6	-5.0	-5.2
N/575	1255.757	-1.3	-2.4	-3.0	-3.1
N/550	1254.826	-1.9	-3.1	-3.4	-3.8
N/500	1251.294	-2.8	-4.4	-4.9	-5.1
N/475	1245.527	-3.3	-4.9	-5.7	-5.8
N/425	1235.057	-2.6	-4.0	-4.7	-4.9
N/400	1229.828	-2.8	-4.4	-5.3	-5.5
N/300	1205.676	-3.0	-4.7	-5.6	-5.9
N/250	1190.508	-3.2	-4.1	-5.0	-5.1
N/175	1169.167	-2.9	-4.3	-5.4	-5.5
N/75	1132.917	-2.8	-4.3	-5.2	-5.3
N/50	1128.066	-2.4	-3.8	-4.1	-4.4
N/25	1123.771	-3.0	-4.6	-5.3	-5.7
NS00	1120.169	-5.9	-7.4	-10.4	-10.8
S/25	1116.391	-3.0	-4.5	-5.5	-5.5
S/125	1104.099	-6.9	-11.0	-12.1	-12.4
S/175	1108.839	-7.0	-10.5	-12.0	-12.4
S/200	1111.569	-9.2	-10.2	-11.6	-12.0
S/225	1115.711	-5.3	-7.4	-8.7	-8.8
S/250	1116.993	-5.2	-7.3	-8.7	-9.0
S/275	1121.490	-6.2	-8.9	-10.2	-10.6
S/300	1124.947	-4.8	-6.9	-8.2	-8.3
S/350	1137.185	-17.6	-20.1	-21.4	-21.9
S/400	1160.522	-4.3	-6.3	-7.3	-7.6

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 1 contd : Changes in Horizontal Distance from hangwall Base Station for FW Pillars.
(Monitoring stations are located on 390M RL bench)

Station No.	Horizontal Distance in meter, October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/425	1169.705	-5.1	-7.0	-8.0	-8.0
S/450	1177.498	-4.0	-5.8	-6.8	-6.8
S/475	1184.466	-3.9	-5.1	-5.9	-5.9
S/500	1190.170	-3.8	-5.0	-5.5	-5.7
S/525	1197.167	-3.5	-4.4	-5.3	-5.3
S/550	1206.498	-3.2	-5.8	-6.1	-6.4
S/575	1213.167	-3.8	-5.0	-5.4	-5.7
S/600	1216.148	-5.5	-5.3	-5.8	-5.8
S/625	1218.553	-2.3	-2.9	-3.6	-3.5
S/650	1223.945	-2.1	-2.5	-2.8	-2.8
S/825/370	1247.862	-6.4	-6.7	-7.4	-7.1
S/810/360	1237.093	-6.0	-	-6.5	-6.4
S/775/360	1226.714	-8.7	-9.1	-9.8	-9.8
S/770/350	1209.790	-5.3	-5.5	-6.1	-6.0
S/810/350	1220.781	-4.0	-3.9	-4.4	-4.1
S/805/350	1207.160	-3.6	-3.3	-3.6	-3.5
S765/350	1199.102	-4.7	-4.8	-5.5	-5.5
S/775/280	1100.801	-3.0	-2.8	-3.8	3.6
S/725/275	1089.225	-2.2	-1.8	-2.9	-2.9
S/650/270	1086.037	-1.9	-1.6	-	-
S/575/270	1070.241	-2.8	-3.2	-4.9	-4.8
S/700/230	992.765	-1.8	-0.3	-2.0	-1.6
S/685/230	994.045	-1.9	-0.8	-2.6	-2.5
S/620/220	968.641	-1.6	-1.1	-2.9	-2.8
S/610/220	966.414	-2.3	-1.5	-	-

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 2: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on 366 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/250	1085.630	-4.8	-7.0	-8.3	-8.6
S/200	1078.232	-5.5	-7.9	-9.4	-9.7
S/150	1071.999	-8.3	-12.3	-14.2	-14.7
S/100	1071.267	-10.8	-16.2	-18.2	-18.8
S/50	1075.261	-23.2	-34.8	-36.9	-37.8
NS/00	1086.345	-3.0	-4.4	-5.3	-5.6
N/50	1092.905	-3.3	-4.8	-5.6	-6.0
N/150	1137.815	-3.3	-4.7	-5.7	-5.9
N/275	1171.290	-2.1	-3.6	-4.5	-4.8

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.

Table 3: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on 354 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/400	1128.782	-2.9	-4.5	-5.8	-5.8
N/500	1161.289	-2.2	-3.3	-4.1	-4.2
N/600	1194.011	-2.0	-2.8	-3.4	-3.5
(Monitoring stations are located on 342 M RL bench)					
N/475	1140.948	-2.5	-3.9	-4.8	-4.9
N/410	1116.325	-2.8	-4.3	-5.2	-5.3
N/300	1080.614	-3.1	-4.5	-5.6	-5.8



(Monitoring stations are located on 330 M RL bench)					
Station No.	Horizontal Distance in meter, October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/600	1165.483	-2.1	-3.1	-4.0	-4.1
N/500	1129.650	-2.5	-3.6	-4.6	-4.8
N/475	1126.809	-2.9	-	-	-
N/450	1116.086	-2.8	-4.0	-5.0	-5.1
N/400	1100.375	-3.5	-5.2	-6.3	-6.6
N/300	1066.725	-3.8	-5.6	-6.7	-7.0
N/250	1051.388	-4.2	-5.8	-6.8	-7.2
N/100	1019.723	-4.2	-6.1	-7.7	-8.1
S/100	1021.503	-7.3	-10.5	-12.6	-12.9
S/200	1029.769	-6.4	-9.1	-11.0	-11.2
S/400	1071.803	-5.4	-7.3	-8.9	-8.9
S/500	1119.450	-3.5	-4.4	-5.5	-5.5
S/600	1141.624	-3.2	-3.8	-4.7	-4.7
(Monitoring stations are located on 340 M RL bench)					
N/50/340	1058.040	-3.1	-4.6	-5.7	-5.9
(Monitoring stations are located on 310 M RL bench)					
S/300	1044.087	-4.6	-6.8	-	-
N/25	985.721	-7.6	-11.4	-13.8	-14.3
N/100	995.726	-4.5	-6.2	-8.0	-8.3
N/175	1006.147	-5.6	-8.2	-10.2	-10.8

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 4: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on 290 M RL bench)

Station No.	Horizontal Distance in meter, October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/100	942.521	-7.3	-10.3	-12.8	-13.3
NS/00	957.476	-7.8	-11.0	-13.6	-14.1
N/100	972.517	-5.1	-7.4	-9.2	-9.4
N/300	1018.625	-4.3	-6.3	-7.8	-8.1
(Monitoring stations are located on 270 M RL bench)					
N/350	1018.180	-4.4	-6.2	-7.8	-8.1
(Monitoring stations are located on 260 M RL bench)					
N/350	1001.423	-5.2	-7.4	-9.2	-9.3
N/300	987.209	-5.4	-8.0	-10.2	-
N/200	953.537	-5.7	-8.2	-10.5	-10.6
N/100	935.345	-5.8	-8.0	-10.0	-10.3
NS/00	922.464	-8.4	-11.7	-14.5	-15.1
S/100	907.552	-7.4	-10.4	-13.4	-13.7
S/200	915.569	-7.0	-9.3	-12.3	-12.9
S/300	932.675	-6.4	-8.1	-10.7	-11.2
S/400	969.240	-5.0	-6.6	-8.6	-8.9
S/500	1010.580	-4.1	-	-6.3	-6.4
(Monitoring stations are located on 220 M RL bench)					
S/300	886.294	-6.4	-8.3	-11.1	-11.5
S/200	868.264	-6.9	-9.1	-12.2	-12.7
S/100	860.585	-7.7	-10.2	-13.4	-14.1
NS/00	875.405	-8.2	-10.9	-14.1	-14.5
N/100	889.488	-7.0	-9.9	-12.1	-12.4
N/200	910.230	-7.0	-10.1	-12.5	-12.9
N/500	1013.926	-3.8	-4.3	-6.2	-6.3

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 5: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 190 M RL bench)

Station No.	Horizontal Distance in meter October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/325	829.306	-1.4	-3.8	-7.2	-7.5
S/350	839.227	-2.6	-9.0	-12.0	-12.3
S/425	866.094	-6.5	-	-	-
(Monitoring stations are located on 180 M RL bench)					
S/425	853.539	-5.6	-6.3	-9.0	-9.4
S/400	837.148	-5.7	-	-	-
S/300	810.945	-6.7	-8.7	-11.8	-12.4
S/75	816.637	-7.9	-11.1	-14.4	-14.9
S/25	822.594	-8.3	-11.5	-14.9	-15.6
N/400	929.018	-6.1	-7.6	-10.1	-
(Monitoring stations are located on 170 M RL bench)					
N/450	943.230	-5.1	-6.7	-9.2	-9.3
N/400	923.938	-6.2	-7.5	-10.3	-10.5
N/300	899.240	-7.0	-8.9	-11.7	-11.9
N/250	870.586	-7.0	-9.6	-12.6	-13.1
S/100	769.728	-8.7	-11.7	-15.3	-15.9
S/200	782.330	-3.1	-	-	-
S/300	800.034	-7.0	-8.5	-11.8	-12.3
(Monitoring stations are located on 160 M RL bench)					
S/250	776.941	-	-10.7	-14.0	-15.2
S/50	767.187	-8.8	-11.5	-15.6	-16.0
N/175	833.543	-7.2	-9.3	-12.8	-12.7
N/275	868.114	-8.0	-10.4	-13.1	-13.8
N/375	906.789	-5.7	-4.3	-10.2	-10.4
(Monitoring stations are located on 140 M RL bench)					
N/375	892.259	-6.0	-6.8	-9.9	-10.3
N/325	864.978	-6.7	-9.0	-11.8	-12.1

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 8: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 100 M RL bench)

Station No	Horizontal Distance meter. April 2019	in	Change in Horizontal Distance in cm.			
			February 2021	April 2022	August 2022	October 2022
S/50	536.174		-6.7	-10.2	-12.1	-10.0
S/150	514.209		-5.4	-7.6	-10.0	-10.4
S/250	516.026		-3.2	-7.6	-9.4	-9.7
S/300	526.476		-3.7	-5.0	-	-6.6
S/400	553.163		-3.0	-2.8	-4.3	-4.6
S/500	598.758		-1.5	-0.7	-1.4	-1.5
(Monitoring stations are located on 80 M RL bench)						
S/325	505.774		-3.8	-3.8	-5.7	-5.7
S/250	493.722		-3.6	-9.2	-11.2	-11.3
S/150	493.181		-5.7	-7.8	-9.6	-10.2
(Monitoring stations are located on 70 M RL bench)						
S/200	478.597		-	-	-	-
S/300	485.722		-	-	-	-
S/350	500.327		-3.2	-2.9	-4.7	-4.8
(Monitoring stations are located on 90 M RL bench)						
N/100	575.054		-7.3	-11.3	-13.8	-14.2
N/150	589.115		-7.6	-10.9	-12.9	-13.4
N/175	599.364		-6.9	-10.7	-12.3	-12.6
N/200	614.903		-7.0	-10.1	-12.0	-12.5
N/200	633.136		-5.9	-8.2	-9.7	-10.1
N/200	660.286		-5.3	-7.7	-9.0	-9.2
(Monitoring stations are located on 340 M RL bench)						
S/25	206.246		-	-	-	-
S/275	102.882		-5.5	-	-	-
(Monitoring stations are located on 160 M RL bench)						
S/245	587.279		-7.0	-10.1	-11.9	-12.5
S/325	596.396		-5.5	-7.4	-8.9	-9.2
S/375	609.051		-4.6	-5.8	-	-7.5
(Monitoring stations are located on 170 M RL bench)						
S/485	-		662.217	-	-1.2	-1.2
S/400	-		628.336	-	-2.7	-2.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V.



Table 7: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on Shear zone)

Station No	Horizontal Distance in meter. February 2021	Change in Horizontal Distance in cm.
		April 2022
S Zone S-825	1247.798	-0.3
S Zone S-810	1237.033	-
S Zone S-775	1226.627	-0.4
S Zone S-770	1209.737	-0.2
S Zone S-810	1220.741	+0.1
S Zone S-805	1207.124	+0.3
S Zone S-765	1199.055	-0.1
S Zone S-775	1100.771	+0.2
S Zone S-725	1089.203	+0.4
S Zone S-650	1086.018	+0.3
S Zone S-575	1070.213	-0.4
S Zone S-700	992.747	+1.5
S Zone S-685	994.026	+1.1
S Zone S-620	968.625	+0.5
S Zone S-610	966.391	+0.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 8: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on Shear zone)

Station No.	Horizontal Distance in meter, February 2021	Change in Horizontal Distance in cm.	
		August 2022	October 2022
140mRL			
N-500	890.109	-1.9	-1.9
N-400	830.505	-3.3	-3.2
390mRL			
S-99	1109.080	+2.3	+1.8
S-53	1114.575	+5.0	+4.6
S Zone S-780	1259.327	+6.9	+7.3
S Zone S-790	1262.048	+7.5	+7.9
S Zone S-827	1276.671	+6.5	+6.7
S Zone S-860	1266.858	+7.7	+8.1
S Zone S-763	1170.819	+6.6	+6.5
S Zone S-798	1163.120	+6.7	+6.8
S Zone S-786	1191.001	+6.4	+6.4
360mRL			
S-865	1217.383	+8.0	+8.2
S-920	1200.938	+8.6	+8.8
S-945	1148.090	+10.0	+10.2
S-940	1104.995	+9.8	+10.2
395mRL			
N-935	1363.071	+7.1	+7.1
N-880	1348.907	+6.9	+7.0
N-820	1325.189	+6.4	+6.3

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 9: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars, (Monitoring stations are located on 370 M RL bench)

Station No.	Horizontal Distance in meter, October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/850	1079.481	-3.2	-5.2	-5.7	-5.7
N/825	1080.326	-4.4	-6.9	-7.3	-7.8
N/750	1074.429	-8.0	-11.7	-12.4	-13.1
N/725	1076.972	-7.1	-9.9	-11.0	-11.2
(Monitoring stations are located on 360 M RL bench)					
N/575	1110.064	-8.0	-12.2	-13.3	-14.0
N/625	1117.785	-7.1	-11.0	-11.9	-12.3
N/650	1093.372	-6.6	-10.1	-11.0	-11.5
N/700	1061.799	-7.0	-10.5	-11.7	-11.9
N/725	1058.302	-11.2	-17.1	-18.4	-19.5
N/775	1060.770	-20.7	-25.1	-26.1	-26.8
N/800	1065.492	-4.8	-7.5	-8.2	-8.5
N/850	1068.669	-3.4	-5.2	-5.6	-6.0
N/875	1065.320	-	-	-	-
N/925	1045.069	-1.1	-2.0	-2.2	-2.2
(Monitoring stations are located on 350 M RL bench)					
N/875	1049.968	-2.2	-3.5	-3.8	-3.8
N/775	1049.858	-5.3	-10.3	-11.2	-11.6
N/700	1047.736	-14.8	-21.8	-23.8	-25.0
S/400	1019.083	-	-11.2	-	-13.2
(Monitoring stations are located on 340 M RL bench)					
N/450	1077.351	-8.7	-13.4	-14.7	-15.5
N/525	1082.133	-8.5	-13.1	-14.3	-15.2
S/175	969.599	-10.2	-18.4	-21.2	-24.1
S/200	971.056	-9.9	-17.7	-20.1	-21.4
S/275	1059.386	-	-	-	-
S/300	988.732	-8.1	-14.5	-16.4	-17.4

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 10: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.

(Monitoring stations are located on 360 M RL bench)

Station No.	Horizontal Distance in meter, October 2018	Change in Horizontal distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/500	1028.800	-	-9.5	-10.3	-11.0
S/650	1043.452	-4.3	-7.4	-8.1	-8.5
S/700	1051.904	-	-	-8.2	-8.7
S/750	1058.332	-3.1	-5.7	-6.2	-6.5
S/800	1070.657	-	-4.8	-	-
(Monitoring stations are located on 330 M RL bench)					
S125	961.236	-9.8	-17.6	-20.0	-21.3
(Monitoring stations are located on 320 M RL bench)					
N/150	932.405	-10.8	-18.8	-21.3	-22.6
N/100	925.838	-10.6	-18.5	-21.0	-22.2
(Monitoring stations are located on 310 M RL bench)					
N/250	937.220	-10.9	-18.4	-20.6	-22.0
N/200	932.800	-10.0	-17.8	-20.2	-21.4
(Monitoring stations are located on 300 M RL bench)					
N350	945.824	-9.9	-17.7	-	-20.7
N/300	943.207	-9.9	-17.5	-19.7	-20.8
(Monitoring stations are located on 290 M RL bench)					
N/425	946.101	-11.0	-19.2	-21.6	-22.6
(Monitoring stations are located on 280 M RL bench)					
N/625	934.326	-8.7	-12.3	-13.5	-13.9
N/575	931.288	-14.7	-19.8	-21.4	-21.7
N/475	941.314	-11.3	-19.5	-21.9	-22.9

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 11: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.
(Monitoring stations are located on 270 M RL bench)

Station No.	Horizontal distance in meter. October 2018	Change in Horizontal distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/825	961.368	-1.9	-2.7	-3.4	-3.6
N/625	933.253	-4.5	-	-	-
(Monitoring stations are located on 260 M RL bench)					
N/750	928.315	-2.7	-4.5	-5.2	-5.4
N/725	920.922	-3.7	-5.8	-6.7	-7.0
S/100	862.646	-10.1	-18.0	-20.8	-22.1
S/200	867.709	-	-	-	-
S/300	883.112	-8.4	-14.8	-17.4	-17.9
(Monitoring stations are located on 250 M RL bench)					
S/350	888.108	-7.4	-12.8	-14.6	-15.3
S/125	855.611	-9.4	-16.8	-19.1	-20.3
S/75	854.076	-10.4	-	-	-
N/25	861.149	-10.1	-17.0	-19.5	-20.7
(Monitoring stations are located on 240 M RL bench)					
S/750	867.567	-2.8	-	-	-
(Monitoring stations are located on 220 M RL bench)					
S/550	854.993	-3.9	-6.7	-7.8	-7.8
S/625	868.426	-3.4	-6.2	-7.1	-7.4
(Monitoring stations are located on 200 M RL bench)					
S/325	838.663	-7.1	-12.4	-14.2	-15.0
S/250	822.848	-8.3	-15.2	-17.1	-18.3
S/150	812.072	-6.5	-13.4	-17.6	-18.7
S/100	808.974	-9.2	-16.2	-18.1	-19.5
S/50	810.541	-8.9	-15.9	-18.3	-19.5
N/50	815.699	-	-	-	-

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 12: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.

(Monitoring stations are located on 190 M RL bench)

Station No.	Horizontal distance in meter, October 2018	Change in Horizontal distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/225	810.354	-8.2	-14.8	-17.0	-18.1
S/150	801.476	-9.0	-15.6	-17.4	-18.9
S/75	799.918	-8.1	-14.1	-16.8	-17.1
(Monitoring stations are located on 180 M RL bench)					
N/100	800.522	-8.8	-15.0	-17.7	-18.6
N/50	796.751	-8.7	-15.0	-17.0	-18.1
S/50	791.809	-8.2	-13.9	-16.1	-17.1
S/125	791.716	-7.8	-13.4	-15.6	-16.4
(Monitoring stations are located on 160 M RL bench)					
S/50	744.854	-8.5	-14.4	-16.4	-17.7
S/150	744.267	-9.0	-15.0	-17.6	-18.2
S/225	756.040	-	-15.1	-17.0	-18.1
(Monitoring stations are located on 130 M RL bench)					
N/300	695.734	-10.1	-16.3	-19.0	-19.9
N/125	730.924	-9.6	-17.0	-19.7	-21.4
N/75	723.088	-10.4	-18.2	-21.3	-22.4
S/25	717.473	-9.7	-16.2	-18.5	-19.5
S/125	715.982	-10.7	-18.9	-22.0	-23.6
N/225	April 2019 564.338	-10.6	-18.9	-	-

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 13. Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.

(Monitoring stations are located on 100mRL bench)

Station No.	Horizontal distance in meter April 2019	Change in Horizontal distance in cm.			
		February 2021	April 2022	August 2022	October 2022
S/250	664.844	-8.1	-15.3	-17.5	-18.1
S/375	714.150	-4.6	-9.1	-10.4	-10.9
(Monitoring stations are located on 70 M RL bench)					
S/250	640.877	-8.7	-16.8	-18.8	-19.7
S/125	585.044	-12.6	-23.2	-26.6	-27.7
N/100	542.254	-14.1	-25.6	-29.8	-32.2
N/250	471.852	-12.3	-20.6	-24.1	-24.6
(Monitoring stations are located on 80 M RL bench)					
N/225	489.339	-12.8	-20.8	-24.3	-25.4
(Monitoring stations are located on 50 M RL bench)					
N/175	486.365	-13.8	-23.6	-26.9	-28.4
N/75	526.262	-16.4	-29.0	-33.4	-36.1
S/25	544.145	-16.2	-28.6	-33.3	-35.0
S/100	562.848	-14.5	-25.9	-30.2	-31.3
(Monitoring stations are located on 30 M RL bench)					
S/150	567.966	-16.6	-31.4	-35.5	-37.3
S/100	543.203	-19.2	-34.9	-40.0	-42.3
S/30	526.064	-18.2	-32.8	-37.1	-39.3
N/160	474.559	-12.8	-22.5	-25.3	-27.0

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 14: Changes in Horizontal Distance from Footwall Base Station for HW Pillars.
(Monitoring stations are located on 380mRL bench)

Station No.	Horizontal distance in meter. February 2021	Change in Horizontal distance in cm.		
		April 2022	August 2022	October 2022
N-974	1052.557	+0.6	+1.1	+0.9
N-944	1069.365	+0.5	+0.8	+0.8
N-910	1087.729	-0.2	-0.5	-0.6
N-855	1097.014	-0.7	-0.9	-0.8
N-790	1094.035	-1.4	-1.0	-2.0
N-715	1086.962	-2.5	-3.0	-3.5
N-705	1087.155	-2.2	-2.7	-3.3
290mRL				
N-750	992.530	-2.2	-2.2	-2.9
N-850	983.979	+0.4	+0.5	+0.5
330mRL				
S-850	1021.436	-0.6	-0.6	-0.8
S-795	1004.720	+0.7	+1.0	+0.9
310mRL				
N-2	912.719	-6.7	-9.5	-10.8
300mRL				
S-181	931.981	-6.8	-9.1	-10.4
270mRL				
S-470	944.177	-2.4	-3.1	-3.7
S-560	950.066	-1.8	-2.0	-2.5
260mRL				
S-490	905.242	-2.0	-2.5	-3.1
230mRL				
S-570	892.939	-1.3	-1.9	-2.6

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.

**DUMP****Table 15: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 435 M RL Dump)**

Station No.	Horizontal distance in meter, January 2019	Change in Horizontal distance in cm.
		February 2021
W/300	311.608	-
W/500	170.017	-
W/675	228.265	-
(Monitoring stations are located on 475 M RL Dump)		
W/450	287.441	+1.1
W/600	303.168	+1.2
W/700	364.045	-
(Monitoring stations are located on 535 M RL Dump)		
W/400	437.048	+0.8
W/600	437.207	+0.8
W/700	512.789	+1.1
(Monitoring stations are located on 520 M RL Dump)		
W/500	385.813	-
W/650	435.882	-
W/800	532.654	-
W/900	593.313	-
W/950	647.070	-

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 16: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 475 M RL Dump)

Station No.	Horizontal distance in meter. April 2019	Change in Horizontal distance in cm.
		February 2021
W/410	288.018	+0.9
W/1275	350.840	-
W/925	389.229	+0.9
W/540	294.132	-
W/725	524.227	-
W/640	312.389	-

Table 16 (Contd.): Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 410 M RL Dump)

Station No.	Horizontal distance in meter. April 2022	Change in Horizontal distance in cm.	
		August 2022	October 2022
W540	1079.815	+0.2	-0.6
W590	-	1072.581	-0.8

Table 16 (Contd.): Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 495 M RL Dump)

Station No.	Horizontal distance in meter. April 2022	Change in Horizontal distance in cm.	
		August 2022	October 2022
W715	1618.589	+1.6	+1.1
W630	1533.679	+1.1	+0.5
W590	1508.840	+1.1	+0.5
W525	1477.285	+0.7	+0.9

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 17: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 515 M RL Dump)

Station No.	Horizontal distance in meter, October 2018	Change in Horizontal distance in cm.			
		February 2021	April 2022	August 2022	October 2022
E/130	1668.464	-6.1	-11.2	-10.1	-11.0
E/170	1703.150	-7.2	-12.8	-12.6	-12.8
E/10	1737.702	-5.3	-10.2	-9.1	-10.2
W/40	1759.657	-5.1	-	-	-
W/100	1782.147	-5.5	-	-	-
(Monitoring stations are located on 495 M RL Dump)					
W/120	1743.351	-	-	-	-
E/110	1637.058	-6.2	-	-	-
E/165	1611.521	-11.7	-15.8	-14.1	-15.1
E/500	1450.291	-5.2	-	-	-
E/600	1502.015	-15.5	-	-	-
(Monitoring stations are located on 475 M RL Dump)					
W/15	1656.298	-	-10.6	-9.2	-10.2
W/160	1699.168	-5.4	-	-	-
E/700	1478.575	-	-	-	-
E/560	1442.519	-	-	-	-
E/465	1420.321	-8.5	-	-	-
(Monitoring stations are located on 455 M RL Dump)					
E/190	1518.000	-	-9.4	-8.6	-9.6
W/150	1645.517	-6.9	-	-	-
W/10	1614.675	-6.7	-	-	-
(Monitoring stations are located on 435 M RL Dump)					
W/125	1600.171	-	-14.9	-15.2	-16.2

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.



Table 18: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 455 M RL Dump)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		February 2021	April 2022	August 2022	October 2022
N/2050	429.939	-0.3	-0.2	+0.2	+0.3
N/1875	426.161	0.0	+0.1	+0.7	+0.6
N/2375	(Jan. 2019)				
	561.920	-1.7	-1.3	-1.0	-1.1
(Monitoring stations are located on 435 M RL Dump)					
N/1875	374.690	-0.8	-1.5	-1.0	-1.2
N/2100	399.191	-6.6	-0.4	+0.1	-0.1
N/2335	(Jan. 2019)				
	497.828	-0.7	-0.5	-0.3	-0.3

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively.

**Subsidence Monitoring****Table 19: Changes in Reduced Level**
(Ground Movement/Subsidence Monitoring Stations are Located on Hangwall Side)

Station No.	Reduced Level in meter, February 2021	Change in Reduced Level in cm.		
		April 2022	August 2019	October 2022
160mRL				
H/W in pit N-60	158.882	+4.7	+0.7	-0.5
170mRL				
H/W in pit S-70	172.151	+0.8	-3.9	-3.7
200 mRL				
H/W in pit S-350	199.132	-2.4	+1.7	+2.5
215 mRL				
H/W in pit S-505	216.861	+5.2	+5.1	+5.9
340 mRL				
H/W in pit S-335	340.637	-1.8	-1.3	-1.3
310 mRL				
H/W in pit N-210	311.215	-1.0	-1.3	-2.0
H/W in pit N-300	309.983	+0.4	-0.7	+0.2
H/W in pit N-395	310.138	0.0	-1.2	+1.1
H/W in pit N-490	310.664	-1.1	-1.6	-0.7
H/W in pit N-560	310.547	+8.2	+5.1	+5.2
270 mRL				
H/W in pit N-615	281.543	-0.6	-2.2	-0.9
H/W in pit N-725	269.994	+8.9	-0.6	+0.5
H/W in pit N-780	270.022	+12.4	+1.5	+1.6
H/W in pit N-820	270.708	+13.1	+3.4	+3.9

Note: "+" and "-" signs indicate increase and decrease in the Reduced Level respectively.



Table 20: Changes in Reduced Level
(Ground Movement/Subsidence Monitoring Stations are Located on Hangwall Side)

Station No.	Reduced Level meter. February 2021	in	Change in Reduced Level in cm.		
			April 2022	August 2019	October 2022
Surface					
H/W Surface N-910	395.121	-	-	-	
H/W Surface N-660	386.652	-	+10.3	+10.9	
H/W Surface N-470	385.998	-	+19.7	+19.3	
H/W Surface N-115	384.556	-	+5.9	+6.4	
H/W Surface S-230	381.481	-	-	-	
H/W Surface S-480	382.090	-	+28.2	+28.1	
H/W Surface S-635	380.770	-	+26.7	+26.6	
H/W Surface S-165	384.786	-	+0.2	+0.3	
H/W Surface N-285	384.656	-	-	-	
H/W Surface N-625	385.615	+4.3	+1.1	+2.2	
H/W Surface S-245	-	-	381.908	+0.1	

Note: "+" and "-" signs indicate increase and decrease in the Reduced Level respectively.

Table 21: Changes in Reduced Level
(Ground Movement/Subsidence Monitoring Stations are Located on Footwall Side)

Station No.	Reduced Level meter. February 2021	in	Change in Reduced Level in cm.		
			April 2022	August 2019	October 2022
Surface					
F/W Surface S-650	390.922		+2.7	+2.3	-
F/W Surface S-280	391.764		+5.6	+3.3	+2.8
F/W Surface S-160	392.555		-	-	
F/W Surface N-60	393.364		+8.5	+4.6	+5.9
F/W Surface N-275	394.010		-	-	
F/W Surface N-430	395.659		-	-	
F/W Surface N-610	397.420		+0.7	+1.8	+1.2
F/W Surface N-725	397.537		-1.6	+1.4	+0.8
F/W Surface N-900	399.327		+2.4	-	



Table 21(Contd): Changes in Reduced Level
(Ground Movement/Subsidence Monitoring Stations are Located on Footwall Side)

Station No.	Reduced Level in meter, February 2021	Change in Reduced Level in cm.		
		April 2022	August 2019	October 2022
355mRL				
F/W in pit N-365	355.279	+1.2	+1.1	+1.2
330mRL				
F/W in pit N-175	336.872	-	+1.3	+1.6
300mRL				
F/W in pit S-195	298.857	+1.1	-0.7	0.0
26mRL				
F/W in pit S-645	260.070	+2.8	-	-
F/W in pit S-421	222.027	+1.7	-0.2	-0.8
180mRL				
F/W in pit S-100	181.262	+1.9	+1.8	+1.2
160mRL				
F/W in pit N-55	161.514	+2.8	+1.2	+1.4
130mRL				
F/W in pit N-445	130.806	+0.3	+1.7	+1.2
110mRL				
F/W in pit N-255	111.528	+7.1	+0.5	+0.7

Note: "+" and "-" signs indicate increase and decrease in the Reduced Level respectively.

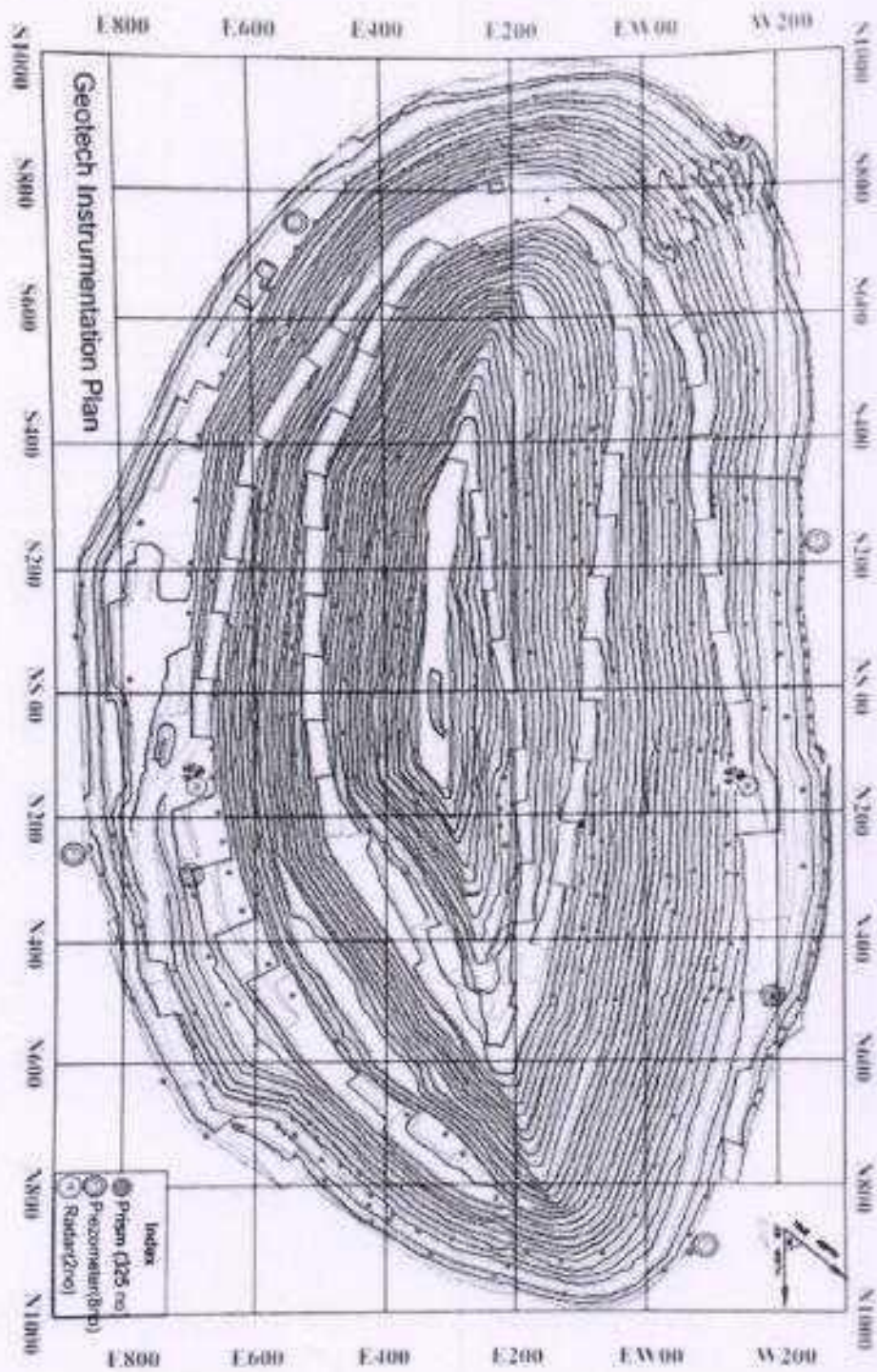


Fig 3: Geotechnical instrumentation plan with slope monitoring pillars.

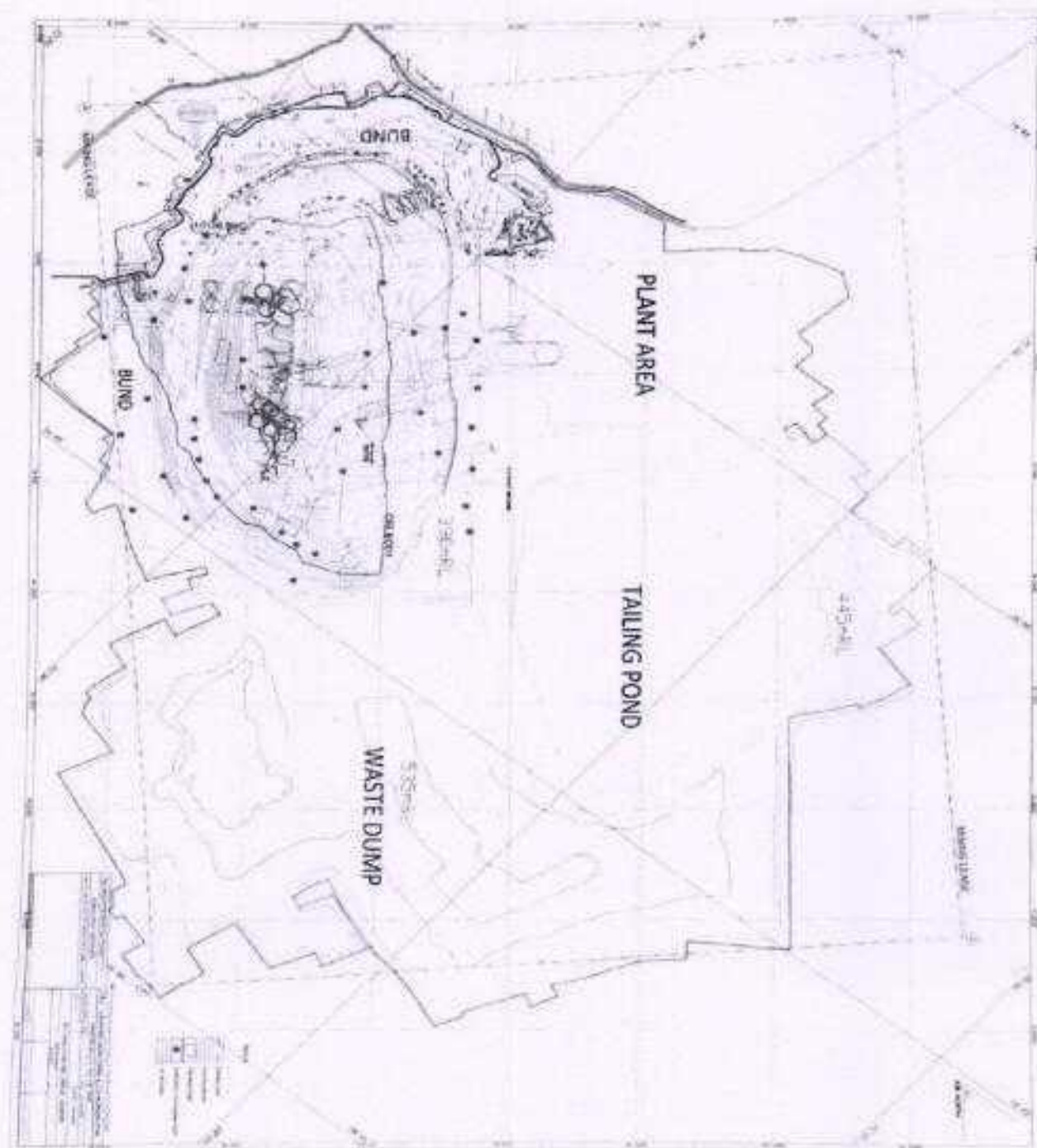


Fig 4: Ground movement monitoring plan above U/G mine.

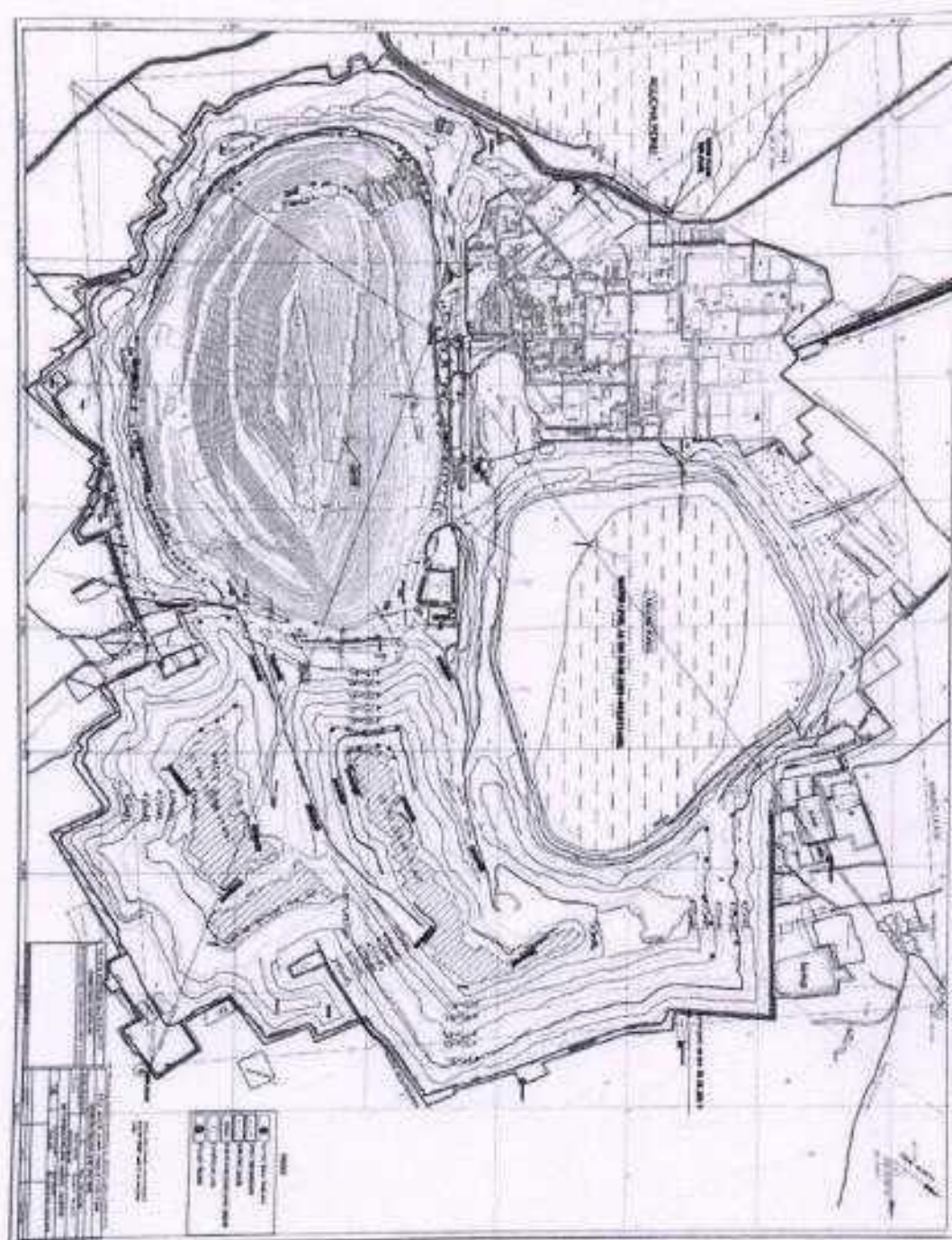


Fig 5: Geotechnical instrumentation plan for Dump with slope monitoring pillars.



Blast vibration data (Monitoring at UG)							
S.No	Date	Blast location (stope)	Monitoring location	Radial distance (m)	MCPD (kg)	PPV (mm/s)	Frequency (Hz)
1	10-Apr-23	-405L_S67	-380L South Access Refuge Chamber	478	185	1.15	80
2	13-Apr-23	-280L_S656	-380L South Access Refuge Chamber	456	77	0.79	80
3	19-Apr-23	-355L_S622	-380L South Access Refuge Chamber	254	62	1.26	96
4	22-Apr-23	-355L_S622	-380L South Access Refuge Chamber	254	125	1.54	120
5	24-Apr-23	-380L_S187	-380L South Access Refuge Chamber	232	125	1.58	95
6	25-Apr-23	-405L_S277	-380L South Access Refuge Chamber	179	107	1.01	105
7	6-May-23	-355L_N82	-380L South Access Refuge Chamber	320	125	0.50	80
8	10-May-23	-355L_S157	-380L South Access Refuge Chamber	265	142	1.66	80
9	15-May-23	-380L_N22	-380L South Access Refuge Chamber	430	85	1.00	100
10	17-May-23	-380L_S307	-380L South Access Refuge Chamber	170	96	0.53	120
11	21-May-23	-355L_S547	-380L South Access Refuge Chamber	200	103	1.59	105
12	14-Jun-23	-405L_S82	-380L South Access Refuge Chamber	330	76	1.73	111
13	14-Jun-23	-380L_S562	-380L South Access Refuge Chamber	220	71	1.25	97
14	15-Jun-23	-430L_N52	-380L South Access Refuge Chamber	400	58	1.1	162
15	17-Jun-23	-380L_S562	-380L South Access Refuge Chamber	220	42	0.536	98
16	26-Jun-23	-405L_S82	-380L South Access Refuge Chamber	330	153	0.741	105
17	8-Jul-23	-455L_N142	-380L South Access Refuge Chamber	440	82	1.54	100.0
18	10-Jul-23	-330L_S637	-380L South Access Refuge Chamber	290	64	1.02	160.8
19	16-Jul-23	305L_S202 B	-380L South Access Refuge Chamber	230	148	0.91	214.3
20	23-Jul-23	-405L_N247	-380L South Access Refuge Chamber	500	101	0.47	167.6
21	31-Jul-23	-380L_S412	-380L South Access Refuge Chamber	140	50	0.52	188.9

22	2-Aug-23	-355L_S232	-355 North Access MB	475	48	0.8	68.6
23	4-Aug-23	-380L_N8	-355 North Access MB	265	86	1.37	90
24	10-Aug-23	-405L_N247	-355 North Access MB	155	150	0.66	68.1
25	14-Aug-23	-405L_S37	-355 North Access MB	318	133	2.08	62.4
26	30-Aug-23	-430L_N202 A	-380L South Access Refuge Chamber	615	57	0.489	111
27	1-Sep-23	-405L_N23	-380L South Access Refuge Chamber	400	59	0.66	180.0
28	2-Sep-23	-380L_S142	-380L South Access Refuge Chamber	280	119	1.39	98.0
29	9-Sep-23	-405L_S562	-380L South Access Refuge Chamber	240	84	0.76	179.0
30	13-Sep-23	-355L_S637	-380L South Access Refuge Chamber	290	44	1.57	171.0
31	15-Sep-23	-405L_N307 A	-380L South Access Refuge Chamber	600	57	1.25	149.0
32	14-Oct-23	-430L_N127	-380L South Access Refuge Chamber	320	190	0.84	100
33	16-Oct-23	-405L_N307	-380L South Access Refuge Chamber	180	136	0.757	97
34	11-Oct-23	-205L_S673	-355 North Level Access	850	61	0.47	112
35	17-Oct-23	-380L_S622	-355 North Level Access	875	89	0.5	90

Peak particle velocity



सर्वोच्च
सर्वोच्च न्यायालय
सर्वोच्च न्यायालय
सर्वोच्च न्यायालय
सर्वोच्च न्यायालय
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Gangs Rejuvenation
Central Ground Water Authority

(नृपत विमर्श हेतु अन्तराष्ट्रिय प्रमाण पत्र)

NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Hindustan Zinc Limited		
Project Address:	Hindustan Zinc Ltd., Rampura Agucha Mine, Village - Agucha, Tehsil - Hurda, Bhiwara		
Village:	Agucha	Block:	Hurda
District:	Bhiwara	State:	Rajasthan
Pin Code:			
Communication Address:	Hindustan Zinc Ltd., Rampura Agucha Mine, Village - Agucha, Tehsil - Hurda, Bhiwara, Hurda, Bhiwara, Rajasthan - 311022		
Address of CGWA Regional Office:	Central Ground Water Board Western Region, S-2, Jhalana Doongri, Jaipur, Rajasthan - 302004		

1. NOC No.:	CGWA/NOC/MIN/REN/2022/7143						
2. Application No.:	21-4/801/RJ/MIN/2008				3. Category:	Over Exploited	
4. Project Status:	Existing Ground Water				5. NOC Type:	Renewal	
6. Valid from:	06/07/2022				7. Valid up to:	07/07/2024	
8. Ground Water Abstraction Permitted:							
Fresh Water		Saline Water		Dewatering		Total	
m/day	m/year	m/day	m/year	m/day	m/year	m/day	m/year
		0.00 0.00		250.00 91250.00			
9. Details of ground water abstraction /Dewatering structures							
Total Existing No.:1						Total Proposed No.:0	
		DW	DCB	SW	TW	MP	MPu
Dewatering Structure*		0	0	0	0	1	0
		0	0	0	0	0	0
DW- Dug Well DCB-Dup-cum-Bore Well (Drill-Bore Well) TB-Tube Well LB-Line Well/PU-Pump							
10. Ground Water Abstraction/Restoration Charges paid (Rs.):							
11. Number of Piezometers/Observation wells to be constructed/monitored & Monitoring mechanism,				No. of Piezometers		Monitoring Mechanism	
						Manual	DWLR* DWLR With Telemetry
*DWLR- Digital Water Level Recorder				1		0	1

(Compliance Conditions given overleaf)

This is an auto-generated document & need not to be signed.

सर्वोच्च न्यायालय, सर्वोच्च न्यायालय, सर्वोच्च न्यायालय - 302004 / 302004, सर्वोच्च न्यायालय, सर्वोच्च न्यायालय

Phone: 011-23020141 Fax: 23020142, 23020143
Email: cgwa@cgwa.gov.in

सर्वोच्च न्यायालय - सर्वोच्च न्यायालय
सर्वोच्च न्यायालय - सर्वोच्च न्यायालय



भारत सरकार
जल संधि मंत्रालय
जल संसाधन, नदी विकास
और लघु सिंचन विभाग
औद्योगिक भूमि जल अधिकार
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

(भूजल विकास हेतु अनापत्ति प्रमाण पत्र)

NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

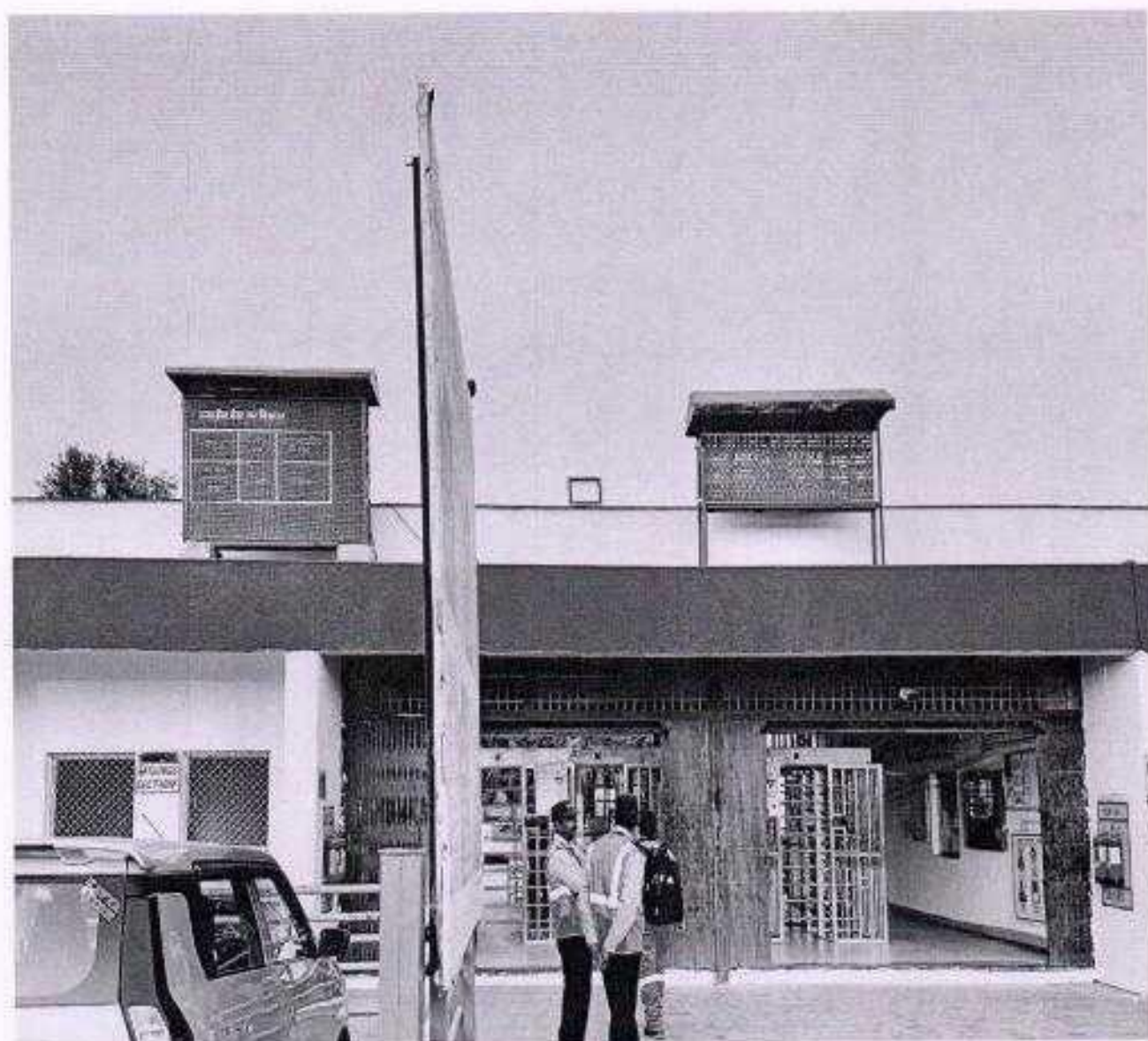
Project Name:	Hindustan Zinc Ltd.		
Project Address:	Hindustan Zinc Ltd., Rampura Agucha Mines, Village - Agucha		
Village:	Agucha	Block:	Hurda
District:	Bhilwara	State:	Rajasthan
Pin Code:			
Communication Address:	Hindustan Zinc Ltd., Rampura Agucha Mine, Village - Agucha, Tehsil- Hurda, Bhilwara, Hurda, Bhilwara, Rajasthan - 311022		
Address of CGWB Regional Office :	Central Ground Water Board Western Region, B-8, Jhalana Doongri, Jaipur, Rajasthan - 302004		

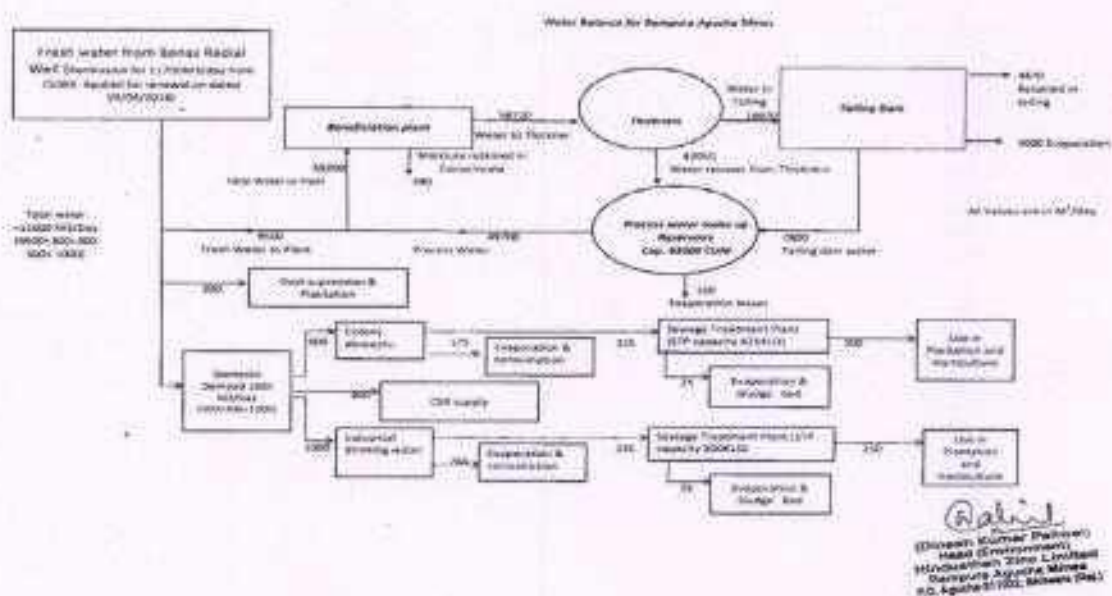
1. NOC No.:	OGWA/NOC/MIN/REN/3/2023/7399									
2. Application No.:	21-4/2/RJ/MIN/2004			3. Category:	Over Exploited					
				(GWRE 2020)						
4. Project Status:	Existing Ground Water			5. NOC Type:	3rd Renewal					
6. Valid from:	06/07/2022			7. Valid up to:	07/07/2024					
8. Ground Water Abstraction Permitted:										
Fresh Water		Saline Water		Dewatering		Total				
m ³ /day	m ³ /year	m ³ /day	m ³ /year	m ³ /day	m ³ /year	m ³ /day	m ³ /year			
11700.00	4270500.00									
9. Details of ground water abstraction /Dewatering structures										
Total Existing No.:6					Total Proposed No.:0					
	DW	DCB	BW	TW	MP	DW	DCB	BW	TW	MP
Abstraction Structure*	1	0	5	0	0	0	0	0	0	0
*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit										
10. Ground Water Abstraction/Restoration Charges paid (Rs.):								41646150.00		
11. Number of Piezometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.	No. of Piezometers					Monitoring Mechanism				
						Manual	DWLR**	DWLR With Telemetry		
**DWLR - Digital Water Level Recorder	2					0	1	1		

(Compliance Conditions given overleaf)
This is an auto generated document & need not to be signed.

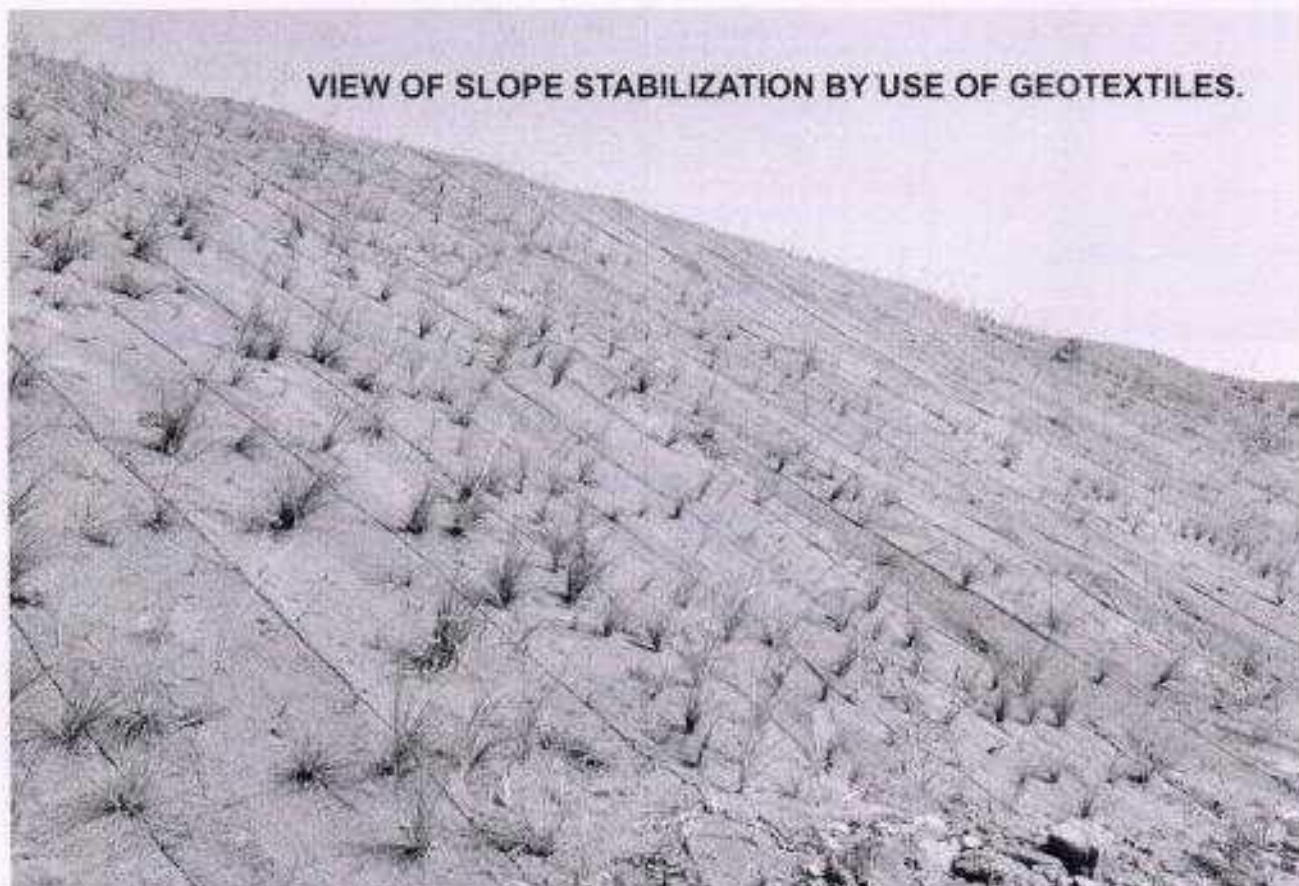
18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383541 Fax: 23382051, 23386743
Website: cgmw-aoc.gov.in

पानी बचावें, जीवन बचावें
SAVE WATER - SAVE LIFE





Water Balance



Geotextiles



o/c



Mine code: 270020

RA Mine/VTC/F.18/2023 / 2182-2184

Dated: 04.01.2023

To

1. The Director General of Mines Safety
Office of DGMS
Barwa Road
DHANBAD
JHARKHAND
PIN: 826001

2. The Dy Director General of Mines Safety
Office of DGMS, North Zone
Room No 201-3, Block -B, CGO Complex
HAPUR ROAD, KAMLA NEHRU NAGAR
GAZIABAD - UP
PIN: 201002

3. The Director of Mines Safety
Office of DGMS
Anasagar Link Road
AJMER, RAJASTHAN
PIN: 305001

Sub. : Submission of Annual Return in Form "T" for the year 2022

Sir,

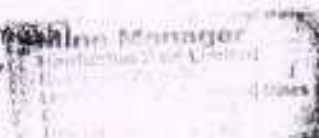
Please find enclosed the Annual Return Form "T" for the year ending 31st December- 2022, in respect of Rampura Agucha Lead and Zinc Underground Mine of Hindustan Zinc Limited.

Enclosed as above

Thanking you

Sincerely yours

(Sachin M. Deshpande)
"Mine Manager"

**Hindustan Zinc Limited**

Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
M +91-9001294956-57 www.hzindia.com

Registered Office : Teshai Bhawan, Udaipur (Rajasthan) 313 004
CIN No. L27206RJ1966PLC001208

[FORM - T]

[See Rule 29B (i)]

Annual Return for the year ending on the 31st December 2022

1. Name of Mines Rampura Agucha Lead and Zinc Underground Mine
2. Postal address of Mines M/S Hindustan Zinc Limited,
Rampura Agucha Mines
P.O. Agucha
Dist. Bhilwara (RA) Pin: 311022
3. Date of opening of Mine 15.01.2010
4. Date of closing (if closed) Not applicable
5. Situation of Mine (District/State) Bhilwara/Rajasthan
6. Name of Owner, Postal address: Sh. Arun Misra
CEO & Whole-time Director
Hindustan Zinc Limited
Yashad Bhawan,
UDAIPUR - 313004

7. Number of person medically examined:

Type of ME	Number of persons required to be Medically examined during 2022		Number of persons Medically examined during 2022	
	OWN	CONT	OWN	CONT
IME	As per requirement		0	484
PME	176	617	176	617

8. Number of persons declared Medically unfit NIL
9. Categorization of the persons Declared unfit NIL


Certified that the information has been given above, is correct to the best of my knowledge.

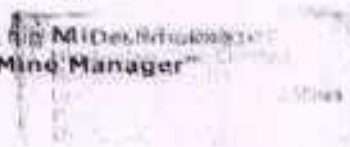
Date: 04.01.2023

Seen & Verified —

Countersigned

Vedant 92-
05/01/23

Signature: 
Name: (See fig) M. Deshpande
Designation: "Mine Manager"





Covered conveyer belt


vedanta

transforming elements

HZL/RAM/ENV/2020-21/785



Dated : 28.08.2020

To,
 The Director,
 Ministry of Environment, Forest and Climate Change,
 Regional Office (Central Region),
 Kendriya Bhawan,
 5th Floor, Sector "II", Aliganj,
 Lucknow – 226024

Subject: Submission of study report in compliance of the EC amendment No: F-11015/267/2008-IA.II(M) dated 28.02.2020 of M/s Hindustan Zinc Limited in the mine lease area of 1200 Ha located in village Agucha, Tehsil Hurda, District Bhilwara, Rajasthan.

Sir,

Additional specific condition No. 3 in the above mentioned amendment letter is read as below:

"PP shall engage suitable agency for conducting subsidence study for increasing the depth of working from 1000mbgl to 1500mbgl. The report shall be submitted to Ministry within 6 months."

In compliance of this condition, study has been conducted by Central Institute for Mining & Fuel Research (CSIR-CIMFR). Copy of the study report "Numerical Modelling Studies for Subsidence Prediction at Rampura Agucha Mine, HZL" is attached herewith for perusal please.

Thanking You,

Yours faithfully,

(Sd/- SBL Director,
 SBL Director,

Director, Agucha SBL
 Hindustan Zinc Limited
 Rampura Agucha Mine
 PO- Agucha
 Dist. - Bhilwara (Ra.)

CC: The Member Secretary,
 IA – Division (Non-Coal Mining)
 Vayu Block, 3rd Floor, Indira Paryavaran Bhawan,
 Ministry of Environment, Forest & Climate Change
 Jorbagh Road, New Delhi-110003.

Hindustan Zinc Limited

Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
 M +91-9001294954-57, F +91-1483 229012 www.hzindia.com

Registered Office : Fakhad Bhawan, Udaipur (Rajasthan) 313 004
 CIN No. L27204RJ1964PLC001209

9/c- Euv

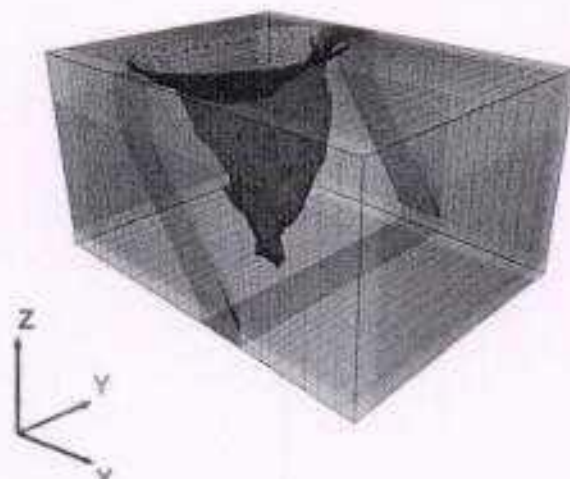


CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(Council of Scientific & Industrial Research)
Barwa Road, Dhanbad – 826 001, Jharkhand
Nagpur Research Center, Unit-1
17/C, Telenkhedi Area, Civil Line, Nagpur 440001, Maharashtra

Report on

Numerical Modelling Studies for Subsidence Prediction at Rampura Agucha
Mine, HZL

PO No. : 2353084587 / 5100027984 Date:07.04.2020



Proj. No. SSP/N/493/2020-2021

July – 2020



Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600, 5159695 Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/ **4792**

Order No 2009-2010/Mines/401

Date: 21/1/2010

M/s Hindustan Zinc Limited

(Rampura Agucha Mine), P.O.- Agucha, Bhilwara,
District :Bhilwara

Sub: Grant of Consent to Establish under section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 for your **Major Mineral Mine** at near Village-Agucha, Tehsil-Hurda, District- Bhilwara (M.L.No.-1/2000).

Ref: (i) Your applications dated 22/11/2009

(ii) Received on 27/11/2009

Sir,

In view of the details submitted vide your above referred applications/ documents, the **Consent to Establish** under section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 is hereby granted for carrying mining activities. This consent is subject to the following stipulations:-

- 1 That this consent is being granted in favour of M/s. Hindustan Zinc Limited, a Mine of **Major Mineral** having M.L.No.-1/2000 in an area measuring 1200 Hectares at/near Village-Agucha, Tehsil-Hurda, District-Bhilwara.
- 2 That this consent is valid for a period from 18/01/2010 to 17/01/2013, or commencement of production whichever is earlier.
- 3 That this consent is valid for following mining activities :-

Mineral	Permitted Mining Capacity
1 LEAD ZINC ORE MINING	6.150 MILLION TONNES PER ANNUM
2 BENEFICIATION PLANT FOR LEAD - ZINC ORE	6.500 MILLION TONNES PER ANNUM

- 4 That you shall achieve following standards in ambient air in mine area / mining activities.

Pollutant	Standards for Ambient Air	Standards for mining activity
SPM	500 µg/M ³	SPM = 600 µg/M ³ (To be measured between 3 to 10 meters from mining activity)
SO _x	120 µg/M ³	
NO _x	120 µg/M ³	
CO	5000 µg/M ³	



Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600, 5159695 Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/

Order No 2009-2010/Mines/401

Date:

- 5 That the Mining unit shall maintain zero discharge status of waste water from the premises. No trade effluent shall be discharged inside/outside mine premises.
- 6 That the occupier/operator of mine shall ensure that all the conditions imposed in the Environmental Clearance granted by the **Ministry of Environment & Forests, Government of India**, vide letter No J-11015/267/2008-IA.II (M) dated 11/12/2009 shall be strictly complied with.
- 7 That the occupier/operator of mine shall ensure that all the conditions imposed in the permission of Central Ground Water Authority granted vide its letter No **21-4(2)/WR/CGWA/2008-632 & 21-4(2)/WR/CGWA/05-417** dated **06/08/2008 & 13/05/2008** shall be strictly complied.
- 8 That you shall not operate the mine without obtaining **Consent to Operate** from the Board.
- 9 That this **Consent to Establish** is for mining of product as mentioned above in **M.L.No.-1/2000** and a separate **Consent to Establish** is required to be taken for Mineral Separation Plant/process if any and for any addition/ modification/ alteration or change in process.
- 10 That the lessee shall develop plantation in atleast 33% of the total lease area to maintain ambient air quality around the mine and the Action Plan for plantation submitted by you, shall be implemented.
- 11 That you will implement all the pollution control measures as per EIA/EMP Report.
- 12 That the top soil shall be stored at earmarked site only shall be utilized for plantation on reclaimed OB dumps.
- 13 The overburden generated during mining shall be stacked at earmarked site as per Approved Mining Plan & as per recommendations of Central Institute of Mining & Fuel Research, Dhanbad. The over burden dump shall be reclaimed by plantation of suitable native plant species.
- 14 Catch drains/ Siltations ponds of appropriate size shall be constructed to arrest silt and sediments flows from mine pits & overburden dumps. Garland drains of adequate size, properly designed shall be constructed around the mine pit & dump yard. Garland drain should be provided with siltation pond.
- 15 Regular monitoring of subsidence, vibration shall be carried out & if any subsidences is observed appropriate measures be undertaken to avoid any loss of life and material and be reported to Board.
- 16 That the HZL shall carryout conditioning of mined ore with water to mitigate fugitive dust emission.
- 17 That Ore Beneficiation plant effluent shall be treated upto prescribed standards & tailing slurry shall be transported in close pipe line to tailing dam.
- 18 That all other general conditions (1 to 21) enclosed as **Annexure** shall be strictly complied with.



Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600, 5159695 Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/

Order No 2009-2010/Mines/401

Date:

- 19 That this Consent is subject to the conditions as stated above and general conditions as stated in Annexure. Further, the mining unit will comply with the provisions of the Air (Prevention & Control of Pollution) Act, 1981 & Water (Prevention & Control of Pollution) Act, 1974 and any such conditions as may be specified from time to time by the State Board under the provisions of the aforesaid Acts.

This bears approval of the competent authority.

Encl: As Above

Yours Sincerely


Group Incharge-Mines

Copy To:-

- 1 Director, Department of Mines & Geology, Government of Rajasthan, Udaipur.
- 2 Mining Engineer, Department of Mines & Geology, Government of Rajasthan, Bhilwara.
- 3 Regional Officer, Regional Office, Rajasthan State Pollution Control Board, Bhilwara- please ensure compliance of Consent Conditions.
- 4 Master File, Consent to Establish, Group Mine, Rajasthan State Pollution Control Board, Jaipur.

Group Incharge-Mines



राजस्थान राज्य प्रदूषण नियन्त्रण मण्डल RAJASTHAN STATE POLLUTION CONTROL BOARD

Annexure

Consent to Establish under Air & Water Acts - Mining Units

General Conditions:-

1. That this consent shall be subject to the condition that you shall operate the mining activities in the area as per the mining right allowed by the Mining Department in the Mining Lease only.
2. That this consent shall be subject to the directions/orders passed in various Mining/Environment related Writ Petitions by Hon'ble High Court and the Hon'ble Supreme Court.
3. That you shall provide the necessary infrastructure facilities including equipment for the monitoring of ambient air in accordance with the directions given to you by the Pollution Control Board's officials from time to time.
4. That Mining Unit shall undertake the phased restoration, reclamation and rehabilitation of lands as per established practices & procedures (provisions of Mine Closure Plan in case of Major Minerals) affected by prospecting or mining operations and shall complete this work before the conclusion of such operations and the abandonment of prospects or mines.
5. That overburden shall be stored in a systematic manner that it does not obstruct the natural drainage pattern of the area. It may be used for back filling. The land shall be identified for disposal of overburden at environmentally compatible site.
6. That Mining unit shall strictly comply with the Mining Plan and Eco Friendly Mining Plan as submitted to & approved by the competent authority. (Eco Friendly Mining Plan for Minor Mineral & mining plan for Major minerals & marble, Granite Mines).
7. That the water spray and sprinkling system so installed should always be maintained in order to utilize the same for dust suppression.
8. That the domestic effluent if any, shall be treated and disposed of with properly designed septic tank followed by soak pit as per prescribed standard.
9. That Air Emissions shall conform to the standards prescribed under the Environment (Protection) Act, 1986.
10. That noise level shall be kept as detailed below and under no circumstances, it shall exceed the prescribed limit:-
 - a. Day time (6.0 AM to 9.0 PM) - 75 dB A (leq)
 - b. Night time (9.0 PM to 6.0 AM) - 65 dB A (leq)
11. That this consent should not be treated as NOC or approval for mining in forest area, if any, falling in the lease and relevant permission under provisions of the Forest (Conservation) Act, 1980 shall be obtained from the competent authority.


4, इन्स्टीट्यूशनल एरिया, झालाना डूंगरी, जयपुर

4, Institutional Area, Jhalana Doongri, Jaipur

Phone : 2709980, 2705731, 2707285 PBX 2711263, 2711329, 2711831, 2707938

Fax : 2710647, 2709980, 2704578

12. That for Diesel Generator Set, acoustic enclosure/acoustic treatment shall be provided to meet the prescribed norms w.r.t. noise as per the Gazette Notification of Ministry of Environment & Forests dated 02.01.99. Adequate stack height with D.G. Sets shall also be provided and maintained. Noise from the Diesel Generator Sets shall be controlled by providing an acoustic enclosure or by treating the room acoustically. The acoustic enclosure/acoustic treatment of room should be designed for minimum 25 dB (A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher. The measurement for Insertion Loss may be done at different points at 0.5 metre from the acoustic enclosure/room and then averaged. The Diesel Generator Sets should also be provided with proper exhausts muffler with Insertion Loss of minimum 25 dB (A). The stack height for the Diesel Generator Sets shall be as notified under the EP Act, 1986.
13. That the industry shall comply with provisions of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 and the Hazardous Waste (Management & Handling) Rules, 1989 and related amendments, as applicable.
14. That this consent is valid, subject to fulfillment of all the other statutory requirements in other Law/Acts/Rules as applicable.
15. That the industry shall submit quarterly compliance of all the above stated conditions to this office.
16. That the unit shall submit Water Cess returns in case the water consumption is more than 10 KLD under provisions of the Water (Prevention & Control of Pollution) Cess Act, 1977 and as amended from time to time.
17. That notwithstanding anything contained in this letter of consent, the State Board hereby reserves to it, the right and power under section 21(6) of the Air (Prevention & Control of Pollution) Act, 1981 & under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review anyone or all the conditions imposed herein-above and to make such variations as deemed fit for the purpose of Air Act & Water Act.
18. That this consent, under no circumstances, be construed as conferment of any property or any interest in the lease area. It is only confined for the purpose of regulation of provisions of the Air Act & Water Act.
19. That any incorrect information submitted in the consent application form shall make the industry liable for legal action under section 38 of the Air Act & under section 43 of the Water Act.
20. That in case of failure to comply with any of the consent conditions stated as above, the consent issued to the industry shall automatically stand revoked without any notice.
21. That this Consent will not exempt you from any legal action for the past violations, if any, of the Act/Rules/Notifications/Circulars etc.


(Group Incharge-Mines)



Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-2716814, 2716813 Fax: 0141-2716814



Registered

File No: F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117

Order No: 2022-2023/Mines/10762

Date: 28/02/2023

Unit Id: 11,060

M/s Hindustan Zinc Limited

(Rampura Agucha Mine), P.O.- Agucha, Bhilwara,

District :Bhilwara

Sub: Grant of Consent to Operate under Section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 for your **Major Mineral** Mine at near Village-Agucha, Tehsil-Hurda, District-Bhilwara (M.L.No-8/1999).

Ref: (i) Your applications dated 28/10/2022.
(ii) Received on 28/10/2022

Sir,

In view of the details submitted vide your above referred applications/ documents, the **Consent to Operate** under Section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 is hereby granted for carrying mining activities. This consent is subject to the following stipulations:-

- 1 That this consent is being granted in favour of **M/s. Hindustan Zinc Limited**, a Mine of **Major Mineral** having **M.L.No- 8/1999** in an area measuring **1200.0000 Hectares** at/near Village-Agucha, Tehsil-Hurda, District-Bhilwara.
- 2 That this consent is valid for a period from **01/03/2023** to **29/02/2028**
- 3 That this consent is valid for following mining activities:-

Mineral	Permitted Mining Capacity
1 Lead & Zinc Ore Mining	6.1500 MILLION TONNES PER ANNUM

- 4 That the project proponent will comply with the Standard as prescribed vide the Ministry of Environment, Forest and Climate Change notification no. GSR 826(E) dated 16th November, 2009 with respect to National Ambient Air Quality standards.

Signature Not Verified

Digitally signed by Khem Chand
Gupta
Date: 2023.02.28 11:09 IST
Reason: Self Attested
Location:





Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-2716814,2716813 Fax: 0141-2716814

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File No F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117

Order No 2022-2023/Mines/10762

Date: 28/02/2023

Unit Id : 11,060

5. That this consent to establish/consent to operate is only for carrying out mining of mineral/ore and not for any processing/beneficiation or crushing/grinding of ore/mineral for which a separate application for consent to establish and/or consent to operate should be submitted. The project proponent is required to obtain separate consent to establish and consent to operate for carrying out mining of other minerals(s), if any or processing/beneficiation of such mineral(s) and for any addition/modification/alteration or change in process.
6. That this **Consent to Operate** is for mining / processing / beneficiation of product as mentioned above in M.L.No.-8/1999 and a separate **Consent to Operate** is required to be obtained for any other Mineral mining/ processing/ beneficiation Plant/process if any and for any addition/ modification/ alteration or change in process.
7. That the occupier/operator of mine shall ensure that all the conditions imposed in the Environmental Clearance granted by the Ministry of Environment , F o r e s t a n d Climate C h a n g e v i d e l e t t e r s dated 11/12/2009,22/08/2014,22/12/2014,28/12/2015 and 28/02/2020 are strictly complied with.
8. That this consent is valid for production of Lead & Zinc Ore Mining @ 6.15 Million Tonnes per Annum. For any change in product and/or increase in capacity/lease area, the mine has to seek fresh Environmental Clearance, consent to establish & consent to operate.
9. That the lease holder shall get the CAAQMS stations configured with the RSPCB OCEMS latest by 30.04.2023, else, Environmental Compensation shall be levied as per norms of RSPCB.
10. That plantation shall be developed so as to cover at least 33% of the total land use for mining and allied activities as given in Approved Mining Plan and shall be maintained at all the time to maintain ambient air quality around the mine.
11. That the lessee shall submit monitoring report of Ambient Air Quality within the lease area, once in 3 months.
12. That the entire water (dewatering in the mine) shall be reused after desilting, for mining operations (drilling etc). No water shall be discharged outside the mining lease area.
13. That haul roads should be regularly graded and compacted. Regular water sprinkling should be carried out on haul roads to minimize dust generations.
14. That adequate measure shall be taken for control of fugitive emissions from the areas prone to air pollution.

Signature Not Verified

Digitally signed by Karam Chand Gupta
Date: 2023.02.28 11:11:09 IST
Reason: Self Attested
Location:





Head Office (Mines)

Rajasthan State Pollution Control Board
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Phone: 0141-2716814, 2716813 Fax: 0141-2716814

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File No F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117

Order No 2022-2023/Mines/10762

Date: 28/02/2023

Unit Id : 11,060

- 15 That you shall not operate any stone crusher/mineral grinding/mineral processing plant within said lease without obtaining prior consent of the State Board.
- 16 That this consent to operate shall not be valid, if the lessee has not obtained permissions required, if any, from NBWL/Forest Department etc. with respect to Wild Life Sanctuary /National Parks/ Critical Tiger Habitats in compliance of various orders passed by any other law/act/rule/regulation or order of MoEF&CC and/or any Court/Tribunal time to time.
- 17 That regular water sprinkling should be carried out in critical areas prone to air pollution and having high levels of SPM and RSPM such as on haul road, loading and unloading points and transfer points.
- 18 That the mine shall not allow making any obstacles to any natural water flow i.e., natural nallah/steam carrying rain water to any water body.
- 19 That the mine shall not allow unauthorized disposal of any solid waste on land inside or outside the premises.
- 20 That this consent to operate shall be subject to compliance of direction/order passed by Courts of Law in the matter, if any.
- 21 That the lessee should dump the overburden in such a manner that it does not get washed away to nearby water tanks and lakes etc. during rainy season.
- 22 This consent shall be subject to validity of mining lease.
- 23 That all other general conditions enclosed as Annexure shall be strictly complied with.
- 24 That this Consent is subject to the conditions as stated above and general conditions as stated in Annexure. Further, the mining unit will comply with the provisions of the Air (Prevention & Control of Pollution) Act, 1981 & Water (Prevention & Control of Pollution) Act, 1974 and any such conditions as may be specified from time to time by the State Board under the provisions of the aforesaid Acts.
- 25 That the grant of this **Consent to Operate** is issued from the environmental angle only, and does not absolve the project proponent from the other statutory obligations prescribed under any other law or any other instrument in force. The sole and complete responsibility, to comply with the conditions laid down in all other laws for the time-being in force, rests with the industry/ unit/ project proponent.

Signature Not Verified

Digitally signed by Khem Chand
Gupta
Date: 2023.02.28 11:09:57
Reason: Self Attested
Location:





Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-2716814,2716813Fax: 0141-2716814

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File No F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/7113-7117

Order No 2022-2023/Mines/10762

Date: 28/02/2023

Unit Id : 11,060

26 That the grant of this **Consent to Operate** shall not, in any way, adversely affect or jeopardize the legal proceedings, if any, instituted in the past or that could be instituted against you by the State Board for violation of the provisions of the Act or the Rules made thereunder.

27 That the grant of this consent to establish/operate is issued from the environmental angle only, and does not absolve the project proponent from the other statutory obligations prescribed under any other law or any other legal instrument in force. The sole and complete responsibility, to comply with the conditions laid down in all other laws for the time-being in force, rests with the industry/unit/project proponent.

This bears approval of the competent authority.

Encl: As Above

Yours sincerely,

Group Incharge-Mines

(A) Copy To:-

- 1 Director, Department of Mines & Geology, Government of Rajasthan, Shastri Circle, Udaipur.
- 2 Regional Officer, Regional Office, Rajasthan State Pollution Control Board, Bhilwara-please ensure compliance of the consent conditions and monitor time to time
- 3 Mining Engineer, Department of Mines & Geology, Government of Rajasthan, Bhilwara-To inform that this consent has been issued from the environmental angle only, and ensuring compliance of any other law/act/rule/regulation or order of any Court / Tribunal is the sole responsibility of the project proponent and the concerned departments
- 4 Master File.

(B)

- 1 The Additional PCCF (WL) and Chief Wild Life Warden, Aranya Bhawan, Jhalana Institutional Area, Jaipur/DCF(WL),Bhilwara, To inform that this consent has been issued from the environmental angle only and ensuring compliance of any other law/act/rule/regulation or order of any Court /Tribunal is the sole responsibility of the project proponent and the concerned departments

Group Incharge-Mines

Signature Not Verified

Digitally signed by Khem Chand Gupta.
Date: 2023.02.28 11:11:09 IST
Reason: Self Attested
Location:



Valid Mine CTO



Head Office (HDF)
Rajasthan State Pollution Control Board
 4, Institutional Area, Jhalana Doongari, Jaipur-302 004
 Phone: 0141-5159600,5159695



Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No : 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

M/s Hindustan Zinc Limited

(Rampura Agucha Mine), P.O.- Agucha, Bhilwara ,
District:Bhilwara

Sub: Consent to Operate under Section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 and under Section 21(4) of Air (Prevention & Control of Pollution) Act, 1981.

Ref: Your application for Consent to Operate dated 28/10/2022 and subsequent correspondence.

Sir,

Consent to Operate under the provisions of Section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 (hereinafter to be referred as the Water Act) and under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981, (hereinafter to be referred as the Air Act) as amended to date and rules & the orders issued thereunder is hereby granted for your Hindustan Zinc Limited Rampura Agucha Mines Beneficiation Plant plant situated at PO - Agucha Agucha Tehsil:Hurda District:Bhilwara , Rajasthan, subject to the following conditions:-

- 1 That this Consent to Operate is valid for a period from 01/03/2023 to 29/02/2028.
- 2 That this Consent is granted for manufacturing / producing following products / by products or carrying out the following activities or operation/processes or providing following services with capacities given below:

Particular	Type	Quantity with Unit
Lead Zinc Ore Beneficiation	Activity	6.50 MILLION TONNES PER ANNUM

- 3 That this Consent to Operate is for existing plant, process & capacity and separate Consent to Establish/Operate is required to be taken for any addition / modification / alteration in process or change in capacity or change in fuel.
- 4 That the quantity of effluent generation along with mode of disposal for the treated effluent shall be as under:

Signature Not Verified

Digitally signed by Rajeev Mahnot
 Date: 2023.06.14 15:33:22 IST
 Reason: Self Attested
 Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No : 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

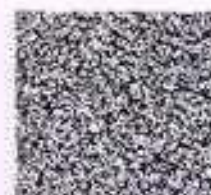
Type of effluent	Max. effluent generation (KLD)	Recycled Qty of Effluent (KLD)	Disposed Qty of effluent (KLD) and mode of disposal
Domestic Sewage	235.000	NIL	210.000 To be treated in STP and to be utilized in plantation and horticulture within the factory premises
Trade Effluent	16670.000	7,800.000	NIL

- 5 That the sources of air emissions along with pollution control measures and the emission standards for the prescribed parameters shall be as under:

Sources of Air Emissions	Pollution Control Measures	Prescribed	
		Parameter	Standard
Primary Crusher New(750TPH)	ADEQUATE STACK HEIGHT, Bag Filter, WATER SPRAYERS, WET SCRUBBER, WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3
Primary Crusher Old(700TON/HR)	ADEQUATE STACK HEIGHT, Bag Filter, WATER SPRAYERS, WET SCRUBBER, WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3

Signature Not Verified

Digitally signed by Rajeev Mahnot
Date: 2023.06.14 15:33:22 IST
Reason: Self Attested
Location:





Head Office (HDF)
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File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No : 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

Secondary Crusher(500TON/HR)	ADEQUATE STACK HEIGHT , Bag Filter , WATER SPRAYERS , WET SCRUBBER , WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3
Two DG Sets (5MW each)(10MW)	ACOUSTIC ENCLOSURE , ADEQUATE STACK HEIGHT	CO Particulate Matter NOx NMHC	150 mg/Nm3 75 mg/Nm3 710 ppm 100 mg/Nm3

- 6 That the **Hindustan Zinc Limited Rampura Agucha Mines Beneficiation Plant** plant will comply with the standards as prescribed vide MoEF notification No. GSR 826(E) dated 16th November, 2009 with respect to National Ambient Air Quality Standards.
- 7 That the Trade Effluent shall be treated before disposal so as to conform to the standards prescribed under the Environment (Protection) Act-1986 for disposal **Into Inland Surface Water**. The main parameters for regular monitoring shall be as under:

Signature Not Verified

Digitally signed by Rajeev Mahnot
Date: 2023.06.14 15:33:22 IST
Reason: Self Attested
Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered:

File No : P(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No : 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

Parameters	Standards
Total Suspended Solids	Not to exceed 100 mg/l
pH-Value	Between 5.5 to 9.0
Oil and Grease	Not to exceed 10 mg/l
Ammonical Nitrogen (as N)	Not to exceed 50 mg/l
Biochemical Oxygen Demand (3 days at 27°C)	Not to exceed 30 mg/l
Chemical Oxygen Demand	Not to exceed 250 mg/l
Nitrate (as NO3)	Not to exceed 50 mg/l

- # That the Trade Effluent shall be treated before disposal so as to conform to the standards prescribed under the Environment (Protection) Act-1986 for disposal into Inland Surface Water. The main parameters for regular monitoring shall be as under

Signature Not Verified

Digitally signed by Rajeev Mahnot
Date: 2023.06.14 15:33:22 IST
Reason: Self Attested
Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No: 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

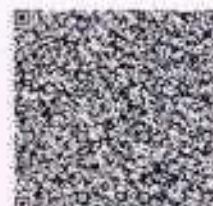
Parameters	Standards
Total Suspended Solids	Not to exceed 100 mg/l
pH Value	Between 5.5 to 9.0
Oil and Grease	Not to exceed 10 mg/l
Biochemical Oxygen Demand (3 days at 27°C)	Not to exceed 30 mg/l
Lead (as Pb)	Not to exceed 0.1 mg/l
Cadmium (as Cd)	Not to exceed 2.0 mg/l
Copper (as Cu)	Not to exceed 3.0 mg/l
Zinc (as Zn)	Not to exceed 5.0 mg/l
Nickel (as Ni)	Not to exceed 3.0 mg/l
Cyanide (as CN)	Not to exceed 0.2 mg/l
Fluoride (as F)	Not to exceed 2.0 mg/l
Sulphide (as S)	Not to exceed 2.0 mg/l
Iron (as Fe)	Not to exceed 3.0 mg/l
Chlorides	Not to exceed 1000 mg/l
Chemical Oxygen Demand	Not to exceed 250 mg/l

9. That this consent to operate is valid for operation of Lead Zinc Ore Beneficiation plant of 6.5 Million Ton Per Annum capacity. The industry has to seek fresh consent to establish for any change in product/by product/process/service/activity and modification/alteration.
10. That total capital investment as on 30.09.2022 as per the C.A. certificate submitted by you is Rs. 103564 (Lakh) which includes the cost of Land, Building, Plant & Machinery and miscellaneous assets.
11. That the industry shall comply with all the conditions of Environmental Clearance (E.C.) issued by the Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India, vide letters no. J-11015/267/2008-IA.II(M) dated 11.12.2009

Page 5 of 11

Signature Not Verified

Digitally signed by Rajeev Mahnot
Date: 2023.06.14 15:33:22 IST
Reason: Self Attested
Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No: 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

- 12 That Hazardous Waste as defined under schedule IV of Hazardous & others Waste (Management, and Transboundary Movement) Rules, 2016 shall not be used as raw material without obtaining prior registration & authorization from the State Board.
- 13 That total water consumption/requirement for lead Zinc Ore Benefication Plant shall not exceed to 9500 KLD which will be met from Banas Radial Wells.
- 14 That industry shall comply with all the conditions of CGWA permission/NoC issued by Central Ground Water Authority, Ministry of Water resource Govt of India vide letter no. 21-4/2/RJ/MIN/2004 dated 08.04.2022.
- 15 That water flow meters shall be provided and maintained at all suitable points to measure quantity of water received from Banas radial wells and water consumption for different purposes. Record of the same shall be maintained on daily basis.
- 16 That unit shall treat 235 KLD domestic sewage at sewage treatment plant of 300 KLD capacity (for mines and beatification plant) that entire treated sewage shall be reused for plantation and horticulture purpose and unit shall maintain zero liquid discharge outside the premises.
- 17 That the total quantity of trade effluent shall not exceed from 16670 KLD. Out of 16670 KLD , 7800 KLD will be recycled/reclaimed from tailing dam and remain 4870 KLD retained in the tailing dam.
- 18 That waste water generated from tailing dam will be roused/recycled completely in mill/process.
- 19 That the industry shall take utmost precaution to cater seepage from tailing dam and ensure complete recycle of seepage water in process only.
- 20 That the industry shall explore & carry out some scientific and technical study with reputed experienced organization in the field for catering of seepage from tailing dam.
- 21 That the industry shall re-circulate the decanted water from the tailing dam and shall maintain Zero Discharge Status from tailing dam.
- 22 That the effluent from the ore benefication plant shall be treated to confirm to the prescribed standards and the tailing slurry shall be transported through a closed pipeline to the tailing dam.
- 23 That the industry shall maintain the stability and safety of the tailing dam as assessed by CWPRS and NIRM
- 24 That no waste water (domestic & trade effluent) will be discharged inside or outside the factory premises in to a stream or well or sewer or on land in any case and complete zero discharge status shall be maintained.

Page 6 of 11

Signature Not Verified

Digitally signed by Rajeev Mahnot
Date: 2023.06.14 15:33:22 IST
Reason: Self Attested
Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No : 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

- 25 That separate energy meter & hour meter shall be provided and maintained at all the air pollution control measures and record of daily running hours of pollution control measures and daily energy consumption shall be maintained in log book.
- 26 That for the control of fugitive emission guidelines / code of practice as issued by CPCB will be followed.
- 27 That the industry shall maintain stack of adequate height at crusher and air pollution control measures shall be operated regularly and efficiently to achieve the prescribed emission standards as per condition no.4.
- 28 That adequate infrastructure facility for stack emission monitoring shall be maintained at the stack of crushers.
- 29 That stack of adequate height as per norms and acoustic enclosure shall be maintained with two DG Sets of 5 MW KVA each.
- 30 That unit shall provide permanent safe infrastructure facility for stack monitoring with stack attached with two D.G set (5 MW each) within a month. The unit shall deposit bank guarantee for the same immediately.
- 31 That no additional source of air emission shall be installed without prior consent from the State Board.
- 32 That all the raw materials and products shall be stored in closed sheds.
- 33 That cemented roads shall be provided and maintained properly inside the premises to minimize fugitive emissions due to vehicular movement.
- 34 That water sprinkling and cleaning of haul roads by vacuum cleaner shall be done regularly to control the fugitive emissions generated due to vehicular movement.
- 35 That dust suppression system shall be maintained to minimize fugitive dust emission in Lead Zinc Ore handling area & at various transfer points and closed conveyor belts shall be used for the transfer of material to reduce the fugitive emissions.
- 36 That unit shall provide flexible curtains vertically attached with crusher house shed(material feeding hopper points) so as to minimize escape of fines in addition to water spray nozzles at feeding hopper.
- 37 That the industry shall maintain dust collection and extraction system to control fugitive dust emissions at all the transfer points & loading/unloading areas.
- 38 That regular monitoring of ground water particularly in respect to heavy metals shall be carried out by establishing adequate numbers of piezometric well around tailing dam.
- 39 That adequate arrangements shall be made to avoid flow of pollutants along with rain water.

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Reason: Self Attested
Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

Registered

File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No: 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

- 40 That the industry shall carryout effluent sampling/stack monitoring/ambient air quality monitoring and submit quarterly analysis report from the State Board laboratory/laboratory recognized by Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India
- 41 That industry shall comply with the provisions of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 & Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (as notified under Environment (Protection) Act, 1986 and record of daily hazardous waste generation and its disposal shall be maintained.
- 42 That the precautions/measures shall be taken for minimization of exposure to the workers involved in handling/processing of the lead and lead bearing material.
- 43 That the unit shall periodically examine their workers at least once in year for lead level in blood as well as urine. Persons with higher lead levels (greater than 40 µg/dl) should be shifted immediately to non-lead activity areas and given special medical treatment till the lead levels come back to acceptable level.
- 44 That the industry shall install and maintain adequately designed rain water harvesting structure for recharge of ground water in and around the area.
- 45 That the plantation of local species in the 33% of total area of the project shall be carried out & maintained.
- 46 That the industry shall get policy renewed from time to time under Public Liability Insurance Act (PLIA) and submit its copy to the Board
- 47 That the industry shall obtain Environmental Clearance from competent authority under EIA Notification dated 14.09.2006 before establishing any such activity which attracts Environmental clearance under EIA Notification dated 14.09.2006.
- 48 That unit shall submit time bound proposal along with Bank guarantee (10 % of total cost of dry tailing facility) within one month, for installation of dry tailing facility instead of simple charge of waste water and tailings into tailing dam.
- 49 That unit shall ensure check and restore ambient air quality monitoring machines as per CAAQMS protocol and if required may be purchase proper CAAQMS machinery setup and ensure online connectivity with RSPCB Server and submit evidence based compliance to the State Board within a period of one month. That unit shall deposit Bank Guarantee for the same immediately.
- 50 That the industry shall submit the quarterly compliance report of all the above conditions to the State Board.

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Location:





Head Office (HDF)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695

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File No : F(HDF)/Bhilwara(Hurda)/1(1)/2023-2024/1629-1631

Order No: 2023-2024/HDF/9370

Date: Jun 14 2023 3:32PM

Unit Id : 11060

- 51 That unit shall install PTZ camera and Online flow meter with the Tailing dam inlet and tailing dam reuse line, within one month, so as to ensure complete reuse of waste water in accordance with water balance submitted. That unit shall deposit Bank Guarantee (10% of total cost of PTZ camera and online flow meter) immediately.
- 52 That PTZ cameras should be installed at the locations to cover entire area of tailing dam.
- 53 That unit shall complete the work related to replacement of monkey ladder to safe monitoring infrastructure monitoring facility for the stack attached with Primary Crusher-New (750 TPH) within one month and submit the evidence based report to the State Board. That unit shall deposit Bank Guarantee for the same immediately.
- 54 That unit shall comply with all the provisions of MSHC Rules, 1989 and amended so and also with PLI Act, 1991.
- 55 That unit shall expedite completion of Hydro geological survey and isotopic analysis study.
- 56 That, notwithstanding anything provided hereinabove, the State Board shall have the power and reserves its right, as contained under Section 27(2) of the Water Act and under Section 21(6) of the Air Act to review anyone or all of the conditions imposed here in above and to make such variation as it deems fit for the purpose of Air Act & Water Act.
- 57 That the grant of this **Consent to Operate** is issued from the environmental angle only, and does not absolve the project proponent from the other statutory obligations prescribed under any other law or any other instrument in force. The sole and complete responsibility to comply with the conditions laid down in all other laws for the time being in force, rests with the industry/ unit/ project proponent.
- 58 That the grant of this **Consent to Operate** shall not, in any way, adversely affect or jeopardize the legal proceeding, if any, instituted in the past or that could be instituted against you by the State Board for violation of the provisions of the Water Act and Air Act or the Rules made thereunder.
- 59 That the Project Proponent shall comply with provisions of the E-waste (Management) Rules, 2016 and ensure that e-waste generated by them is channelized through collection centre or dealer or authorized producer or dismantler or recycler or through designated take back service provider of the producer to authorized dismantler or recycler.
- 60 That the Project Proponent shall maintain record of e-waste generated by them in Form-2 and make such records available for scrutiny by the Board.

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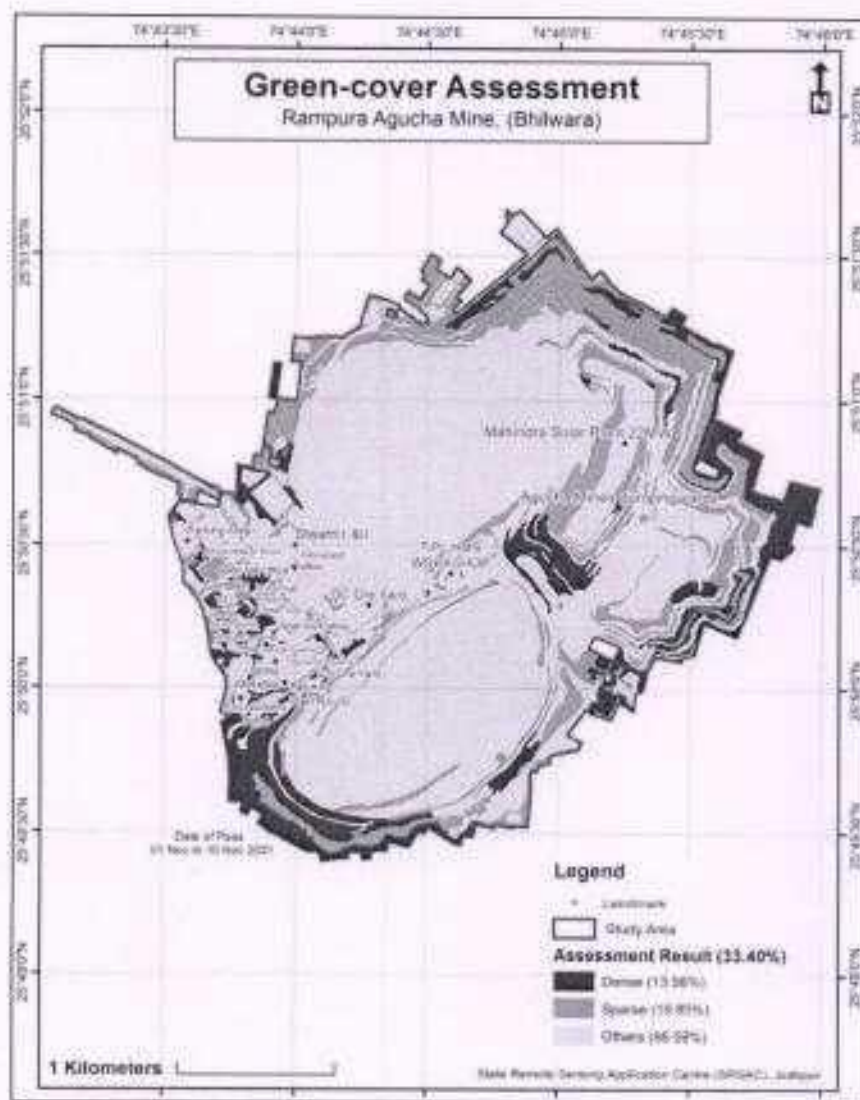
Valid Beneficiation plant CTO



Tailing close pipe line

Green Cover Assessment

For Rampura Mine, Agucha of Hindustan Zinc Limited
located in Rajasthan



By

State Remote Sensing Application Centre (SRSAC)
Department of Science & Technology (DST), Government of Rajasthan
Subhash Nagar, Pal Road, Jodhpur – 342008 (Raj.)

January 2023

This report is the outcome of the study conducted at
SRSAC, Jodhpur, Rajasthan.

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Preface

State Remote Sensing Application Centre (SRSAC) of the Department of Science & Technology, Government of Rajasthan, endeavours to make the best possible use of remote sensing and Geographic Information System (GIS) technologies towards fostering sustainable development in Rajasthan.

In Rajasthan, the remote sensing activities started with the establishment of Aerial Photo Interpretation Laboratory (APIL) in 1979 as a part of the centrally sponsored Desert Development programme, to assist soil and water conservation planning in the State, under State Agriculture Department. Later on, in 1985 looking to the multi-disciplinary utilities of Remote Sensing technology, the laboratory was transferred to the State Department of Science and Technology and renamed as State Remote Sensing Application Centre (SRSAC).

SRSAC functions to fulfil the following objectives:

- To regularly generate a databank consisting of temporal and spatial databases.
- To generate information systems for natural resources.
- To interact with various user agencies for the formulation and implementation of developmental planning, using remote sensing technique.
- To undertake short term and long term experimental and operational remote sensing studies for various natural resources, infrastructure, and urban planning.
- To collaborate/interact with national-level remote sensing institutes like National Remote Sensing Centre (NRSC), Hyderabad, Space Application Centre (SAC), Ahmedabad, Regional Remote Sensing Centres (RRSC's) to carry out joint projects.
- To popularize remote sensing and GIS by organizing training-courses/workshops/seminars for different state user departments, technocrats, students, etc.

The Centre has been catering to the natural resource survey, monitoring and planning needs of the State since past more than three decades. Assistance is regularly provided to the user departments in the State for planning the development activities using Remote Sensing and GIS techniques. The Centre has long been collaborating with Indian Space Research Organisation (ISRO), Department of Space, Govt. of India for executing state level projects using space-based information support.

Four major categories of projects being carried out at SRSAC are:

1. Generating numerous geospatial layers for information support

Building natural resources information system, Land-use & land-cover (LULC) mapping, crop acreage estimation, surficial waterbodies mapping, groundwater quality mapping, wasteland mapping, land-degradation mapping, wetland mapping, forest blocks mapping, geomorphological & lineaments mapping, infrastructural mapping, cadastral mapping, administrative boundaries demarcation

2. Planning various natural resources management and development planning activities

Supporting decentralized rural development planning, forecasting agricultural outputs, Panchayat Samiti wise master-plan of water-harvesting-structure sites, silt prevention studies in Pushkar Lake, conservation planning of Jodhpur lift canal

3. Monitoring the landscape through change detection activities

Watersheds monitoring, waterbodies monitoring, river-flow change analysis, monitoring the crop-residue-burning, eco-sensitive zone monitoring, LULC change detection around mining areas, wasteland change analysis, forest cover change analysis, encroachment studies, industrial green cover assessment

4. Capacity building of the user departments / students / common man

Organizing trainings/courses/workshops/seminars, preparing atlases such as Resource Atlas of Rajasthan, Ground Water Atlas of Rajasthan, Watershed Atlas of Rajasthan, Ayurvedic Medicinal Plants Atlas of Rajasthan, Soil Resource Atlas of Rajasthan, exclusive workshops for spatial empowerment of Panchayati Raj Institutions

The Centre aims to move forward from information support towards decision support for sustainable development and management of natural resources along with infrastructure development and urban planning through the application of remote sensing and GIS technology.

This report is an outcome of the study that was conducted by the Centre to assess the green cover area within the boundaries of Rampura Agucha Mine, of Hindustan Zinc Limited, Rajasthan, using remote sensing and GIS technologies.

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List of abbreviation

DST	Department of Science & Technology
ESA	European Space Agency
GIS	Geographic Information System
Gol	Government of India
GoR	Government of Rajasthan
HRSI	High-Resolution Satellite Imagery
IRS	Indian Remote Sensing Satellite
ISRO	Indian Space Research Organization
NDVI	Normalized Difference Vegetation Index
NIR	Near-Infrared
NRSC	National Remote Sensing Centre
SRSAC	State Remote Sensing Application Centre

1. Introduction

Hindustan Zinc, a Vedanta Group Company, is one of the world's largest and India's only integrated producer of Zinc-Lead and Silver. The Company has its headquarters at Udaipur in the State of Rajasthan where it has its Zinc-Lead mines and smelting complexes. Hindustan Zinc is self-sufficient in power with captive thermal power plants and has ventured into green energy by setting up wind power plants. The Company is ranked 1st in Asia-Pacific and globally 5th in Dow Jones Sustainability Index in 2021 amongst Mining & Metal companies. Hindustan Zinc is a certified Water Positive Company and is the only Indian company to be recognized at the S&P Global Platts Metal Award 2022.

The company has embarked on an ambitious sustainability journey, led by its Sustainability Goals 2025, driven by its vision of 'ZERO HARM, ZERO DISCHARGE, ZERO WASTE.' These Sustainability Goals were developed by the company as an action agenda for accomplishing its overarching long-term goal of creating positive impacts across the value chain.

Green cover is the area with tree plantation and is intended to reduce pollution from the surrounding air. Both gaseous and particulate pollutants can get absorbed if an appropriate green cover is maintained. As per the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, green belt is to be developed and maintained to minimize the impact due to air pollution and noise pollution in the environment. A minimum of 33% of the area is to be kept for green belt development.

2. Objective

The objective of the study presented here was to perform geospatial mapping of the study area for demarcation of the area under green (vegetation) cover, along with the approximation of tree count.

3. Study Area

The study area for the report presented here is Rampura Mine, Agucha located in Bhilwara District of Rajasthan.

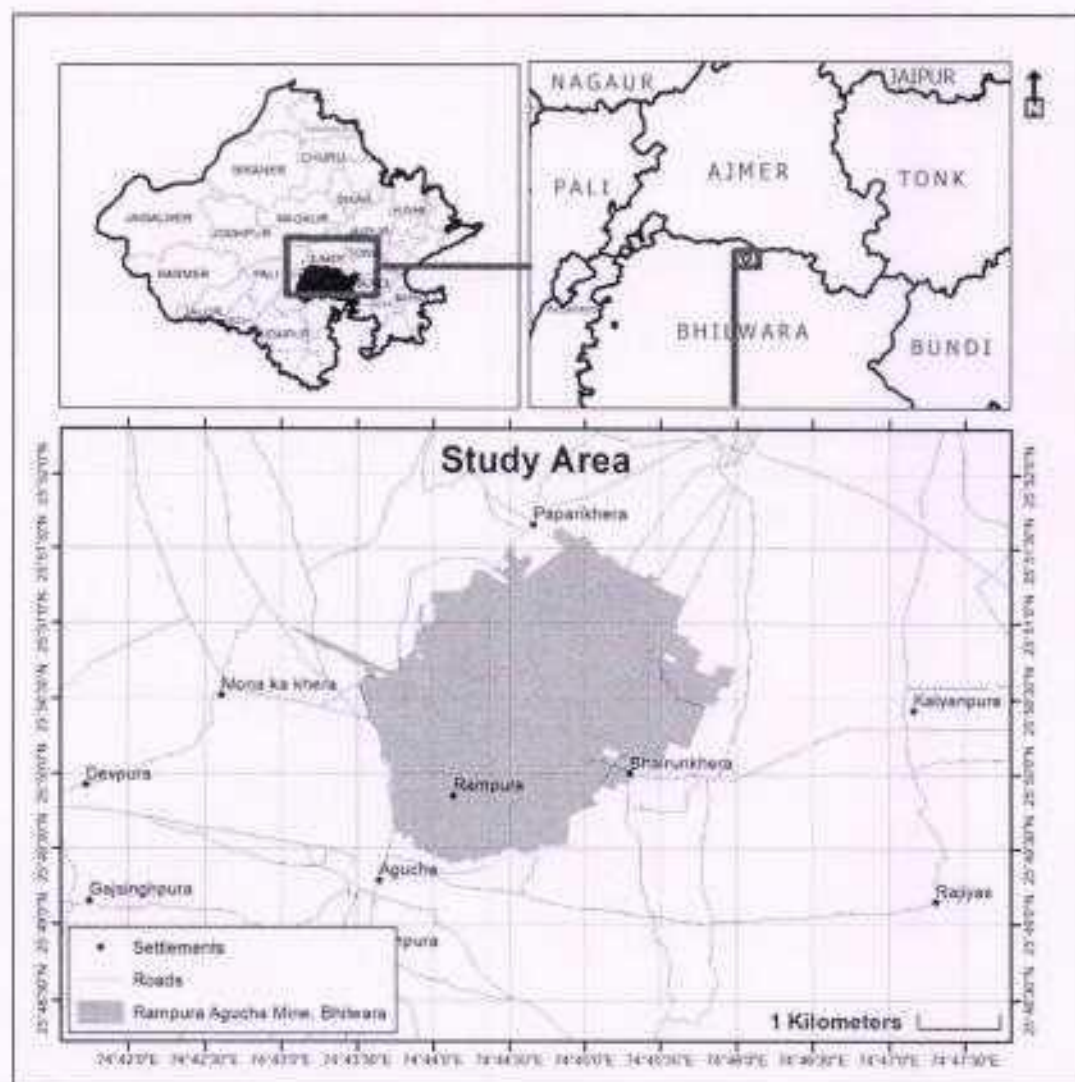


Figure 1: Study area

4. Datasets used

4.1 Satellite data

The green cover analysis was performed on Copernicus Sentinel-2 surface reflectance (Level-2a) data of date ranging from 1st November 2021 to 10th November 2021 (Figure 2). During the analysis, six bands were utilized, namely, Blue, Green, Red, Near-infrared, Shortwave Infrared-1 and Shortwave Infrared-2 (band numbers 2, 3, 4, 8, 11 and 12). The spatial resolution of the bands 2, 3, 4 and 8 was of the order 10 m, while for bands 11 and 12, it was 20 m. Additionally, IRS-Cartosat-2E satellite image dataset of spatial resolution 0.65 m panchromatic / 2 m multispectral was used as the reference.

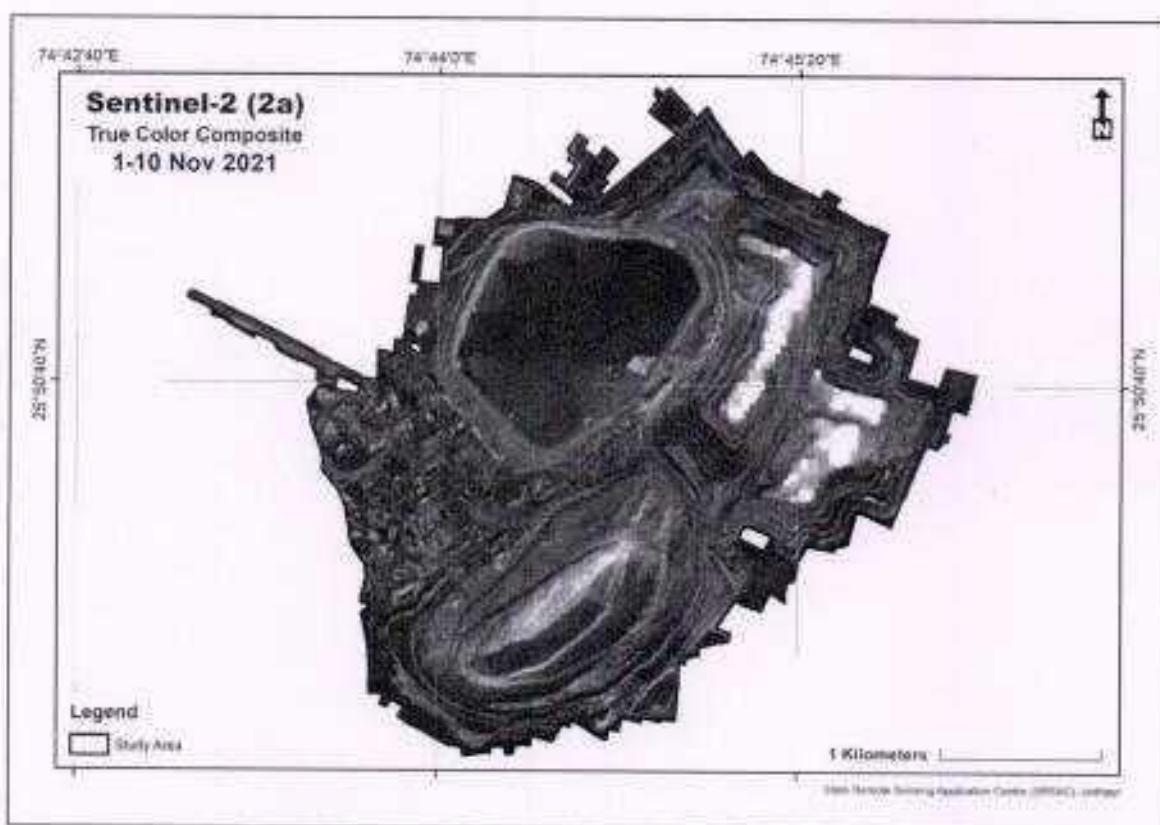


Figure 2: True color composite of Sentinel-2(2a) satellite data (between 1 to 10 Nov 2021) that was used for green-cover assessment

4.2 Field data

Field visit was conducted in the month of 20th April 2023, wherein, geo-tagged field photographs were acquired in order to support the ground truth requirements during the analysis. A few of the ground truth photographs are shown in Annexure 1.

5. Methodology

The study consisted of the following steps in the methodology (Figure 3):

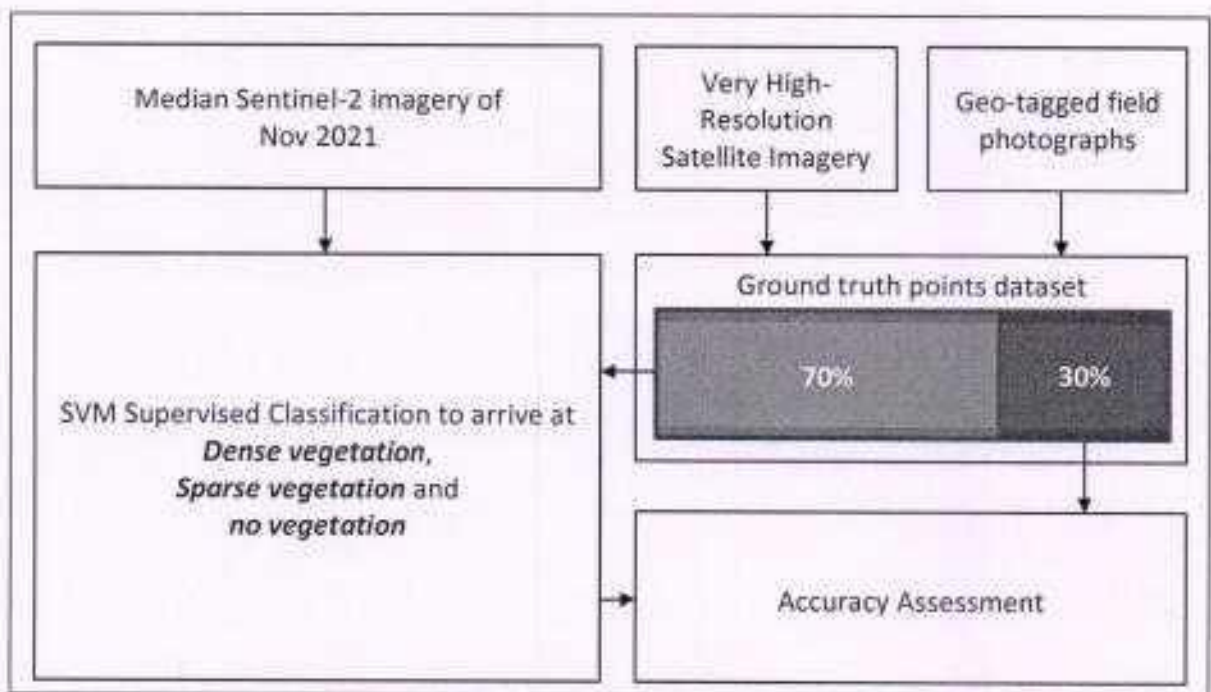


Figure 3: Overall methodology

1. **Designing the classification scheme:** A three-class classification schema was designed that consisted of (i) dense green-cover, (ii) sparse green-cover / new plantation and (iii) other classes.
2. **Procurement/processing of primary satellite images:** As mentioned in Section 4.1, the Copernicus-Sentinel-2 satellite image composite was prepared for the purpose of

green cover analysis. This composite was prepared using the images from the month of November 2021 due to the following reasons.

- For the month of November, the agricultural cropped regions show a low/nil value of NDVI as during this period, Kharif crops are mostly harvested and Rabi crops are not grown to the stage where vegetation is significant.
- Vegetation detected in this month imagery is inclusive of both – permanent and seasonal vegetation.
- **Preparing a ground truth points dataset:** A set of ground truth points was the prime requisite for validating the results of the study. The ground truth information was carefully compiled from various data sources, such as field photographs, drone-based images and very high-resolution satellite imagery. Field visit was conducted for collecting geotagged field photographs. Very high-resolution satellite data from Cartosat-2 series of satellites was procured from NRSC Data Centre of Indian Space Research organization (ISRO). This highly detailed satellite data was referred while preparing a geospatial points layer that was called as the ground truth points dataset (Figure 4). One part (about 70%) of the total ground truth points was used for training the classifier model, while the other part (about 30%) of the total ground truth points was utilized while performing the accuracy assessment. The training dataset was used to sample the input Sentinel-2 satellite imagery.

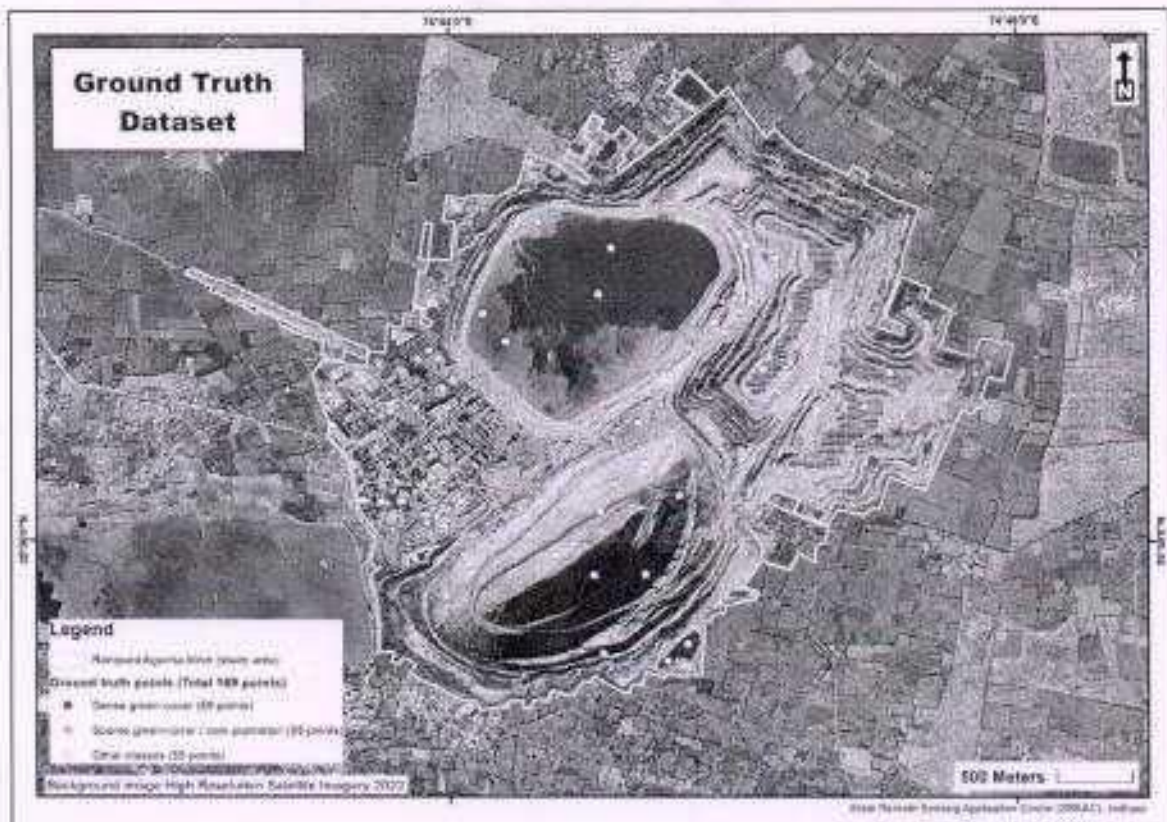


Figure 4: Ground truth dataset comprising a total of 169 points distributed across the study area

- **Classification using the Support Vector Machine (SVM) classifier:** The SVM classifier was used for the green cover analysis. The details of this classifier can be found in Pal and Mather (2005). SVM classifier was trained using the above sampled training dataset. Using the trained SVM classifier model, the unknown pixels from the Sentinel-2 satellite imagery were classified. The output classified image was tested for the accuracy of classification using the testing ground truth dataset. Kappa accuracy of assessment was determined. Class-wise area statistics were determined.

6. Results and Discussion

The resultant classified image is as shown in Figure 5. The result was tested for the accuracy using an independent set of testing ground truth dataset as mentioned in the previous section.

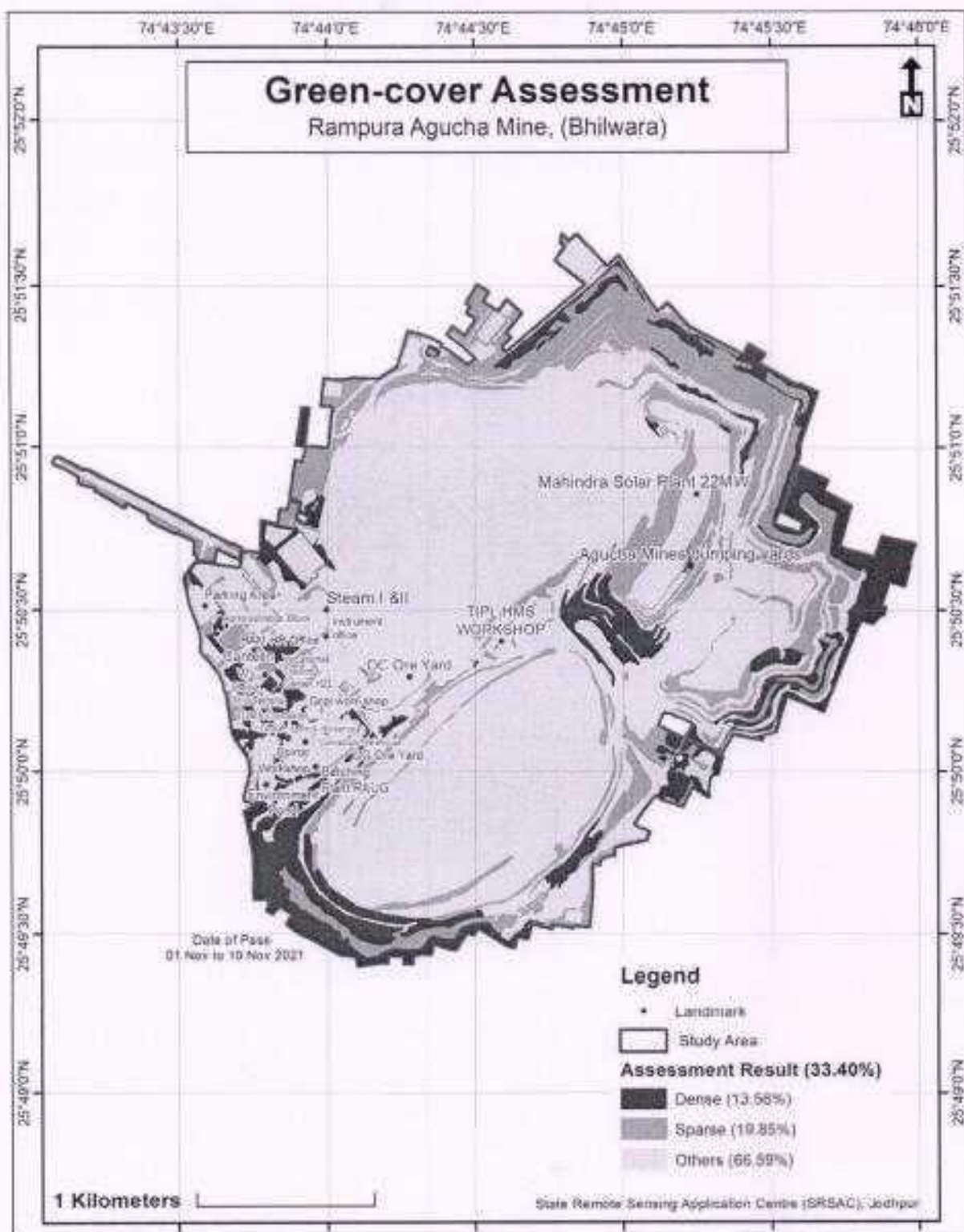


Figure 5: Assessment results

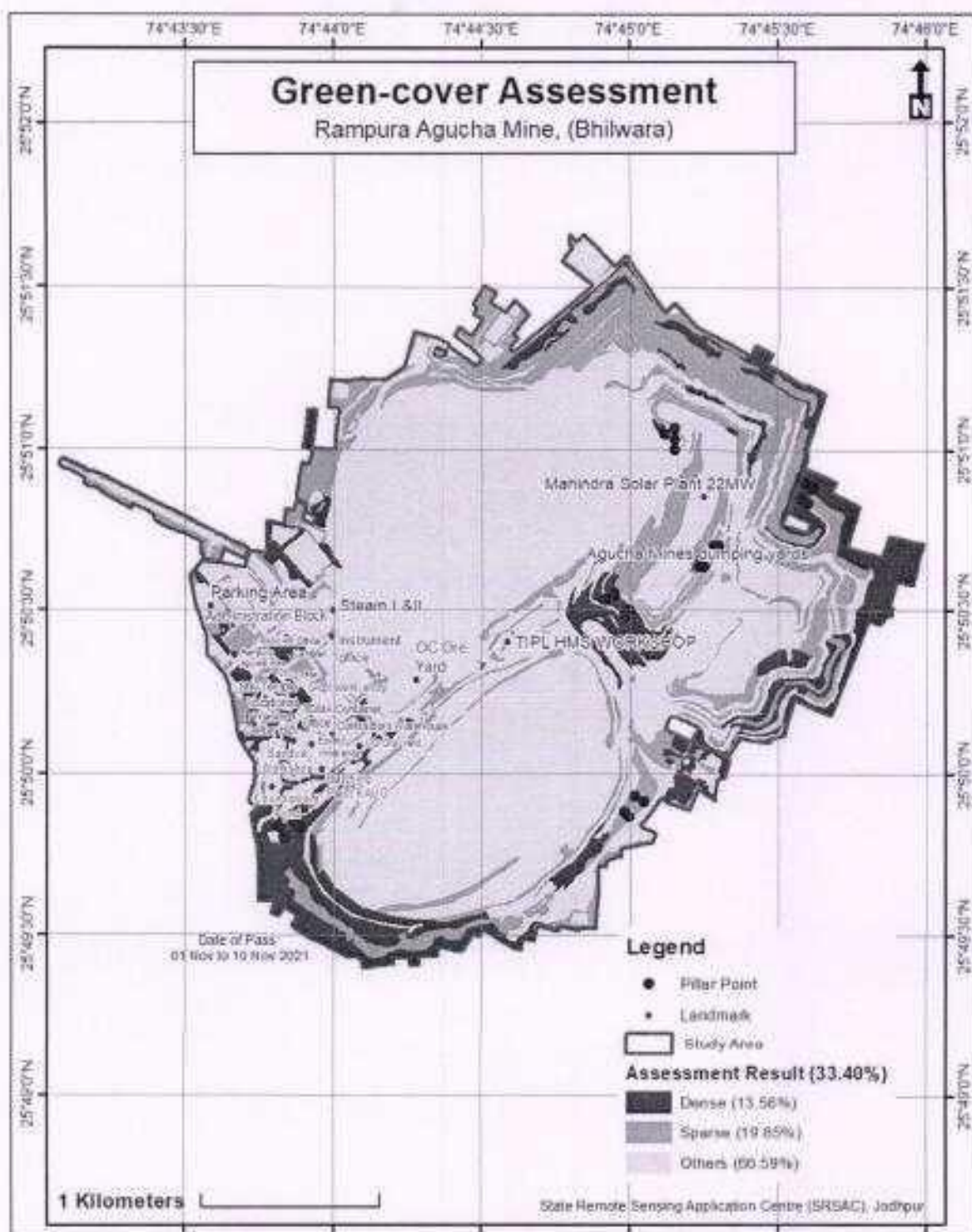


Table 2: Results

S. No.	Category	Area		Total Green Area (Ha.)	Total Green Cover %
		Hectares	Percentage		
1.	Dense	138.06	13.56	340.16 Ha.	33.40 %
2.	Sparse	202.10	19.85		
3.	Others	678.00	66.59		
Total Area		1018.16			

Table 2: Tree Count Dense

Site	Area Type	Tree (.50 Ha)	Average (1+2+3/3)	Tree in 1 Ha.
1	Dense	1980	$5053/3 = 1684.33$	$1684.33 \times 2 = 3368.67$
2	Dense	1703		
3	Dense	1370		
Total Count		5053	Total Count in 1 Ha.	3369 (Rounding off)

Table 3: Tree Count Sparse

Site	Area Type	Tree (.50 Ha)	Average (1+2+3/3)	Tree in 1 Ha.
1	Sparse	734	$1699/3 = 566.33$	$566.33 \times 2 = 1132.67$
2	Sparse	530		
3	Sparse	435		
Total Count		1699	Total Count in 1 Ha.	1133 (Rounding off)

Table 4: Tree Count Study Area

S. No.	Category	Area		Total Trees	Total Trees (Approx.)
		Hectares	Tree Count		
1.	Dense	1	3369	$138.06 \times 2047 = 4,65,124$	6,94,103
2.	Sparse	1	1133	$202.10 \times 1133 = 2,28,979$	

7. Conclusion

Green cover area estimation was carried out using Sentinel-2 Image of date range from 1st to 10th of November 2021 with Cartosat-2E satellite imagery of Feb 2022 as reference. The analysis was also supported by the field-based ground truth information. Supervised learning-based image classification approach was adopted for classifying the input Sentinel-2 satellite imagery into three class-categories named dense, sparse and no green cover. The resultant classified image was tested for accuracy with respect to the ground truth dataset. As per the results, as on 10th November 2021, the total green cover area within the boundaries of Rampura Mine, Agucha was calculated to be 33.40 % of the total area.

8. References

- Drishya, J., & Roshni, T. (2018). Spatiotemporal variability of soil moisture and drought estimation using a distributed hydrological model. In *Integrating disaster science and management* (pp. 451-460). Elsevier.
- Pal, M., & Mather, P. M. (2005). Support vector machines for classification in remote sensing. *International journal of remote sensing*, 26(5), 1007-1011.



Figure 7: Layout Plan Agucha Zinc Colony

9. Annexure-1: Field Photographs









10. Flora of Rampura Mine

<p>Peepal (<i>Ficus religiosa</i> or sacred fig) Native: India</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Karyan (<i>Ficus benghalensis</i>) Native: Indian Subcontinent</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Ajray (<i>Tamarix arbuscula</i>) Native: India</p>  <ul style="list-style-type: none"> It is a small tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Bottle Brush (<i>Callistemon</i>) Native: Australia</p>  <ul style="list-style-type: none"> It is a small tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Gulmohar (<i>Delonix regia</i>) Native: India</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Sheesham (<i>Dalbergia sissoo</i>) Native: Indian Subcontinent</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Narm (<i>Acacia indica</i>) Native: Indian Sub-Continent</p>  <ul style="list-style-type: none"> It is a small tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Bottomland (<i>Conocarpus dioecus</i>) Native: Florida</p>  <ul style="list-style-type: none"> It is a small tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Kadam or Barflower Tree (<i>Nerium oleander</i>) Native: South & southeast Asia</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Indian Redwood (<i>Shorea robusta</i>) Native: India, Bangladesh and Sri Lanka</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Kachar (<i>Bauhinia variegata</i>) Native: Southeast Asia</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Conocarp (<i>Phyllanthus glaucocarpus</i>) Native: Southeast Asia</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Shalimar (<i>Morus alba</i>) Native: China</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Kadam or Almond (<i>Prunus amygdalus</i>) Native: Iran</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.
<p>Blackboard Tree (<i>Albizia schlegelii</i>) Native: Southern China, tropical Asia and Australia</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions. 	<p>Cashe (<i>Albizia schlegelii</i>) Native: Indian Subcontinent</p>  <ul style="list-style-type: none"> It is a large tree with a spreading canopy and a thick, gnarled trunk. The leaves are dark green and glossy. It is a dioecious tree, meaning it has separate male and female trees. The male tree has small, round, yellowish flowers, while the female tree has small, round, greenish fruits. It is a common tree in India, especially in the northern and central regions.

Figure 8: Flora Of Rampura Mine

11. Annexure-2: Details of Plantations

Azadirachta Indica

Saraca Indica

Plumeria Pudica

Hyophorbe Lagenicaulis

Hibiscus Rosa-Sinensis

Cascabela Thevetia

Dalbergia Sissoo

Ficus Benamina

Millettia Pinnata

Cycas Revoluta

Delonix Regia

Phoenix Dactylifera

Alstonia Scholaris

Araucaria Columnaris

Acacia Nilotica

Nerium Indicum

Psidium Guajava

Terminalia Arjuna