ENVIRONMENTAL MONITORING REPORT

BASED ON DATA GENERATED

FROM

OCTOBER 2020 – MARCH 2021

FOR

PENGUIN TRADING & AGENCIES LIMITED

MAA PARVATI ENCLAVE, 'D' BLOCK, 2ND FLOOR, At/Po: BARBIL - 758035,
District: KEONJHAR, ODISHA
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RAIKELA – TANTRA IRON ORE MINES

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1.0 INDRODUCTION

Raikela – Tantra Iron Mines of M/s Penguin Trading & Agencies Ltd. is an Iron ore mine operating since 1987 in the district of Sundargarh of Odisha State. The mining lease covering an area of 49.372 ha is located in the villages Raikela and Tantra (**Figure No: 1.1**), under Bonai sub-division of Sundargarh district. The area is approximately 100 kms from the Steel city of Rourkela by road and 10 kms from the mining town Koida. A vicinity map up to 10 kms radius from the center of the lease is given in **Figure No: 1.2**. Presently (during the period, i.e from October 2020 to March 2021) the mine has produced 4, 53, 800.00 MT of Iron ore by mechanized method of mining. As per EIA notification 2006 the mine has already received Environmental Clearance from State Environment Impact Assessment Authority (SEIAA), Odisha on 27th December, 2012 vide letter no: 354/SEIAA for production of Iron Ore up to 1.080 million ton per annum.

2.0 PRESENT STATUS OF THE PROJECT

At present from October 2020 to March 2021 the mine has produced Iron Ore of 4, 53, 800.00 MT, apart from this 5, 15, 336.965 MT of Iron ore has been dispatched to the outside parties like Steel and Sponge Iron Plants by road. During the financial year 2020-21 the mines has produced Iron Ore to the tune of 10, 78, 900 MT. The surface plan of the mines is given in **Figure No: 2.1**

The operation of the mines is being carried out in all total three no. of quarries in two sections, the Raikela section and Tantra section, Raikela section is having two quarries i.e. Raikela & Raikela West in operation. The detail bench parameters of all the quarries are as follows:

Table No. 2.1: Dimensions of Working Quarries

Quarry Name	Quarry Size (in m)			Top RL	Bottom RL	No. of Benches	Bench Size (in m)	
	L	W	D				W	H
Raikela	540	360	96	834	738	16	12	06
Tantra	360	260	30	822	792	05	12	06

The present working depth of Top pit in Raikela section is between 834m to 738m AMSL. In Tantra section the present working depth of the pit is between 822m to 792m AMSL. The working has gone down from 834m AMSL to 738m AMSL in Raikela section and from 822m AMSL to 792m AMSL in Tantra section, but it has not encountered the ground water table so far.

The project proponent has complied with the specific conditions mentioned in the environmental clearance and the status of compliance is also provided.

Figure No: 1.1 Location Map of the Project

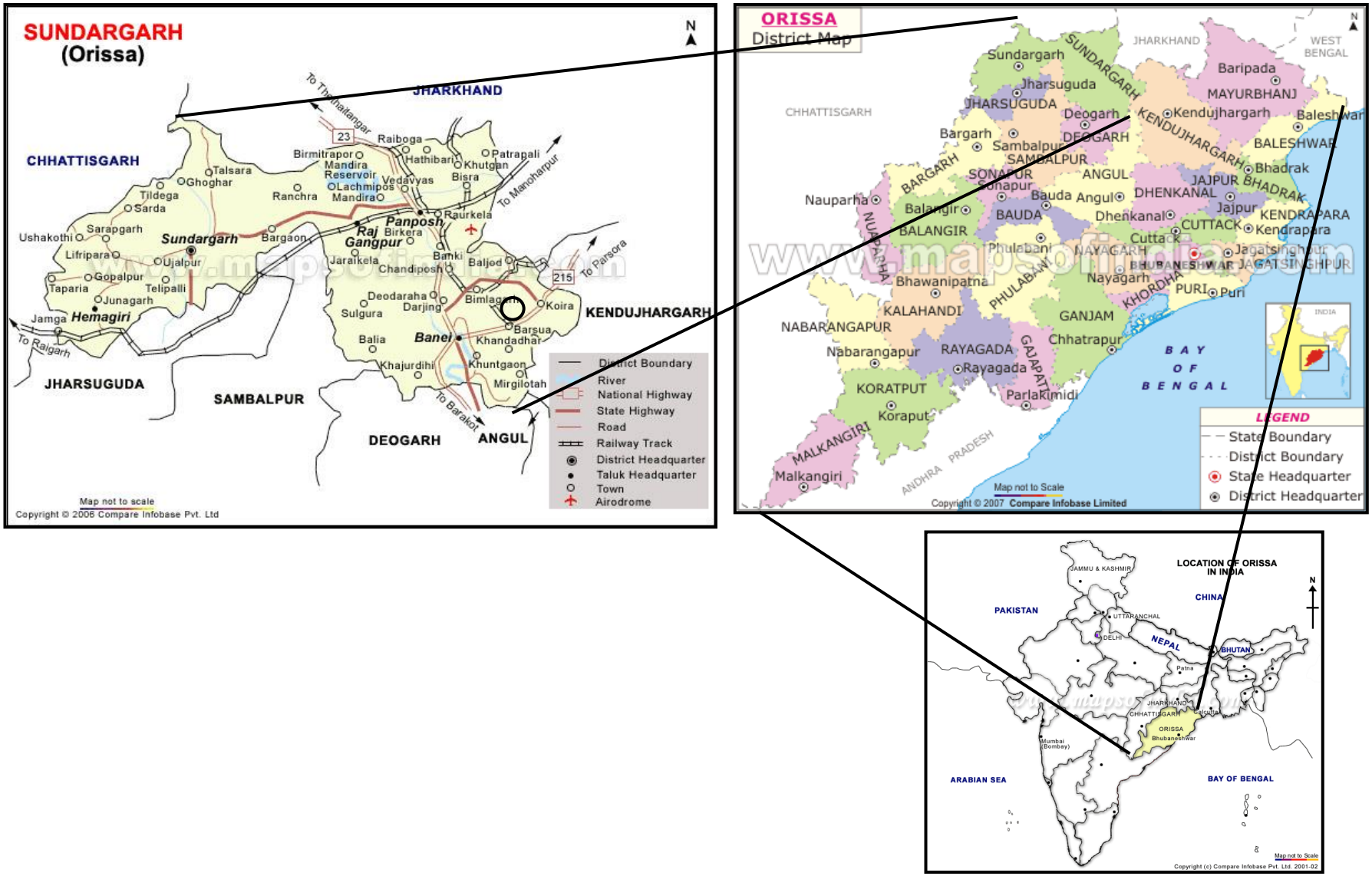


Figure No: 1.2 VICINITY MAP

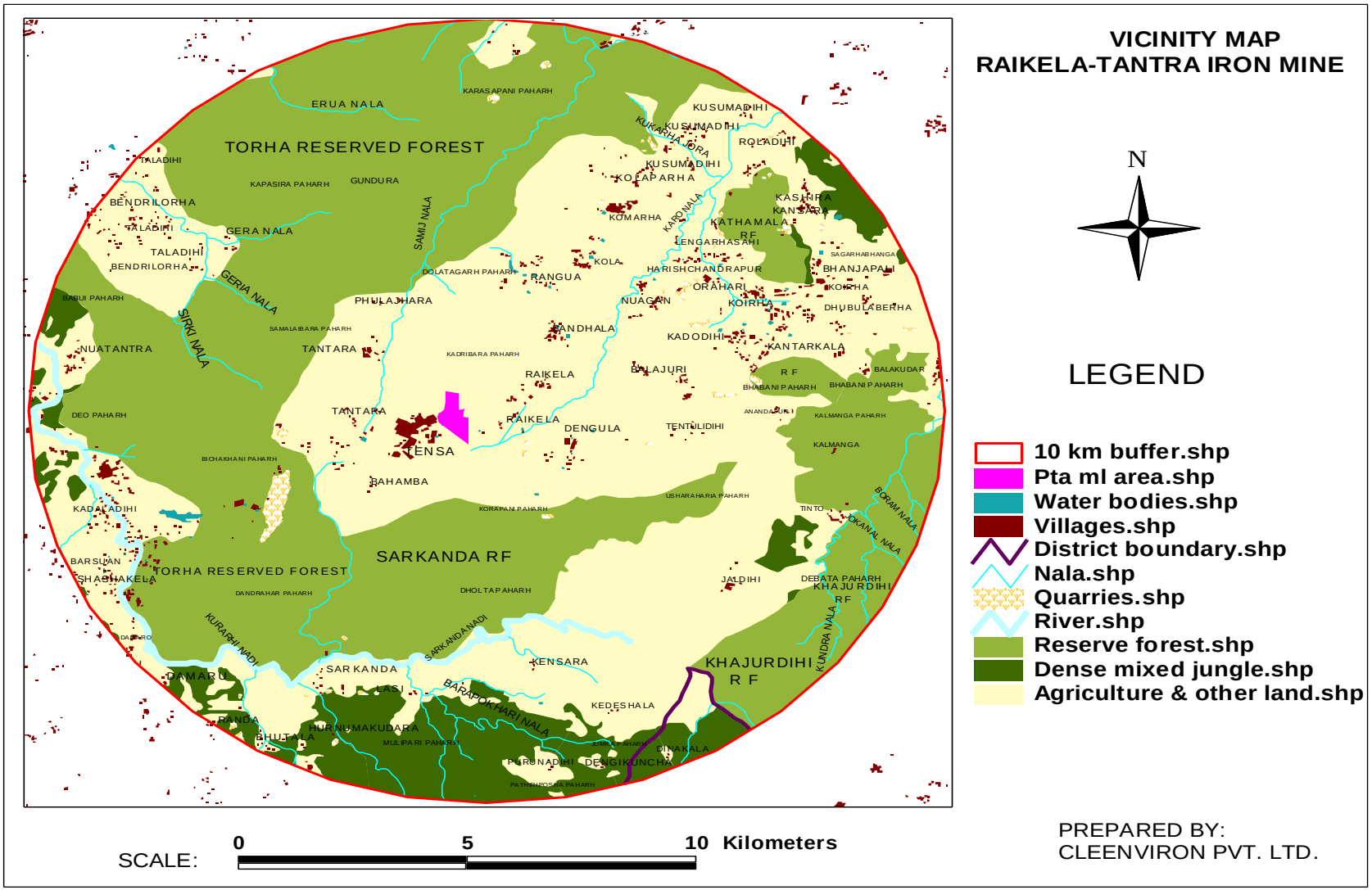
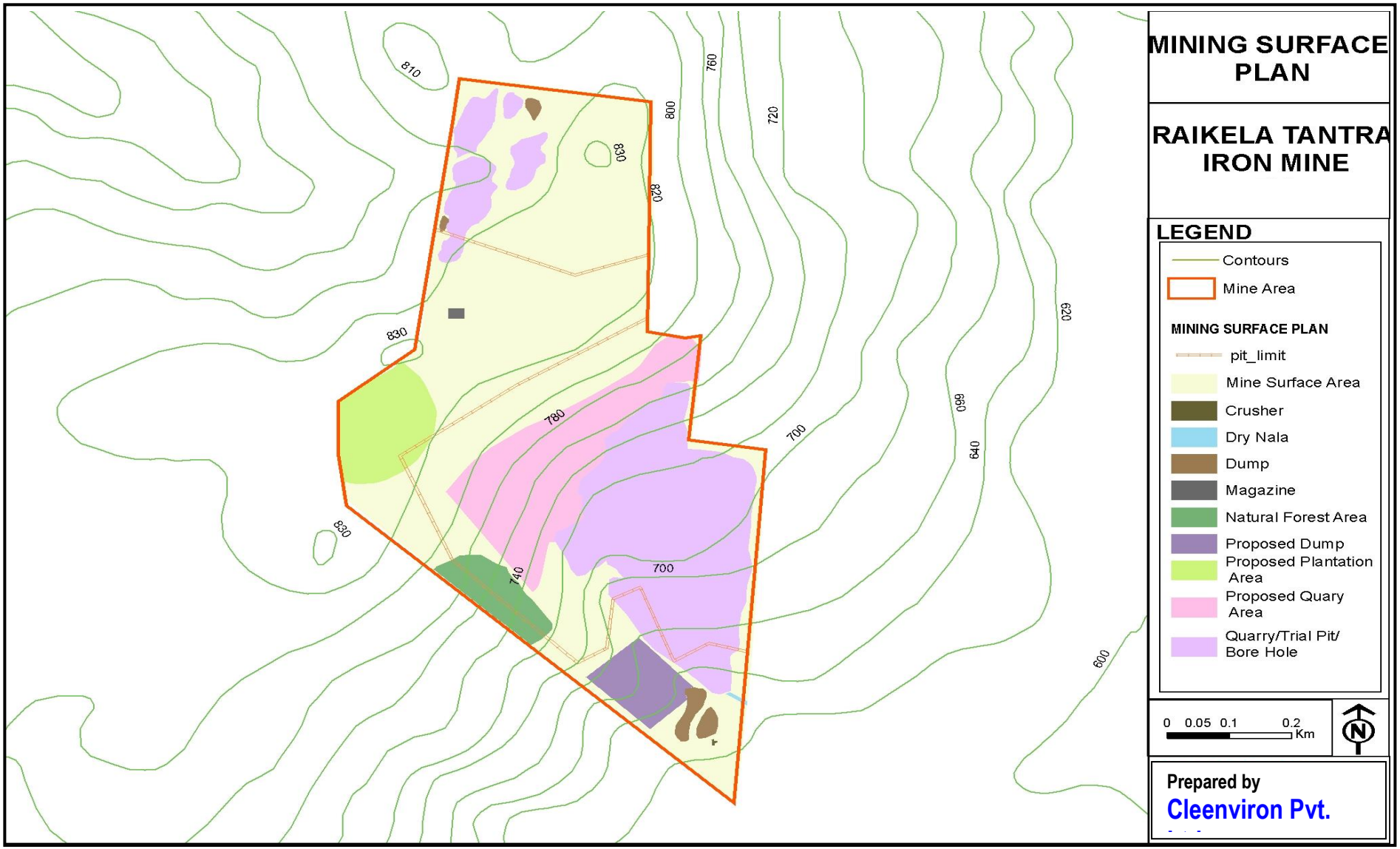


Figure No: 2.1 SURFACE PLAN OF RAIKELA – TANTRA IRON MINE



General Conditions:

1. Three continuous ambient air quality monitoring stations are fixed within the core zone and four in the buffer zone are fixed in consultation with SPCB and considering the meteorological data. Monitoring is being carried out with a frequency of once in every month at each locations of buffer zone for the parameters like PM2.5, PM10, SO_2, NO_2 & CO and three continuous ambient air quality monitoring stations are being operated continuously and 24 hours monitoring data are recorded.
2. Fugitive dust emission monitoring is also carried out at 5 locations within the mining lease area on twice weekly basis for the parameter Particulate Matter and data thus collected is reported.
3. The Noise level is monitored on once in a week basis in the work places and once in a month in buffer zone of the mining lease area.
4. Ground water level and quality is monitored on quarterly basis and surface water quality is monitored every month and data thus collected is reported.
5. To know the status of soil quality in and around the mining lease area, Soil samples are collected from two locations on six monthly basis and data thus collected are reported.
6. The regular monitoring is being carried out by NABL accredited Laboratory and empanelled laboratory of State Pollution Control Board, Odisha.
7. During the period of six months from October 2020 – March 2021 the project proponent has done plantation of 12500 saplings including species like, Karanja, Neem, Teak, Neem, Amla, Ukalipotas, Gambhari, Imlee, Chakunda, Sirish, Simaruba, Sisoo, Jack-fruit, Gulmohar, Bamboo, Khaeera, Accacia SPP, Accacia Magnum, Baula, Buken, Sitafala in and around backfilled area, stabilized OB dump, safety zone as replacement & along Karo Nala, Puja Place of Villages, Koira College and surrounding villages out of which 9855 saplings have survived till date. The survival rate is found to be around 79.5%.

3.0 ASPECTS CONSIDERED FOR ENVIRONMENTAL MONITORING

This report is based on the monitoring results generated from October 2020 to March 2021 covering post-monsoon, winter and early summer seasons of the year. Ambient Air Quality within the buffer zone, Surface Water Quality & Noise Level monitoring also in buffer zone was carried out on monthly basis at each location. Ambient Air Quality in core zone was monitored 24 hours continuous basis and Fugitive dust emission monitoring was carried out on twice weekly basis at each locations. The Noise monitoring within core zone was also monitored weekly basis. However other aspects like, Ground Water quality, Ground Water level, Stream Flow measurement and Stack emission from DG sets are carried out on quarterly basis, i.e. during November and February months of the year. Soil quality monitoring is carried out on six monthly basis. Environmental Monitoring data were generated at Raikela & Tantra Iron Mines and its buffer zone covering the following aspects in detail.

i. Micro-meteorological study
ii. Ambient Air Quality Study
iii. Fugitive Dust Emission Monitoring
iv. Surface Water Quality Study
v. Ground Water Quality Study
vi. Ground Water Level Study
vii. Soil Quality Study
viii. Noise Level Study

Monitoring of environmental parameters for collection of data involves field work, which is described below:

3.1 Micro-meteorological Monitoring

To record the hourly meteorological data one automatic weather monitoring station has been installed within the ML area near Mines Site Office and parameters like, wind speed, wind direction, temperature, relative humidity and rainfall is being recorded.

3.2 Ambient Air Monitoring

As per the letter no 14257/Ind. I-Con-(Misc) 1533, Dated: 01.12.2018 from SPCB, Bhubaneswar and recommendation of CSIR – NEERI, the ambient air quality monitoring stations are fixed which are as follows. Total 3 (Three) monitoring stations are fixed within the core zone including 1 (One) at the entry and exit point of the ML area and 4 (Four) in the buffer zone. The monitoring locations are fixed according to the micro-meteorological data and in consultation with State Pollution Control Board. The monitoring was carried out for parameters like PM2.5, PM10, SO_2, NO_2 & CO and monitoring was carried out once in every month at each location within the buffer zone. Within core zone continuous monitoring for 24 hours is carried out in all the three locations. For collection of samples Respirable Dust sampler and Fine Particulate Sampler was placed at each locations, sampling and analytical techniques are followed as per the standard method of ambient air sampling and analysis.

3.3 Fugitive Dust Emission Monitoring

To assess fugitive dust emission level, total 5 (Five) monitoring stations are fixed in the core zone. The monitoring locations are fixed nearer to the most dust generation sites like working pits (Raikela & Tantra) of the Mine and downwind of the OB dump, Weigh Bridge and Screen Plant, within the quarry. The monitoring was carried out for parameter Particulate Matter and monitoring was carried out twice in every week at each locations. For collection of samples High Volume Sampler, Make: Envirotech Instruments Pvt. Ltd., New Delhi, Model: APM 415 was placed at each location, sampling and analytical techniques are followed as per the standard method of sampling and analysis.

3.4 Surface Water Quality Study

Total eight locations were fixed for sampling of the surface water quality from Karo River, Samij Nallah, Teherai Nallah & Kuradihi Nallah which are flowing near the ML area within the buffer zone of 10kms. The sampling and analysis of all the water bodies mentioned were carried out on monthly basis from up stream of ML area as well as downstream of ML area. The parameters analyzed are as per the surface water quality standards, IS: 2296 (Class C). Few parameters like pH, Temperature and DO are recorded at the site. For other parameters the samples were fixed and preserved as per the standard methods of sampling by APHA 23rd edition.

3.5 Ground Water Quality Study

To find out the ground water quality of the area, a net work of 5(five) existing dug wells are fixed and the sampling was carried out on quarterly basis during month of May and August, as per the environmental clearance conditions of MoEF. The parameters analyzed were as per the drinking water standards of IS 10500. Few parameters like pH and Temperature are recorded at the site. For other parameters the samples were fixed and preserved as per the standard methods of sampling by APHA 23rd edition.

3.6 Ground Water Level Study

To assess the ground water availability and fluctuation, a net work of 5 (Five) existing dug wells are fixed (from where the ground water quality study were carried out) for ground water level measurement. To measure the ground water level piezometers are fixed at each dug wells and the variation of ground water level are being studied on quarterly basis during the months of May for summer season and August for monsoon season.

3.7 Noise Level Study

Noise monitoring were carried out at 5 (Five) different locations within the Core zone once in every week and 4 (Four) locations within the buffer zone once in every month. The measurements were done by Sound Level Meter, make: Envirotech Instruments Pvt. Ltd., New Delhi, in dB(A) at a height of 1.5 meter, above ground level and away from the sound reflecting sources like walls and buildings etc.

3.8 Soil Quality Monitoring

Soil monitoring were carried out at 2 (two) different locations, one within the Core zone and one location within the buffer zone, once in six months period during the month of May.

4.0 SAMPLING LOCATIONS

4.1 Ambient Air Quality Monitoring

Three ambient air quality monitoring station were fixed within the core zone and four stations were fixed in the buffer zone. The locations of monitoring stations are shown in the **Figure No: 4.1 & 4.2.** General precautions were taken to position the Respirable Dust Samplers at all the locations. The descriptions of the Ambient Air Monitoring Stations are as follows:

A-1 Near Mines Site Office:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation from both the working quarries.

A-2 Near Stabilized OB Dump Eastern Side of Mining Lease Boundary:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation, Haulage road from tantra section of the mines and also the emissions from the new crusher plant.

A-3 Near Main Entry Gate of the Mine:

The sampling station is located within the core zone to assess the present level of pollution due to the overall mining operation and emission of dust due to ore and overburden hauling by trucks.

A-4 Mines Office Area:

The sampling station is located nearest to the core zone (500m from the South-East ML boundary) to assess the direct effect of mining operations on the background air quality and receptors.

A-5 Village Dengula:

The location was selected outside the core zone and to assess the effect of mining and hauling of Iron Ore from the mine to outside Crusher Plants and Sponge Iron Plants on the background air quality and receptors.

A-6 Tensa Town:

This location is situated in the buffer zone of the mine and selection of this location was done as to assess the effect of the mining operation on the local receptors, as this town is falling in the predominant wind direction towards west - south-west of the lease area.

A-7 Village Bahamba:

This location is situated in the buffer zone of the mine and selection of this location was done as to assess the effect of the mining operation on the local receptors, as this village is falling in the predominant wind direction towards south-west of the lease area.

The distances and directions of the Ambient Air Quality monitoring locations are summarized below:

Table No 4.1: Ambient Air Quality Monitoring Stations

Sl No	Name of Location	Zone	Distance	Direction
1	Near Mines Site Office	Core	-	-
2	Near Lease Boundary of Tantra Section	Core	-	-
3	Near Main Entry & Exit Gate of the Mine	Core	-	-
4	Mines Office Area	Buffer	500 m from ML Area	SE
5	Village Dengula	Buffer	2.5 km from ML Area	SE
6	Tensa Town	Buffer	1.3 km from ML Area	W
7	Village Bahamba	Buffer	2.6 km from ML Area	SW

4.2 Fugitive Dust Monitoring:

Five fugitive dust emission monitoring locations are established inside the core zone, to find out the amount of dust being generated from the source during the excavation, drilling & hauling of Iron Ore and overburden. The locations of the stations are shown in the **Figure No: 4.2.** The descriptions of fugitive emission monitoring locations are as follows:

F-1 Downwind of Excavator/ Drill Machine within the Quarry (Raikela Section)

This location was fixed within quarry of Raikela section and while operation of mining equipments are on. Towards the down wind direction of the whole quarry area within a distance of 25m, one high volume sampler was set for 4 hours operation and the parameter monitored is SPM general precautions are obeyed while collection of samples.

F-2 Downwind of Excavator/ Drill Machine within the Quarry (Tantra Section)

This location was fixed within quarry of Tantra section and while operation of mining equipments are on. Towards the down wind direction of the whole quarry area within a distance of 25m, one high volume sampler was set for 4 hours operation and the parameter monitored is SPM general precautions are obeyed while collection of samples.

F-3 Downwind of OB Dump Area

This location was fixed to evaluate the amount of pollution load on the ambient air due to moving of heavy earth moving equipments like Dozer, Dumpers etc. The sampler was being operated for continuous of 4 hours at the downwind of OB dump at a distance of 25m from the dump and parameter like SPM is measured.

F-4 Downwind of Weigh Bridge

This location was fixed to evaluate the amount of pollution load on the ambient air due to moving of loaded Dumpers for weighing. The sampler was being operated for continuous of 4 hours at the downwind direction at a distance of 25m from the weigh bridge and parameter like SPM is measured.

F-5 Downwind of Screen Plant

This location was fixed to evaluate the amount of pollution load on the ambient air due to screening operation of Iron Ore and excavated ROM. The sampler was being operated for continuous of 4 hours at the downwind direction at a distance of 25m from the Screen Plant and parameter like SPM is measured.

Figure No: 4.1 AMBIENTAIR MONITORING LOCATIONS IN BUFFER ZONE

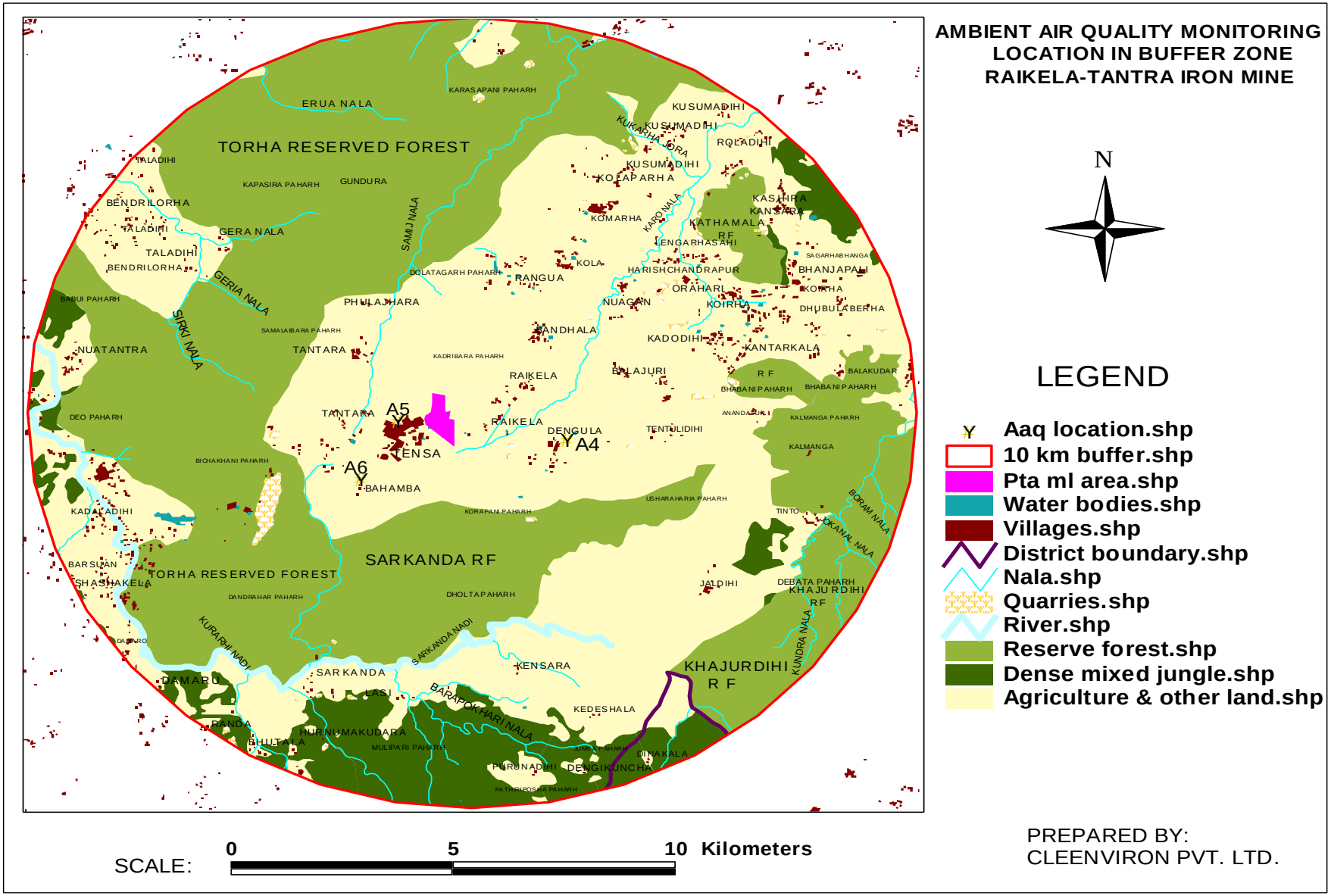
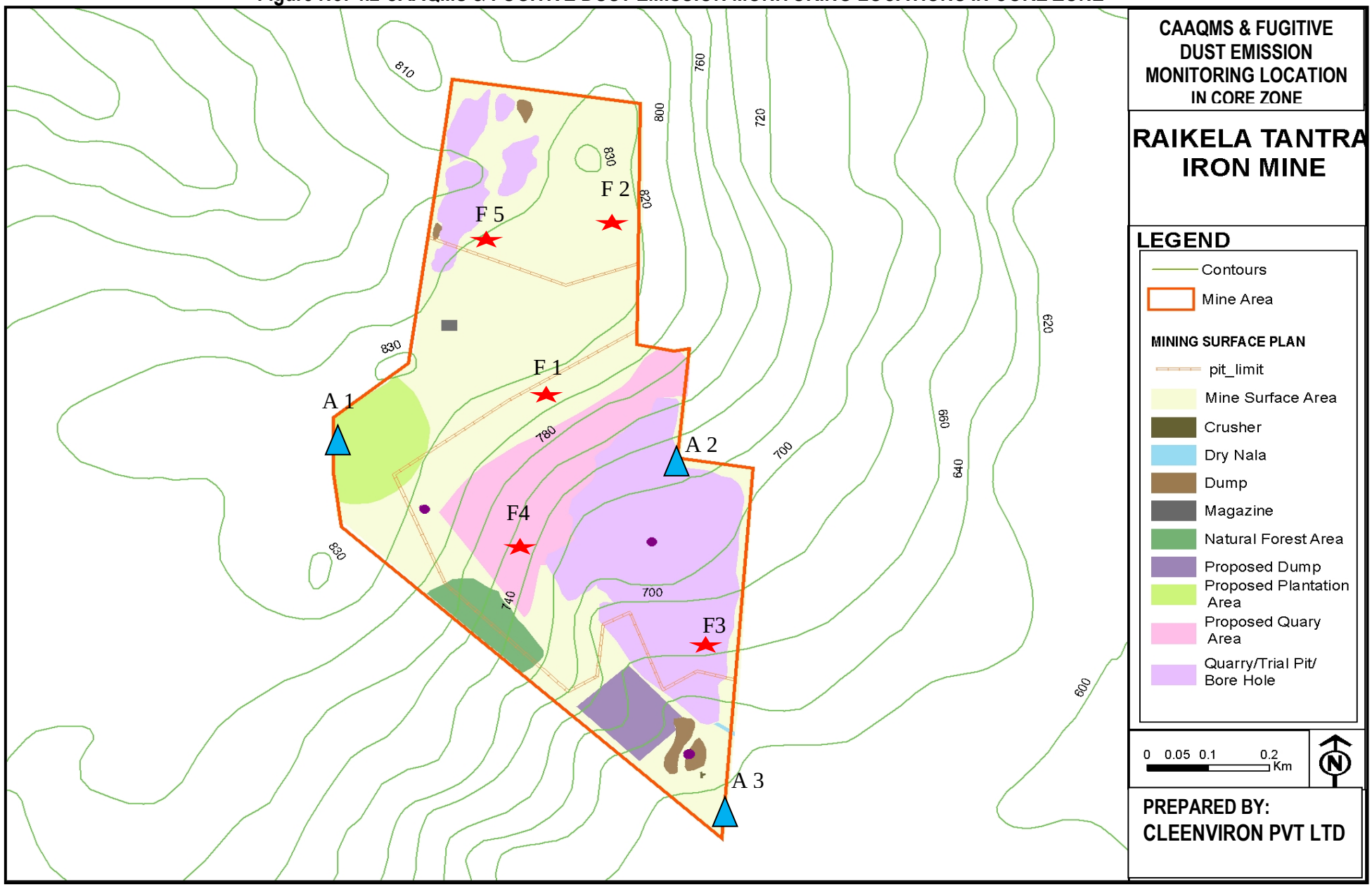


Figure No: 4.2 CAAQMS & FUGITIVE DUST EMISSION MONITORING LOCATIONS IN CORE ZONE



4.3 Surface Water Quality:

In order to assess the quality of water from the surface water bodies mentioned due to the mining activity. Two sampling locations were set one at 100 m up-stream of ML area and second at 100 m downstream of ML area on each of the water bodies, the locations of sampling are shown in the **Figure No: 4.3.** The samples were being collected on monthly basis. The descriptions of the locations are given below:

SW-1 Karo River Water before ML Area

The sample was collected from Karo river around 100 m up stream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-2 Karo River Water after ML Area

The sample was collected from Karo river around 100 m downstream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the river.

SW-3 Samij Nallah Water before ML Area

The sample was collected from Samij nallah around 100 m up stream of the ML area and analyzed for 31 parameters as per the Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-4 Samij Nallah Water after ML Area

The sample was collected from Samij nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

SW-5 Kuradihi Nallah Water before ML Area

The sample was collected from Kuradihi nallah around 100 m up stream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-6 Kuradihi Nallah Water after ML Area

The sample was collected from Kuradihi nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

SW-7 Teherai Nallah Water before ML Area

The sample was collected from Teherai nallah around 100 m up stream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the back ground concentration of the parameters.

SW-8 Teherai Nallah Water after ML Area

The sample was collected from Teherai nallah around 100 m downstream of the ML area and analyzed for 31 parameters Surface Water Quality Standards IS 2296 (Class – C) to find out the effect of mining activity on concentration of the parameters in the downstream of the nallah.

4.4 Ground Water Level:

Ground Water level were monitored by fixing a network of existing dug wells of 3(Three) nos in the nearby villages as well as in the core zone. A map showing the sampling locations is depicted in **Figure No: 4.4**. Ground water levels were measured during month of May and August to know the

amount of seasonal fluctuation and availability of ground water during summer season of the area. The details of the sampling locations are described below:

GW-1 Village Dengula Dug Well
The water level was measured from the dug well of Dengula village near Panchayat road to know the availability as the villagers are using the dug well water for their drinking purpose.

GW-2 Village Bandhal Dug Well
The water level was measured from the dug well of Bandhal village to know the availability as the villagers are using the dug well water for their drinking purpose.

GW-3 PTA Mines Office Dug Well
The water level was measured from the dug well of the mines office of M/s Penguin Trading and Agencies Ltd to know the availability during the lean seasons as the water is used for supply to hutting and mines office.

4.5 Ground Water Quality:
Ground Water quality was monitored from a net work of existing dug wells/ bore wells/ tube wells in core as well as in buffer zone. Samples were collected during the month of May and August for evaluating the quality of the water and analyzed as per IS 10500.

GW-1 Mines Office Dug Well
The water sample was collected from the dug well of the mines office of M/s Penguin Trading and Agencies Ltd and was tested for drinking water quality as the water is used by the officials for their drinking purpose and also supply of drinking water for the workers working in the mines. The water is also supplied in the labour hutting near by the mines office.

GW-2 Village Dengula Dug Well
The water sample was collected from the dug well of Dengula village near Panchayat road and was tested for drinking water quality as the villagers are using the dug well water for their drinking purpose.

GW-3 Village Raikela Bore Well
The water sample was collected from the bore well of Raikela village and was tested for drinking water quality as the villagers are using the bore well water for their drinking and domestic purpose.

GW-4 Village Bandhal Dug Well
The water sample was collected from the dug well of Bandhal village and was tested for drinking water quality as the villagers are using the dug well water for their drinking purpose.

GW-5 Bore Well Near Bottom Weigh Bridge
The water sample was collected from the bore well near the bottom weigh bridge and was analysed for drinking water quality as the water is supplied for drinking purpose in the mine for the mine workers.

Figure No: 4.3 SURFACE WATER QUALITY & STREAM FLOW MEASUREMENT LOCATION MAP

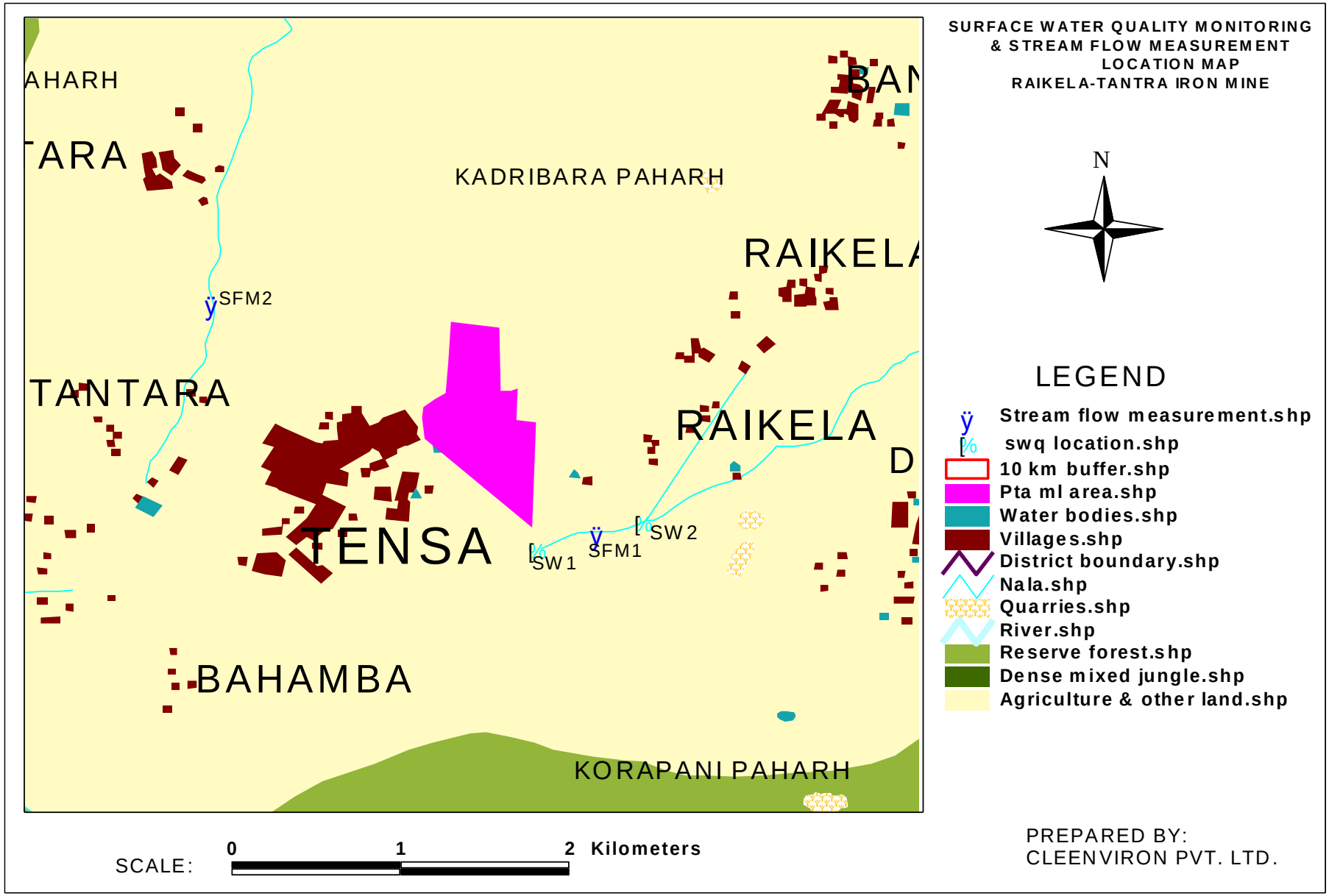
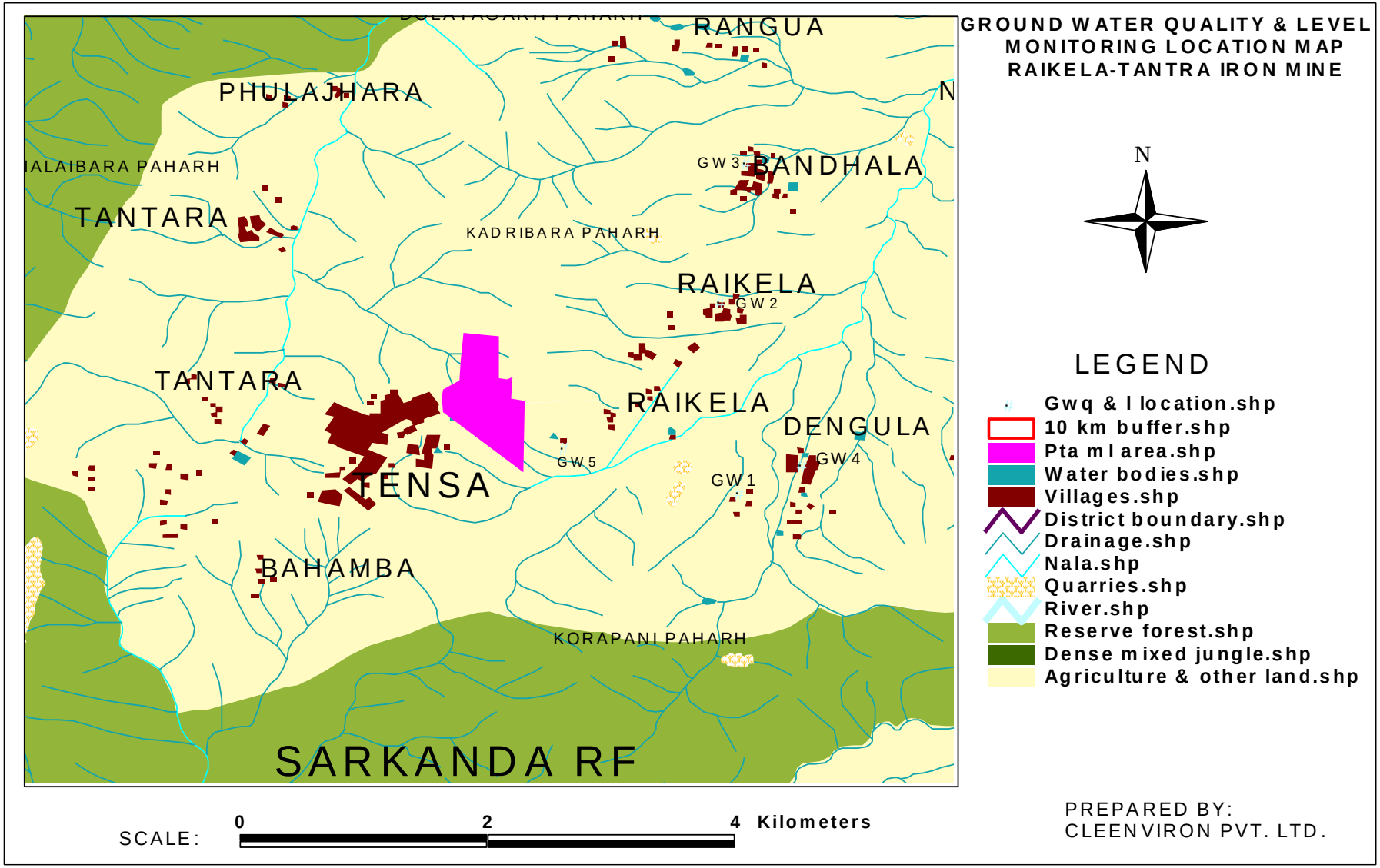


Figure No: 4.4 GROUND WATER LEVEL AND QUALITY MONITORING LOCATION MAP



4.6 Noise Level Monitoring

Noise levels were measured at total 9(Nine) different locations within the core as well as buffer zone. To assess the impact of the mining operation on the ambient noise level two locations were fixed within the core zone i.e. within the quarry during operation of machineries and second at the mines office area. Four locations were selected at source and the monitoring was carried out to assess the SPL in dB(A) from the HEMM during operation. Three more locations are fixed at three villages within the buffer zone to know the noise level at the receptor locations due to the mining activity. The sampling locations are shown in the **Figure No: 4.5.** A brief description of the monitoring location is given below:

N-1 Drill Machine Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Drill Machine on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out near the Drill Machine at a distance of 2 m.

N-2 Excavator Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the excavator on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-3 Loader Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Loader on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-4 Dumper Operator's Cabin

This monitoring was carried out to assess the noise level due to the operation of the Dumper on the Operator. This monitoring was done as per the DGMS guidelines for occupational safety of the workers. The monitoring was carried out within the Operator's Cabin.

N-5 Quarry Area during Mining Operation

This station was selected to assess the ambient noise level due to the operation of HEMM within the quarry area during ongoing mining works. The monitoring was carried out inside the quarry and at distance of 100 m from the operating machines.

N-6 Mines Office area

This station was selected to assess the ambient noise level due to the mining activity at mines office area. The monitoring was carried out within the mines office premises.

N-7 Village Dengula

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Dengula.

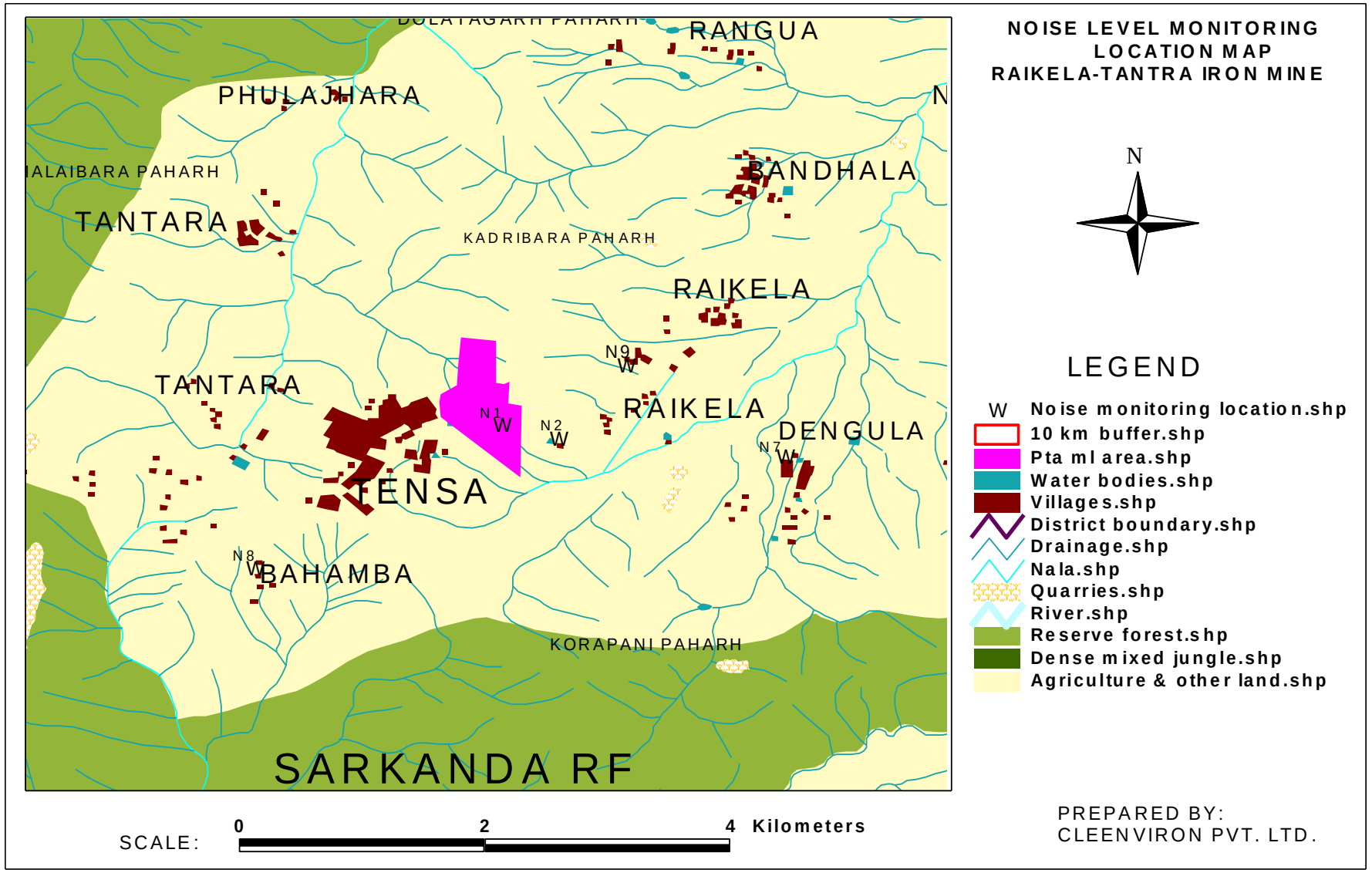
N-8 Village Raikela

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Raikela.

N-9 Village Bandhal

This station was selected to assess the ambient noise level in the buffer zone at the receptor locations and the impact of the mining activity on the village. The monitoring was carried out within the village Bandhal.

Figure No: 4.5 NOISE LEVEL & SOIL QUALITY MONITORING LOCATION MAP



4.7 Soil Quality Monitoring

Soil monitoring is carried out at two different locations, one near the OB dump and other from the agriculture land near the Mines office in the buffer zone. The sampling locations are shown in the **Figure No: 4.5.** A brief description of the monitoring location is given below:

S-1 Land Near the OB Dump

This location is selected to assess the soil quality due to dumping of Over burden and wastes generated from the mining operation.

S-2 Agriculture Land near the Mines Office

This location is selected to assess the soil quality in the buffer zone and its effects due to the runoff from the mining lease area to the nearby agriculture land during monsoon.

5.0 METHODOLOGY OF SAMPLING & ANALYTICAL PROCEDURES

5.1 Micro-meteorological Monitoring

An Automatic Weather Monitoring station is installed in front of the Mine Site office to collect site specific micro-meteorological data, the station is installed at the highest elevation point of the mines with a tripod stand and is fixed permanently. The station is having provision for monitoring of Wind Speed, Wind Direction, Temperature, Relative Humidity and Rainfall. The instrument is having data logging facility at an interval of 1 hour and can store up to 8000 data without interruption as it is operated by Solar Panel and one 12 volt battery for night time operation.

5.2 Ambient Air Monitoring

Air quality samples were monitored for significant parameters like, PM2.5, PM10, SO_2, NO_2 & CO. For sampling and analysis methods prescribed by CPCB were followed and Respirable Dust Samplers (RDS) and Fine Particulate Samplers, Make: Universal Scientific Calibration Services were used at the site. For CO measurements a direct reading instrument having electrochemical sensor based calibrated digital monitor was used at the site and being operated continuously.

24 hours continuous samplings were carried out continuously at all the three locations within core zone. Within buffer zone the monitoring is done once in a month.

All the analytical techniques followed are as per CPCB approved and as per Indian Standard methods.

Sulphur Dioxide sampling and analysis was carried out by following Improved West & Gaeke Method. The detection limit was 3µg/m^3.

Nitrogen Oxides sampling and analysis was carried out by following modified Jacob & Hochheiser method (Sodium Arsenite Method). The detection limit was 6µg/m^3.

5.3 Fugitive Dust Emission Monitoring

Fugitive Dust emission samples were collected for parameter like, SPM. For sampling and analysis, methods prescribed by CPCB were followed and A High Volume Sampler APM 415, Make: Envirotech Instruments Pvt. Ltd. were used at the site.

5.4 Water Quality Sampling

As per the standard practice, one sample from each station was collected once, during the month of November & February. Grab water samples were collected in plastic container by standard

sampling technique. Necessary precautions were taken for sample preservation. The parameters like pH, Temp and Conductivity were measured at the site by using portable instruments. All other parameters were analysed as per the standard methods for Water and Waste Water analysis by APHA 23rd edition.

5.5 Noise Level Monitoring

Ambient Noise level monitoring was carried out with an integrating Sound Level Meter, Model: SLM 100, Make: Envirotech Instruments Pvt. Ltd. in dB(A) and Model: SL 4001, Make: Lutron. The measurements were collected at a height of 1.5m from the ground level and away from any sound reflecting sources like walls and buildings etc.

The Ambient Noise monitoring was carried out on continuous basis by the data logging system of the instrument and data are logged on at every minute for 24 hours. The Sound Pressure Level was measured and Lmin, Lmax & Leq were calculated and interpreted for data analysis.

5.6 Soil Quality Monitoring

Soil monitoring was carried out by collecting soil samples from the two different sites as per the Methods Manual for Soil Testing by Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India.

6.0 DATA ANALYSIS

6.1 Micro-meteorological Data

6.1.1 Wind Speed & Wind Direction

During the entire period from 1st October to 31st March all total 4368 no. of data are recorded by the instrument and after interpretation of the collected data it was found that Calm condition prevailed over 13.19%, while considering the 24 hourly data. 9.65% calm condition prevailed from morning 6 hrs to 14hrs for the entire study period, 7.94% calm condition prevailed from 14hrs to 22hrs and 22.22% calm condition prevailed from 22hrs to 06hrs. The predominant wind directions were from NE with average wind speed 2.40 m/sec. The wind rose diagrams for the entire study period are depicted on the **Figure No: 6.1, 6.2, 6.3 & 6.4.**

6.1.2 Temperature

The maximum & minimum temperature during the entire study period was divided in to three parts as the study period was covering post-monsoon, winter season as well as early summer. The Minimum temperature during the post-monsoon season was found to be 8.36°C and the Maximum temperature was found to be 29.92°C up to the end of 30th November. The minimum and maximum relative humidity during the post-monsoon season is found to be 28.79% and 96.78%.

The minimum and maximum temperature during the winter season i.e. from December to February was found to be 4.79°C and 32.64°C. The minimum and maximum relative humidity during the winter season is found to be 17.4% and 96.35% and during the early summer the relative humidity was ranging between 12.56% to 91.12% and minimum temperature was 16.18°C and maximum temperature was 36.47°C. **Table No 6.1** shows a summary of micro-meteorological data collected for the entire period.

6.1.3 Rainfall

The total rain fall from 1st October to 31st March was observed to be 84.87 mm. during the study period. A month wise rainfall data recorded at the site is depicted in **Table No 6.1.**

Table No: 6.1
A Summary of the Micro-meteorological Data

Sl No	Parameters	From October 2020 – March 2021
1	Predominant Wind Direction	NE
2	Calm Condition %	13.19
3	Average Wind Speed m/sec	2.40
4	Temperature ^{o}C **Post-monsoon Season** Minimum Maximum **Winter Season** Minimum Maximum **Early Summer Season** Minimum Maximum	 8.36 29.92 4.79 32.64 16.18 36.47
5	**Relative Humidity (%)** Minimum Maximum	 12.56 96.78
6	**Rain Fall in mm** October November December January February March **Total**	 52.07 0.6 0.0 1.8 11.0 19.4 **84.87**

Figure No: 6.1 **Wind Rose Diagram & Wind Class Distribution for 24 Hours**

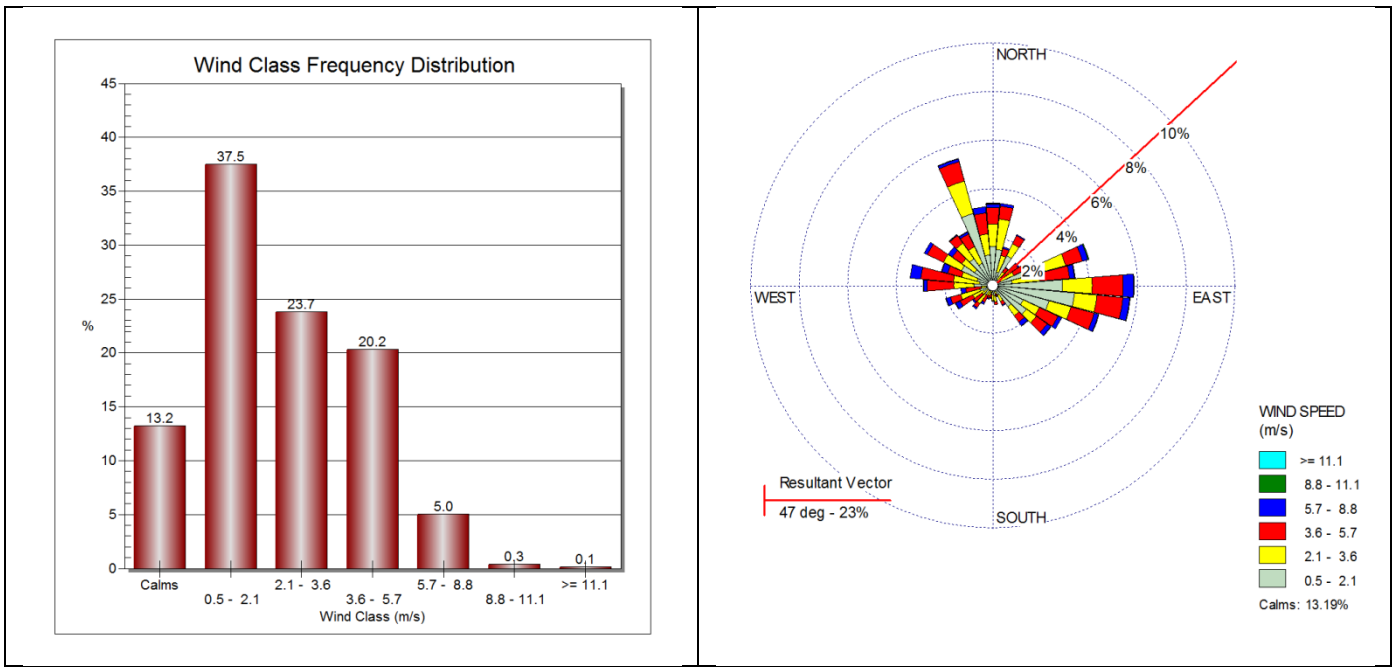
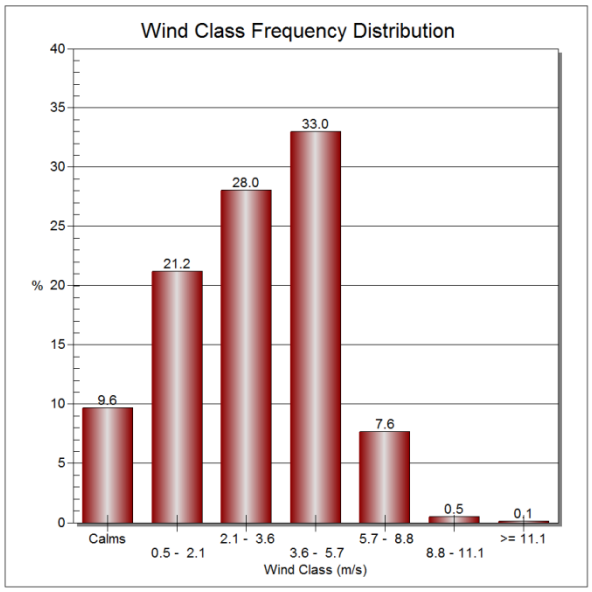


Figure No: 6.2 Wind Rose Diagram & Wind Class Distribution from 6 – 14 Hours



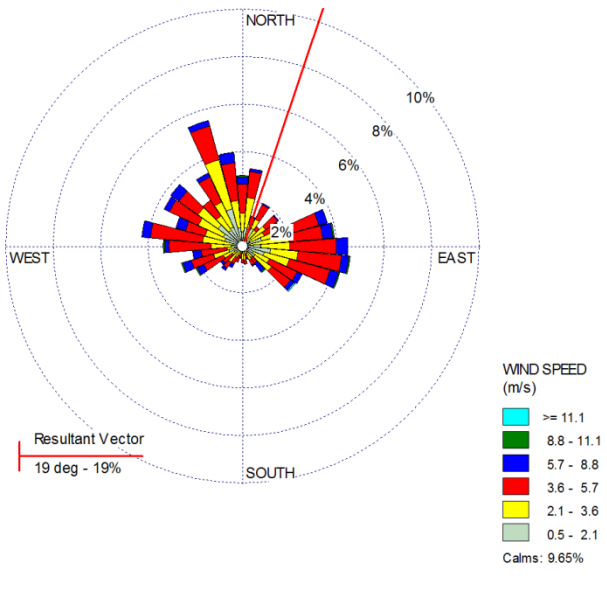
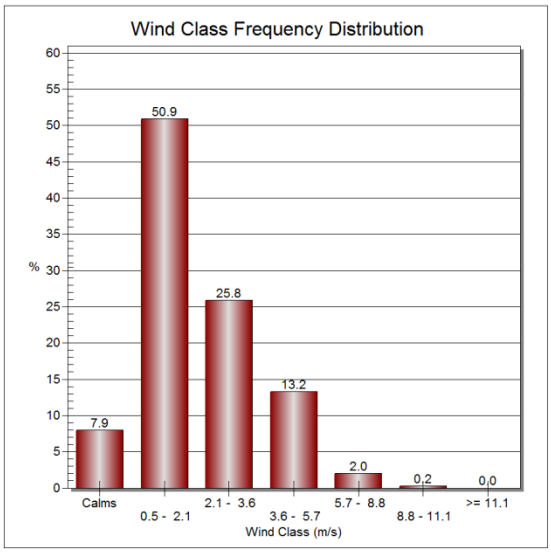


Figure No: 6.3 Wind Rose Diagram & Wind Class Distribution from 14 – 22 Hours



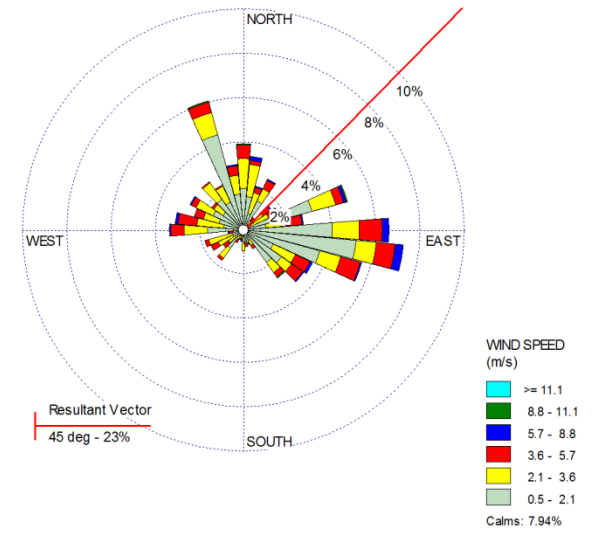
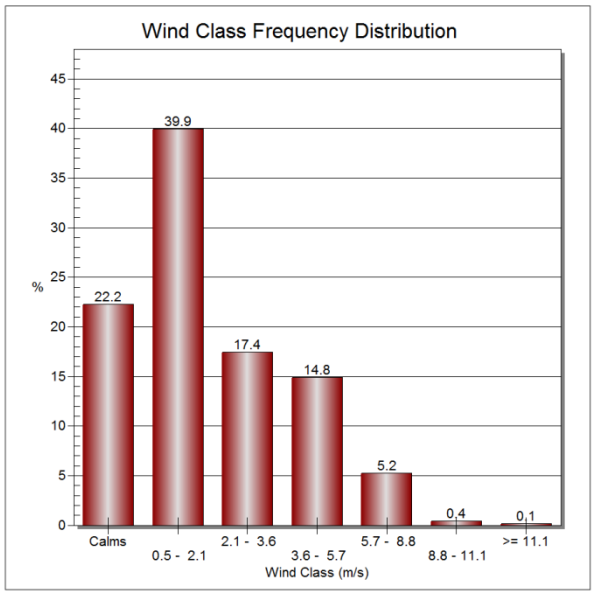
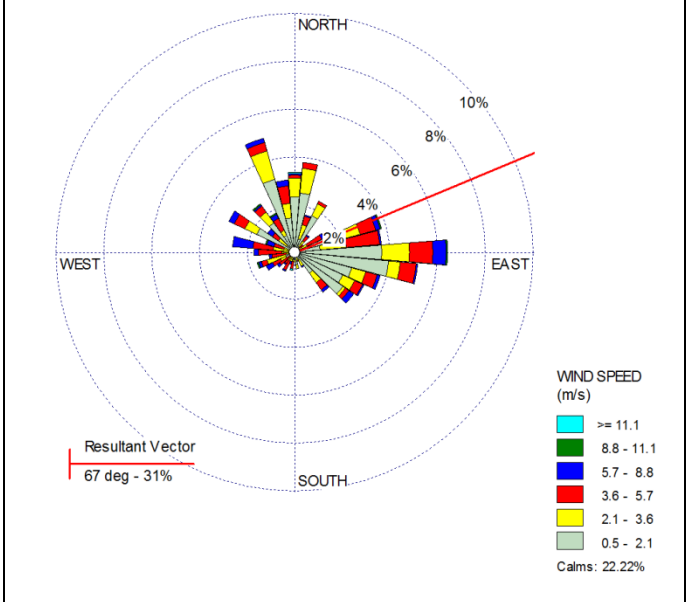


Figure No: 6.4 Wind Rose Diagram & Wind Class Distribution from 22 – 06 Hours





6.2 Ambient Air Quality Data

6.2.1 Near Mines Site Office (A-1) [Core Zone]

PM2.5

Data as given in the **Table No: 6.2** shows that the maximum value was 24.97µg/m^3, the lowest value was 21.56µg/m^3 and the average value was 23.5µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.2** shows the maximum value was 74.84µg/m^3, the lowest value was 67.08µg/m^3 and the average value was 71.4µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.2** shows the maximum value was 4.88µg/m^3, the lowest value was 3.59µg/m^3 and the average value was 4.2µg/m^3.

NO_2

The data given in the **Table No: 6.2** shows the maximum value was 18.42µg/m^3, the lowest value was 13.4µg/m^3 and the average value was 15.7µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO
All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.2

Months	PM2.5	PM10	SO_2	NO_2
October 2020	21.56	67.08	4.00	16.58
November 2020	22.18	68.05	4.33	18.42
December 2020	24.97	74.84	3.59	13.40
January 2021	24.23	72.08	4.00	14.63
February 2021	24.52	73.80	4.38	14.59
March 2021	23.56	72.82	4.88	16.56
Minimum	**21.56**	**67.08**	**3.59**	**13.4**
Maximum	**24.97**	**74.84**	**4.88**	**18.42**
Average	**23.5**	**71.4**	**4.2**	**15.7**
98% tile	**21.6**	**67.2**	**3.6**	**13.5**

6.2.2 Stabilized OB Dump Near Eastern Side of Mining Lease Boundary (A-2) [Core Zone]

PM2.5
Data as given in the **Table No: 6.3** shows that the maximum value was 25.62µg/m^3, the lowest value was 22.8µg/m^3 and the average value was 24.1µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10
The data given in the **Table No: 6.3** shows the maximum value was 75.66µg/m^3, the lowest value was 67.46µg/m^3 and the average value was 72.0µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2
The data given in the **Table No: 6.3** shows the maximum value was 4.59µg/m^3, the lowest value was 3.89µg/m^3 and the average value was 4.3µg/m^3.

NO_2
The data given in the **Table No: 6.3** shows the maximum value was 24.69µg/m^3, the lowest value was 14.95µg/m^3 and the average value was 19.0µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO
All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.3

Months	PM2.5	PM10	SO_2	NO_2
October 2020	23.08	67.46	4.59	24.69
November 2020	22.80	69.66	4.59	20.79
December 2020	24.26	72.32	4.35	15.56
January 2021	24.23	72.45	4.21	15.62
February 2021	24.73	74.57	3.89	14.95
March 2021	25.62	75.66	4.43	22.34
Minimum	**22.8**	**67.46**	**3.89**	**14.95**
Maximum	**25.62**	**75.66**	**4.59**	**24.69**
Average	**24.1**	**72.0**	**4.3**	**19.0**
98% tile	**22.8**	**67.7**	**3.9**	**15.0**

6.2.3 Near Main Entry Gate of Mines (A-3) [Core Zone]

PM2.5

Data as given in the **Table No: 6.4** shows that the maximum value was 26.22µg/m^3, the lowest value was 23.78µg/m^3 and the average value was 24.8µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.4** shows the maximum value was 76.42µg/m^3, the lowest value was 70.55µg/m^3 and the average value was 73.1µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.4** shows the maximum value was 5.62µg/m^3, the lowest value was 3.84µg/m^3 and the average value was 4.3µg/m^3.

NO_2

The data given in the **Table No: 6.4** shows the maximum value was 19.72µg/m^3, the lowest value was 14.45µg/m^3 and the average value was 16.8µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.4

Months	PM2.5	PM10	SO_2	NO_2
October 2020	24.10	70.55	3.98	16.76
November 2020	23.78	71.33	4.05	18.67
December 2020	24.56	73.82	3.96	14.45
January 2021	25.05	71.98	4.10	16.74
February 2021	25.13	74.43	3.84	14.54
March 2021	26.22	76.42	5.62	19.72
Minimum	**23.78**	**70.55**	**3.84**	**14.45**
Maximum	**26.22**	**76.42**	**5.62**	**19.72**
Average	**24.8**	**73.1**	**4.3**	**16.8**
98% tile	**23.8**	**70.6**	**3.9**	**14.5**

6.2.4 Mines Office Area (A-4) [Buffer Zone]

PM2.5

Data as given in the **Table No: 6.5** shows that the maximum value was 30µg/m^3, the lowest value was 16µg/m^3 and the average value was 24.7µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.5** shows the maximum value was 87µg/m^3, the lowest value was 49µg/m^3 and the average value was 72.3µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.5** shows the maximum value was 8.0µg/m^3, the lowest value was 4.0µg/m^3 and the average value was 5.7µg/m^3.

NO_2

The data given in the **Table No: 6.5** shows the maximum value was 34µg/m^3, the lowest value was 17µg/m^3 and the average value was 23.7µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.5

Months	PM2.5	PM10	SO_2	NO_2
October 2020	26	77	5	19
November 2020	16	49	7	31
December 2020	30	82	4	24
January 2021	19	60	4	17
February 2021	29	87	6	17
March 2021	28	79	8	34
Minimum	**16**	**49**	**4**	**17**
Maximum	**30**	**87**	**8**	**34**
Average	**24.7**	**72.3**	**5.7**	**23.7**
98% tile	**16.3**	**50.1**	**4.0**	**17.0**

6.2.5 Village Dengula (A-5) [Buffer Zone]

PM2.5

Data as given in the **Table No: 6.6** shows that the maximum value was 27µg/m^3, the lowest value was 15µg/m^3 and the average value was 21.2µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.6** shows the maximum value was 78µg/m^3, the lowest value was 40µg/m^3 and the average value was 57.0µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.6** shows the maximum value was 5.0µg/m^3, the lowest value was 4.0µg/m^3 and the average value was 4.7µg/m^3.

NO_2

The data given in the **Table No: 6.6** shows the maximum value was 33µg/m^3, the lowest value was 16µg/m^3 and the average value was 23.8µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.6

Months	PM2.5	PM10	SO_2	NO_2
October 2020	16	40	5	23
November 2020	26	78	5	25
December 2020	17	46	5	16
January 2021	27	60	5	22
February 2021	15	46	4	24
March 2021	26	72	4	33
Minimum	**15**	**40**	**4**	**16**
Maximum	**27**	**78**	**5**	**33**
Average	**21.2**	**57.0**	**4.7**	**23.8**
98% tile	**15.1**	**40.6**	**4.0**	**16.6**

6.2.6 Tensa Town (A-6) [Buffer Zone]

PM2.5

Data as given in the **Table No: 6.7** shows that the maximum value was 28µg/m^3, the lowest value was 16µg/m^3 and the average value was 21.5µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.7** shows the maximum value was 81µg/m^3, the lowest value was 47µg/m^3 and the average value was 63.5µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.7** shows the maximum value was 7.0µg/m^3, the lowest value was 4.0µg/m^3 and the average value was 5.2µg/m^3.

NO_2

The data given in the **Table No: 6.7** shows the maximum value was 22.0µg/m^3, the lowest value was 13.0µg/m^3 and the average value was 18.5µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m^3

Table No: 6.7

Months	PM2.5	PM10	SO_2	NO_2
October 2020	19	57	6	21
November 2020	26	79	4	15
December 2020	16	47	6	22
January 2021	22	61	4	13
February 2021	18	56	4	18
March 2021	28	81	7	22
Minimum	**16**	**47**	**4**	**13**
Maximum	**28**	**81**	**7**	**22**
Average	**21.5**	**63.5**	**5.2**	**18.5**
98% tile	**16.2**	**47.9**	**4.0**	**13.2**

6.2.7 Village Bahamba (A-7) [Buffer Zone]

PM2.5

Data as given in the **Table No: 6.8** shows that the maximum value was 31µg/m^3, the lowest value was 20µg/m^3 and the average value was 24.5µg/m^3.

All the readings are below the permissible limit of 60µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

PM10

The data given in the **Table No: 6.8** shows the maximum value was 89µg/m^3, the lowest value was 51µg/m^3 and the average value was 68.8µg/m^3.

All the readings are below the permissible limit of 100µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

SO_2

The data given in the **Table No: 6.8** shows the maximum value was 8.0µg/m^3, the lowest value was 3.0µg/m^3 and the average value was 5.7µg/m^3.

NO_2

The data given in the **Table No: 6.8** shows the maximum value was 29.0µg/m^3, the lowest value was 14.0µg/m^3 and the average value was 24.0µg/m^3.

All the readings are below the permissible limit of 80µg/m^3 as specified in the National Ambient Air Quality Standards, CPCB Notification 18th November 2009.

CO

All the CO readings are found to be below the detection limit of 114.4µg/m^3

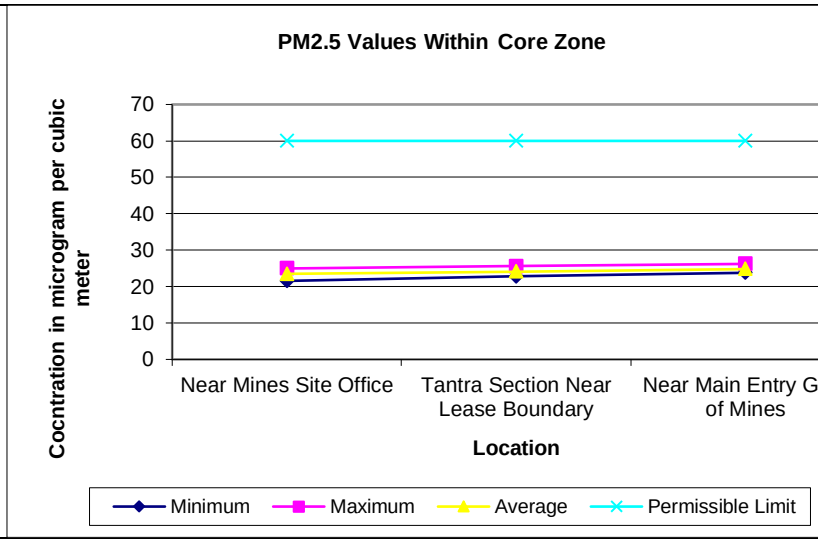
Table No: 6.8

Months	PM2.5	PM10	SO_2	NO_2
October 2020	24	66	4	24

Months	PM2.5	PM10	SO_2	NO_2
November 2020	20	60	8	28
December 2020	26	89	8	23
January 2021	24	66	3	14
February 2021	31	81	4	26
March 2021	22	51	7	29
Minimum	**20**	**51**	**3**	**14**
Maximum	**31**	**89**	**8**	**29**
Average	**24.5**	**68.8**	**5.7**	**24.0**
98% tile	**20.2**	**51.9**	**3.1**	**14.9**

Figure No: 6.5 Graphical Representations of PM2.5 Values in Core & Buffer Zone

Core Zone



Buffer Zone

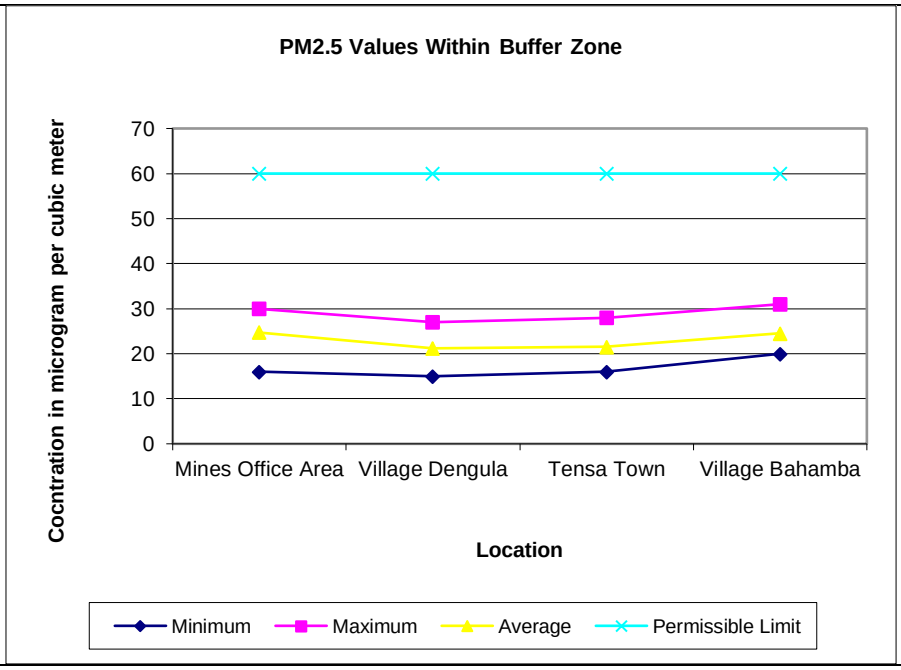
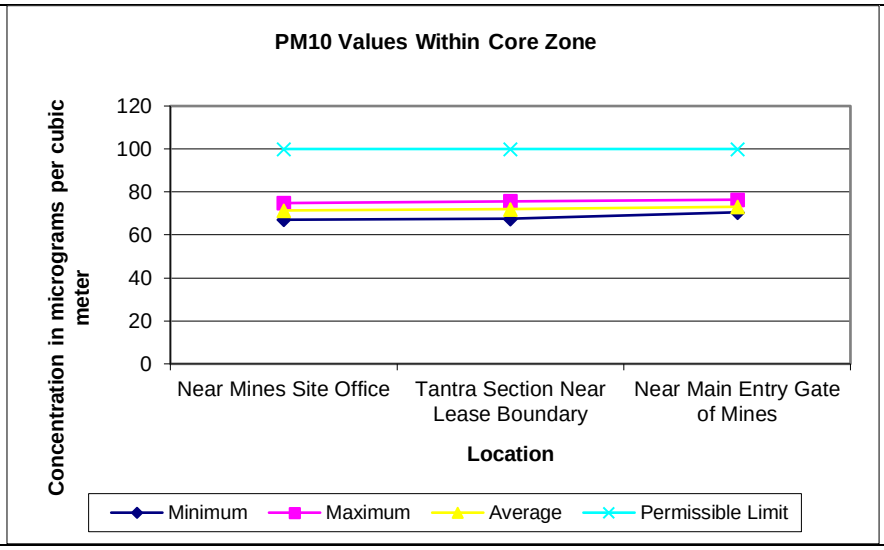


Figure No: 6.6 Graphical Representations of PM10 Values in Core & Buffer Zone

Core Zone



Buffer Zone

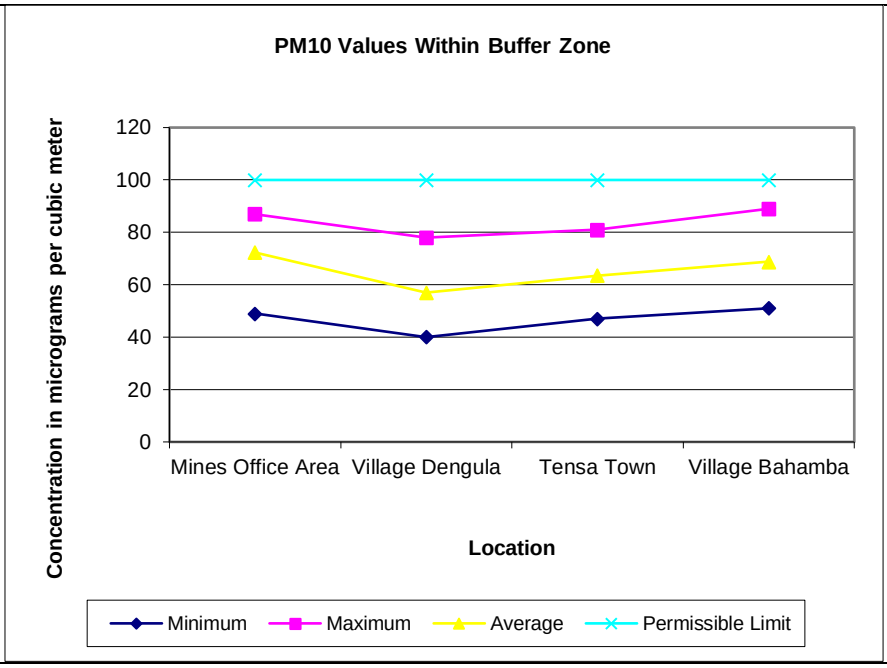
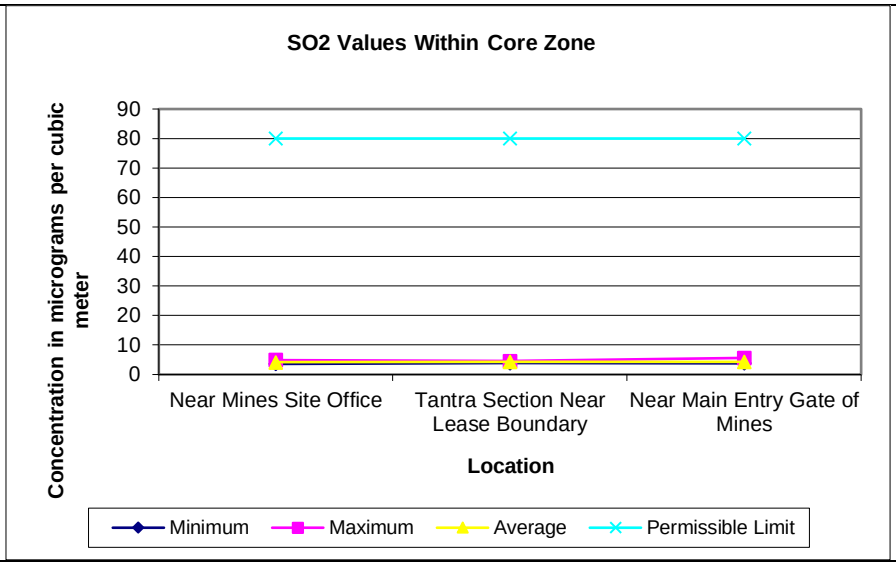


Figure No: 6.7 Graphical Representations of SO_2 Values in Core & Buffer Zone

Core Zone



Buffer Zone

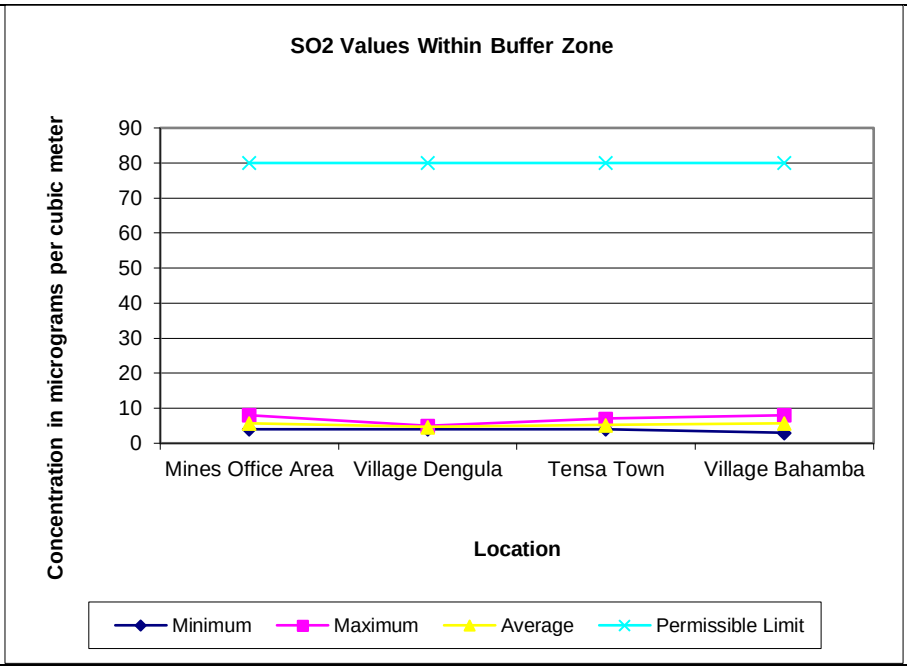
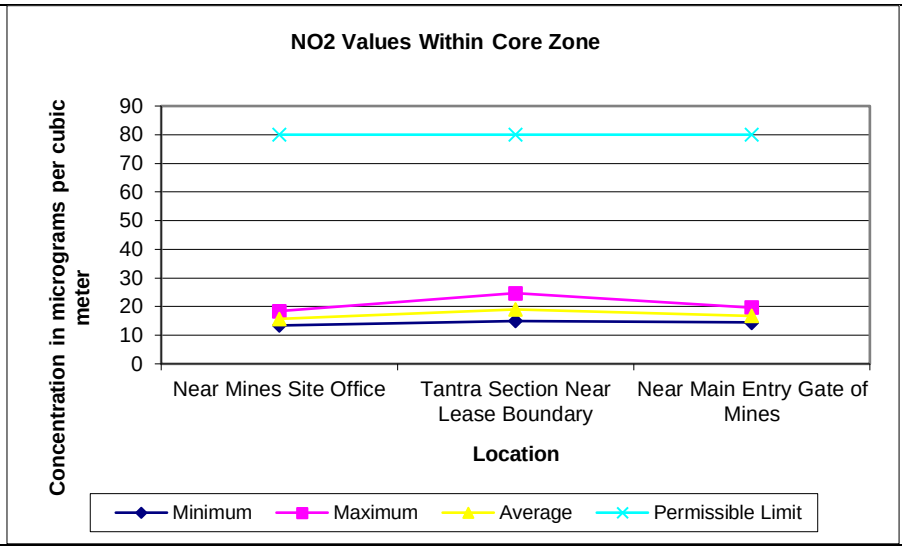
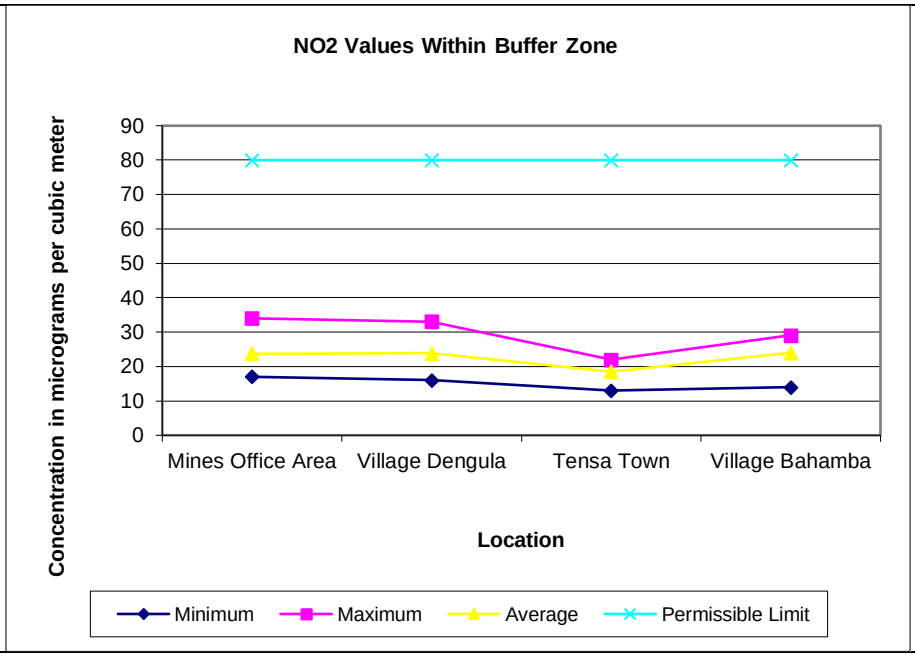


Figure No: 6.8 Graphical Representations of NO_2 Values in Core & Buffer Zone

Core Zone



Buffer Zone



5.1 Fugitive Dust Emission Data

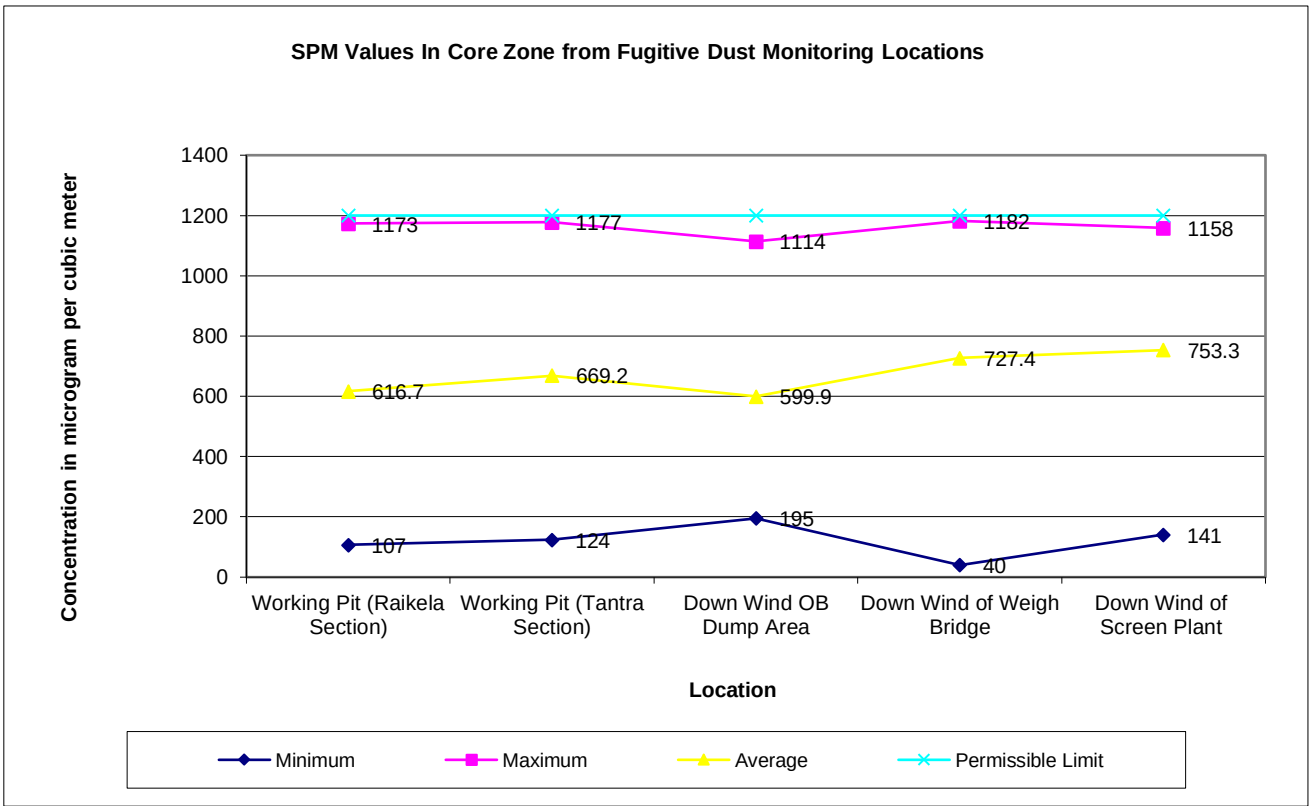
The fugitive dust samples collected from five locations during October to March months is detailed below.

Table 6.9 Fugitive Dust Emission Monitoring Data

Location	Working Pit Raikela Section	Working Pit Tantra Section	Down Wind OB Dump	Down Wind Weigh Bridge	Down Wind Screen/Crusher Plant
	280	495	273	593	530
	282	211	312	947	997
	185	155	629	1017	741
	927	246	486	977	469
	844	1107	555	1008	756
	789	881	704	789	803
	107	676	870	800	968
	233	378	1000	639	850
	1055	932	531	332	979
	502	301	195	447	696
	894	815	310	566	1108
	382	780	933	787	141
	946	672	599	951	842
	628	441	491	413	649
	153	755	589	689	438
	252	243	453	784	412
	699	522	362	520	579
	418	192	402	40	278
	170	177	369	309	434
	267	148	418	561	866
	148	1134	408	789	894
	253	901	669	833	856
	640	832	643	1182	597
	825	1134	697	869	594
	883	908	598	801	1110
	732	855	968	673	875
	546	640	633	206	820
	1129	124	339	357	463
	528	302	701	867	1108
	622	588	612	863	765
	577	1046	736	913	850
	446	453	821	1066	711

	873	844	876	993	1039
	1173	844	356	605	919
	842	1177	592	749	667
	680	1140	829	1022	1142
	1062	906	765	801	955
	819	759	786	691	866
	965	792	389	550	363
	711	653	567	938	435
	236	968	833	659	722
	859	978	383	956	945
	956		1114		1158
Minimum	107	124	195	40	141
Maximum	1173	1177	1114	1182	1158
Average	616.70	669.17	599.91	727.43	753.26
98%tile Value	141.44	143.68	260.52	176.12	256.08

Figure No: 6.9 Graphical Representations of SPM Values



5.2 Water Quality

SW-1 Karo River Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.10.**

Table No: 6.10
Karo River Water (100 m upstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.58	6.5 – 8.5
5.	Electrical Conductivity	82.12	-
6.	Dissolved Oxygen (Min.)	5.97	4
7.	BOD (3 days at 27°C)	1.40	3
8.	Total Dissolved Solids	54.00	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	37.32	-
11.	Chlorides (as Cl)	9.10	600
12.	Sulfate (as SO_4)	0.59	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	11.44	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	10.03	-
18.	Magnesium (as Mg)	2.99	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	1.48	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.05	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-2 Karo River Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.11.**

Table No: 6.11
Karo River Water (100 m Downstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.54	6.5 – 8.5
5.	Electrical Conductivity	69.85	-
6.	Dissolved Oxygen (Min.)	6.03	4
7.	BOD (3 days at 27°C)	1.17	3
8.	Total Dissolved Solids	45.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	35.52	-
11.	Chlorides (as Cl)	8.27	600
12.	Sulfate (as SO_4)	0.38	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	7.04	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	9.35	-
18.	Magnesium (as Mg)	2.98	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	1.27	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-3 Samij Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.12.**

Table No: 6.12
Samij Nallah Water (100 m upstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.96	6.5 – 8.5
5.	Electrical Conductivity	102.73	-
6.	Dissolved Oxygen (Min.)	6.07	4
7.	BOD (3 days at 27°C)	1.33	3

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
8.	Total Dissolved Solids	67.00	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	50.85	-
11.	Chlorides (as Cl)	10.75	600
12.	Sulfate (as SO_4)	0.28	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	7.92	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	12.47	-
18.	Magnesium (as Mg)	4.82	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	1.00	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-4 Samij Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.13.**

Table No: 6.13
Samij Nallah Water (100 m Downstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	7.13	6.5 – 8.5
5.	Electrical Conductivity	112.03	-
6.	Dissolved Oxygen (Min.)	5.95	4
7.	BOD (3 days at 27°C)	1.00	3
8.	Total Dissolved Solids	75.00	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	57.07	-
11.	Chlorides (as Cl)	9.10	600
12.	Sulfate (as SO_4)	1.01	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	7.92	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	12.37	-
18.	Magnesium (as Mg)	6.36	-

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	1.37	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	100	5000

SW-5 Kuradihi Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.14.**

Table No: 6.14
Kuradihi Nallah Water (100 m upstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	7.02	6.5 – 8.5
5.	Electrical Conductivity	153.00	-
6.	Dissolved Oxygen (Min.)	6.08	4
7.	BOD (3 days at 27°C)	1.00	3
8.	Total Dissolved Solids	100.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	82.44	-
11.	Chlorides (as Cl)	8.60	600
12.	Sulfate (as SO_4)	2.03	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	9.97	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	20.04	-
18.	Magnesium (as Mg)	7.88	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.29	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-6 Kuradihi Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.15.**

Table No: 6.15
Kuradihi Nallah Water (100 m Downstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	7.20	6.5 – 8.5
5.	Electrical Conductivity	160.55	-
6.	Dissolved Oxygen (Min.)	6.03	4
7.	BOD (3 days at 27°C)	1.00	3
8.	Total Dissolved Solids	105.00	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	76.93	-
11.	Chlorides (as Cl)	8.60	600
12.	Sulfate (as SO_4)	1.32	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	6.75	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	18.21	-
18.	Magnesium (as Mg)	7.65	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.42	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	505	5000

SW-7 Teherai Nallah Water Before ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.16.**

Table No: 6.16
Teherai Nallah Water (100 m upstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.63	6.5 – 8.5
5.	Electrical Conductivity	52.80	-
6.	Dissolved Oxygen (Min.)	6.07	4
7.	BOD (3 days at 27°C)	1.00	3
8.	Total Dissolved Solids	34.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	27.11	-
11.	Chlorides (as Cl)	7.94	600
12.	Sulfate (as SO_4)	2.49	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	7.04	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	5.19	-
18.	Magnesium (as Mg)	4.13	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.46	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	55	5000

SW-8 Teherai Nallah Water After ML area:

The sample after analysis and in comparison with the Standards prescribed in the Surface Water Quality Standard, IS 2296 (Class – C), water used for Drinking with conventional treatment followed by Disinfection is found to be well within the prescribed limits in both the seasons monitored. The results are detailed in **Table No. 6.17.**

Table No: 6.17
Teherai Nallah Water (100 m Downstream of the ML area)

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
1.	Colour	< 5	300
2.	Odour	Agreeable	-
3.	Taste	Agreeable	-
4.	pH Value	6.50	6.5 – 8.5
5.	Electrical Conductivity	53.20	-
6.	Dissolved Oxygen (Min.)	6.00	4
7.	BOD (3 days at 27°C)	1.00	3

Sl No	Parameters	Six Monthly Average Value	Surface Water Quality Standard as per IS: 2296 (Class C)
8.	Total Dissolved Solids	35.33	1500
9.	Oil & Grease	< 0.10	0.1
10.	Total Hardness (as $CaCO_3$)	30.62	-
11.	Chlorides (as Cl)	7.28	600
12.	Sulfate (as SO_4)	4.85	400
13.	Total Nitrate (as NO_3)	< 2.20	50
14.	Free Carbon Dioxide (as CO_2)	7.92	-
15.	Free Ammonia (as NH_3)	< 0.012	-
16.	Fluoride (as F)	< 0.05	1.5
17.	Calcium (as Ca)	6.83	-
18.	Magnesium (as Mg)	3.30	-
19.	Copper (as Cu)	< 0.1	1.5
20.	Iron (as Fe)	0.87	50
21.	Manganese (as Mn)	< 0.05	-
21.	Zinc (as Zn)	< 0.02	15
22.	Total Arsenic (as As)	< 0.002	0.2
23.	Mercury (as Hg)	< 0.01	-
24.	Lead (as Pb)	< 0.10	0.1
25.	Cadmium (as Cd)	< 0.01	0.01
26.	Hex. Chromium (as Cr^{+6})	< 0.01	0.05
27.	Selenium (as Se)	< 0.01	0.05
28.	Cyanide (as CN)	< 0.002	0.05
29.	Phenolic Compounds (as C_6H_5OH)	< 0.002	0.005
30.	Anionic Detergents (as MBAS)	< 0.05	1.0
31.	Total Coliforms	505	5000

GW-1 Mines Office Bore Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months but parameter like pH is found to be slightly acidic in both the months. All other parameters are well within the limit. The detail results are given in the **Table No 6.18 & 6.19.**

GW-2 Village Dengula Dug Well. 1

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good but parameter like pH is found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19.**

GW-3 Village Raikela Bore Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months except the parameter like pH is exceeding the prescribed limits and found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19.**

GW-4 Village Bandhal Dug Well

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good in both the months except the parameter like pH is exceeding the prescribed limits and found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19.**

GW-5 Bore Well Near Bottom Weigh Bridge

In comparison of the parameters with the prescribed limits of IS 10500, it was found that the water quality is good except, pH is found to be slightly acidic in both the months. The detail results are given in the **Table No 6.18 & 6.19.**

Table No: 6.18
Ground Water Quality Data for the Month of November

Sl No	Parameters	Sample Collected during month of November					Max. Desirable Limit As per IS 10500:2012
		GW1	GW2	GW3	GW4	GW5	
1.	Colour	< 5	< 5	< 5	< 5	< 5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity	0.2	1.2	0.1	0.3	0.2	5.0
5.	pH Value	5.27	5.33	5.32	5.68	5,37	6.5 – 8.5
6.	Temperature	26.1	26.1	26.1	26.3	28.8	-
7.	Total Hardness (as $CaCO_3$)	12.75	42.52	25.51	59.53	12.24	600
8.	Iron (as Fe)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.3
9.	Chlorides (as Cl)	2.98	12.9	5.96	11.91	3.88	1000
10.	Residual Free Chlorine	0.10	0.26	0.12	0.32	0.05	1.0 (min)
11.	Total Dissolved Solids	18	48	34	64	16	2000
12.	Electrical Conductivity	28.9	74.5	53.9	102.5	24.7	-
13.	Calcium (as Ca)	5.11	8.52	6.82	17.04	3.27	200
14.	Magnesium (as Mg)	< 1.0	5.17	2.07	4.13	0.99	100
15.	Copper (as Cu)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.5
16.	Manganese (as Mn)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.3
17.	Sulfate (as SO_4)	< 0.50	< 0.50	< 0.10	< 0.50	< 0.10	400
18.	Total Nitrate (as NO_3)	< 2.20	< 2.20	< 2.20	< 2.20	< 2.20	45
19.	Fluoride (as F)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1.5
20.	Cadmium (as Cd)	ND	ND	ND	ND	ND	0.003
21.	Lead (as Pb)	ND	ND	ND	ND	ND	0.01
22.	Arsenic (as As)	ND	ND	ND	ND	ND	0.05
23.	Mercury (as Hg)	ND	ND	ND	ND	ND	0.001
24.	Selenium (as Se)	ND	ND	ND	ND	ND	0.01
25.	Nickel (as Ni)	ND	ND	ND	ND	ND	0.02
26.	Zinc (as Zn)	ND	ND	ND	ND	ND	15.0
27.	Total Chromium (as Cr)	ND	ND	ND	ND	ND	0.05
28.	Total Alkalinity (as $CaCO_3$)	08	16	12	24	08	600
29.	Acidity	08	14	08	16	16	-
30.	Sulphide (as H_2S)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.05
31.	Sodium (as Na)	1.35	4.10	2.42	3.60	0.59	-
32.	Potassium (as K)	0.76	2.40	0.76	1.41	0.40	-
33.	Total Bacterial Count	Absent	Absent	Absent	Absent	Absent	Absent
34.	E coli	Absent	Absent	Absent	Absent	Absent	Absent

Table No: 6.19
Ground Water Quality Data for the Month of February

Sl No	Parameters	Sample Collected during month of February					Max. Desirable Limit As per IS 10500:2012
		GW1	GW2	GW3	GW4	GW5	
1.	Colour	< 5	< 5	< 5	< 5	< 5	15
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable

Sl No	Parameters	Sample Collected during month of February					Max. Desirable Limit As per IS 10500:2012
		GW1	GW2	GW3	GW4	GW5	
4.	Turbidity	0.1	0.2	0.1	0.2	0.3	5.0
5.	pH Value	5.25	5.59	5.39	5.71	5.29	6.5 – 8.5
6.	Temperature	20.8	20.8	20.8	20.7	20.7	-
7.	Total Hardness (as $CaCO_3$)	19.76	35.56	43.47	31.61	15.8	600
8.	Iron (as Fe)	0.34	0.32	0.18	0.50	0.42	0.3
9.	Chlorides (as Cl)	7.94	10.91	7.94	7.94	6.94	1000
10.	Residual Free Chlorine	0.36	0.34	0.46	0.40	0.18	1.0 (min)
11.	Total Dissolved Solids	33	48	32	42	18	2000
12.	Electrical Conductivity	54.3	72.4	48.8	63	28	-
13.	Calcium (as Ca)	1.58	6.33	4.75	7.91	3.16	200
14.	Magnesium (as Mg)	3.84	4.80	7.68	2.87	1.91	100
15.	Copper (as Cu)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.5
16.	Manganese (as Mn)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.3
17.	Sulfate (as SO_4)	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	400
18.	Total Nitrate (as NO_3)	< 2.20	< 2.20	< 2.20	< 2.20	< 2.20	45
19.	Fluoride (as F)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1.5
20.	Cadmium (as Cd)	ND	ND	ND	ND	ND	0.003
21.	Lead (as Pb)	ND	ND	ND	ND	ND	0.01
22.	Arsenic (as As)	ND	ND	ND	ND	ND	0.05
23.	Mercury (as Hg)	ND	ND	ND	ND	ND	0.001
24.	Selenium (as Se)	ND	ND	ND	ND	ND	0.01
25.	Nickel (as Ni)	ND	ND	ND	ND	ND	0.02
26.	Zinc (as Zn)	ND	ND	ND	ND	ND	15.0
27.	Total Chromium (as Cr)	ND	ND	ND	ND	ND	0.05
28.	Total Alkalinity (as $CaCO_3$)	16	24	12	20	08	600
29.	Acidity	06	12	08	12	06	-
30.	Sulphide (as H_2S)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.05
31.	Sodium (as Na)	3.26	2.72	0.66	2.42	0.58	-
32.	Potassium (as K)	1.69	1.88	0.22	2.22	0.13	-
33.	Total Bacterial Count	Absent	Absent	Absent	Absent	Absent	Absent
34.	E coli	Absent	Absent	Absent	Absent	Absent	Absent

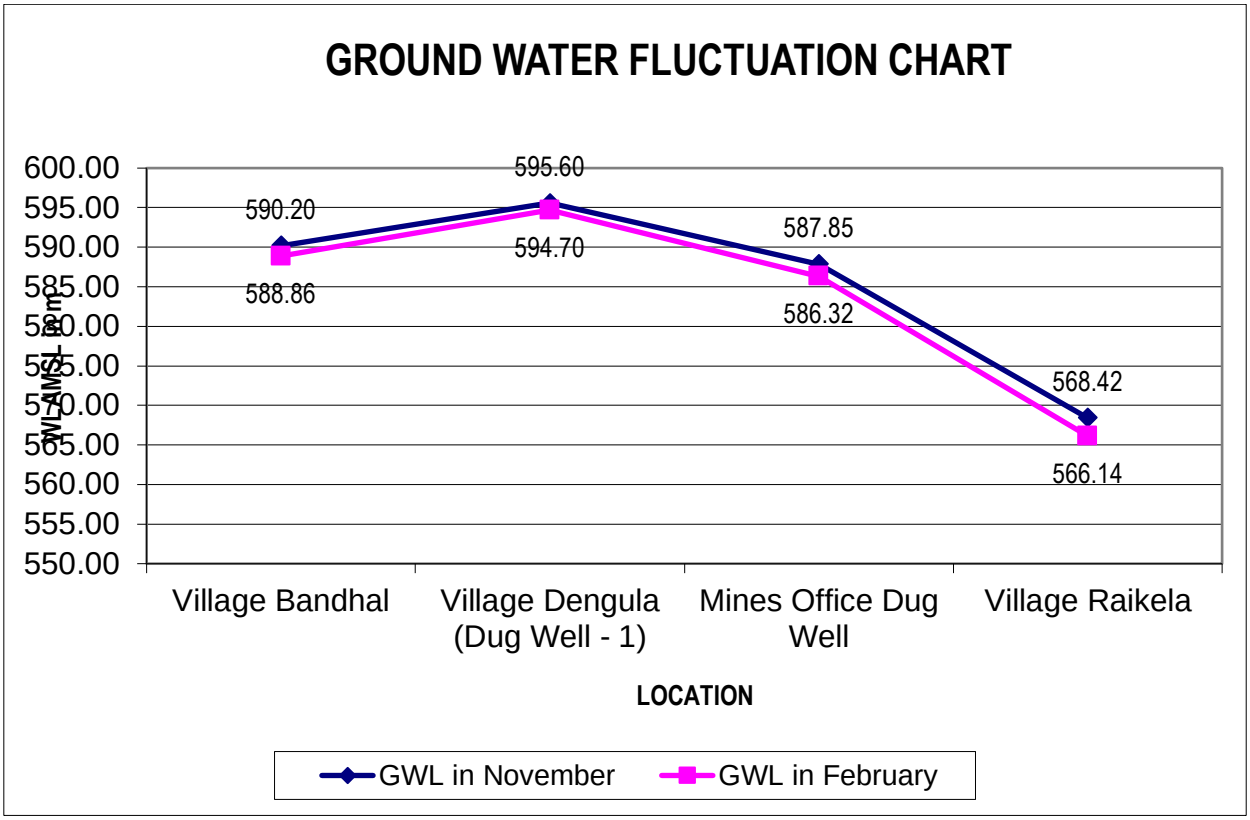
5.3 Ground Water Level Data

The ground water level measured from the existing dug wells mentioned above are found to be varying significantly i.e. in the month of November the level was found to be higher in comparison to the month of February. The detail data is given below in the **Table No 6.20**, with a graphical representation of the fluctuation in **Figure No: 6.10.**

Table No 6.20: Ground Water Level Data

Sl No	Location	Ground Level in m AMSL	Ground Water Level in m AMSL		Height of Water Column in m	
			November	February	November	February
1	Village Dengula (Dug Well - 1)	599.8	595.60	594.70	4.25	3.35
2	Village Bandhal	598.6	590.20	588.86	3.35	2.76
3	Mines Office Dug Well	591.9	587.85	586.32	1.20	0.32
4	Village Raikela	578.2	568.42	566.14	6.27	4.59

Figure No 6.10 : Seasonal Fluctuation of Ground Water Level



5.4 Noise Level Monitoring Data

Noise monitoring was carried out at five different locations of the mine every week. Four more locations were fixed for monitoring of noise level in the buffer zone on monthly basis. The Sound Pressure Level recorded are calculated for Lmin, Lmax, Leq, for HEMM working within the mining area and Lmin, Lmax, Leq Day-time and Leq Night-time for buffer zone locations. All the noise level data from October to March with average Leq values are given in the **Table No 6.21**

N-1 Drilling Machine

The noise level range between 91.1 and 87.0 dB(A) and the average Leq value is 88.2 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-2 Excavator Operator's Cabin

The noise level range between 86.5 and 78.7 dB(A) and the average Leq value is 80.6 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-3 Loader Operator's Cabin

The noise level range between 88.4 and 80.3 dB(A) and the average Leq value is 81.6 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-4 Dumper Operator's Cabin

The noise level range between 82.2 and 78.8 dB(A) and the average Leq value is 81.1 dB(A) during the study period.

On comparison of the results with Permissible Exposure limits in case of continuous Noise as per OSHA, USA it was found that the noise level is well within the exposure limits.

N-5 Working Pit Area during Operation of HEMM

The noise level range between 71.7 and 49.6 dB(A) and the average Leq Day-time value is 55.2 dB(A) during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Industrial area for both day and night time.

N-6 Mines Office Area

The noise level range between 59.8 and 40.9 dB(A) and the average Leq Day-time and Leq Night-time values are 54.8 and 45.9 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Industrial area for both day and night time.

N-7 Village Dengula

The noise level range between 63.4 and 39.5 dB(A) and the average Leq Day-time and Leq Night-time values are 57.6 and 43.4 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

N-8 Village Raikela

The noise level range between 61.5 and 39.4 dB(A) and the average Leq Day-time and Leq Night-time values are 56.7 and 43.4 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

N-9 Village Bandhal

The noise level range between 58.9 and 41.7 dB(A) and the average Leq Day-time and Leq Night-time values are 53.9 and 44.5 dB(A) respectively during the study period.

On comparison of the results with ambient air quality standards in respect of noise by CPCB, it was found that the ambient noise levels from this location was well within the standards for Residential area for both day and night time.

Table No: 6.21
Noise Level Data from October to March

DRILL MACHINE	OCT	NOV	DEC	JAN	FEB	MAR	AVERAGE VALUE
Leq dB(A)	88.2	88.1	87.7	87.6	87.9	89.3	
Leq dB(A)	87	87.9	88.5	88.5	88	91.1	
Leq dB(A)	88.1	87.7	88	88.4	88.6	88.1	
Leq dB(A)	87.9	87.3	87.9	87.8	88.2	89.2	
Average Leq dB(A)	87.8	87.8	88.0	88.1	88.2	89.4	88.2
Lmax	88.2	88.1	88.5	88.5	88.6	91.1	91.1
Lmin	87.0	87.3	87.7	87.6	87.9	88.1	87.0
EXCAVATOR OPERATOR CABIN	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq dB(A)	81.7	80.1	79.8	79.8	80	82.7	
Leq dB(A)	81.3	79.9	79.9	79.9	80.1	80.9	
Leq dB(A)	80.9	80.7	80.2	79.4	79.6	80.3	
Leq dB(A)	81.6	80.0	78.7	79.8	79.5	86.5	
Average Leq dB(A)	81.4	80.2	79.7	79.7	79.8	82.6	80.6
Lmax	81.7	80.7	80.2	79.9	80.1	86.5	86.5
Lmin	80.9	79.9	78.7	79.4	79.5	80.3	78.7
LOADER OPERATOR CABIN	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq dB(A)	80.3	81.9	81.5	80.6	81.8	80.8	
Leq dB(A)	82.9	81.4	81.4	81.4	80.9	88.4	
Leq dB(A)	81.8	80.9	81.3	80.9	81.6	80.7	
Leq dB(A)	80.3	81.5	81.5	81.4	81.6	81.6	
Average Leq dB(A)	81.3	81.4	81.4	81.1	81.5	82.9	81.6
Lmax	82.9	81.9	81.5	81.4	81.8	88.4	88.4
Lmin	80.3	80.9	81.3	80.6	80.9	80.7	80.3
DUMPER OPERATOR CABIN	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq dB(A)	78.8	81.5	81.6	81	80.9	80.7	
Leq dB(A)	80.5	81.7	81.5	81.4	81.8	80.5	
Leq dB(A)	81.5	81	81.7	80.9	82.1	80.9	
Leq dB(A)	82.2	80.9	81.1	81	81.6	80.1	
Average Leq dB(A)	80.8	81.3	81.5	81.1	81.6	80.6	81.1
Lmax	82.2	81.7	81.7	81.4	82.1	80.9	82.2
Lmin	78.8	80.9	81.1	80.9	80.9	80.1	78.8
MINES WORKING AREA	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq dB(A)	50.5	71.7	56.7	56.6	56.5	62.7	
Leq dB(A)	51	71.5	56.6	56.4	56.4	53.6	
Leq dB(A)	50.8	49.6	56.5	56.3	55.3	51.4	
Leq dB(A)	50.5	49.8	56.6	55.9	56	50.2	
Average Leq dB(A)	50.7	60.7	56.6	56.3	56.1	50.9	55.2
Lmax	51.0	71.7	56.7	56.6	56.5	62.7	71.7
Lmin	50.5	49.6	56.5	55.9	55.3	50.2	49.6
MINES OFFICE AREA	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq Day Time dB(A)	51.5	55.9	54.7	56.1	54.3	56.4	54.8
Leq Night Time dB(A)	41.5	52	42	53.1	41.5	45.2	45.9

Lmax	58.8	59.7	58.8	58.8	58.9	63.6	59.8
Lmin	35.8	47.6	37.9	49.8	35.2	39.1	40.9
VILLAGE DENGULA	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq Day Time dB(A)	52.0	62	60.4	61.8	55.4	53.9	57.6
Leq Night Time dB(A)	40.2	47.1	37.3	59.9	40.8	34.8	43.4
Lmax	57.8	67.7	66.1	66.2	63	59.4	63.4
Lmin	35.8	40.6	33.9	56.2	39.5	31.1	39.5
VILLAGE RAIKELA	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq Day Time dB(A)	61.4	60.8	58.8	58.9	58.3	42	56.7
Leq Night Time dB(A)	54.8	41.2	40.4	43	41.1	40	43.4
Lmax	65.3	64.2	64.8	64.8	65	45.1	61.5
Lmin	51.2	40.9	33.8	35.8	39.8	35.1	39.4
VILLAGE BANDHAL	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**AVERAGE VALUE**
Leq Day Time dB(A)	54.3	54.2	53.6	53.4	53.7	54.3	53.9
Leq Night Time dB(A)	51.4	49.4	40.7	43.4	41.3	40.6	44.5
Lmax	57.8	57.6	60.1	57.8	60.3	59.7	58.9
Lmin	47.4	47.2	39.8	41.1	39.3	35.4	41.7

6.0 CONCLUSION

6.1 Ambient Air Quality

It is concluded from the above study that the overall ambient air quality of the Raikela & Tantra Iron Ore Mines of Penguin Trading & Agencies Ltd. is good and the action taken by the mines authority were quite satisfactory. No results in the buffer are exceeding the prescribed limit.

6.2 Fugitive Dust Emission Monitoring

It is concluded from the above study that the fugitive dust emission from the five locations monitored at the Raikela & Tantra Iron Ore Mines of Penguin Trading & Agencies Ltd. is good and the action taken by the mines authority were quite satisfactory. No results are exceeding the prescribed limit of 1200 $\mu g/m^3$ as per MOEF notification dated 4th October 2010 for Iron Ore mining operations.

6.3 Water Quality

The surface water quality of all the locations monitored are found to be well within the prescribed standards as per IS 2296 (Class – C) and the ground water quality of the entire area was also good except pH, which was found to be slightly acidic and less than 6.5.

6.4 Ground Water Level

There is no problem in the availability ground water of the area.

6.5 Noise level

Noise monitoring results show that noise levels are well within the limits at all the stations, and there is no problem in the area due to noise from the mining activity.

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