

Ref. No. BIM/E&L/2021-22/159

Date: 30.11.2021

To,
The Director, IA Division,
Ministry of Environment, Forests and Climate Change,
Indira Paryavaran Bhawan, Jor Bagh Road, Aliganj,
New Delhi – 110003

Sub: Six monthly status of compliance of conditions stipulated in Environmental Clearance (grant order of MoEF No. J-11015/351/2006-IA.II(M), dated 29th October 2010) for the period ending 30th September 2021.

Sir,

Please find enclosed herewith the updated six monthly compliance report with respect to the conditions stipulated by MoEF&CC, Govt. of India, New Delhi while granting Environmental Clearance to integrated Barsua-Taldih- Kalta Iron Ore Mines (ML-130) of M/s. Steel Authority of India Limited for production of 8.05 MTPA vide MoEF letter No. J-11015/351/2006-IA.II(M), dated 29th October 2010 for the period ending 30th September 2021. The report also contains the updated status of environmental monitoring of air, water and noise pertaining to the period ending 30th September 2021.

Thanking You,

Yours Faithfully,
For SAIL/Barsua-Taldih-Kalta Iron Mines



(P K Rath)

Chief General Manager, BIM & KIM

Encl : As Above

Copy to:

1. The Dy. Director General of Forest (C), MoEF&CC, Govt. of India, Regional Office (EZ), A/3 Chandrasekharpur, Bhubaneswar-751023 (Odisha)
2. The Chairman, Central Pollution Control Board, Paribesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, New Delhi-110032
3. The Member Secretary, Odisha State Pollution Control Board, Paribesh Bhawan, A/118 Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012 (Odisha)

Status of Compliance to Conditions Stipulated in Environmental Clearance

(EC order no. J-11015/351/2006-IA.II(M), dt. 29.10.2010, F. No. J-11015/351/2006-IA.II(M) (pt.) dated 30.03.2016, J-11015/351/2006-IA.II(M), dated 03.07.2020 and corrigendum dated 13.07.2020 and J-11015/351/2006-IA.II(M), dated 17.03.2021) of Integrated Barsua –Taldih – Kalta Iron Ore Mining Project (ML – 130), Village Tantra, District Sundergarh, Odisha, Raw Materials Division, SAIL
(Period: April 2021 to September 2021)

A. Specific Conditions

Sl. No	Condition	Compliance Status
(i)	The Project proponent shall obtain consent to Establish and Consent to Operate from the State Pollution Control Board, Orissa and effectively implement all the conditions stipulated therein.	Consent to Establish was obtained from SPCB, Odisha for a capacity of 8.05 MTPA for Integrated Barsua – Taldih- Kalta Mining Project (ML-130) Vide No. 609/IND-II-NOC-5182, dated 13.01.2012. Also, Consent to Establish has been amended on dated 24.08.2021 for change in product mix. CTO has been obtained from SPCB, Odisha Vide No. 14129/IND-I-CON-1(A), dated 17.09.2021 for a quantity of 8.05 MTPA with validity up to 31.03.2022. Necessary actions are being taken to effectively implement the conditions stipulated therein.
(ii)	The environmental clearance is subject to grant of approval of the State Land use Department, Government of Orissa for diversion of agricultural land for non agricultural use.	There is 19.059 Ha of agricultural land present out of 2486.383 Ha of total mine lease area of ML -130. However, the same is present in the non-mineralized zone of the lease area and not required to be utilized for mining and allied activities till the life of mines. Hence, diversion of agricultural land for non-agricultural purpose doesn't require.
(iii)	Necessary Forestry Clearance (FC) under the FC Act, 1980 for an area of 2347.641 ha is forest land involved in the project shall be obtained. Environmental Clearance is subject to grant of FC.	Stage-II forestry clearance/ final approval under FC Act 1980 for mining and allied activities & safety zone for 2 nd RML period was obtained from Ministry of Environment, Forest & Climate Change, Govt. of India vide its order No.F.No.8-90/1996-FC (pt.), dtd. 06.03.2013.
(iv)	Environmental Clearance is subject to final order of the Hon'ble Supreme court of India in the matter of Goa Foundation Vs. Union of India in Petition (Civil) No.460 of 2004, as may be applicable to this project.	Agreed.
(v)	Environmental Clearance is subject to obtaining clearance under the Wildlife (Protection) Act, 1972 from the competent authority, as may be applicable to this project.	No notified National Park / Wildlife Sanctuary / Biosphere Reserve / Tiger Reserve are located within 10 kms from the Mining Lease boundary. Hence it is not applicable to this mining project.
(vi)	The project proponent shall ensure that no natural watercourse and drainage channels except first order channels Id1, Id2, Id3, Id4, Id5, Id6, Id7 and Id8 passing through the mine lease shall be diverted. The channels shall be so diverted that it finally meets its final natural course.	Due precautions are being taken and ensured that no natural watercourse / drainage channels obstructed due to any mining operation at the mines. So far only Id1, Id2 & Id8 have been diverted and finally meet their final natural course.

Period: April 2021 to September 2021

Sl. No	Condition	Compliance Status
(vii)	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.	Though the generation of top soil is very less, it is being stacked separately and used for rehabilitation of dumps and other areas through plantation. During the period, 140cbm topsoil has been utilized out of total 2523cbm topsoil stored at earmarked site for plantation purpose. The top soil will be utilized for land reclamation and plantation purpose only.
(viii)	The OB generated 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 project proponent shall carry out slope stability study through an expert organization like CIMFR, Dhanbad for attaining the proposed height of dump of 60m in three lifts and submit report to the ministry and its Regional Office within three months. Proper terracing of the OB dumps shall be carried out so that the overall slope of the dump shall be maintained to 27°. Compliance status shall be submitted to the MoEF and its Regional Office located at Bhubaneswar on six monthly basis.	The over burden (OB) / sub-grade ore generated during the mining operations is being stored at earmarked sites only, as per the approved Scheme of Mining. Phase wise stabilization with installation of coir mats and broadcasting of grass seeds are carried out as per approved schemes. For effective stabilization, terracing of the OB dumps with overall slope of the dump is being maintained to below 27°. Also, Geo-textile coir matting of 28000 Sq. m has been done in Barsua Block. Plantation has also been carried out over all the old dumps slopes for stabilization and prevention of washout. Some of the photographs showing Geo-textile coir matting at Barsua mines are shown in Annexure XI . Regular Compliance Status Report on six monthly basis is submitted to MoEF&CC and its Regional Office.
(ix)	Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps to prevent run off of water and flow of sediments directly into the agricultural fields, the first order channels, the Samaj Nallah, the Kuradihi Nallah, and other water bodies. Garland drains, setting tanks and check dams of appropriate size, gradient and length shall be constructed around the mine pit, dumps to prevent run off of water and flow of sediments.	There are 33 nos. of Check dams / Retaining wall / Toe walls provided in Barsua-Taldih-Kalta mines to prevent direct flow of washout to nearby agricultural fields and water bodies. Also the surface runoff from the Barsua Mines has been channelized through a series of Garland drains into 3E pit to prevent direct flow of runoff to nearby water bodies. During the period, repairing of existing toe wall at Dump-8 of Barsua Iron Mines has been completed. Further, construction of 100 m retaining wall with Garland Drain and settling pit along the waste dump at Taldih-C Block and 500 m retaining wall with Garland Drain and settling pit along the Mine quarry at Taldih Block is under progress. Some of the photographs showing Garland drain, settling pit, Check dams / Retaining wall / Toe walls in Barsua-Taldih-Kalta Iron Mines are shown in Annexure XI .
(x)	Dimension of the retaining wall at the toe of the over burden dumps and the OB benches within the mine to check run-off and siltation shall be based on the rain fall data.	Toe walls, garland drains and siltation ponds at the OB Dumps have been constructed to control the surface runoff from the OB dumps. Based on the rainfall of the region, 1.5m to 2.0m width and 1.5m to 2.0m height toe walls were provided.

Period: April 2021 to September 2021



Sl. No	Condition	Compliance Status
(xi)	The water recovery and spill way system shall be so designed that the natural water resources are not affected and that no spill water goes into the nearby Karo River and other water bodies.	The tailing dam top is at 420.5m. AMSL. Maximum settled slime level is at 416.5m. AMSL and the spill way is at 418.0m. AMSL. Also a system for recovery and recycling of clean water from the tailing pond has been provided at Barsua Iron Mine under Zero Discharge Project. The quality of overflow water is monitored regularly and found within the norm.
(xii)	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.	Dry Fog System (DFS) and wet screening arrangements have been provided in the Ore Handling Plant to mitigate fugitive dust emission at Barsua Block. Also Mist Cannon & Water injection system has been provided near mobile Crushing & Screening area at Kalta & Taldih Block. Some of the photographs of Dry Fog System (DFS) and Mist Cannon are shown in Annexure XI .
(xiii)	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.	Effluent generated from the ore beneficiation plant is being treated in Thickeners followed by Tailing Ponds. The clear water to the tune of 60 % is being recycled and the underflow from thickener is discharged into Tailing Dam. The quality of the dam seepage water is being monitored and found to be in compliance with the discharge quality standards. Currently tailing slurry from the beneficiation plant is being transported through proper channel to tailing pond.
(xiv)	The project proponent shall take necessary safeguard measures to ensure that there is no leaching from the pond.	The Tailing Pond at Barsua Iron Mine is located on the hard & plain area and is in operation since 1969. As iron ore in the region does not containing any heavy metals and no chemicals are being used in the beneficiation of ore at the mine, leaching of metals from the pond is not expected. The quality of the ground water at downstream of tailing pond is measured regularly.
(xv)	The decanted water from the tailing pond shall be re-circulated and there should be zero discharge from the tailing pond.	System for recovery and recycling of decanted water from the tailing pond has been provided at Barsua Iron Mine under Zero Discharge Project. A photograph showing Zero Discharge is shown in Annexure XI .
(xvi)	Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of particulate matter such as crusher zone, loading and unloading point and all transfer points during handling of the ore. Extensive water sprinkling shall be carried out on roads. It should be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the CPCB.	Dry Fog System (DFS) and Mist Cannon have been provided in crushing and screening plant. Also, fixed water sprinklers of about 6 km have been provided in the permanent haul roads. Further, regular water sprinkling is being done with 2 X 28KL highly pressurized mobile water tankers for Barsua Block, 1 X 12 KL & 1 X 10KL mobile water tanker for loading area of Barsua, 2 X 12 KL & 5 X 8 KL mobile water tankers for Kalta Block and 1 X 12 KL & 1 X 20 KL mobile water tankers for Taldih Block which is sufficient to keep the haul road in wet condition. Some photographs of water sprinkling arrangement are shown in Annexure XI .

Period: April 2021 to September 2021



Half yearly EC compliance Report

Integrated Barsua-Taldih-Kalta Iron Mines

Sl. No	Condition	Compliance Status
(xvii)	Plantation shall be raised in an area of 1658.803 ha including a 7.5m wide green belt in the safety zone around the mining lease, OB dumps, around beneficiation plant, mine benches around tailing ponds, roads etc. by planting the native species in consultation with the local DFO. The density of the trees should be around 2500 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.	Safety Zone plantation over 93.679 ha safety zone area of Barsua-Taldih-Kalta Iron Mines has been completed through State Forest Department. Apart from this, so far 2, 32,865 saplings have been planted covering an area of 112.98 ha since 2010. In the year 2021-22, total 7000 saplings have been planted over an area of 2.50 ha at Barsua block. However, development of green belt in an area of 1658.803 ha will be completed during conceptual period, after reclamation and rehabilitation of mined out pits, OB dumps and mine benches. The detail of plantation is placed at Annexure I .
(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.	A technical feasibility study for hydro-geological, rain water harvesting and augmentation of ground water has been conducted through M/s Tirupati Balajee Maharaj Consultant (P) Ltd. As per recommendation, two (02) nos. of Check dams i.e. one in Kuradih nala near pump house and other at Tantra Village near Taldih Block has already been constructed. The following measures have also been adapted for conservation and augmentation of ground water. ➤ The surface run-off generated from the mine is channelized through a series of garland drain to lowest level of pit for ground water recharge. ➤ Series of check dams at different strategic locations are being constructed.
(xix)	Regular monitoring of ground water level and quality shall be carried out in and around the project area 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 SGWB/CGWB and the data thus collected may be sent regularly to the MoEF and its regional office at Bhubaneswar and the Regional Director, CGWB.	Regular monitoring of ground water level and quality is being carried out and the monitoring reports are being submitted regularly. 3 nos. of open wells as well as tube wells have been selected all around the mines viz, Barsua Valley, Tensa and Kalta for regular monitoring of water levels & quality. Further, 2 Nos. of piezometers have been installed at Barsua valley and Taldih for ground water monitoring. The monitoring results of ground water level and quality are placed as Annexure – III and Annexure – IV respectively .
(xx)	The groundwater and surface water in and around the mine including tailing ponds shall be regularly monitored at strategic locations for heavy metals. The monitoring stations shall be established in consultation with the Regional Director, CGWB and SPCB.	Monitoring for heavy metals in ground water, surface water and tailing pond discharge are being carried out on monthly basis. Water quality for the period from April 2021 to September 2021 is placed in Annexure - V .

Period: April 2021 to September 2021

Sl. No	Condition	Compliance Status
(xxi)	Appropriate mitigative measures shall be taken to prevent pollution of the Karo River in consultation with the State Pollution control Board.	Detailed study has been conducted through IIT Kharagpur to assess the impacts of mining on water bodies and suggest measures to minimize the impacts. Some of the recommendations suggested by IIT, Kharagpur like silt traps, check dams, sedimentation ponds, plantation on the slopes have been made at various strategic locations and the same are under continuous implementation at other sites. Also a system for zero discharge has been provided at Barsua Iron Mines to prevent discharge of tailing pond overflow water to Kuradih nallah.
(xxii)	Regular monitoring of the flow rate of the spring and perennial nallahs flowing in and around the project area shall be carried out and records maintained.	Regular monitoring of the flow rate of the spring and perennial nallahs i.e. Kuradih Nalla at Barsua part and Samaj Nalla at Taldih & Kalta part are being done and records are being maintained. Flow rate of spring and perennial nalla for the period from April 2021 to September 2021 is placed in Annexure – IX .
(xxiii)	The project proponent shall obtain necessary prior permission of the competent authorities for drawl of requisite quantity of water (surface water) required for the project.	Department of Water Resources, Govt. of Odisha has allocated 3.406 cusec of Surface Water from Kuradih Nalla in favour of Barsua Iron Mines vide letter No. 4897/WR, dated 15.02.2021.
(xxiv)	Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with the Regional Director, CGWB.	A Technical Feasibility Study for hydro-geological, rain water harvesting & augmentation of ground water resources has been conducted through M/s Tirupati Balajee Maharaj Consultant (P) Ltd. Two (02) nos. of Check dams has already been constructed, one in Kuradih nala near pump house and other at Tantra Village near Taldih Block as per recommendation.
(xxv)	Vehicular emissions shall be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operation and in transportation of mineral. The vehicles carrying the mineral shall be covered with a tarpaulin and shall not be overloaded.	Pollution Under Control (PUC) certificate is made compulsory for deployment of vehicles in Mines. Scheduled / Preventive maintenance of HEMM and light vehicles are undertaken regularly to keep the vehicular emissions under control. The vehicles used for transportation of ore are covered with tarpaulins and ensured that there is no overloading with the help of weighbridge. The vehicular emission results of HEMM are placed in Annexure – VIII .
(xxvi)	Mineral handling area shall be provided with adequate number of high efficiency dust extraction system. Loading and unloading areas including all the transfer points should also have efficient dust control arrangements.	Mineral handling plant has been provided with the dust control measures like Dry Fog System (DFS), Mist Cannon & Water injection system at hopper and other transfer units. Also water spraying is being done at Loading & unloading areas.
(xxvii)	Occupational health surveillance program of the workers shall be undertaken periodically to observe any contractions due to exposure of dust and take corrective	Occupational health surveillance programs of the workers are being undertaken periodically to observe any contractions due to exposure of dust. Health records of the workers are maintained. Barsua Iron Mines has



Half yearly EC compliance Report

Integrated Barsua-Taldih-Kalta Iron Mines

Sl. No	Condition	Compliance Status
	measures, if needed. Health records of the workers shall be maintained.	been certified with ISO 45001:2018. Copy of certificate enclosed as Annexure XIII .
(xxviii)	Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be carried out and record maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly.	Pre-placement medical examination and periodical medical examination of the workers engaged in the project are being carried out. During the April 2021 to September 2021, IME for 165 nos. of contractual employees and PME for 19 nos. of regular employee have been done and records are being maintained. Schedule of health examination of the workers is also drawn and followed accordingly.
(xxix)	Sewage treatment plant shall be installed for the colony. ETP shall also be provided for the workshop and the wastewater generated during mining operation.	Individual septic tank with soak pits has been provided in the colony. ETP has been provided for treatment of effluents from the ore beneficiation plant consisting of Thickeners followed by Tailing Pond. About 60% of clear water from the Thickener as overflow, recycled back to the system. The underflow from the Thickener is being drained to the Tailing Pond for further settling of solids. State-of-art Oil & grease traps have been provided for treating the effluents from workshop and garages. Some photographs are shown in Annexure XI .
(xxx)	The R&R of the project affected people, if any shall be carried out as per the NPRR.	Not Applicable.
(xxxi)	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 MOEF and its Regional office located at Bhubaneswar.	Digital processing of the entire lease area using remote sensing technique has been studied through satellite imagery i.e. Linear Imaging Self-Scanner during March, 2021 by IIT ISM, Dhanbad. Copy of the report is enclosed as Annexure - XII .
(xxxii)	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and construction such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	SAIL has a well developed township at Tensa and Kalta with residential accommodation for its workers with all necessary infrastructure and construction such as LPG gas connection, electricity for cooking, welfare amenities like toilets, drinking water and medical facilities etc. Whenever required, the construction labour are hired from the local villagers and only few are being hired from outside, for which housing facilities along with necessary infrastructure are being provided at the existing colony of the mines.
(xxxiii)	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered fauna namely elephant, sloth bear, peacock etc. spotted in the study area. All the safeguard measures brought out in the Wildlife Conservation Plan so prepared specific to this project site shall be effectively implemented.	All precautions are undertaken for not to disturb the flora and fauna inside the lease area. All necessary facilities are being extended to the local Forest Department for implementation of the wildlife conservation activities regularly. Also State Government had approved the study report prepared by an expert committee under the chairmanship of RCCF, Rourkela. Accordingly, an amount of Rs.17.82 Crore has been deposited in CAMPA through RTGS in A/c. No.344902010105428 on 26.02.2013 as a part of the Site Specific Conservation. Also, an amount

Period: April 2021 to September 2021



Half yearly EC compliance Report

Integrated Barsua-Taldih-Kalta Iron Mines

Sl. No	Condition	Compliance Status
		of Rs.10,69,14,469.00 @ Rs.43,000.00 per Ha. has been deposited in three phases towards implementation of comprehensive wild life management plan prepared for Bonai-Keonjhar forest division. Again, so far an amount of Rs. 516.71 Lakhs has been incurred since 2013-14 in various activities as part of Site Specific Conservation Plan from the fund realised by SAIL.
(xxxiv)	The critical parameters such as RSPM (Particulate matter with size less than 10micron i.e., PM10) SO ₂ and NO _x in the ambient air within the impact zone, peak particle velocity at 300m distance or written the nearest habitation whichever is closer shall be monitored periodically. Further, quality of discharged water shall also be monitored for TDS, DO, PH and 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.	Critical parameters i.e. PM10, PM2.5, NO _x and SO ₂ in ambient air and relevant parameters in the effluents are being monitored regularly. The effluent quality for the period from April 2021 to September 2021 is placed in Annexure - VI . Also 3 Nos. of Continuous Ambient Air Quality Monitoring Stations (CAAQMS) at Barsua-Kalta has been installed and data are being transmitted to SPCB server. The monitored data is being displayed at the main gate of the mines. Copy of EC compliance along with environmental quality data is being uploaded to the company website www.sail.co.in.
(xxxv)	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 MoEF&CC, New Delhi 5 years in advance of final mine closure for approval.

B. General Conditions

Sl. No	Condition	Compliance Status												
(i)	No change in mining technology and scope of working should be made without prior approval of the MoEF & CC.	Mining is being done as per the approved Mining Plan/ Scheme of Mining and amended Environmental Clearance.												
(ii)	No change in the calendar plan including excavation, quantum of mineral iron ore and waste should be made.	<p>There will be no change in the calendar plan including excavation, quantum of mineral iron ore and waste. ROM production at various mining blocks of Barsua-Taldih-Kalta Iron Mines is kept within permitted capacity of EC / approved Mining Plan.</p> <p>The quantity of Production for the period April 2021 to September 2021 is as follows:</p> <table><tr><td></td><td>BIM</td><td>TIM</td><td>KIM</td></tr><tr><td>ROM</td><td>1272820.00</td><td>778050.00</td><td>1556300.00</td></tr><tr><td>Tailings/ Sub-grade Fines</td><td>301239.72</td><td>63556.38</td><td>0.00</td></tr></table>		BIM	TIM	KIM	ROM	1272820.00	778050.00	1556300.00	Tailings/ Sub-grade Fines	301239.72	63556.38	0.00
	BIM	TIM	KIM											
ROM	1272820.00	778050.00	1556300.00											
Tailings/ Sub-grade Fines	301239.72	63556.38	0.00											

Period: April 2021 to September 2021

Sl. No	Condition	Compliance Status
(iii)	Four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RSPM (Particulate matter with size less than 10 micron i.e., PM ₁₀), SO ₂ and NO _x monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with SPCB.	Four nos. of ambient air quality monitoring stations at Barsua-Taldih-Kalta Iron Mines have been established in the core zone as well as in the buffer zone based on the topography and meteorological conditions of the area. Regular ambient air quality monitoring of key parameters (PM _{2.5} , PM ₁₀ , SO ₂ and NO _x) to mining industries as per the guidelines of MoEF&CC and CPCB is being done. Moreover, 3 Nos. of Continuous Ambient Air Quality Monitoring Stations (CAAQMS) at Barsua & Kalta have also been commissioned and data are being transmitted to SPCB server.
(iv)	Data on ambient air quality RSPM (Particulate matter with size less than 10 micron i.e., PM ₁₀), SO ₂ and NO _x should be regularly submitted to the Ministry of environment and Forest including its Regional office located at Bhubaneswar and the SPCB / CPCB in six months.	Ambient air quality monitoring data (PM _{2.5} , PM ₁₀ , SO ₂ and NO ₂) is being submitted to MoEF&CC, New Delhi and Regional Office, Bhubaneswar along with the compliance reports. Air Quality report for the period April 2021 to September 2021 is placed as Annexure – II . Air quality data is also being submitted to SPCB and CPCB in every six months.
(v)	Fugitive dust emissions from all the sources should be controlled regularly. Water spraying arrangement on haul roads, loading and unloading and at transfer points should be provided and properly maintained.	Dry Fog System (DFS) and Mist Cannon have been provided in crushing and screening plant. Also, fixed water sprinklers of about 6 km have been provided in the permanent haul roads. Further, regular water sprinkling is being done with 2 X 28 KL highly pressurized mobile water tankers for Barsua Block, 1 X 12 KL & 1 X 10 KL mobile water tanker for loading area of Barsua, 2 X 12 KL & 5 X 8 KL mobile water tankers for Kalta Block and 1 X 12 KL & 1 X 20 KL mobile water tankers for Taldih Block. All these dust control measures installed at the mines are sufficient to control fugitive dust emission.
(vi)	Measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in operations of HEMM, etc. should be provided with ear plugs / muffs.	Regular maintenances and periodic checks of the HEMM are being carried out to control noise below 85 dB (A) in the work environment. The operators engaged in blasting/ drilling operations and operator of HEMM are provided with PPEs such as ear plug/ ear muffs with helmet. Use of these protective measures is ensured by educating the workers on ill effect of the prolonged excessive exposure to high Noise levels and daily checks by shift mining engineers regarding usage of ear plug/ear muffs. The measured noise level in critical areas is placed in Annexure – VII .
(vii)	Industrial waste water (workshop and waste water from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19 th May, 1993 and 31 st December, 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluent.	State-of-art Oil & grease traps have been provided for treating the effluents from workshop and garages in the HEMM maintenance unit. Effluents generated from the beneficiation plants are being treated in Thickeners followed by Tailing Ponds. The clear water to the tune of 60% is being recycled and the underflow from thickener is discharged into Tailing Dam.


Period: April 2021 to September 2021

Annual yearly EC compliance report

Sl. No	Condition	Compliance Status								
(viii)	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. Occupational health surveillance program of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed.	Dust masks have been provided to personnel working in dusty areas and ensured by daily checks. Training on safety and health aspects is being imparted on regular basis. A full-fledged Occupational Health Centre (OHC) is run by the mines for regular health surveillance. Periodical Medical Examination (PME) of all workmen working in the mines is being done at our OHC once in every five years/three/one year depending on category.								
(ix)	A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.	A full-fledged Environmental Management Cell (EMC) has been established to look after environmental aspects headed by an experienced engineer in the rank of Senior Manager, who directly reports to Head of Mines. He is further assisted by two more experienced officers for environmental management at mines.								
(x)	The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year wise expenditure should be reported to the MoEF&CC and its Regional Office located at Bhubaneswar.	<p>Funds earmarked for environmental protection measures at the mines are booked separately and not being diverted for other purpose. Year wise expenditure for last 3 years on Environmental protection measures is furnished below.</p> <p>The details of expenditure are placed as Annexure – X.</p> <table> <tr> <th>Year</th> <th>Approx. Expenditure</th> </tr> <tr> <td>2019-20</td> <td>210.09 Lakhs</td> </tr> <tr> <td>2020-21</td> <td>398.58 Lakhs</td> </tr> <tr> <td>2021-22 ((up to Sept' 2021)</td> <td>87.85 Lakhs</td> </tr> </table>	Year	Approx. Expenditure	2019-20	210.09 Lakhs	2020-21	398.58 Lakhs	2021-22 ((up to Sept' 2021)	87.85 Lakhs
Year	Approx. Expenditure									
2019-20	210.09 Lakhs									
2020-21	398.58 Lakhs									
2021-22 ((up to Sept' 2021)	87.85 Lakhs									
(xi)	The project authorities should inform to the Regional Office located at Bhubaneswar regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	The Barsua and Kalta Blocks under the ML-130 are operating since 1960 and 1966 respectively. Development work in Taldih block started since 9 th June 2016 and installation of various facilities at Taldih Block are under progress & will be informed in due time after installation of the facilities.								
(xii)	The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer(s) of the Regional Office by furnishing the requisite data / monitoring reports.	Full co-operation is extended to the officer(s) of the regional office of MoEF&CC by furnishing the requisition data information, monitoring reports etc.								
(xiii)	The project proponent shall submit six monthly reports on the status of compliance of the stipulated environmental clearance conditions including results of monitored data to the MoEF, its Regional Office Bhubaneswar, and the respective Zonal Office of CPCB. The proponent shall upload the status of compliance of the EC	<p>Six monthly compliance reports on the status of implementation of environmental safeguards are being submitted to MoEF&CC, New Delhi, Regional Office, MoEF&CC, Bhubaneswar, Central Pollution Control Board and State Pollution Control Board.</p> <p>Copy of the compliance report including environmental quality data is being uploaded to the SAIL web site i.e. www.sail.co.in.</p>								

Period: April 2021 to September 2021

Sl. No	Condition	Compliance Status
	conditions on their website and shall update the same periodically. It shall simultaneously be sent to the regional Office of the MoEF, Bhubaneswar, the respective Zonal Office of CPCB and SPCB.	
(xiv)	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parishad / Municipal corporation, Urban local Body and the Local NGO, if any, from whom suggestions, representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Copy of clearance letter was notified in public places and community centers. A copy of the environmental clearance letter has already been sent to the Panchayat. The clearance letter has been put on the Company website i.e. www.sail.co.in .
(xv)	The State Pollution Control Board should display a copy of the clearance letter at the regional Office, District Industry Centre and the Collector's Office / Tehsildar's Office for 30 days.	-
(xvi)	The environmental statement for each financial year ending 31 st March in Form-V as is maintained to be submitted by the project proponent to the concerned SPCB as prescribed under the EP Rules- 1986, as amended subsequently, shall also be put on the website of the company and shall also be sent to the Regional office of the MoEF, Bhubaneswar by e-mail.	Being complied with.
(xvii)	The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter is available with the SPCB and also at web site of the MoEF at http://envfor.nic.in and a copy of the same should be forwarded to the Regional Office of the Ministry located at Bhubaneswar.	Already advertised.


P. K. RATH
 Chief General Manager
 SAIL, RSP, BIM, TIM & KIM



BARSUA-TALDIH-KALTA IRON MINE, RMD, SAIL

DETAILS OF PLANTATION

YEAR	INSIDE MINING LEASE			OUTSIDE MINING LEASE		
	No. of trees	Area in Ha.	Rate of survival in %	No. of trees	Area in Ha.	Rate of survival in %
2010-11				8450	3.86	85
2011-12	25000	8.00	74	4600	3.02	65
2012-13	25000	10.00	85	1780	0.80	70
2013-14	25480	10.20	95	1620	1.20	90
2014-15				7400	3.30	72
2015-16	11600	16.00	65	8700	5.00	80
2016-17	8000	5.00	85	9985	3.50	80
2017-18	500	0.40	75	17750	8.40	70
2018-19	300	0.20	85	11700	4.90	79
2019-20				45000	21.20	47
2020-21				13000	5.50	81
2021-22				7000	2.50	85
TOTAL	95880	49.800	82.21	136985	63.180	67.48

Apart from above, the following plantation has been done through State Forest Department

1. Safety Zone Plantation of 32073 saplings over an area of 93.679 Ha
2. 1.5 times safety zone plantation of 28104 saplings over an area of 140.519 Ha
3. Compensatory Afforestation of 1237179 saplings over an area of 6122.269 Ha



BARSUA-TALDIH-KALTA IRON MINES
DETAIL ANALYSIS OF AIR QUALITY MONITORING

Location	1st QUARTER 2021-22					'JULY 2021					'AUGUST 2021					'SEPTEMBER 2021					
	RSPM (PM ₁₀)	PM _{2.5}	SO ₂	NO _x	CO	RSPM (PM ₁₀)	PM _{2.5}	SO ₂	NO _x	CO	RSPM (PM ₁₀)	PM _{2.5}	SO ₂	NO _x	CO	RSPM (PM ₁₀)	PM _{2.5}	SO ₂	NO _x	CO	
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	
Unit																					
A) Ambient Air Quality in Residential, rural & other areas.																					
Norm as per NAAQS	100	60	80	80	4	100	60	80	80	4	100	60	80	80	4	100	60	80	80	4	
A 1	85.00	45.00	12.50	20.30	1.14	48.00	30.19	7.85	14.28	0.21	47.82	23.97	7.00	12.04	0.22	45.07	23.96	6.00	9.75	0.19	
A 2	80.00	43.00	9.30	21.00	0.91	44.39	26.83	7.33	12.89	0.21	51.14	28.18	7.89	13.11	0.26	46.61	26.27	6.95	11.98	0.27	
A 3	82.00	45.00	10.30	13.10	1.01	47.18	22.96	7.11	12.45	0.26	49.37	27.33	7.82	13.00	0.25	39.35	19.57	5.55	9.19	0.16	
A 4	87.00	46.00	10.80	17.00	1.27	59.87	32.38	8.31	14.74	0.47	47.19	27.57	7.87	13.38	0.27	51.78	29.19	7.51	12.83	0.29	

Note : Ambient Air Quality Monitoring was conducted as per MoEF Notification No. GSR 826(E), dtd.16.11.2009.

B) Results of Fustive Emission / Work Zone Quality.

Norm as per IBM	1st QUARTER 2021-22		'JULY 2021		'AUGUST 2021		'SEPTEMBER 2021	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³	1200 µg/m ³
Actual(PM)								
F 1	-	-	78.63	315.72	170.13	375.58	92.47	298.39
F 2	-	-	98.46	423.93	228.42	410.27	102.6	309.36
F 3	-	-	88.53	311.54	128.06	295.74	82.36	201.29
F 4	-	-	105.2	418.51	218.56	411.57	128.36	311.16
F 5	-	-	113.8	491.42	242.54	390.72	148.68	327.58
F 6	-	-	98.42	375.41	156.21	305.67	82.44	168.56
F 7	-	-	147.2	653.46	296.64	512.66	182.57	384.42
F 8	-	-	135.7	432.56	245.85	392.42	102.16	284.16
F 9	-	-	104.5	527.45	207.52	510.87	94.64	303.29
F 10	-	-	186.2	575.31	218.46	525.65	139.47	390.28
F 11	-	-	108.4	350.6	148.38	335.54	84.51	281.57
F 12	-	-	27.69	711.26	315.22	585.13	157.47	386.38

*** unit in µg/m³**

Note : Fustive emission standards as per MoEF Notification No. GSR 809(E), dtd.4.10.2010 on iron ore mining and processing. Particulate matter (PM)₁₀-1200 µg/m³ at a distance of 25±2m. In the pre dominant downward direction from the source of generation .

Locations :

- A 1 : Tensa Hospital, Tensa
- A 2 : Barsua valley, Township
- A 3 : Tantara Village
- A 4 : Mine Site Office (KIM)
- F1 : Ore Handling plant(BIM)
- F2: Excavation & loading (BIM)
- F3 : Haul Road(BIM)
- F4 : Dump Area(BIM)
- F5 : Stock pile & Loading(B/V. BIM)
- F6 : Haul Road (TIM)
- F7 : Mobile Screening Area (TIM)
- F8 : Excavation Area(TIM)
- F9: Drilling Area (KIM)
- F10: Excavation & Loading Area (KIM)
- F11: Haul Road Area (KIM)
- F12: Mobile Crushing & Screening Area (KIM)

**Annexure – III****BARSUA-TALDIH-KALTA IRON MINE****GROUND WATER LEVEL MEASUREMENTS**

Location ID	Location	Water level below the Ground Surface (in meters)	
		Pre-Monsoon (April-May 2021)	Monsoon (August 2021)
OW1	Barsua Railway Station, Open well	-	0.35
OW2	Zero Pount Open well, Tensa	-	1.55
OW3	Kalta Basti Open well, Kalta	-	1.52



BARSUA-TALDIH-KALTA IRON MINE
WATER QUALITY OF GROUND WATER

Sl. No.	Parameters V	1st QUARTER 2021-22			JULY 2021			AUGUST 2021			SEPTEMBER 2021		
		GW1	GW 2	GW3	GW1	GW2	GW3	GW1	GW2	GW3	GW1	GW2	GW3
1	pH	7.21	7.16	7.33	6.58	5.5	5.35	5.85	5.7	5.32	6.27	6.06	5.6
2	Colour(Hazen unit)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
3	Turbidity (NTU)	0.84	1.28	0.61	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	2.8	2.6	<1.0
4	Temperature °C	-	-	-	30.6°C	30.2°C	26.6°C	31.3°C	31.1°C	31.3°C	30.2°C	28.8°C	28.8°C
5	Total Hardness as CaCO ₃ ,mg/l	96	96	88	144	116	44	108	124	40	128	140	60
6	Alkalinity as CaCO ₃ ,mg/l	132	60	80	176	116	40	136	124	48	144	116	40
7	Chlorides as Cl ⁻ , mg/l	12	35	14	24	40	32	8	28	8	8	8	8
8	Calcium as Ca, mg/l	22	22	14	34	27	13	19.2	41.6	9.6	24	32	6.4
9	Magnesium as Mg, mg/l	9	9	12	15	12	3	14.6	4.9	3.9	16.5	14.6	10.7
10	Residual Free Chlorine, mg/l	-	-	-	<1.0	<1.0	<1.0	<1.0	3	2	<1.0	<1.0	<1.0
11	Sulphate as SO ₄ ,mg/l	<4.0	5	<4.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
12	Nitrate as NO ₃ , mg/l	<0.1	14	1.1	1.8	1.8	2	2.6	2	1.8	1.9	1.8	0.9
13	Iron as Fe,mg/l	0.178	0.162	<0.05	0.215	0.205	0.189	0.315	0.106	0.296	0.302	0.115	0.223
14	Copper as Cu,mg/l	<0.01	<0.01	<0.01	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
15	Manganese as Mn,mg/l	0.016	0.018	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
16	Phenolic Compounds C ₆ H ₅ OH, mg/l	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
17	Zinc as Zn, mg/l	0.057	0.213	0.262	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18	Cadmium as Cd, mg/l	-	-	-	<0.003	<0.003	<0.003	<0.002	<0.002	<0.002	<0.003	<0.003	<0.003
19	Arsenic as As, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Cyanide as CN, mg/l	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
21	Lead as pb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Total Chromium as Cr ⁺⁶ , mg/l	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
23	Mineral oil ,mg/l	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
24	Fluoride as F, mg/l	<0.1	0.23	0.248	0.123	0.109	0.093	0.125	0.107	0.08	0.122	0.116	0.09
25	Selenium as Se, mg/l	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26	Total Dissolved solids (mg/l)	170	159	133	163	160	87	135	111	68	147	175	85
27	Aluminium as Al mg/l	<0.01	<0.01	0.048	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
28	Boron as B mg/l	<0.05	<0.05	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
29	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
30	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
31	Mercury as Hg, mg/l	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
32	Anionic detergent	-	-	-	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

NB :

GW 1 : Hand pump at Zero point : (BIM)

GW 2 : Hand pump at Banka Bazar B/Valley

GW 3 : Hand Pump at Kalta Village (KIM)

WATER QUALITY OF STREAM SAMPLES/SURFACE WATER

WATER QUALITY OF STREAM SAMPLES/SURFACE WATER

Sl.No.	Parameters	1st QUARTER 2021-22						JULY 2021						AUGUST 2021						SEPTEMBER 2021											
		SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
1	pH	7.39	7.26	7.17	7.16	7.04	7.02	6.51	6.48	5.75	5.42	6.05	6.3	6.1	6.29	5.97	6.14	6.63	6.68	6.45	6.83	6.73	6.62	6.63	6.3	6.45	6.83	6.73	6.62	6.63	6.3
2	Temperature	-	-	-	-	-	-	22 ^o C	23 ^o C	23 ^o C	24 ^o C	28 ^o C	28 ^o C	30 ^o C	30.1 ^o C	30.3 ^o C	30.3 ^o C	30.6 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	29 ^o C	
3	Turbidity(NTU)	2.60	6.70	3.90	5.80	1.90	1.30	2	2.8	2.3	2.5	3.8	4	3.5	3.8	2.6	3.6	2.5	2.9	4.2	4.5	3.8	3.6	3.9	3.8	4.2	4.5	3.8	3.6	3.9	3.8
4	Residual Free Chlorine mg/l	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
5	Alkalinity as CaCo3 mg/l	20.00	28.00	32.00	32.00	36.00	44.00	24	32	24	20	20	52	40	32	24	24	32	60	60	60	24	24	32	40	60	60	24	24	32	40
6	Chloride as Cl mg/l	8.00	12.00	12.00	10.00	8.00	12.00	16	20	16	12	4	8	8	4	4	4	8	48	12	8	8	8	8	8	8	12	8	8	8	8
7	Total Hardness as CaCo3 mg/l	20.00	24.00	28.00	36.00	28.00	48.00	20	20	16	16	16	40	20	24	16	12	16	48	100	36	24	20	36	52	100	36	24	20	36	52
8	Calcium as Ca mg/l	<10	<10	<10	<10	<10	10.00	8	8	3.2	4.8	4.8	13	4.8	4.8	4.8	4.8	6.4	2.8	11.2	4.8	6.4	4.8	3.2	6.4	11.2	4.8	6.4	4.8	3.2	6.4
9	Magnesium as Mg mg/l	2.00	3.00	3.00	6.00	2.00	6.00	<0.243	<0.243	1.044	0.972	0.972	1.94	1.9	2.9	0.972	<0.243	0.243	3.9	17.5	5.8	1.9	1.9	0.972	1.94	17.5	5.8	1.9	1.9	0.972	1.94
10	Sulphate as So4 mg/l	<4	<4	4.00	<4	<4	<4	2	2	2	2	2	3	<1.0	<1.0	<1.0	<1.0	3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
11	Nitrate as No3 mg/l	1.59	0.65	1.94	1.92	0.61	0.59	2.4	2.8	2.5	2.6	4.2	4.5	2.8	3.8	2.6	3.2	3	3.5	2.5	2.6	2.4	2.8	2.7	2.2	2.5	2.6	2.4	2.8	2.7	2.2
12	Fluoride as F mg/l	<0.1	<0.1	0.17	<0.1	<0.1	0.12	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
13	Total dissolve Solids mg/l	35.00	48.00	46.00	50.00	52.00	63.00	23	29	21	20	25	54	35	39	32	27	33	68	38	76	36	29	30	38	76	36	29	30	38	76
14	Total Suspended Solids mg/l	-	-	-	-	-	-	6	8	6	9	6	8	8	12	10	14	10	12	28	27	30	32	24	22	28	27	30	32	24	22
15	D.O.	6.10	5.40	5.80	5.70	5.30	4.80	4.8	4.5	4.9	4.5	5.8	5.5	4.5	4.4	4.6	4.5	4.5	4.4	4.8	4.6	4.5	4.5	4.4	4.3	4.8	4.6	4.5	4.5	4.4	4.3
16	COD	-	-	-	-	-	-	5	8	6	7	8	10	7	6	8	6	5	6	8	6	7	4	5	7	8	6	7	4	5	7
17	Oil and Grease mg/l	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18	Iron as Fe mg/l	<0.05	0.43	0.20	0.54	0.06	0.14	0.962	1.065	0.886	0.993	0.868	0.99	0.602	0.602	0.521	0.548	0.615	0.494	0.669	0.554	0.553	0.462	0.482	0.433	0.669	0.554	0.553	0.462	0.482	0.433
19	Copper as Cu mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.03	<0.03	<0.03	<0.03	<0.04	<0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
20	Zinc as Zn mg/l	<0.05	<0.05	<0.05	0.01	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1.0	<1.0	<0.01	<0.01	<0.01	<0.01	<1.0	<1.0	<0.01	<0.01	<0.01	<0.01
21	Aluminium as Al mg/l	0.03	0.19	0.08	0.28	0.07	0.10	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
22	Boron as B mg/l	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
23	Manganese as Mn mg/l	0.01	0.02	0.01	0.02	<0.01	0.01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
24	Lead as Pb mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
25	Cadmium as Cd mg/l	-	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
26	Arsenic as As mg/l	-	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
27	Mercury as Hg mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<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	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28	Nickel as Ni mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
29	Chromium as Cr +6mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
30	Phenolic compound mg/l	-	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
31	Cyanide as CN mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
32	Kjeldahl Nitrogen as N mg/l	-	-	-	-	-	-	5	6	6	8	6	8	5.6	6.2	5.6	6.2	6	8	6	7	6	8	6	6	6	7	6	8	6	6
33	Arsenic as Ni mg/l	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

BARSUA-TALDIH-KALTA IRON MINES
WATER QUALITY RESULTS OF EFFLUENT

Sl.No.	Parameters	1st QUARTER' 2021-22			JULY 2021			AUGUST 2021			SEPTEMBER 2021	
		EW-1	EW-2	EW-1	EW-2	EW-1	EW-2	EW-1	EW-2	EW-1	EW-2	EW-2
1	pH	-	7.21	6.22	6.63	6.95	6.4	6.23	6.4	6.23	6.45	6.45
2	Temperature	-	-	30.4 ⁰ C	30.4 ⁰ C	31.3 ⁰ C	31.2 ⁰ C	29 ⁰ C	29 ⁰ C	29 ⁰ C	29 ⁰ C	29 ⁰ C
3	Selenium as Se, mg/l	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4	Total Residual Chloride mg/l	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
5	Alkalinity as CaCO ₃ mg/l	-	56.00	40	44	56	52	40	52	40	52	52
6	Chloride as Cl mg/l	-	10.00	12	12	8	4	4	4	4	8	8
7	Total Hardness as CaCO ₃ mg/l	-	48.00	32	32	40	44	32	44	32	48	48
8	Calcium as Ca mg/l	-	13.00	8	11.2	6.4	9.6	4.8	9.6	4.8	8	8
9	Magnesium as Mg mg/l	-	4.00	2.9	0.97	5.8	4.9	4.9	4.9	4.9	6.8	6.8
10	Nitrate as NO ₃ mg/l	-	1.39	3	2.8	<0.02	<0.02	3.8	<0.02	3.8	3.9	3.9
11	Fluoride as F mg/l	-	0.10	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
12	Total dissolve Solids mg/l	-	75.00	37	46	59	61	38	61	38	54	54
13	Suspended Solids mg/l	-	-	8	6	6	6	12	6	12	14	14
14	B.O.D (3 days at 27 ⁰ C) mg/l	-	5.00	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
15	C.O.D	-	-	10	8	7	9	8	9	8	9	9
16	Oil and Grease mg/l	-	-	<1.0	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17	Total Chromium as Cr mg/l	-	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	Copper as Cu mg/l	-	<0.01	<0.05	<0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
19	Zinc as Zn mg/l	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20	Boron as B mg/l	-	<0.05	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
21	Odour	-	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
22	Colour	-	-	Agreeable	Agreeable	3	10	8	10	8	10	10
23	Lead as Pb mg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
24	Cadmium as Cd mg/l	-	-	<0.003	<0.003	<0.001	<0.001	<0.003	<0.001	<0.003	<0.003	<0.003
25	Arsenic as As mg/l	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
26	Mercury as Hg mg/l	-	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
27	Nickel as Ni mg/l	-	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
28	Hexavalent Chromium as Cr ⁺⁶ mg/l	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
29	Phenolic compound As C ₆ H ₅ OH mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
30	Cyanide as CN mg/l	-	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
31	Dissolved Phosphate as P mg/l	-	-	<0.02	<0.02	<0.02	<0.02	-	<0.02	-	NT	NT
32	Ammonical Nitrogen as N mg/l	-	-	NT	NT	NT	NT	NT	NT	<0.02	<0.02	<0.02
33	Total Kjeldahl Nitrogen as N mg/l	-	-	7	5	8	6	8	6	8	7	7
34	Free Ammonia as NH ₃ mg/l	-	0.02	<0.02	<0.02	<0.2	<0.2	NT	<0.2	NT	<0.02	<0.02
35	Iron as Fe mg/l	-	0.598	0.778	0.765	0.562	0.566	0.872	0.566	0.872	0.862	0.862

N.B:

EW 1 : Tailing Dam Area Before Discharge

EW 2 : Tailing Dam Area After Discharge



Annexure-VII

**BARSUA-TALDIH-KALTA IRON MINE
AMBIENT NOISE QUALITY**

Sl.No.	LOCATION	1st QUARTER 2021-22		JULY 2021		AUGUST 2021		SEPTEMBER 2021	
		Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)
1	Tensa Hospital	48.8	40	48.3	36.3	54.8	45.6	48.2	36.1
2	VTC Tensa	63.4	53.8	54.4	37.4	55.2	36.4	52.2	38.3
3	Barsua Valley Township	50.4	43.1	50.0	42.2	52.0	41.5	52.7	41.8
4	Tantra Village (TIM)	51.3	41.5	50.37	33.66	46.9	39.8	51.81	34.12
5	Guest House Kalta	49.4	40.3	48.64	36.97	47.56	35.89	49.96	37.22



BARSUA-TALDIH-KALTA IRON MINE

Annexure-VII

WORK ZONE NOISE QUALITY

Sl.No.	LOCATION	1st QUARTER 2021-22			JULY 2021		AUGUST 2021		SEPTEMBER 2021	
		Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)	Day time Leq. dB (A)	Night time Leq. dB (A)
1	Drilling (BIM)	-	-	71.1-74.2	Not in operation	Not in operation	70.1-73.4	Not in operation	72.2-73.2	Not in operation
2	Excavation & Loading (BIM)	-	-	64.3-69.1	58.7-60.3	57.7-62.5	64.4-69.8	57.7-62.5	70.1-71.2	61.5-62.7
3	Haul Road (BIM)	-	-	67.3-71.9	62.2-66.2	61.5-64.2	64.6-72.2	61.5-64.2	70.7-72.1	63.1-64.5
4	Secondary Crusher (BIM)	-	-	71.0-73.4	63.7-67.8	60.7-65.8	70.5-72.5	60.7-65.8	72.1-73.5	63.7-64.6
5	Wagon Loading Area (B/V)	-	-	64.3-70.4	60.4-64.8	59.5-65.6	65.7-69.4	59.5-65.6	70.5-71.3	64-65.2
6	Haul Road (TIM)	-	-	71.3-72.8	64.55-65.2	61.6-66.0	72.6-74.2	61.6-66.0	72.5-73.5	63.2-64.7
7	Crushing & Screening (TIM)	-	-	71.4-72.4	63.16-64.3	59.8-65.1	70.5-72.8	59.8-65.1	71.9-73.6	63.2-64.9
8	Excavation Area (TIM)	-	-	71.0-72.5	63.2-63.5	58.9-63.1	70.2-72.4	58.9-63.1	72.4-73.3	63.7-64.2
9	Drilling (KIM)	-	-	70.93-73.5	Not in operation	Not in operation	72.6-73.9	Not in operation	72.21-73.00	Not in operation
10	Excavation & Loading (KIM)	-	-	66.6-69.56	57.34-64.76	57.5-58.2	65.7-69.2	57.5-58.2	70.13-73.76	60.25-63.20
11	Haul Road (KIM)	-	-	62.24-72.2	53.55-67.4	62.9-67.2	70.8-71.8	62.9-67.2	71.32-72.80	60.75-63.22
12	Crushing & Screening (KIM)	-	-	71.6-73.2	65.6-68.43	66.5-68.1	73.2-74.3	66.5-68.1	72.72-73.62	64.23-65.54



BARSUA-TALDIH-KALTA IRON MINES

RESULTS OF VEHICULAR EMISSION					
Sl. No.	Vehicle Registration No.	K-Avg	HSU%	MIN Rpm(Avg)	MAX Rpm (Avg)
1	ORDP003791	0.05	68	725.0	1725.0
2	ORDP003792	0.05	68	745.0	1745.0
3	ORDP003793	0.05	68	755.0	1755.0
4	ORDP003794	0.05	68	757.5	1757.5
5	OR14W9579	0.05	68	762.5	1762.5
6	ORDP003796	0.05	68	772.5	1772.5
7	OR14W9578	0.05	68	777.5	1780.0
8	OD14M4886	0.05	68	775.0	1775.0
9	OR14X3345	0.05	68	869.0	1869.0
10	OR14T4195	0.05	68	806.7	1807.0
11	ORDP003801	0.05	68	812.2	1812.2
12	OD14X3496	0.05	68	816.5	1816.0
13	ORDP003803	0.05	68	821.7	1822.0
14	ORDP003804	0.05	68	826.5	1826.5
15	EX-22	0.05	68	831.5	1831.5
16	OD09P0558	0.05	68	832.5	1832.5
17	OD35B5648	0.05	68	836.5	1836.5
18	OD35E2367	0.05	68	841.5	1841.5
19	OD35C0459	0.05	68	846.5	1846.5
20	OD09P1125	0.05	68	851.5	1851.5
21	OD09P1359	0.05	68	856.5	1856.5
22	OR14K5951	0.05	68	862.0	1862.2
23	OD09P1116	0.05	68	867.2	1867.7
24	OR09J6403	0.05	68	871.7	1872.0
25	OR14T9129	0.05	68	881.7	1881.7
26	OD14T5529	0.05	68	525.2	1525.2
27	OD14N1867	0.05	68	633.0	1633.0
28	OD14T5528	0.05	68	643.7	1643.7
29	OD14M7690	0.05	68	686.2	1686.2
30	OD14U4056	0.05	68	692.5	1692.5
31	OR02BM5769	0.05	68	690.0	1690.0
32	OD33AA7889	0.05	68	700.0	1700.0
33	G9190	0.05	68	584.0	1584.0
34	OD09N8499	0.05	68	595.2	1595.2
35	OD33F5039	0.05	68	701.5	1701.5



BARSUA-TALDIH-KALTA IRON MINE

FLOW RATE OF PERENNIAL NALLAH			
Month	Locations		
	Kuradih Nalla (in m ³ /Sec)	Samaj Nalla, Taldih (in m ³ /Sec)	Samaj Nalla, Kalta (in m ³ /Sec)
1st QUARTER 2021-22	-	-	-
JULY' 2021	19.86	2.73	2.70
AUGUST' 2021	12.65	1.36	2.13
SEPTEMBER' 2021	18.62	2.22	2.09

**Annexure- X****BARSUA-TALDIH-KALTA IRON MINE****TOTAL EXPENDITURE INCURRED FOR ENVIRONMENTAL PROTECTION
MEASURES DURING THE YEAR 2021-22.**

Sl. No.	Environmental Protection Measures	Amount (in Lakhs)
1	Maintenance of Plantation & House Keeping of CAAQMS	9.63
2	Water Spraying	9.00
3	Environmental Monitoring	4.32
4	Maintenance of CAAQMS	5.97
5	Construction of check dams/ toe wall	38.24
6	Payment for Protection Watchers	20.69
Total		87.85

**PHOTOGRAPHS SHOWING ENVIRONMENTAL PROTECTION MEASURES AT
BARSUA-TALDIH-KALTA IRON MINES**



Coir mating over the dump at Barsua



Wheel washing facility at Taldih Mines



Retaining wall at Sub-grade dump at Barsua



Dry Boulder wall at Waste Dump, Taldih



Check Dam across the Najkura Nalla at Kalta



Tow wall at the bottom of Dump-8, Barsua



Retaining wall around tailing stockyard



Garland drains to channelized the water towards Area 3E pit



Area 3E pit which act as settling pit during Monsoon



Check dam constructed across the overflow channel of tailing dam to re-cycle the water, Barsua



Dry fog system at Crusher, Barsua



Fixed sprinkler at Crusher, Barsua



Fixed Sprinkler at Loading Plant, Barsua



Road Dust Suppression at Kalta



Operation of Mist Cannon at Kalta Block



Oil & Grease trap at F/M Area, Barsua



Thickener at Barsua

**LAND USE AND LAND COVER MAP OF BARSUA-TALDIH-KALTA (ML-130) &
ML-139 MINING LEASES AREA OF BARSUA & KALTA IRON MINES, ODISHA**

Sponsored by

Steel Authority of India Limited



Raw Materials Division

Consultant-in-Charge

Dr. Vasanta Govind Kumar Villuri

Assistant Professor



Department of Mining Engineering

Indian Institute of Technology (Indian School of Mines), Dhanbad

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Introduction

Land Use Land Cover Land studies are carried out to reveal how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. The water types include wetlands or open water. The Land Use information describes how people use the landscape. Such uses include developmental use, conservation related use, or mixed uses.

Land use and land cover map of Barsua Iron Mines, Odisha have been developed from Linear Imaging Self scanning Sensor (LISS) data obtained from Indian Remote Sensing satellite- Resource sat-2, LISS-IV (2021) sensor and Cartosat (2021) sensor. The satellite images so obtained were processed applying supervised classification method have using the Erdas Imagine software. The Land Use Land Cover has been classified into six classes, which are built-up land, open forest, dense forest, agricultural land, wasted land and water body. The areas under each of these classes were estimated on the basis of the pixel grid cell process in Erdas Imagine software following the rules of NRSC/ISRO Land Use and Cover Monitoring. The theme of Barsua Iron Mines, Odisha LULC is given in the following **Table 1**.

Table-1. Descriptions of land use and land cover classes (Source- NRSC/ISRO)

Sl.	Description-1	Description-2	Remark
1.	Built-up Land	Urban	Residential, Mixed built up, Public / Semi Public, Communication, Public utilities /facility, Commercial, Transportation, Reclaimed land, Vegetated Area, Recreational, Industrial, Industrial / Mine dump, Ash/ Cooling pond.
		Rural	Rural.
		Mining	Mine / Quarry, Abandoned Mine Pit, Land fill area.
2.	Agriculture Land	Crop land	Kharif, Rabi, Zaid, Two cropped, More than two cropped.
		Plantation	Plantation-Agricultural, Horticultural, Agro Horticultural.

		Fallow	Current and Long Fallow.
		Current Shifting cultivation	Current Shifting cultivation.
3.	Forest Land	Evergreen/Semi evergreen	Dense / Closed and Open category of Evergreen / Semi evergreen.
		Deciduous	Dense / Closed and Open category of Deciduous and Tree Clad Area.
		Forest Plantation	Forest Plantation.
		Scrub Forest	Scrub Forest, Forest Blank, Current & Abandoned Shifting Cultivation.
		Swamp/ Mangroves	Dense / Closed & Open Mangrove.
4.	Barren/ uncultivable/ Wastelands	Salt Affected Land	Slight, Moderate & Strong Salt Affected Land.
		Gullied/ Ravinous Land	Gullied, Shallow ravine & Deep ravine area.
		Scrub land	Dense / Closed and Open category of scrub land.
		Sandy area	Desertic, Coastal, Riverine sandy area.
		Barren rocky	Barren rocky.
		Rann	Rann.
5.	Wetlands/Water Bodies	Inland Wetland	Inland Natural and Inland Manmade wetland
		Coastal Wetland	Coastal Natural and Coastal Manmade wetland
		River / Stream / canals	Perennial & Dry River/stream and line & unlined canal/drain
		Water bodies	Perennial, Dry, Kharif, Rabi & Zaid extent of lake/pond and reservoir and tanks

Built-up land: It is an area of human habitation developed due to non-agricultural use and that has a cover of buildings, transport and communication, utilities in association with water, vegetation and vacant land. LULC map consists of 3 classes under built-up viz., urban, rural and mining. In this region, ore mining town have emerged Barsua Iron Mines.

Forest: The term forest is used to refer to land with a tree canopy cover of more than 10 percent and area of more than 0.5 ha. Forests are determined by both the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m. The two categories i.e. open forest and dense forest is predominant in Barsua Iron Mines.

Wasted land or Wet land: Wasted lands are those areas where the water table is at, near, or above the land surface for a significant part of most years. The hydrologic regime is such that aquatic or hydrophyte vegetation usually is established, although alluvial and tidal flats may be no vegetated. Wastelands frequently are associated and topographic lows, even in mountainous regions.

Water body: This category comprises areas with surface water in the form of ponds, river, lakes, tanks and reservoirs. Rivers/streams are natural course of water flowing on the land surface along a definite channel/slope regularly or intermittently towards a sea in most cases or in to a lake or an inland basin in desert areas or a marsh or another river. Canals are artificial watercourse constructed for irrigation, navigation or to drain out excess water from agricultural lands.

Agricultural land: These are the lands primarily used for farming and for production of food, fiber, and other commercial and horticultural crops. Agricultural Land may be defined broadly as land used primarily for production of food and fiber. These are the areas with standing crop as on the date of Satellite overpass. Cropped areas appear in bright red to red in color with varying shape and size in a contiguous to noncontiguous pattern. They are widely distributed indifferent terrains; prominently appear in the irrigated are as irrespective of the source of irrigation. It includes Kharif, Rabi and Zaid croplands along with areas under double or triple crops.

1. Barsua- Taldih- Kalta area land use and land cover (ML-130):

The Barsua- Taldih- Kalta mining area (2472.561 ha) was classified for land use and land cover by using supervised classification technique. Seven classes are identified over the study area namely dense forest (1493.722 ha), open forest (272.976 ha), water bodies (2.704 ha), agricultural land and plantation (10.350 ha), barren land/waste land (272.976 ha), mining land (303.441 ha) and built-up (50.684 ha) shown in Figure-1.

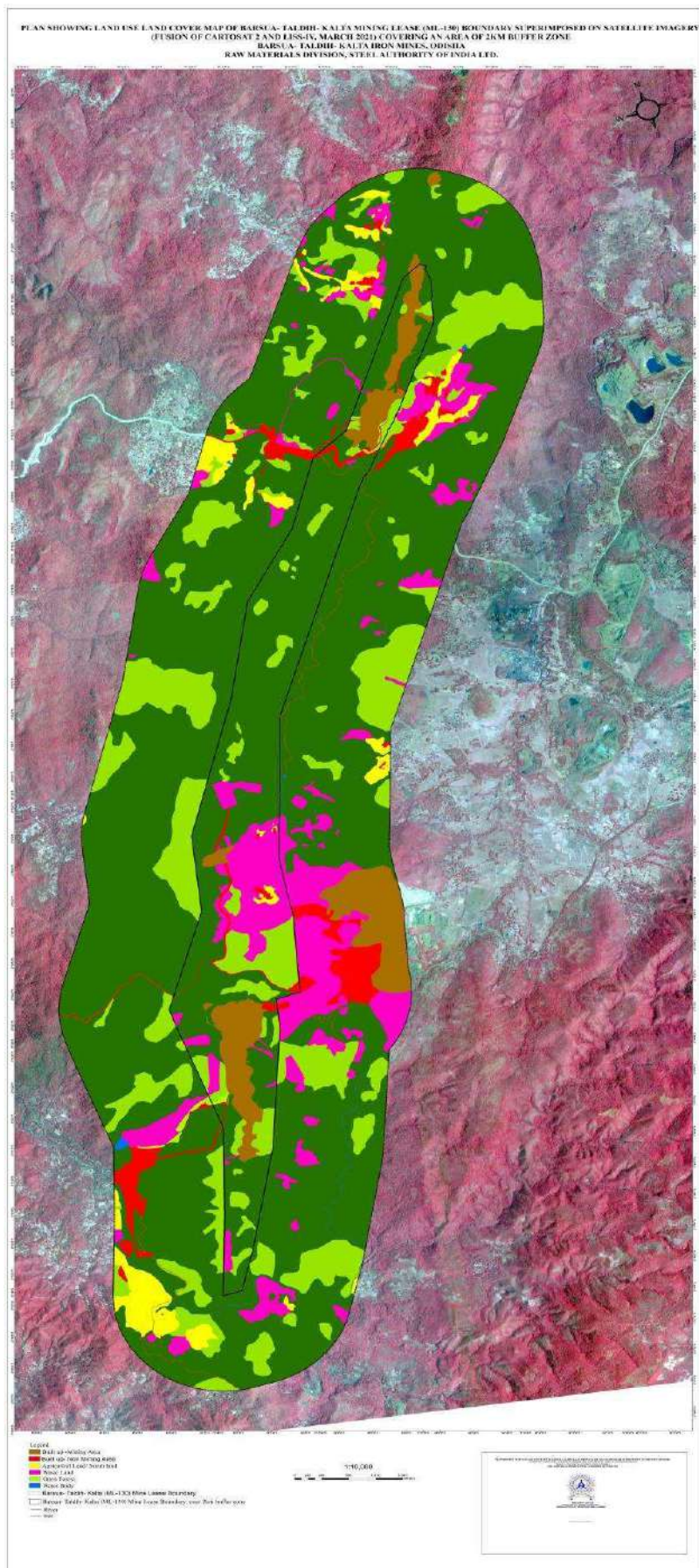


Figure: 1. Land use Land cover map of Barsua-Taldih- Kalta Mine Lease (ML-130)

Accuracy assessment was carried out using 100 points, from field data, existing maps and land cover map of (Bhuvan ISRO). Then location of the 100 points was chosen using random stratified method to represent different land cover classes of the area. The land cover mapping of the images, ancillary data and the result of visual interpretation was integrated with the classification result using GIS in order to improve the classification accuracy of the classified image.

The summary of the land use land cover classifications is shown in the Table 2. The classification distributions are shown in the Figure 2.

Table 2: Land use land cover classifications of ML-130 Lease

LU/LC classes	ML-130 Mining Lease (ha)
Built-up Land	50.684
Agriculture Land	10.350
Dense forest	1493.722
Open Forest	338.684
Water body	2.704
Waste land	272.976
Mining	303.441
Total Area (ha)	2472.561

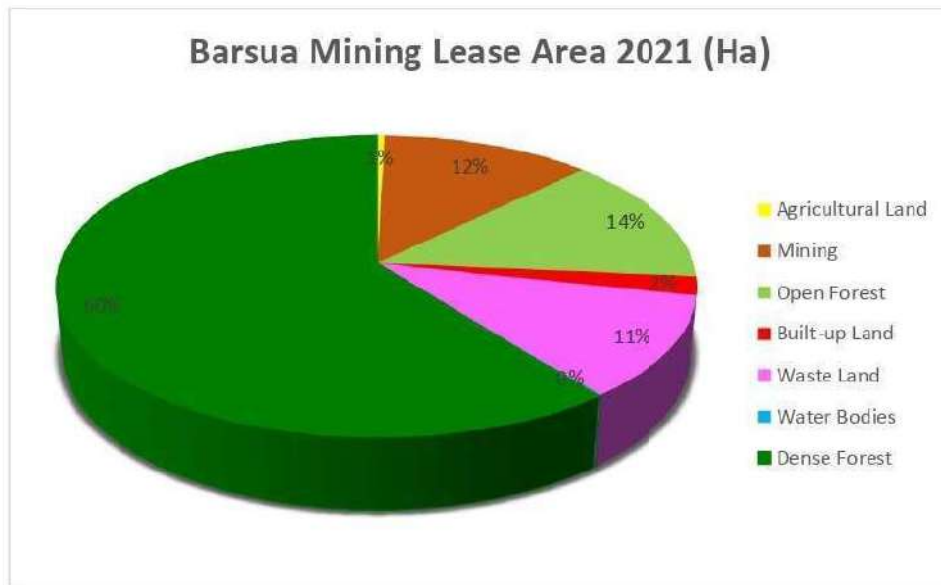


Figure 2: Land use distribution of Barsua-Taldih-Kalta (ML-130) Iron Mines