HIRA POWER & STEELS

Ref : 2128/HPSL/2022-23/2128

Date : 21.09.2022

To,

The Member Secretary
Chhattisgarh Environment Conservation Board
Paryavas Bhawan, North Block, Sector-19
Atal Nagar – 492 002
District : Raipur (C.G.)

Sub : Submission of Consent Compliance Report of Hira Power and Steels Limited Unit-II

Ref : Consent to Operate Order No.1200/TS/CECB/2022 dated 23.05.2022

Respected Sir,

This has reference to the above mentioned subject and Consent of the Board issued under Section-25 of the Water (Prevention and Control of Pollution) Act, 1974 and under Section-21 of the Air (Prevention and Control of Pollution) Act, 1981, please find enclosed herewith Consent compliance Report audited by Ultimate Envirolytical Solutions.

This is for your kind information and record, please.

Kindly acknowledge the receipt of the same.

Thanking you,

Yours faithfully,
For, HIRA POWER AND STEELS LIMITED, UNIT-II

Authorized Signatory

Copy to : The Regional Officer
Regional Office
Chhattisgarh Environment Conservation Board
Commercial Complex, Chhattisgarh Housing Board Colony
Kabir Nagar
Raipur (C.G.) – 492099.

Compliance status report of the conditions stipulated in Consent of the Board renewed for the period of 23/05/2022 to 31.03.2023 under section 25/26 of the Water (Prevention and Control of Pollution) Act, 1974 for production (18,000 MT / Year) of Ferro Alloys (including low/medium Carbon Ferro Alloys) by 1 x 3.0 MVA. 1 x 3.6 MVA and 1 x 6.0 MVA submerged are furnace and 12 MT/Heat CLU Converter vide letter No. 1200/TS/CECB/2022 Naya Raipur Atal Nagar, Dated: 23/05/2022.

<table>
<tr><th>Sr. No.</th><th>Additional Conditions</th><th>Compliance</th></tr>
<tr><td>1</td><td>Production capacity of Ferro Alloys (including Low / Medium Ferro Alloys) shall not be enhanced from 18,000 Metric Tons/Annum under any circumstances after installation of Alumina Thermic Process - 600 Metric Tons/Annum for production of Low / Medium Carbon Ferro Manganese (Ferro Alloy), failing which, this consent shall be treated as null & void. The products / total production capacity shall not exceed the capacity for which consent has previously been issued</td><td>We agree. Production capacity of Ferro Alloys will not be enhanced in any circumstances.<table><tr><td>Ferro alloys Production</td><td>Year</td></tr><tr><td>44827.18 MT</td><td>2018-19</td></tr><tr><td>45359.06 MT</td><td>2019-20</td></tr><tr><td>40006.52 MT</td><td>2020-21</td></tr><tr><td>47934.43 MT</td><td>2021-22</td></tr></table></td></tr>
<tr><td>2</td><td>Industry shall ensure proper treatment of industrial and domestic effluent. Industry shall ensure treated effluent quality within the standards prescribed by Board published in Gazette Notification dated 25.03.88. The treated effluent shall be utilized in plantation, dust suppression, sprinkling on roads or other useful purposes within premises. Industry shall not discharge any liquid effluent what so ever generated in to the river or any surface water bodies. No effluent shall be discharged outside of the premises in any circumstance. Hence, zero discharge condition shall be maintained all the time.</td><td>We Comply.</td></tr>
<tr><td>3</td><td>Industry shall follow the standards prescribed by Ministry of Environment, Forest and Climate Change, Government of India regarding specific water consumption</td><td>We Comply.</td></tr>
<tr><td>4</td><td>Industry shall submit monitoring report of effluent regularly.</td><td>We comply (Monitoring report of effluent water is attached in Annexure I)</td></tr>
<tr><td>5</td><td>Industry shall adopt dry ash extraction and dry ash disposal system. Industry shall incorporate total ash utilization as integral part of the project. Ash generated from plant shall not be stored on land in open areas in any circumstances. The ash generated shall be stored in closed silos only. The ash generated shall be collected in dry form in storage silos as temporary storage and it shall be utilized 100% for other beneficial uses such as brick making, road construction, cement making, filling in low-lying areas and abandoned mines etc. Industry shall provide ash storage silos of sufficient capacity. If at any point of time all the storage silos completely</td><td>Yes, we have complied. Our fly ash utilization is 100%. It is stored in closed Silo of capacity 550 MT. From silo fly ash is sent in closed tippers to fly ash brick manufacturers for making fly ash bricks.</td></tr>
</table>

	filled with ash, then in that case industry shall shut down the plant till such time the ash disposed to other beneficial uses. Industry shall also reclaim the ash dumping area with a cover of soil and plantation without delay. Industry shall ensure transportation of fly ash/bottom ash for back filling / beneficial uses by covered vehicles to prevent emission during transportation.	
6	Industry shall ensure the fly ash utilization as per the notification of Ministry of Environment, Forest and Climate Change, Government of India vide letter dated 31/12/2021.	100 % Utilization of Fly Ash.
7	All fuel shall be stored above ground level in pucca platform in covered shed. Industry shall provide safe and scientific arrangement for collection, storage, transportation and disposal of all solid wastes such as fly ash, bottom ash, slag etc. generated. Solid wastes (Slag) shall be stored above ground level in pucca platform in covered area for few days only and not for longer period. Slag generated shall be utilized as raw material for production of Silico Manganese. Industry shall obtain letter of authorization under Hazardous and Other Wastes (Management and Trans Boundary Movement) Rules, 2016 from the Board and comply with the rule.	All fuel & solid waste is stored above ground level in pucca platform. Solid waste is being effectively complied with collection, storage, handling, transportation and disposal are being done scientifically. Fe-Mn slag is being used as raw material for the production of Si-Mn and Si-Mn slag is used as aggregate for civil works & filling of low-lying area.
8	Industry shall ensure transportation of raw materials / slag / waste by properly covered vehicles. Vehicles used for transporting the wastes / sludge shall be covered with tarpaulins and optimally loaded. Vehicular emissions shall be kept under control and regularly monitored. Industry shall also ensure use of mechanically covered vehicles for transportation of raw materials, fuel, dust generating products on or before 12/07/2023.	We are regularly using mechanically covered vehicles. Photographs of the same are enclosed herewith **Annexure-II**
9	All internal roads shall be made Pucca. Good housekeeping practices shall be adopted by the industry.	All the internal roads are corrected (pucca). Good housekeeping practices have been adopted. Regular sprinkling of water and road cleaning is being done with the help of pneumatic sweeping machine (please refer to **Annexure- III**).
10	Industry shall use fly ash brick, fly ash blocks or fly ash-based products in their construction / repairing activities.	100 % utilization of Fly ash which is sent to fly ash brick manufacturers for manufacturing fly ash bricks.
11	Industry shall submit environmental audit report audited by reputed Government Institution like IIT / NIT or recognized institution empaneled / accredited by Ministry of Environment, Forest and Climate Change, Government of India or NABL within three months.	We Complied (Environment Audit report is attached as **Annexure IV**)

12	Industry shall submit report of compliance of the consent conditions every year to the Board prepared by third party within three months.	We Comply, last consent compliance was submitted on dated 16.11.2022.
13	Industry shall enhance the capacity of rainwater harvesting systems to increase the ground water recharge within three months.	Rain water harvesting report is prepared by NIT, Raipur is prepared which will be constructed after rainy season. Report is attached as **Annexure-V.**
14	Wide green belt of broad leaf local species shall be maintained all along the plant premises. As far as possible maximum area of open spaces shall be utilized for plantation purposes. Industry shall maintain green belt within and around the plant premises in at-least 33% area of total project area.	The existing plantation is being strengthened to increase the density. Till date we have planted more than 22658 tree saplings in and around our factory premises. At present total green covered area is around 33.28% inside the factory and above 40% including roadside plantation. (Latest Verified Plantation Report is enclosed as **Annexure – VI**).
15	Industry shall submit Environment Statement to the Board as per provision of Environment (Protection) amendment Rule, 1993 for the previous year ending 31st March on or before 30th September every year.	We have complied with condition. We are regularly submitting Environmental Statement to the Board. Please refer to our letter No.438/HPSL/2020-21/452 dated. 16.09.2021. Please refer **Annexure-VII.**
16	This renewal of consent is being issued under the "Scheme of Auto Renewal of Consent" of the Board issued vide office order no. 5937 dated 29/01/2018 as per self-certificate submitted by authorized signatory Mr. D.P. Singh, Executive Director of M/s Hira Power and Steels Limited, Unit-II, Urla Industrial Area, District - Raipur (C.G.).	We Comply.
17	Chhattisgarh Environment Conservation Board reserves the rights to revoke the consent / renewal of consent at any time for any violation/non-compliance.	We Comply.
18	If industry fails to comply any of the above condition(s), the bank guarantee submitted by industry may be forfeited and this renewal of consent in consent may be cancelled without further notice	We Accept.

Compliance status report of the conditions stipulated in Consent renewed for the period of 23/05/2022 to 31.03.2023under section 21 of the Air (Prevention and Control of Pollution) Act, 1981 for production (18,000 MT/Year) of Ferro Alloys (including low / medium Carbon Ferro Alloys) by 1 x 3.0 MVA. 1x3.6 MVA & 1 x 6.0 MVA submerged are furnace and 12 MT/Heat CLU Converter vide letter No. 1200/TS/CECB/2022 Nava Raipur Atal Nagar, Dated: 23/05/2022.

Sr. No.	Additional Conditions	Compliance
1	Production capacity of Ferro Alloys (including Low / Medium Ferro Alloys) shall not be enhanced from 18,000 Metric Tons/Annum under any circumstances after installation of Alumina Thermic Process - 600 Metric Tons/Annum for production of Low / Medium Carbon Ferro Manganese (Ferro Alloy), failing which, this consent shall be treated as null & void. The products / total production capacity shall not exceed the capacity for which consent has previously been issued	We agree. Production capacity of Ferro Alloys will not be enhanced in any circumstances. Ferro alloys Production Year 44827.18 MT 2018-19 45359.06 MT 2019-20 40006.52 MT 2020-21 47934.43 MT 2021-22
2	Industry shall operate and maintain the existing air pollution control systems effectively and regularly to ensure the particulate matter emission from any point source below 40 mg/Nm3 all the time. Industry shall provide appropriate dust suppression/dust extraction system with bag filters at all fugitive dust emission sources such as material / wastes loading, unloading, handling, conveying system, transfer points/junction points, stock house etc. Good housekeeping practices shall be adopted by the industry. Industry shall also maintain the ambient air quality within the factory premises within prescribed limits. Chhattisgarh Environment Conservation Board may further stipulate stringent particulate matter emission limit depending upon environmental conditions.	Agreed. All the air pollution control systems are being operated and maintained to ensure the particulate matter Emission from point sources below 40 mg/NM3. All the effective steps to control the fugitive emission inside our factory premises are executed. Fogging system has been provided to conveying system and all the transfer points. Photographs of the same are enclosed herewith as **Annexure-VIII** for your ready reference please.
3	Industry shall follow the standards prescribed by Ministry of Environment, Forest and Climate Change, Government of India regarding gaseous emission.	We comply.
4	Industry shall ensure online connectivity of Continuous Emission Monitoring System – CEMS as per CPCB guidelines for relevant parameters in installed in stack(s) of Ferro Alloys Plant within three months. Calibration and validation of data shall be carried out of all (power plant & ferro alloys) CEMS and industry shall ensure availability of real time data in CECB / CPCB server. Industry shall submit stack and ambient air quality monitoring reports to the Board regularly	Continuous online stack emission monitoring system (Opacity meter) have been provided to the common stack attached to 3.0 & 3.6 MVA furnaces, stack attach to 2*5.5 MVA stack attached to 6.0 MVA furnace and stack attached to CLU converter. Data on ambient air quality and stack emission is being submitted to the Board every month (Please refer to **Annexure – IX**).

5	Industry shall adopt dry ash extraction and dry ash disposal system. Industry shall incorporate total ash utilization as integral part of the project. Ash generated from plant shall not be stored on land in open areas in any circumstances. The ash generated shall be stored in closed silos only. The ash generated shall be collected in dry form in storage silos as temporary storage and it shall be utilized 100% for other beneficial uses such as brick making, road construction, cement making, filling in low-lying areas and abandoned mines etc. Industry shall provide ash storage silos of sufficient capacity. If at any point of time all the storage silos completely filled with ash, then in that case industry shall shut down the plant till such time the ash disposed to other beneficial uses. Industry shall also reclaim the ash dumping area with a cover of soil and plantation without delay. Industry shall ensure transportation of fly ash/bottom ash for back filling / beneficial uses by covered vehicles to prevent emission during transportation	Yes, we have complied. Our fly ash utilization is 100%. It is stored in closed Silo of capacity 550 MT. From silo fly ash is sent in closed tippers to fly ash brick manufacturers for making fly ash bricks.
6	Industry shall ensure the fly ash utilization as per the notification of Ministry of Environment, Forest and Climate Change, Government of India vide letter dated 31/12/2021.	100 % utilization of fly ash generated in our plant.
7	All fuel shall be stored above ground level in pucca platform in covered shed. Industry shall provide safe and scientific arrangement for collection, storage, transportation and disposal of all solid wastes such as fly ash, bottom ash, slag etc. generated. Solid wastes (Slag) shall be stored above ground level in pucca platform in covered area for few days only and not for longer period. Slag generated shall be utilized as raw material for production of Silico Manganese. Industry shall obtain letter of authorization under Hazardous and Other Wastes (Management and Trans Boundary Movement) Rules, 2016 from the Board and comply with the rule	Solid waste is being effectively complied with collection, storage, handling, transportation and disposal are being done scientifically. Fe-Mn slag is being used as raw material for the production of Si-Mn and Si-Mn slag is used as aggregate for civil works & filling of low-lying area.
8	Industry shall ensure transportation of raw materials / slag / waste by properly covered vehicles. Vehicles used for transporting the wastes / sludge shall be covered with tarpaulins and optimally loaded. Vehicular emissions shall be kept under control and regularly monitored. Industry shall also ensure use of mechanically covered vehicles for transportation of raw materials, fuel, dust generating products on or before 12/07/2023.	We are regularly using mechanically covered vehicles. Photographs of the same are enclosed herewith **Annexure-II**

9	All internal roads shall be maintained pucca. Industry shall adopt good housing keeping practice	All the internal roads are corrected (pucca). Good housekeeping practices have been adopted. Regular sprinkling of water and road cleaning is being done with the help of pneumatic sweeping machine (please refer to **Annexure- III**).
10	Industry shall use fly ash brick, fly ash blocks or fly ash-based products in their construction / repairing activities	100 % Fly ash generated from our industry is sent to fly ash brick manufacturers for making fly ash bricks.
11	Industry shall submit environmental audit report audited by reputed Government Institution like IIT / NIT or recognized institution empaneled / accredited by Ministry of Environment, Forest and Climate Change, Government of India or NABL within three months	We Complied (Environment Audit report is attached as **Annexure IV**)
12	Industry shall submit report of compliance of the consent conditions every year to the Board prepared by third party within three months	We Comply, last consent compliance was submitted on dated 16.11.2021.
13	Wide green belt of broad leaf local species shall be maintained all along the plant premises. As far as possible maximum area of open spaces shall be utilized for plantation purposes. Industry shall maintain green belt within and around the plant premises in at-least 33% area of total project area	The existing plantation is being strengthened to increase the density. Till date we have planted more than 22658 tree saplings in and around our factory premises. At present total green covered area is around 33.28% inside the factory and above 40% including roadside plantation. (Latest Verified Plantation Report is enclosed as **Annexure – VI**).
14	Industry shall submit Environment Statement to this Board as per provision of Environment (Protection) amendment Rule, 1993 for the previous year ending 31st March on or before 30th September every year	We have complied with condition. We are regularly submitting Environmental Statement to the Board. Please refer to our letter No.438/HPSL/2020-21/452 dated. 16.09. 2021.Please refer **Annexure-VII.**
15	This renewal of consent is being issued under the "Scheme of Autorenewal of Consent" of the Board issued vide office order no. 5937 dated 29/01/2018 as per self-certificate submitted by authorized signatory Mr. D.P. Singh, Executive Director of M/s Hira Power and Steels Limited, Unit-II, Ural Industrial Area, District - Raipur (C.G.).	We Comply.
16	Chhattisgarh Environment Conservation Board reserves the rights to revoke the consent / renewal of consent at any time for any violation/non-compliance	We Comply.
17	If industry fails to comply any of the above condition(s), the bank guarantee submitted by industry may be forfeited and this renewal of consent in consent may be cancelled without further notice	We Accept.

Annexure-I (Effluent Water Report)

Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272, Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 I Email : ultimatenviro@gmail.com

Name & Address Of The Customer			
To, **HIRA POWER AND STEEL LTD.** **KHASRA NO.: 511/1, 512/2,** **URLA INDUSTRIAL AREA** **RAIPUR (C. G.) 492003**	Report No	UES/TR/22-23/02404	
	Lab. Ref. No.	UES/22-23/W/07033-07034	
	Date of Sampling	17/08/2022	
	Date of Receipt	18/08/2022	
	Date of Report	22/08/2022	
	Date of Analysis	Start:18/08/2022	End: 22/08/2022

SAMPLE DETAILS			
Customer Sample ID	Siltration Tank Water	Customer Ref. No. & Date	P.O. NO. 7200004006/U102, DATED: 16/06/2022
Sample Type	1. Inlet Water 2. Outlet Water	Sample Condition At Receipt	Ok
Packing of Sample	Jerry Cane (3 ltr. *2) Glass bottle (1 ltr. *2)	Sample Collected By	Laboratory Chemist
Other Details	Sealed	Quantity Received	Approx. 4 Ltr. each

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	LIMITS AS PER CONSENT	Inlet Water	Outlet Water
1	pH Value at 25.2°C	-	IS:3025:(Part-11): 1983, RA 2012	5.5 To 9.0	7.64	7.34
2	Total Suspended Solid	mg/L	IS:3025:(Part-17): 1984, RA 2012	100	82.0	24.0
3	Chemical Oxygen Demand	mg/L	IS:3025:(Part-58):2006, RA 2012	250	74.0	34.0
4	Bio-chemical Oxygen Demand at 27°C for three day	mg/L	IS:3025:(Part-44):1993 RA 2014	30	8.4	3.6
5	Oil & Grease	mg/L	IS:3025:(Part-39):1986	10	1.4	N.D.

Note : mg/lit.: milligram per liter. N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

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

22/08/22
REVIEWED BY

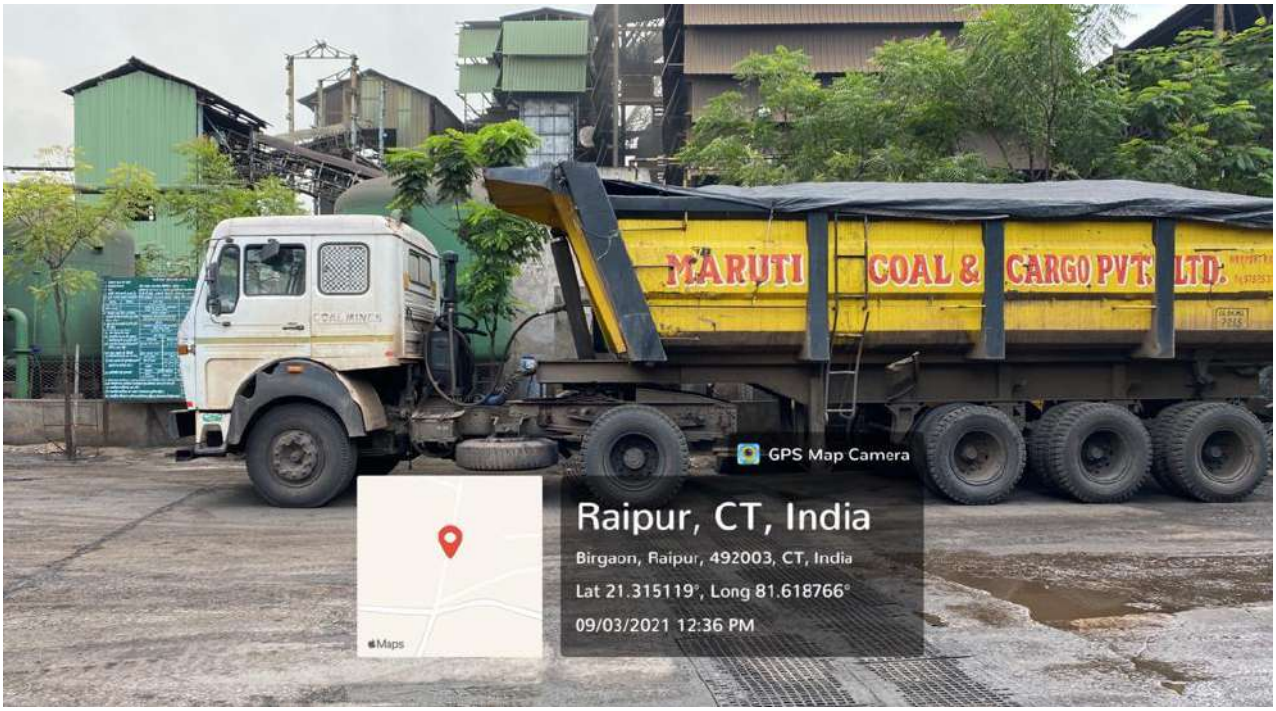
ULTIMATE ENVIROLYTICAL SOLUTIONS

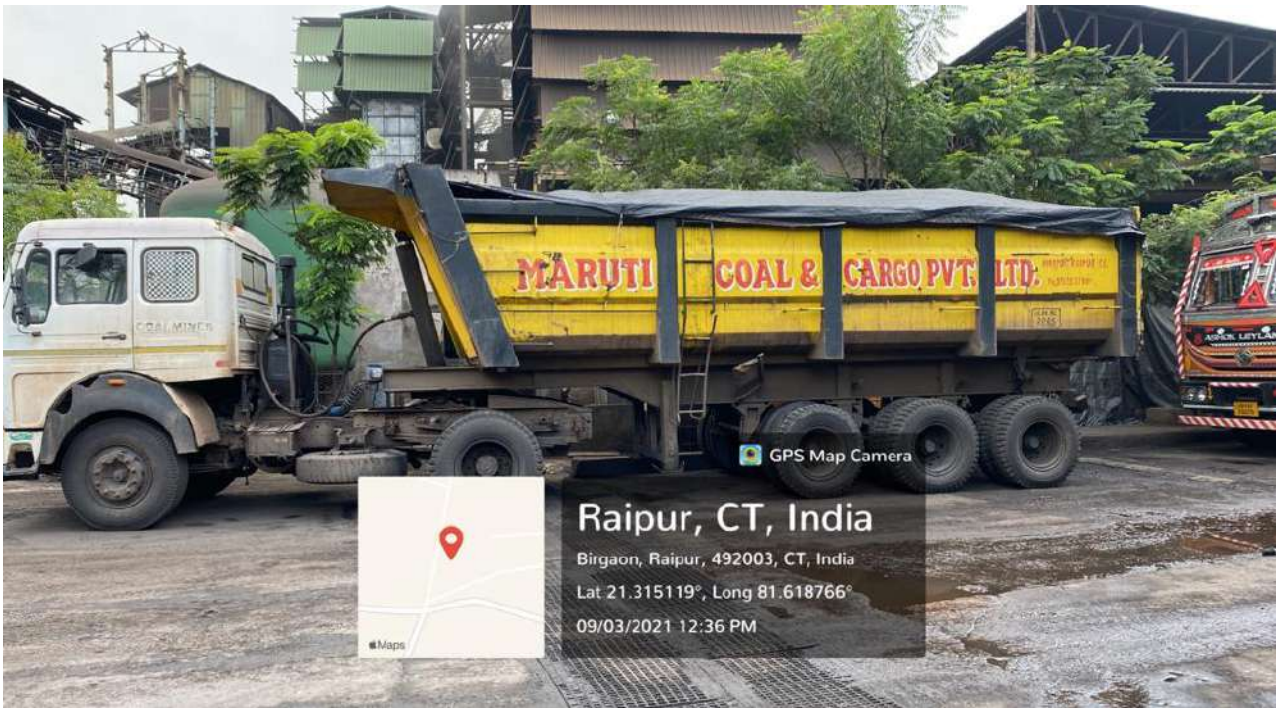
For ULTIMATE ENVIROLYTICAL SOLUTIONS
22/08/22
AUTHORIZED SIGNATORY

----------End of the test report----------

Annexure-II (Covered Vehicles Photographs)

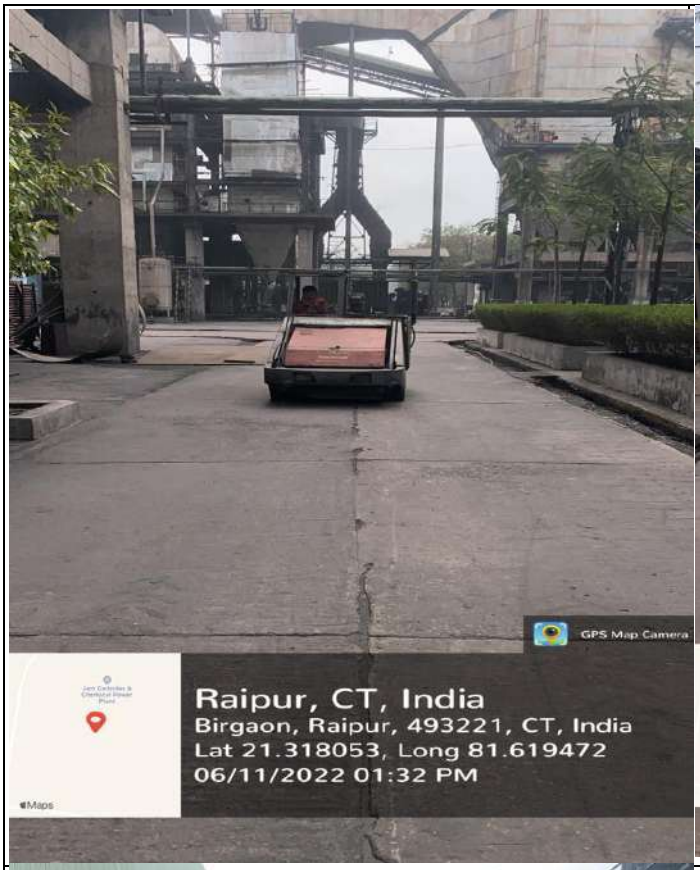
COVERED TRUCKS

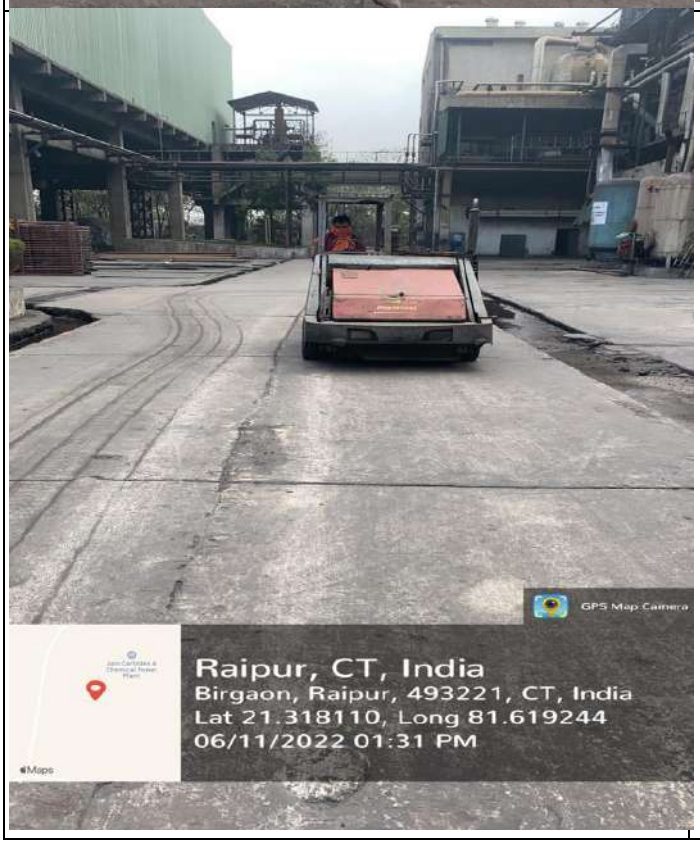




Annexure-III (Sweeping Machine Photographs)

SWEEPING MACHINE CLEANING ROAD





Annexure-IV (Environment Audit Report)

ENVIRONMENT AUDIT REPORT

of

M/s Hira Power & Steel Limited (Unit – II)

Plot No.511/1, 512/2, 513/1, 513/2,513/3,513/4

Urla Industrial Area

Raipur – (C.G.)

Audited By –

ULTIMATE ENVIROLYTICAL SOLUTIONS

HDD – 272, PHASE – III, NEAR JP SQUARE,

KABIR NAGAR, RAIPUR (C. G.)

Email – id:ultimatenviro@gmail.com

2. PRODUCTS & PRODUCTION CAPACITY

PRODUCTS

S.N.	UNIT	NAME OF PRODUCT
1.	Power Plant	ELECTRICITY
2.	Ferro Alloy	FERRO & SILCO MANGNESE

PRODUCTION CAPACITY :

NAME OF PRODUCT	Capacity (MT/Annum)
Electricity	20 MW
Ferro Alloys and Ferro Alloys (Including Low/Medium Carbon) Or Pig Iron	30,000 MTPA And 18,000 MTPA Or 56,000 MTPA

3. PROCESS FLOW CHARTS

FERRO ALLOY PLANT

1. INTRODUCTION

M/s Hira Power & Steel Limited is company of **HIRA** group a known group well equipped with technocrats and in-house technology for production of Sponge Iron, Steel, Power, Ferro Alloys, Structural and Mining. The HPSL has its manufacturing units located in the states of Chhattisgarh. Numbers of Engineers, staffs & consultants are on the permanent role of HPSL. has its corporate office at civil lines Raipur – 492001. The unit had set-up at urla industrial area Raipur, 15kms away from Raipur the capital city of Chhattisgarh state. The plant is producing Ferro alloys as well as generating power for self-utilization, generally used by Steel manufacturing Plants.

NAME OF THE INDUSTRY : M/s Hira Power & Steel Limited Unit – II

LOCATION : Plot No. 511/1, 512/2, 513/1, 513/2, 513/3,513/4Urla Industrial Area Raipur – (C.G.)

LONGITUDE/LATITUDE : **A**: 21°19'18.33" N81°37'11.39" E

: **B:** 21°18'57.79" N81°37'00.43" E

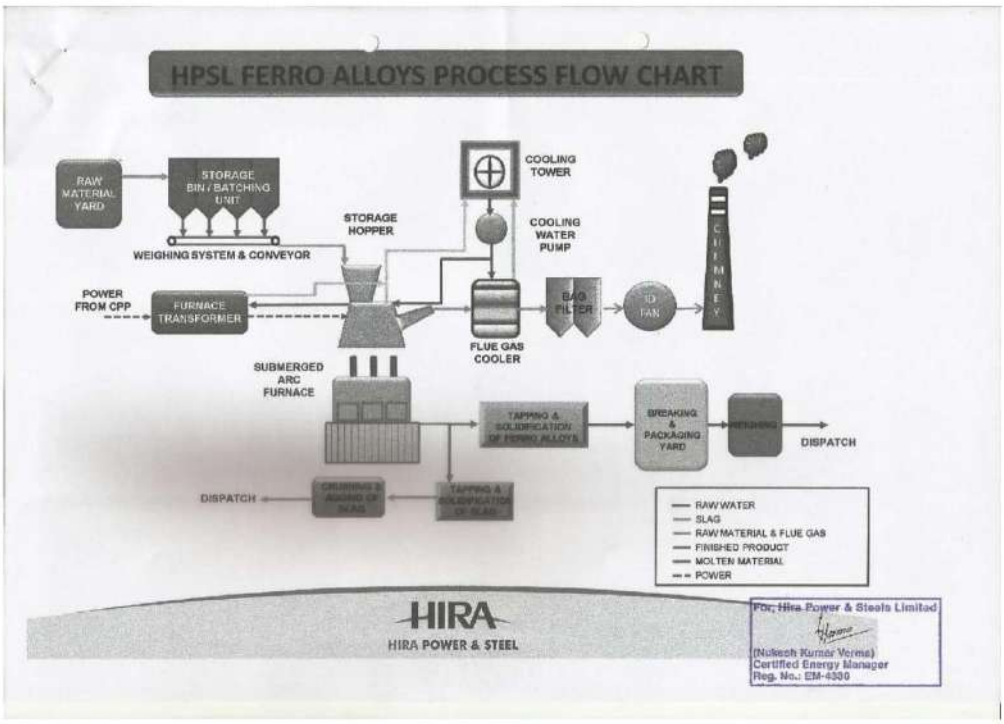
ELEVATION : 276.70 MTRS. (APPROX)

WATER SOURCE : CSIDC / BORE WELL

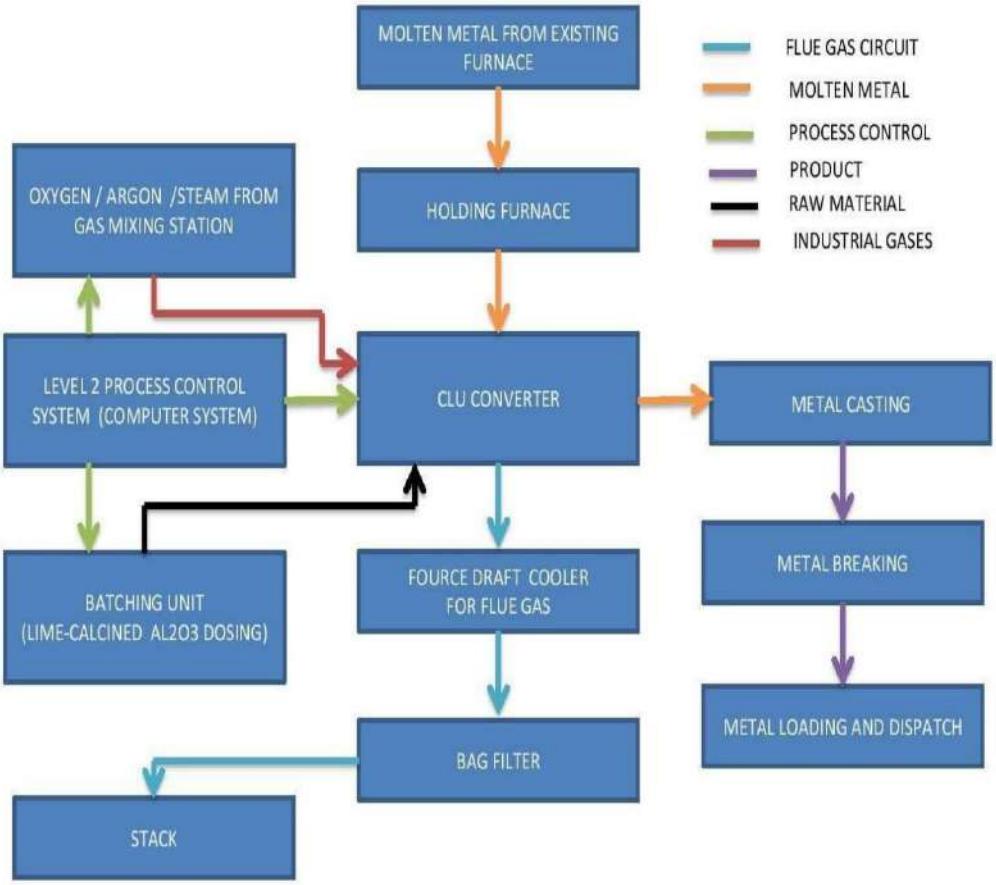
POLLUTION LEVEL : WELL WITHIN PRESCRIBED NORMS.

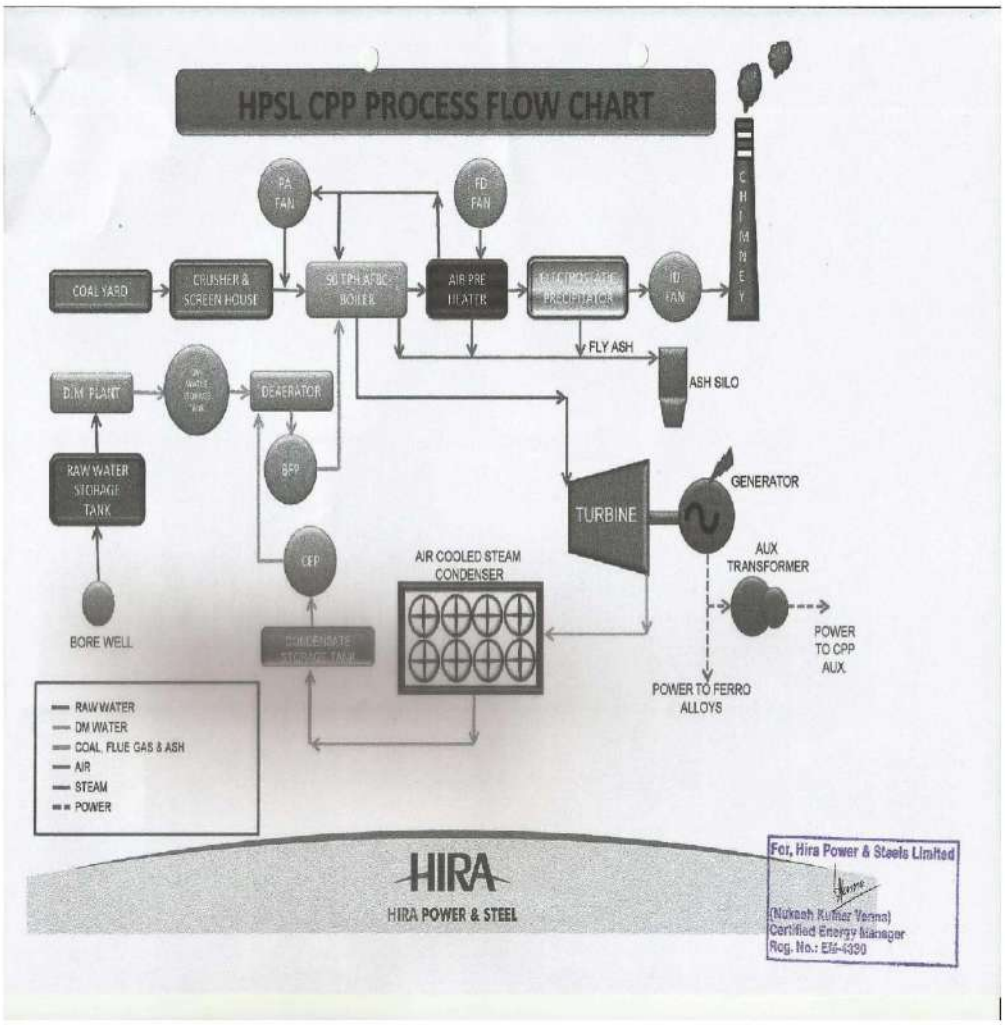
MANPOWER :

S.N.	Name of Unit	Existing Man Power		
		Direct	Indirect	Total
1	Administration	145	0	145
2	Ferro Alloys	220	141	361
3	Power Plant	72	26	98
4	CCS	86	16	102
Total Manpower		**523**	**183**	**706**


HPSL FERRO ALLOYS PROCESS FLOW CHART
RAW MATERIAL YARD
STORAGE BIN / BATCHING UNIT
WEIGHING SYSTEM & CONVEYOR
STORAGE HOPPER
COOLING TOWER
COOLING WATER PUMP
POWER FROM CPP
FURNACE TRANSFORMER
FLUE GAS COOLER
BAG FILTER
ID FAN
CHIMNEY
SUBMERGED ARC FURNACE
TAPPING & SOLIDIFICATION OF FERRO ALLOYS
BREAKING & PACKAGING YARD
DISPATCH
DISPATCH
RAW WATER
SLAG
RAW MATERIAL & FLUE GAS
FINISHED PRODUCT
MOLTEN MATERIAL
POWER
HIRA
HIRA POWER & STEEL
For, Hira Power & Steels Limited
(Nukesh Kumar Verma)
Certified Energy Manager
Reg. No.: EM-4330

Process Flow Chart CLU Converter




HPSL CPP PROCESS FLOW CHART
PA FAN
FD FAN
CHIMNEY
COAL YARD
CRUSHER & SCREEN HOUSE
50 TPH AFBC BOILER
AIR PRE HEATER
ELECTROSTATIC PRECIPITATOR
ID FAN
FLY ASH
ASH SILO
D.M PLANT
DEAERATOR
RAW WATER STORAGE TANK
BFP
TURBINE
GENERATOR
CEP
AIR COOLED STEAM CONDENSER
AUX TRANSFORMER
BORE WELL
POWER TO CPP AUX.
POWER TO FERRO ALLOYS
RAW WATER
DM WATER
COAL, FLUE GAS & ASH
AIR
STEAM
POWER
HIRA
HIRA POWER & STEEL
For, Hira Power & Steels Limited
(Nukesh Kumar Verma)
Certified Energy Manager
Reg. No.: EM-4390

4. AIR EMISSION SOURCES & CONTROL MEASURES

AIR EMISSION SOURCES

TYPE OF EMISSION	SOURCE OF EMISSION
FUGITIVE EMISSION	1. Raw Material Handling 2. Crusher & Screening 3. Material Transfer Points 4. Loading and Unloading Yard 5. Roads/Vehicle Movements 6. Material Stock Yards 7. Coal Handling area 8. Coal Crushing & Conveying 9. Fly Ash Loading points 10. Slag loading & Handling
STACK EMISSIONS	1. Captive Power Plant (20 MW) 2. Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)

Air Pollution Control Measures

The status of Air Pollution around the Plant is being monitored regularly. The following measures are adopted to keep the ambient air quality as prescribed the limits in National Ambient Air Quality Monitoring Standards.

1. De-dusting and dust suppression systems i.e. Electrostatic Precipitators, Bag Filters with Suction Hoods, Cyclones, Road sweeping machine, Dry Fog systems, Water sprinkling system are installed for control of emission level.
2. Specifically and essentially required dust control systems already installed on Cooler outlet area, Product separation buildings, crushing units, Day bin area, Power Plant Boilers, Ferro Alloy Electric Arc furnaces. These systems are checked regularly and their emission is monitored and maintained within prescribed limits.
3. All the stacks are designed specifically and necessary arrangements for monitoring of PM, SO2 and NOx. On duty personnel is regularly check the process parameters and initiate appropriate control measures in case monitoring highlights non-conformity with limits.
4. The work zone air quality is monitored regularly.
5. All dust suppression systems is being maintained properly and checked on regular intervals to minimize the dust level.
6. All de-dusting systems is maintained to run satisfactorily.
7. Leakages from equipment and ducts are being checked and stopped.

8. Water spraying and sprinkling is being done regularly.
9. Regular Encouraging activities & training is being imparted for workers to understand the importance of these systems so that they pay adequate attention towards the functioning of these systems.
10. Regular log books of Pollution Control equipment are maintained to detect malfunctions.
11. All dusts bends are being cleaned regularly.
12. Each unit head is responsible to have better Environment Management System.

Maintenance/Monitoring for Air Environment

1. Continuous emission monitoring system is installed.
2. Regular Ambient Air Quality is being monitored with ground level concentration inside the factory premises as well as around the plant.
3. Regular stack monitoring (PM, SO2, NOx) is being carried out.
4. ESP is being maintained to give the maximum efficiency.
5. All dust control systems is checked and their emission is being monitored and maintained within the prescribed limits.
6. All dust suppression systems is maintained properly with sprinkling of water to suppress the dust.
7. All fugitive emissions are minimized. If found any leakage in duct, transfer points etc. than same will be stopped.
8. Training of workers through Environmental Protection Cell.

AIR POLLUTION CONTROL EQUIPMENTS WITH CONTINOUS MONITORING SYSTEM

Stack Attached To Plant	Pollution Control Equipment	Monitoring System
Captive Power Plant (20 MW)	Electrostatic Precipitator	Opacity Meter & SOx NOx Analyser
Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)	Bag Filter	Opacity Meter

- Monitoring Report of Ambient Air Quality monitoring in enclosed as **Annexure – I.**
- Data of CEMS of Power plant & Ferro Alloys is being regular transferred to CECB & CPCB Server.
- Its **U.R.L.**: http://envirofront. m2mlogger.com/

  User Name: environment@hpslindia.com & **Password**: Primaeq@0185.

ESP & Bag Filter is being maintained to give the maximum efficiency 99.8%

S.N.	Stack	Particulate Matter (mg/Nm^3)		Efficiency %
		Inlet	Outlet	
1	3.0 & 3.6 MVA SUBMERGED ARC FURNACE 'A & B'	24152.4 mg/Nm3	34.8 mg/Nm3	99.8 %
2	5.5 MVA SUBMERGED ARC FURNACE 'C'	19426.4 mg/Nm3	40.8 mg/Nm3	99.7 %
3	5.5 MVA SUBMERGED ARC FURNACE 'D'	20342.5 mg/Nm3	38.4 mg/Nm3	99.8 %
4	6 MVA SUBMERGED ARC FURNACE 'E'	22468.2 mg/Nm3	34.6 mg/Nm3	99.8 %
5	CLU CONVERTER & THERMITE	19426.4 mg/Nm3	22.8 mg/Nm3	99.8 %
6	20 MW AFBC	ESP Inlet	Outlet	
		26428.2 mg/Nm3	42.5 mg/Nm3	99.8 %

Photographs of Air Pollution Control Equipment

1. Fogging system on conveyor belts and transfer points

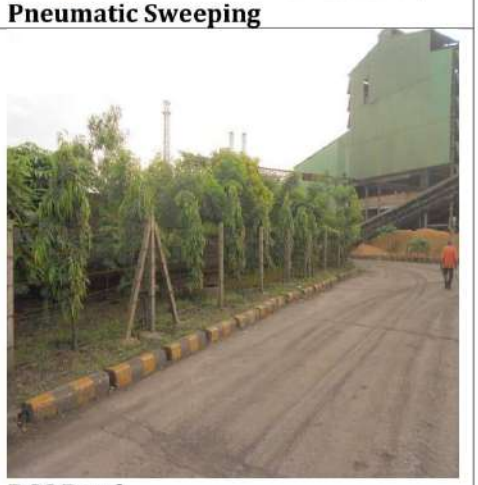
2. Covered shed for crusher

3. RCC Road, Pneumatic sweeping and water sprinkling

RCC Road

Pneumatic Sweeping

RCC Road



RCC Road

Static Sprinklers

Mobile Sprinklers

ESP attached with Chimney – Power Plant

Bag filters Attached with Chimney – Ferro Alloy Plant

Online Gas Analyzer for continuous emission monitoring at Chimney – Power Plant

5. WATER POLLUTION SOURCES & CONTROL MEASURES

The utilization water for plant consumption is designed on a Zero discharged concept and all cooling water is recirculated. However, 17.18 m3/day of cooling tower blow down & 6.12 m3/day of Boiler blow-down is generated which is utilized for dust suppression at the coal handling area, silo area, raw material yard and road. Effluent from the plant bathrooms & toilets is being treated in septic tank followed by soakage pit.

In order to check any discharge of process effluents, the waste water management system encompasses installation of 1 pair settling tanks in plant premises with proper utilization arrangement for horticulture purpose and water sprinkling on roads, yards and ash silo-areas within the plant premises. Septic tanks and soak pits are also provided for treatment of domestic waste water.

Effluent	Generation Quantity	Treatment Arrangement	Mode of Disposal
Cooling Tower Blow Down	17.18 m^3/day	Settling Tanks	Used in dust suppression at the coal handling area, silo area, raw material yard and roads.
Boiler Blowdown	6.12 m^3/day	Settling Tanks	Used in dust suppression at the coal handling area, silo area, raw material yard and roads.
Domestic Waste Water	76.24 m^3/day	Treated through septic tank and followed by soakage pit.	NA

- Monitoring report of Wastewater Inlet & Outlet Quality is enclosed as **Annexure - II**

Waste Water Treatment Facilities

Settling tanks for collection & treatment of effluent

6. SOLID WASTE GENERATION AND DISPOSAL DETAIL

In the process of manufacturing Sponge Iron, Coal is used as a source of Heat and as a reluctant. During the process of making Sponge Iron, it generates Solid Waste in the form of Char, which is mainly used in our AFBC based power plant, as a fuel and also sold in market.

Fraction of Coal (called Coal Fines) after sizing and screening is being injected pneumatically into the Kiln, as a process requirement. A small quantity of Dolomite is being used as a De-sulphur zing Agent.

For Ferro Alloys Manufacturing:

The generated slag from Ferro Alloys manufacturing are being stored in slag yard scientifically and being utilized for filling the low-lying area/ inter locking tiles and for road preparation purposes.

SOLID WASTE GENERATION DETAIL

Description	Current Metric Tonnes/Month	Method of Collection	Method of Disposal
Bag Filter Dust	2018.937	Pneumatic Conveyors	Land filling (Within Premises)
Fly Ash	86899.51	Pneumatic Conveyors	Brick/Block/Other Products Manufacturing
Ferro Slag	47077.24	Through Payloader	Road Construction (Within Premises)

7. HAZARDOUS WASTE GENERATION AND DISPOSAL DETAIL

As per the Hazardous Waste Authorisation Used Oil & Used Resin are the Hazardous Waste is generated from the plant apart from it very few amounts of Cotton waste also generated from workshop but only used oil is being generated from all the units, which is properly being handled and stored at their designated place and being sold to authorized parties as per the rules.

Category of Hazardous Waste as per the Schedules I, II and III of these rules	Authorised mode of disposal or recycling or utilization or co-processing etc.	Quantity (Tonnes/Annum)
Used/Spent Oil (Schedule-I, Cat. No.- 5.1)	For manufacturing of copper pads, heating ladle & machinery lubrication or sold to authorized recyclers	15 KL/Year
Spent ion exchange resin containing toxic metals (Schedule-I, Cat. No.- 35.2)	Utilized for energy recovery in boiler for steam or power generation	0.25 MT/Year

Reports of Solid Waste (Fly Ash) attached as **Annexure – III** &Hazardous Waste **attached as Annexure- IV.**

8. HOUSE KEEPING

Good housekeeping contributes greatly to efficient operations, improved employee morale, better productivity and reduction of accidents. Housekeeping standards reflect an organization's work culture.

Good housekeeping can only be achieved by proper planning. This includes a well-planned process layout, orderly arrangement of equipment; systematic material storage stacking and movement; and waste disposal; coupler with day-to-day maintenance of cleanliness and tidiness.

*All the internal roads in the plant premises have been made of concrete (RCC).

*Sufficient no. of water sprinklers has been installed, at required locations.

*Water tanker has also engaged for water spaying round the clock on all the internal road as well outside roads, yards.

9. PLANTATION

HPSL is making sincere efforts for conservation and protection of the environment. In this stream greenery is the need of the hour in HSPL and in the past years, it has become the key promising activity in and around the campus and new heights has been attained in this field. All these efforts were made in view to not only reduce the pollution, but also to ensure our commitment towards the betterment of the environment.

The species so far planted in and around campus has shown tremendous vegetative growth, which has contributed, considerably in a quantitative and qualitative increase in greenery.

The selection of species was made by taking into consideration the available resources and limitations *viz.*, type of soil, availability of rain water and sub-surface water (ground water), disease infection and pest infestation, nutrient availability and finally the prevailing climatic conditions, in and around the campus.

Plantation efforts will be carried-on to the maximum possible extend in and around HSPL campus. In this direction, we are making efforts for avenue plantation from HSPL besides the road, nearby villages. which shows our sincerity in making efforts for continual improvement in quality of environment not only inside the HSPL campus, but also in the adjacent area as well as district of Raipur. Out all these efforts have been made in totally different manner than the other as we are having a well-developed nursery, inside our campus, where we grow all the spices to be taken up under the plantation program. Our effort is not only economical, but also viable and easily adoptable as the saplings are well familiar to survive and grow in the same atmosphere prevailing in the campus.

Total land area of the industry in acres	According to the consent condition, the area of land reserved for plantation in acres	Total number of plantations done so far on reserved land	Total number of plantations done so far outside the industry premises.
43.49	14.35	18,650	3480

Plantation Verification Report is attached **Annexure – V**

Photographs Showing Plantation inside our Factory Premises






10. Brief Detail of Plant

<table>
<tr><td>1.</td><td>Industry Name & Address</td><td colspan="3">M/s Hira Power & Steel Limited
Plot No. 511/1, 511/2, Urla Industrial Area, Raipur – (C.G.)</td></tr>
<tr><td>2.</td><td>Industry's Occupier/Director/ CEO/Authorised Person Name & Address with Contact Number</td><td colspan="3">Name – Mr. Devendra Pratap Singh
Position – Executive Director
Address – Plot No. 511/1,511/2 , Urla Industrial Area, Raipur – (C.G.)

Phone Number: 0771 – 4082500</td></tr>
<tr><td>3.</td><td>Industry's E-Mail, Phone No. & Fax No.</td><td colspan="3">E-Mail : environment@hpslindia.com
Phone Number: 0771 – 4082500
Fax Number: 0771- 4082501</td></tr>
<tr><td rowspan="3">4.</td><td rowspan="3">Products & Production Capacity (As per Consent)</td><td>Products</td><td colspan="2">Production Capacity</td></tr>
<tr><td>Electricity (Captive Power Plant)</td><td colspan="2">20 MW</td></tr>
<tr><td>Ferro Alloys
and
Ferro Alloys (Including Low/Medium Carbon)
Or
Pig Iron</td><td colspan="2">30,000 MTPA
And
18,000 MTPA
Or
56,000 MTPA</td></tr>
<tr><td>5.</td><td>Consent/Consent Renewal Validity</td><td colspan="3">Consent No. 1200 /TS/CECB/2022 Nava Raipur Atal Nagar, Dated 23 / 05 / 2022 valid up to 31.03.2022</td></tr>
<tr><td rowspan="8">6.</td><td rowspan="8">Information regarding water source, water pollution control system and contaminated water treatment system</td><td colspan="3">Source of Water – Chhattisgarh State Industrial Development Corporation (CSIDC)

Source of Water – Borewell (For Domestic Use)</td></tr>
<tr><td>Description</td><td>Quantity of water used (in KLD)</td><td>Quantity of effluent water (in KLD)</td></tr>
<tr><td>Domestic</td><td>76.24</td><td>60.992</td></tr>
<tr><td>Cooling</td><td>324.38</td><td>17.18</td></tr>
<tr><td>Boiler</td><td>76.00</td><td>06.12</td></tr>
<tr><td>Others (Dust Suppression & Plantation)</td><td>26.57</td><td>00</td></tr>
<tr><td colspan="3">Knowledge of domestic contaminated water treatment system including capacity-
Septic Tank & Soak pit is being used for disposal of Domestic effluent in plant.</td></tr>
<tr><td colspan="3">Knowledge of industrial contaminated water treatment systems including capacity –
In our Plants, water is being used for cooling purpose in re circulating manner. Two Settling tanks capacity of 178 KL and 150 KL are constructed at different location at plant, to utilize the discharge water</td></tr>
</table>

		in Horticulture and for water sprinkling purpose, after filtration. Discharge water quality is being maintained within the prescribed norms.
		Information about number and location of installed water meters Bore well (For Domestic) Total Flow meter – 4 Nos. Locations – 1. Power Store 2. Raw Material Area 3. Pump House 4. DG Set

7. Knowledge of unit wise air pollution control system

Plant Name	**Pollution Control Equipment**
AFBC CAPTIVE POWER PLANT (20 MW)	Electrostatic Precipitator
Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)	Bag Filters

STACK ATTACHED TO PLANT	**EQUIPMENT NAME**	**DATE OF INSTALLATION**	**REDUCTION EFFICIENCY GUARANTEED BY MANUFACTURER (IN %)**	**APPLICATION**
3.0 and 3.6 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	23.02.2010	99.8	Bag Filter Dust
5.5 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	19.05.2006	99.8	Bag Filter Dust
5.5 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	19.05.2006	99.8	Bag Filter Dust
6.0 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	23.02.2010	99.8	Bag Filter Dust
CLU Converter (12 MT/Heat)	PULSE JET BAG FILTER	20.05.2016	99.8	Bag Filter Dust
CAPTIVE POWER PLANT	ELECTRONIC PRECIPITATOR	19.05.2016	99	Fly Ash Connection

Information of Fugitive Emission Control System	Fugitive emission reduction measures are taken such as Water sprinkling through sprinklers, water guns & water tankers, dense green belt development, covered storage of raw material, fuels and wastes. Raw material, fuels, finished products and solid wastes are being transported in duly covered vehicle after spraying water on it.

Information regarding unit-wise chimney	**Plant Name**	**Stack Height**	**Detail of Continuous Emission Monitoring System**

	height and online monitoring system installed in the chimney along with results	AFBC CAPTIVE POWER PLANT (20 MW)	72 m	Make- Forbes Marshall Model- DCEM2100 Party- Prima Equipment's Instrument-Dust Opacity Meter (PM) Make- PRIMA Model- PSGM-1-D-AGS Party- Prima Equipment's Instrument-SOx NOx Analysers
		3.0 and 3.6 MVA Submerged Arc Furnace 5.5 MVA Submerged Arc Furnace 5.5 MVA Submerged Arc Furnace 6.0 MVA Submerged Arc Furnace CLU Converter (12 MT/Heat)	30 m 35 m 35 m 40 m 35 m	Make- Prima Model- PE-SPMMS-C91 Party- Prima Equipment's Instrument-Dust Opacity Meter (PM)
		Stack Monitoring Report is Attached as **Annexure-VI**.		
	Information regarding the ambient air quality, including the number and location of the continuous ambient air quality monitoring system and results as per the consent condition	Ambient Air Quality Report is Attached as **Annexure-I.**		
	Information of electricity meters installed for air pollution control	Energy Meter Report is Attached as **Annexure-VII.**		
8.	Unit wise raw material information Information of Raw Material/Fuel/Finished Products storage	**List of Raw Materials**	**Raw Materials (Consumption per month) TPM**	
		Manganese Ore	1,34,400	
		Carbonaceous	36,000	
		Dolomite	9,600	
		Iron Ore	4,800	
		Electrode Paste	1,920	
		High Carbon Ferro Alloy	17,880	
		Calcined Lime	1,152	

		Calcined Dolomite		648	
		Si Mn Fines		1,476	
		Raw materials like Coal & Iron Ore and Finished Products are being kept in shed and covered area.			
9.	Information of transportation of raw materials / fuels / finished products	Source and Mode of transportation along with distance of raw material & its specification is attached as **Annexure-VIII**.			
10.	Solid waste management system	Recycling/Reuse in the Manufacturing process or sold to Si-Mn Producers.			
11.	Solid waste management system Plantation related information	Power Plant	Type of solid waste	Quantity generated per month	Disposal/Treatment system
		Power Plant Ferro Alloy Plant	Fly Ash	86899.51	Brick/Block/Other products manufacturing
		Total land area of the industry in acres	Fe Mn Slag	47077.24	Recycling/Reuse in the Manufacturing process
12.	Plantation related information	Total Land area of the industry in acres	According to the consent condition, the area of land reserved for plantation in acres	Total number of plantations done so far on reserved land	Total number of plantations done so far outside the industry premises.
		43.49	14.35	18,650	3480
13.	Rain water harvesting system information	At present HPSL is going to enhance rain water harvesting system whose planning and designing has been surveyed by NIT, Raipur as per the study report the mean annual rainfall occurring over a study area is 1249 mm. which is resulting into runoff and losses due to evaporation as well as infiltration/percolation losses. From the hydrological and hydrogeological study, it is found that the total natural ground water recharge potential on annual basis is approximately 53000 m3. It is also suggested that by adopting artificial recharge structure as well as by developing the existing pond within the plant premises, the recharge potential can be enhanced. In addition, the overall demand of plant may be reduced in the monsoon season by utilizing the storm water from the pond. The storm water collected from the plant premises may be stored in the pond. Report is attached as **Annexure IX.**			
14.	Status of internal Roads	All the internal roads are made pucca.			
15.	Information				

	regarding the formation of environment cell and the name and designation of the authorized person involved in it.	**ENVIRONMENT MANAGEMENT CELL** 01) Shri D.P Singh (Executive Director) 02) Mr. Aviral Tiwari (Senior Engineer) 03) Mr. Bhagirati Kaushik (Chemist) 04) Sample Boys (02 Nos)
16.	Information regarding the amount reserved for the Environment Safeguard	181.76 Lakhs.
17.	Detail of Authorisation under Hazardous & Other Waste (Management &Trans boundary Movement) Rule, 2016 with Renewal and Validity.	Hazardous Waste Authorisation No.–3641/HSMD/HO/CECB/2020 dated: 21/07/2020 valid till 23.06.2025.

ANNEXURE- I

Format No. : UES/FORM/09

Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272, Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 I Email : ultimatenviro@gmail.com

Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

Name & Address Of The Customer			
To, **HIRA POWER AND STEEL LTD.** **KHASRA NO.: 511/1, 512/2,** **URLA INDUSTRIAL AREA** **RAIPUR (C. G.) 492003**	Report No	UES/TR/21-22/09484	
	Lab. Ref. No.	UES/21-22//015360	
	Date of Sampling	24/02/2022	
	Date of Receipt	25/02/2022	
	Date of Report	28/02/2022	
	Date of Analysis	Start: 25/02/2022	End: 28/02/2022

SAMPLE DETAILS

Customer Sample ID	Silteration Tank Water	Customer Ref. No. & Date	P.O. No. 11/HPSL U102/PO/21-22/88, Dated: 24.10.2021
Sample Type	1. Inlet Water 2. Outlet Water	Sample Condition At Receipt	Ok
Packing of Sample	Jerry Cane (3 ltr. *2) Glass bottle (1 ltr. *2)	Sample Collected By	Laboratory Chemist
Other Details	Sealed	Quantity Received	Approx. 4 Ltr. Each

TEST REPORT

SR. NO.	PARAMETER	UNIT	METHOD OF TEST	LIMITS AS PER CONSENT	Inlet Water	Outlet Water
1	pH Value at 25.2°C	-	IS:3025:(Part-11): 1983, RA 2012	5.5 To 9.0	7.09	7.80
2	Total Suspended Solid	mg/L	IS:3025:(Part-17): 1984, RA 2012	100	160	18.0
3	Chemical Oxygen Demand	mg/L	IS:3025:(Part-58):2006, RA 2012	250	152.0	26.0
4	Bio-chemical Oxygen Demand at 27°C for three day	mg/L	IS:3025:(Part-44):1993 RA 2014	30	26.2	6.3
5	Oil & Grease	mg/L	IS:3025:(Part-39):1986	10	1.5	N.D.

Note : mg/lit.: milligram per liter. N.D.: Not Detected.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

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

28/02/22
REVIEWED BY

For ULTIMATE ENVIROLYTICAL SOLUTIONS
28/02/22
AUTHORIZED SIGNATORY

----------*End of the test report*----------

ANNEXURE- II

Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272, Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 I Email : ultimatenviro@gmail.com

Recognized by Ministry of Environment Forest and Climate Change under EP act 1986

Name & Address Of The Customer			
To, **HIRA POWER AND STEEL LTD.** **KHASRA NO.: 511/1, 512/2,** **URLA INDUSTRIAL AREA** **RAIPUR (C. G.) 492003**	Report No.	UES/TR/21-22/09477	
	Lab Ref No.	UES/21-22/AAQM/015350 - 15353	
	Date of Sampling	24/02/2022 to 25/02/2022	
	Date of Receipt	25/02/2022	
	Date of Report	28/02/2022	
	Date of Analysis	Start: 25/02/2022	End: 28/02/2022

SAMPLE DETAILS	
Monitoring For	Ambient Air Quality Monitoring
Sampling Location	1. Near CHP Area 2. Beside Power Store 20 MW 3. Solar Panel Area 4. Near Main Gate
Customer Ref. No. & Date	P.O. NO. 11/HPSL U102/PO/21-22/88, DATED: 24.10.2021
Duration Of Sampling	As per CPCB norms
Sample Collected By	Laboratory Chemist
Sampling Procedure	As Per Method Reference
Sample Quantity/Packing	Filter Paper (PM_{10}): 1X1 No., Filter Paper ($PM_{2.5}$): 1X1 No. SO_2: 30mlX1 No. PVC Bottle, NO_2: 30mlX1 NO. PVC Bottle,

Test Method for Ambient Air Quality Monitoring

Parameter	Method Reference
Particulate Matter size less than 10 microns (PM_{10})	IS:5182:(Part-23):2006 & CPCB Guidelines Vol.-I
Particulate Matter size less than 2.5 microns ($PM_{2.5}$)	IS:5182:(Part-24):2019 & CPCB Guidelines Vol.-I
Sulphur Dioxide (SO_2)	IS:5182:(Part-2):2001, RA 2006 & CPCB Guidelines Vol.-I
Nitrogen Dioxide (NO_2)	IS:5182:(Part-6):2006 & CPCB Guidelines Vol.-I

TEST REPORT

Parameter	Unit	NAAQM Standard	Results			
			Near CHP Area	Beside Power Store 20 MW	Solar Panel Area	Near Main Gate
PM_{10}	$\mu g/m^3$	100	78.5	80.1	75.2	68.7
$PM_{2.5}$	$\mu g/m^3$	60	35.5	39.8	40.4	32.5
SO_2	$\mu g/m^3$	80	14.4	15.8	14.2	15.5
NO_2	$\mu g/m^3$	80	26.6	27.6	28.0	27.1
CO	mg/m^3	4.0	0.59	0.60	0.54	0.48

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

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

28/02/22
REVIEWED BY

For ULTIMATE ENVIROLYTICAL SOLUTIONS
28/02/22
AUTHORIZED SIGNATORY

----------End of the test report----------

Annexure-III

HIRA POWER & STEELS

क्रमांक : 2029/एचपीएसएल/2022-23/2029 दिनांक: 18.05.2022

प्रति,
श्रीमान क्षेत्रीय अधिकारी,
क्षेत्रीय कार्यालय,
छ.ग. पर्यावरण संरक्षण मण्डल,
कबीर नगर, व्यवसायिक परिसर,
छ.ग. गृह निर्माण मण्डल कालोनी,
कबीर नगर, रायपुर (छ.ग.)

विषयः **वर्ष 2021-22 (अप्रैल 2021 से मार्च 2022) तक की अवधि में ताप विद्युत से जनित फ्लाई ऐश यूटिलाईजेशन की वार्षिक रिपोर्ट प्रेषित करने के संबंध में।**

संदर्भः **आपका पत्र क्र0. 508/क्षेका/छ.प.सं.मं/2022 रायपुर दिनांक 17.05.2022**

महोदय,

उपरोक्त विषयांतर्गत संदर्भित पत्र के माध्यम से आपके द्वारा दिनांक 01.04.2021 से 31.03.2022 तक की अवधि में जनित फ्लाई ऐश यूटिलाईजेशन के संबंध में चाही गई जानकारी आपके द्वारा प्रदत्त प्रपत्र में भरकर सादर संलग्न कर प्रेषित की जा रही है।

ज्ञातव्य हो कि वित्तीय वर्ष 2021-22 (दिनांक 01.04.2021 से 31.03.2022 तक) की अवधि का वार्षिक विवरण पत्रक (Annual Return) हमारे पत्र क्र0. 2023/HPSL/2022-23/2023 **दिनांक** 05.05.2022 के माध्यम से आपके कार्यालय को प्रेषित की जा चुकी है, जिसकी छायाप्रति आपके सुलभ संदर्भ हेतु सादर संलग्न है।

सधन्यवाद

भवदीय,
वास्ते, हीरा पॉवर एण्ड स्टील्स लिमिटेड, यूनिट –II

अधिकृत हस्ताक्षरकर्ता

प्रतिलिपिः श्रीमान सदस्य सचिव, छ.ग. पर्यावरण संरक्षण मण्डल, नवा रायपुर अटलनगर, जिला–रायपुर (छ.ग.) को सूचनार्थ प्रेषित।

स्थापित कोल आधारित थर्मल पॉवर प्लांट उद्योगों से उत्पन्न फ्लाई ऐश की उपयोगिता की स्थिति के संबंध में जानकारी

(दिनांक 01.04.2021 से 31.03.2022 तक की अवधि का विवरण)

क्र0.	थर्मल पॉवर उद्योग का नाम एवं पता	क्षमता (मेगावॉट में)	उत्पन्न फ्लाई ऐश की मात्रा (दिन. 01.04.2021 से दिनांक 31.03.2022 तक की अवधि में)	सीमेंट प्लांट में प्रदाय	ईट निर्माण	भू–भराव	ऐश–डाईक हाईट/रैजिंग/ निर्माण	कृषि कार्य हेतु	खदान में भराव	अन्य (जिस प्रयोजन में फ्लाई ऐश का उपयोग किया गया है, उसकी संक्षिप्त जानकारी दें)	कुल	प्रतिशत उपयोग
01	हीरा पॉवर एण्ड स्टील्स् लिमिटेड, खसरा नं. 511/1, 512/2, उरला औद्योगिक क्षेत्र, रायपुर–492003 (छ.ग.)	20 MW	86299.51	0.00	86299.51	0.00	0.00	0.00	0.00	0.00	86299.51	100%
02												

HIRA POWER AND STEELS LTD.

HIRA POWER & STEELS

Ref: 2023/HPSL/2022-23/2023 Date: 05.05.2022

To,
The Regional Officer,
Regional Office,
Chhattisgarh Environment Conservation Board,
Commercial Complex, Chhattisgarh Housing Board Colony,
Kabir Nagar, Raipur (C.G.)

Sub: Fly ash utilization annual report / return for the financial year 2021 – 22

Respected Sir,

With reference to above cited subject, we are submitting herewith fly ash utilization annual report / return (Annexure – I) for the financial year 2021 - 22 **(April 1st 2021 to March 31st 2022)** for your ready reference and record, please.

Fly ash is being disposed off by us systematically & scientifically as per Fly Ash Notification dated 14th September, 1999 and its amendments by MoEF&CC.

Kindly acknowledge the receipt of the same.

Thanking You,

Yours faithfully,

For, **HIRA POWER AND STEELS LIMITED, UNIT – II**

Authorized Signatory

Encl: A/a

CC: 1. The Member Secretary, Chhattisgarh Environment Conservation Board, Paryavas Bhavan, North Block, Sector – 19, Atal Nagar, District - Raipur (C. G.) 492 002
2. The Regional Director, Central Pollution Control Board, 3rd Floor, Sahkar Bhawan, North TT Nagar, Bhopal -462003
3. The Scientist, Ministry of Environment, Forest and Climate Change, Integrated Regional Office, Aranya Bhawan, North Block, Sector-19, Atal Nagar, District - Raipur (C. G.) 492 002.

Annexure - I

HIRA POWER & STEELS LIMITED, (UNIT – II)

Khasra No. 511/1, 512/2, Urla Industrial Complex, Raipur (C.G.) – 492 003

FLY ASH GENERATION & UTILIZATION REPORT FOR THE FINANCIAL YEAR 2018-19 (April 1st 2021 to March 31th 2022)

Sr. No.	Month	Fly Ash Generation in the Month (MT)	Supply to the Cement Plant (MT)	Brick Manufacturing (MT)	Land Filling (MT)	Ash Dyke Raising / Construction (MT)	Agriculture (MT)	Mine Filling (MT)	Any Other Use (MT)	Total (MT)	Percentage (%)
4	Apr-21	7902.92	0.00	7902.92	0.00	0.00	0.00	0.00	0.00	7902.92	100.00
5	May-21	6081.49	0.00	6081.49	0.00	0.00	0.00	0.00	0.00	6081.49	100.00
6	Jun-21	7728.42	0.00	7728.42	0.00	0.00	0.00	0.00	0.00	7728.42	100.00
7	Jul-21	7566.17	0.00	7566.17	0.00	0.00	0.00	0.00	0.00	7566.17	100.00
8	Aug-21	7325.52	0.00	7325.52	0.00	0.00	0.00	0.00	0.00	7325.52	100.00
9	Sep-21	8462.85	0.00	8462.85	0.00	0.00	0.00	0.00	0.00	8462.85	100.00
10	Oct-21	6384.26	0.00	6384.26	0.00	0.00	0.00	0.00	0.00	6384.26	100.00
11	Nov-21	5979.37	0.00	5979.37	0.00	0.00	0.00	0.00	0.00	5979.37	100.00
12	Dec-21	8353.28	0.00	8353.28	0.00	0.00	0.00	0.00	0.00	8353.28	100.00
13	Jan-22	7442.96	0.00	7442.96	0.00	0.00	0.00	0.00	0.00	7442.96	100.00
14	Feb-22	6605.83	0.00	6605.83	0.00	0.00	0.00	0.00	0.00	6605.83	100.00
15	Mar-22	6466.44	0.00	6466.44	0.00	0.00	0.00	0.00	0.00	6466.44	100.00
Total		**86299.51**	**0.00**	**86299.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**86299.51**	86299.51

Annexure-IV

HIRA

HIRA POWER & STEELS

Ref: 2014/HPSL/2022-23/2014 Date: 22.04.2022

To,

The Regional Officer,
Regional Office,
Chhattisgarh Environment Conservation Board,
Commercial Complex, Chhattisgarh Housing Board Colony,
Kabir Nagar, Raipur (C.G.)

Sub: Submission of Hazardous Waste Annual Return (Form - 4) for the financial year 2021 -22.

Ref:

1. Authorization No. 340/HO/HSMD/CECB/ATAL NAGAR, RAIPUR Dated: 21.07.2020
2. Authorization granted vide letter No. 3641/HSMD/HO/CECB/2020 Dated: 21.07.2020

Respected Sir,

Please find enclosed herewith Hazardous Waste Annual Return in Form – 4 as prescribed under the Hazardous and other Waste (Management and Transboundary Movement) Rules, 2016 for the financial year 2021-22 in respect of Hira Power & Steels Limited, Unit – II.

This is for your kind information and record, please.

Kindly acknowledge the receipt of the same.

Thanking You,

Yours faithfully,
For, **HIRA POWER & STEELS LIMITED, UNIT - II**

Authorized Signatory

Encl: A/a

CC: The Member Secretary, Chhattisgarh Environment Conservation Board, Paryavas Bhawan, North Block, Sector – 19, Atal Nagar, Dist. - Raipur (C.G.) – 492 002

FORM 4

[See rules 6(5), 13(8), 16(6) and 20 (2)]

FORM FOR FILING ANNUAL RETURNS

[To be submitted to State Pollution Control Board by 30th day of June of every year for the preceding period April to March]

1.	Name and address of facility :	Hira Power & Steels Limited, Unit-II Urla Industrial Complex, Dist. : Raipur (C.G.)
2	Authorization No. and Date of issue :	3641/HSMD/HO/CECB/2020 Dated. 21.07.2020
3	Name of the authorized person and full address with telephone, fax number and e-mail:	Shri D.P.Singh Hira Power & Steels Limited, Unit-II Khasra No. 511/1, 512/2, Urla Industrial Complex, Raipur (C.G.) P: +91 771 4082500, 4082600 Fax : +91 771 4082501
4	Production during the year (product wise), wherever applicable.	Ferro Alloys : 47934.738 Metric Tonnes Captive Power Plant : 170028614 KWH

Part A. To be filled by hazardous waste generators

1.	Total quantity of waste generated category wise.	Used / Spent Oil (5.1)	2.400 KL.
		Spent Ion Exchange resin containing toxic metals (35.2)	Nil
2.	Quantity dispatched (i) To disposal facility (ii) To recycler or pre-processors. (iii) Others.	N.A.	
3.	Quantity utilized in-house, if any -	Used /Spent Oil (5.1)	2.400 KL (For manufacturing of copper pad, heating ladle & machinery lubrication)
		Spent Ion Exchange resin containing toxic metals (35.2)	NIL (Spent ion exchange resin mixed with coal & used as supplementary energy resource in boiler for stream or power generation.)
4.	1. Quantity in storage at the end of the year-	Used /Spent Oil (5.1)	Nil
		Spent Ion Exchange resin containing toxic metals (35.2)	Nil

Part B. To be filled by Treatment, storage and disposal facility operators

1	Total quantity received -	N.A.
2	Quantity in stock at the beginning of the year –	N.A.
3	Quantity treated –	N.A.
4	Quantity disposed in landfills as such and after treatment –	N.A.
5	Quantity incinerated (if applicable)-	N.A.
6	Quantity processed other than specified above –	N.A.
7	Quantity in storage at the end of the year -	N.A.

Part C. To be filled by recyclers or co-processors or other users

1	Quantity of waste received during the year (1) Domestic sources (2) Imported (if applicable)	N.A.
2	Quantity in stock at the beginning of the year –	N.A.
3	Quantity recycled or co-processed or used –	N.A.
4	Quantity of products dispatched (whenever applicable)-	N.A.
5	Quantity of waste generated –	N.A.
6	Quantity of waste disposed –	N.A.
7	Quantity re-exported (wherever applicable)-	N.A.
8	Quantity in storage at the end of the year -	N.A.

Signature of the Occupier or
Operator of the disposal facility

Date : 22.04.2022

Place : Raipur

Annexure-V

राष्ट्रीय प्रौद्योगिकी संस्थान रायपुर
(राष्ट्रीय महत्व का संस्थान)

National Institute of Technology Raipur
(An Institution of National Importance)

Department of Civil Engineering

No. NITRR /Civil /Consultancy/ 2021/ 197 Raipur, Dated: 11.11.2021

To,

HIRA Power & Steel Ltd., Unit II
Urla Industrial Complex
Raipur (Chhattisgarh) - 492003

Subject: Submission of Report "Planning and Designing for Rain Water Harvesting System in the Industry"

Reference: 1. Service Order No. No. 7200003266/P101; Dated 19.06.2021
2 Tax Invoice No. NITRR/Civil/1981; Dated 09.07.2021

****

Sir,

With reference the **planning and Designing for Rain Water Harvesting System in the premises of industry as mentioned above, 01 copy of the detailed report is hereby submitted, inclusive of following items:** :

1. Site visit & field observation details
2. Location map of site
3. Rainfall analysis
4. Runoff assessment
5. Adequacy of drainage provided
6. Rain water harvesting system and Identification of artificial recharge zone for groundwater recharge
7. Recommendations

Prepared By:

10/11/2021

(Dr. Ishtiyaq Ahmad)
Assistant Professor
Civil Engineering Dept.
N.I.T. Raipur

10/11/2021

(Dr. Manikant Verma)
Assistant Professor
Civil Engineering Dept.
N.I.T. Raipur

Dr. D. C. Jhariya
Assistant Professor
Applied Geology Dept.
N.I.T. Raipur

Forwarded by:

11.11.21

Head, Civil Engg Dept.
N.I.T. Raipur

G.E. ROAD, RAIPUR (Chhattisgarh) 492 010
☎ : 0771-4270336; 2255920 (Dept); 🖷: 2255261; URL: www.nitrr.ac.in

REPORT

Planning And Designing for Rainwater Harvesting System in Hira Power & Steels Ltd., Unit-2, Urla (Raipur)

(Service Order No. 7200003266/P101; Dated 19.06.2021)

Submitted by:

Dr. Ishtiyaq Ahmad

Dr. Mani Kant Verma

Dr. D. C. Jhariya

National Institute of Technology Raipur

Chhattisgarh – 492010

TABLE OF CONTENT

1. SITE VISIT & FIELD OBSERVATIONS:

The site was visited by Dr. Ishtiyaq Ahmad, Dr. Mani Kant Verma [Asstt Prof., Dept. of Civil Engg. NIT Raipur] & Dr. D. C. Jhariya [Asstt Prof., Dept. of Applied Geology, NIT Raipur] along with HIRA Group Officials on **25th June 2021**. The observations and photographs of the important locations were taken during preliminary site visitfor necessary actions. After the preliminary site visit, topographic survey has been performed on the site for obtaining elevation and checking the suitability of the drainage structure provided. The topographic survey was performed using advanced surveying instruments like Differential Global Positioning System (DGPS) & Total Station. The field survey and hydrogeological survey was performed over the site to obtain necessary primary data for further advancement.

Fig. 1. Site visit by officials

Fig. 2. Survey performed on site with various instruments

Following dataset was provided by HIRA group after the visit:

1. Working/surface plan of HIRA Power & Steels Ltd.
2. Bore well detail.
3. Water logging points within the site.

2. OBJECTIVE OF STUDY:

The scope for scientific study on "Planning and Designing for Rainwater Harvesting System in Hira Power & Steels Ltd., Unit-2, Urla (Raipur)" are as follows:

1. Rainfall data assessment with its future trend.
2. Survey of the plant for existing drainage.
3. Survey of the plant for rooftop area estimation.
4. Survey for the slope identification/ flow path.
5. Identification of suitable site for ground water recharge.
6. Identification of rooftop slope/ drainage path draining to the existing drainage system and the section which is not draining to an existing system.
7. Hydrogeological study for identifying suitable site for ground water recharging.
8. Estimation of rainfall and runoff amount with various parts of the year.
9. Design and drawing of rainwater harvesting structures.
10. Feasibility study of rain water harvesting system.

3. LOCATION OF SITE:

The HIRA Power & Steels Ltd. is located in Urla Industrial Complex, Urla, District: Raipur of Chhattisgarh state between latitudes 21°18'52.9236"N to 21°19'18.3828"N and longitudes 81°37'0.2676"E to 81°37'19.4412"E. The location map is shown below as **Fig. 3.** The entire area within the plant has been categorized into various classes based on land use land cover as per the current condition and computed using Google Earth and GIS platform by taking the reference of plant layout provided in the form of AutoCAD drawing. Boundary map is shown in **Fig. 4** & details are given in **Table 1** and **2.**

Table 1. Categorized area within plant into various classes

S. No.	Description of area	Area (In hectares)	Area (%)
1	Roofs	6.21	35.29
2	Pavement (Concrete)	5.43	30.86
3	General unimproved lands	3.56	20.22
4	Parks	0.25	1.42
5	Woodlands with sandy soils	2.15	12.21
	Total =	17.60	100.00

Table 2. Land use around the proposed drainage network

S. No.	Description of area	Area (in hectares)	Area (%)
1	General unimproved lands	3.40	19.31
2	Pavement (Concrete)	1.18	6.70

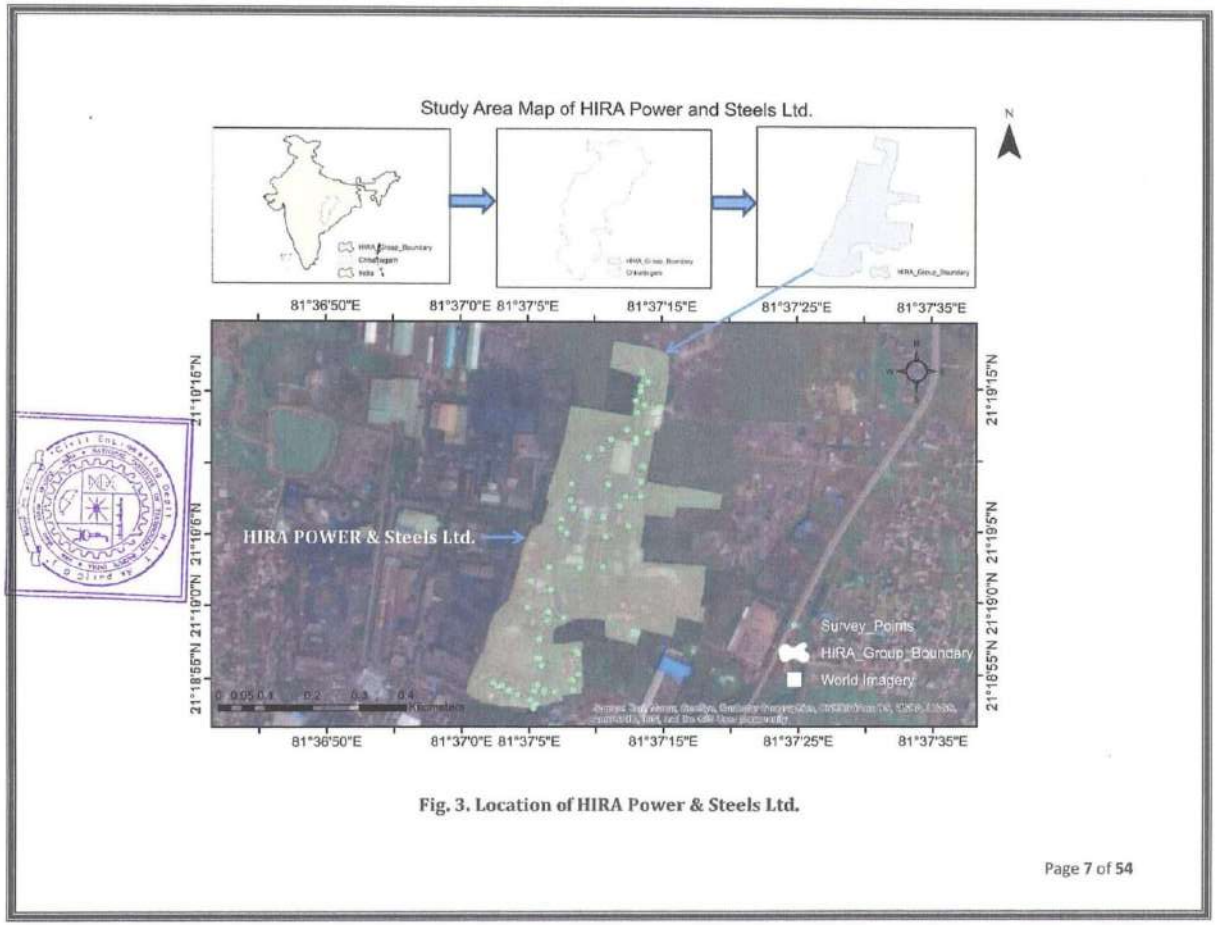


Fig. 3. Location of HIRA Power & Steels Ltd.

Fig. 4. Boundary map of HIRA Power & Steels Ltd

4. RAINFALL ANALYSIS:

The daily rainfall data was obtained from Indian Meteorological Department (IMD) gridded data for the period of 1901 to 2017. The monsoon sets in the month of June and continues till October. The graph in **Fig. 5** represents the plot of annual rainfall (mm) for last 117 years. The graph in **Fig.6** represents the plot of annual daily maximum rainfall (mm) for last 30 years. The graph in **Fig.7** represents the plot of annual 5-day maximum rainfall (mm) for last 30 years.The study area is receiving maximum rainfall during monsoon season with mean annual rainfall of **1385.83 mm. Fig. 8 and Fig. 9** are the drainage catchment area and contour map of the plant. **Fig. 10** represents proposed drainage network, proposed water treatment plant (WTP) location and proposed probable ground water recharging (GWR) locations.

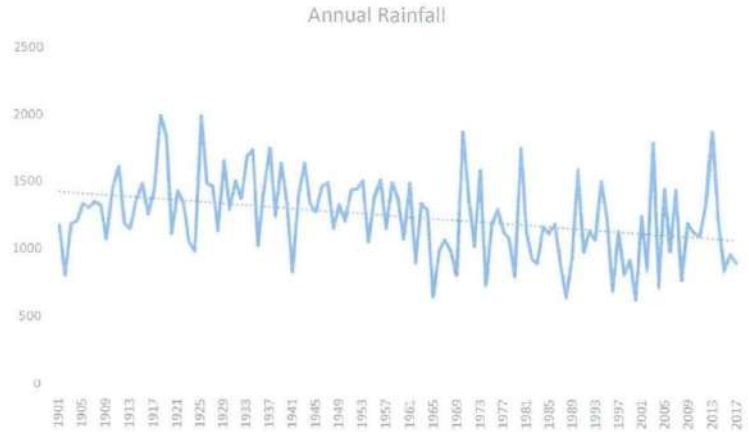


Fig. 5. Plot of Annual rainfall (mm) and Trend for last 117 years

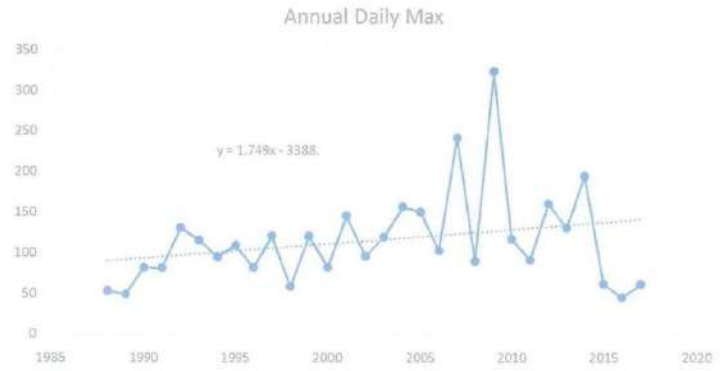


Fig.6. Plot of Annual daily maximum rainfall (mm) and Trend for last 30 years

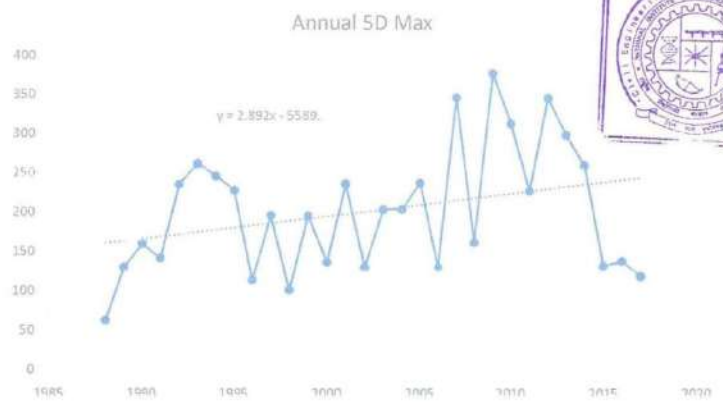


Fig.7. Plot of Annual 5-Day maximum rainfall (mm) and Trend for last 30 years

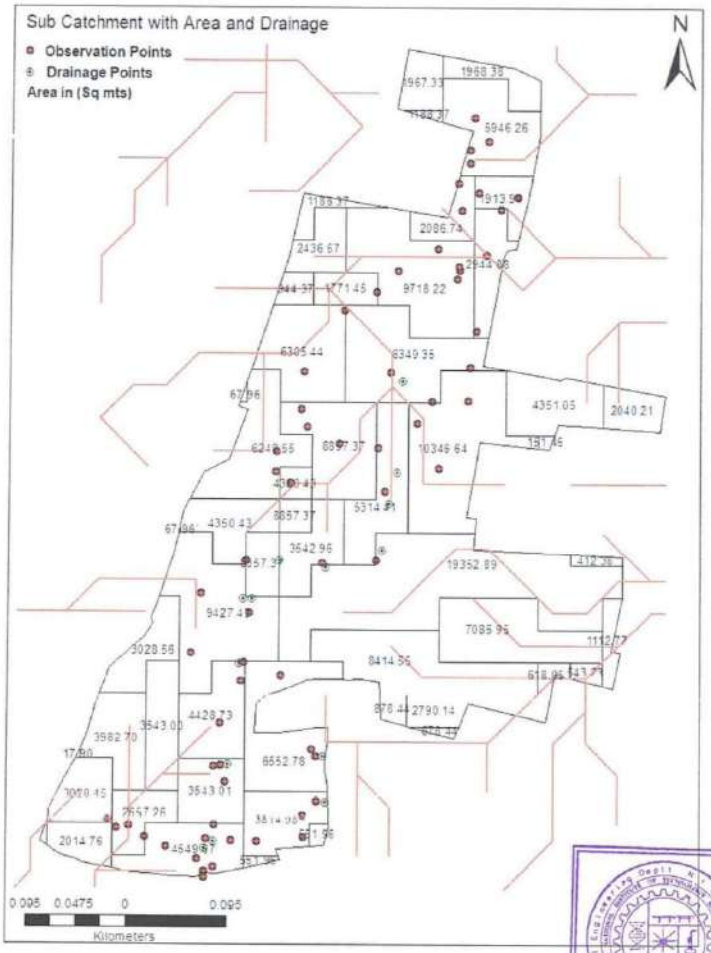


Fig. 8. Drainage catchment area

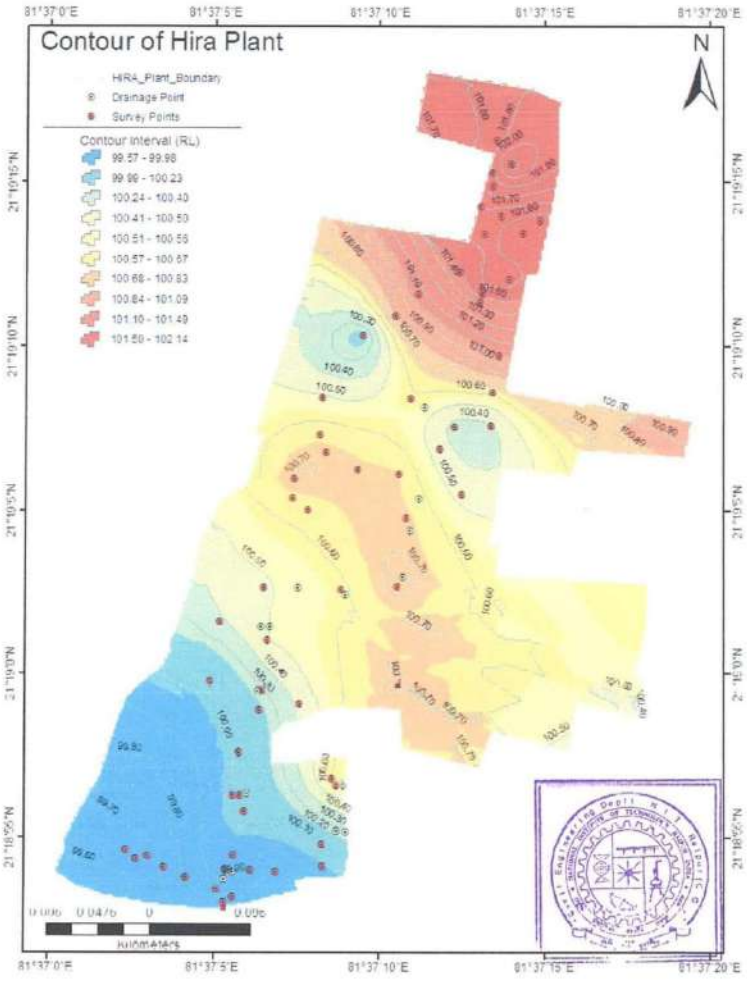


Fig.9. Contour map of Hira Plant

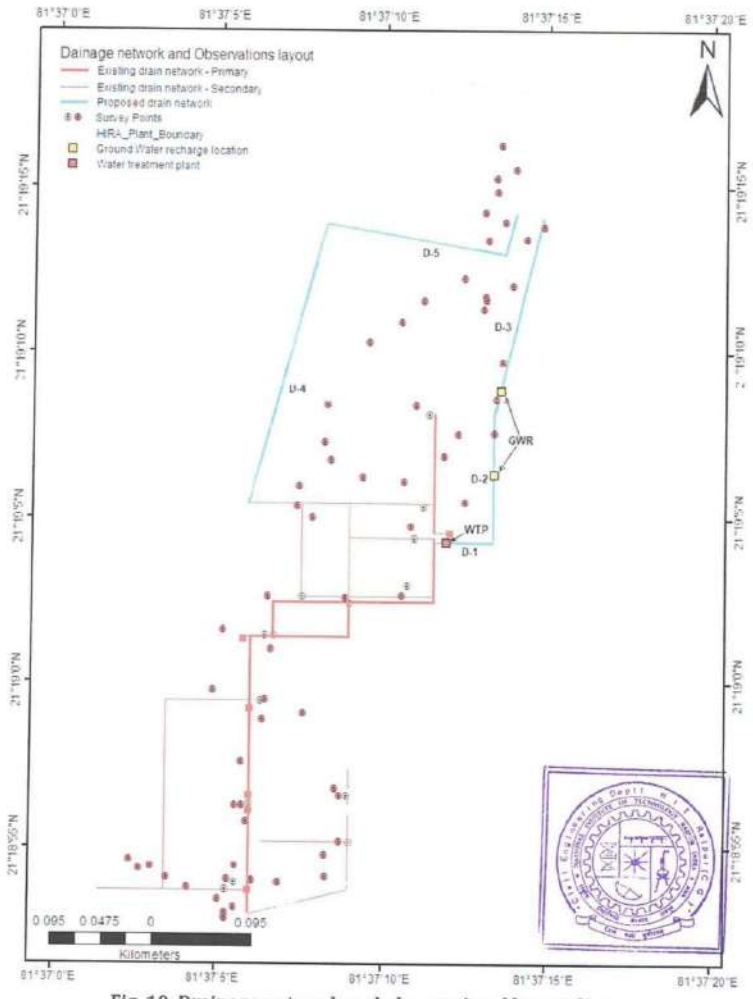


Fig. 10. Drainage network and observational layout diagram

5. RUNOFF ASSESSMENT:

Potential amount of runoff is computed by using rational formula. The runoff is computed using following equation

$$Q = 0.028 * P * A * I_c$$

Where,

Q = max- runoff in m^3/s;
P = co-efficient of runoff for the catchment characteristics;
A = area of catchment in hectares;
I_c = critical intensity of rainfall in cm/hour.

The principal factors governing P are: (i) porosity of the soil, (ii) area, shape and size of the catchment, (iii) vegetation cover, (iv) surface storage viz. existence of lakes and marshes, and (v) initial state of wetness of the soil. Catchments vary so much with regard to these characteristics that it is evidently impossible to do more than generalize on the values of P. Judgment and experience must be used in fixing P.

Table 3: Maximum value of P in the formula $Q = 0.028 * P * A * I_c$

Steep, bare rock and also city pavements	0.90
Rock, steep but wooded	0.80
Plateaus, lightly covered	0.70
Clayey soils, stiff and bare	0.60
lightly covered	0.50
Loam, lightly cultivated or covered	0.40
largely cultivated	0.30
Sandy soil, light growth	0.20
covered, heavy brush	0.10

Based on the catchment characteristics, the value of P is taken respectively.

Table 4: Based on categorization of area within plant value of P is taken as shown

S. No.	Description of area	Value of P	Area (in hectares)	Area (%)
1	Roofs	0.95	6.21	35.29
2	Pavement (Concrete)	0.95	5.43	30.86
3	General unimproved lands	0.4	3.56	20.22
4	Parks	0.25	0.25	1.42
5	Woodlands with sandy soils	0.15	2.15	12.21
		Total =	17.60	100.00

Intensity of rainfall is determined using the equation,

$$i = \frac{KT^x}{(D+a)^n}$$

Where,

i = maximum intensity (cm/h);

T = return period (years);

D = duration (hours);

K, x, a and n are coefficients for the area represented by the station.

Rambabu et al. (1979) have analyzed the self-recording rain gauge rainfall records of 42 stations in the country and have obtained the values of coefficients K, x, a and n. For the central zone of India and with reference to nearest of study area the values are taken as:

K= 11.45, x= 0.156, a=1.25, n=1.032.

Hence the equation gets reduced to:

$$I = \frac{11.45 * T^{0.156}}{(D+1.25)^{1.032}}$$

Determining the critical rainfall intensity for 50 years return period and 24 hours duration using above equation:

$$i = \frac{11.45 * 50^{0.156}}{(3 + 1.25)^{1.032}}$$
$$i = 4.74\ cm/h$$

Taking factor of safety and peak flow conditions into consideration, the value for critical intensity of rainfall $\mathbf{i_c}$ is taken as **5 cm/h.** From IDF curve the maximum intensity of rainfall for 50 years return period is obtained as **6 cm/h.** Therefore, the maximum hourly rainfall is taken as **6 cm/h** and maxima daily rainfall from historical record length is taken as **180 mm/day** for the analysis in the present study.

Thus, runoff generated for different catchments are mentioned as below:

Table.5 Runoff generated for the area categorized within the plant for proposed drainage network

Proposed Drain	Drain Catchment Area (hectare)	Value of P	Intensity of rainfall (cm/h)	Runoff, Q (m^3/s)
D-1	0.2540	0.4	6	0.0170
D-2	0.7806	0.4	6	0.0527
D-3	0.4859	0.4	6	0.0326
D-4	1.8892	0.4	6	0.1269
D-5	1.1804	0.95	6	0.1884
			Total runoff generated=	**0.4176**

6. ADEQUACY OF DRAIN PROVIDED:

In order to cater the drainage of rain water or water accumulated in the site from this categorized area, a series of drains and settling pits have been provided in the plant.

The drain size and its capacity provided to carry out water from each categorized area are mentioned in **Fig.11** and **Table 6** as:

Table. 6 Runoff generated for each catchment

S. No.	Proposed Drain	Depth (m)	Width (m)	Slope	Area (sq. m.)	Perimeter (m)	Hydraulic Mean Depth (m)	Velocity (m/s)	Drain Capacity (m^3/s)
1.	D-1	1.0	0.50	1:944	0.5	2.5	0.2	0.3180	0.1590
2.	D-2	1.0	0.50	1:968	0.5	2.5	0.2	0.3140	0.1570
3.	D-3	1.0	0.50	1:1025	0.5	2.5	0.2	0.3052	0.1526
4.	D-4	1.0	0.50	1:540	0.5	2.5	0.2	0.4204	0.2102
5.	D-5	1.0	0.50	1:654	0.5	2.5	0.2	0.3821	0.1910

Now comparing the runoff generated for each catchment with respect to the drain capacity provided for conveying the water in the form of drain for each categorized area to check its adequacy in the **Table 7** below:

Table. 7 Adequacy of garland drain provided

Proposed Drain	Runoff Generated, Q (m^3/s)	Drain Capacity (m^3/s)	Check (Drain Capacity > Runoff generated)	Status of Garland Drain Provided
D-1	0.0170	0.1590	Yes	adequate
D-2	0.0527	0.1570	Yes	adequate
D-3	0.0326	0.1526	Yes	adequate
D-4	0.1269	0.2102	Yes	adequate
D-5	0.1884	0.1910	Yes	adequate

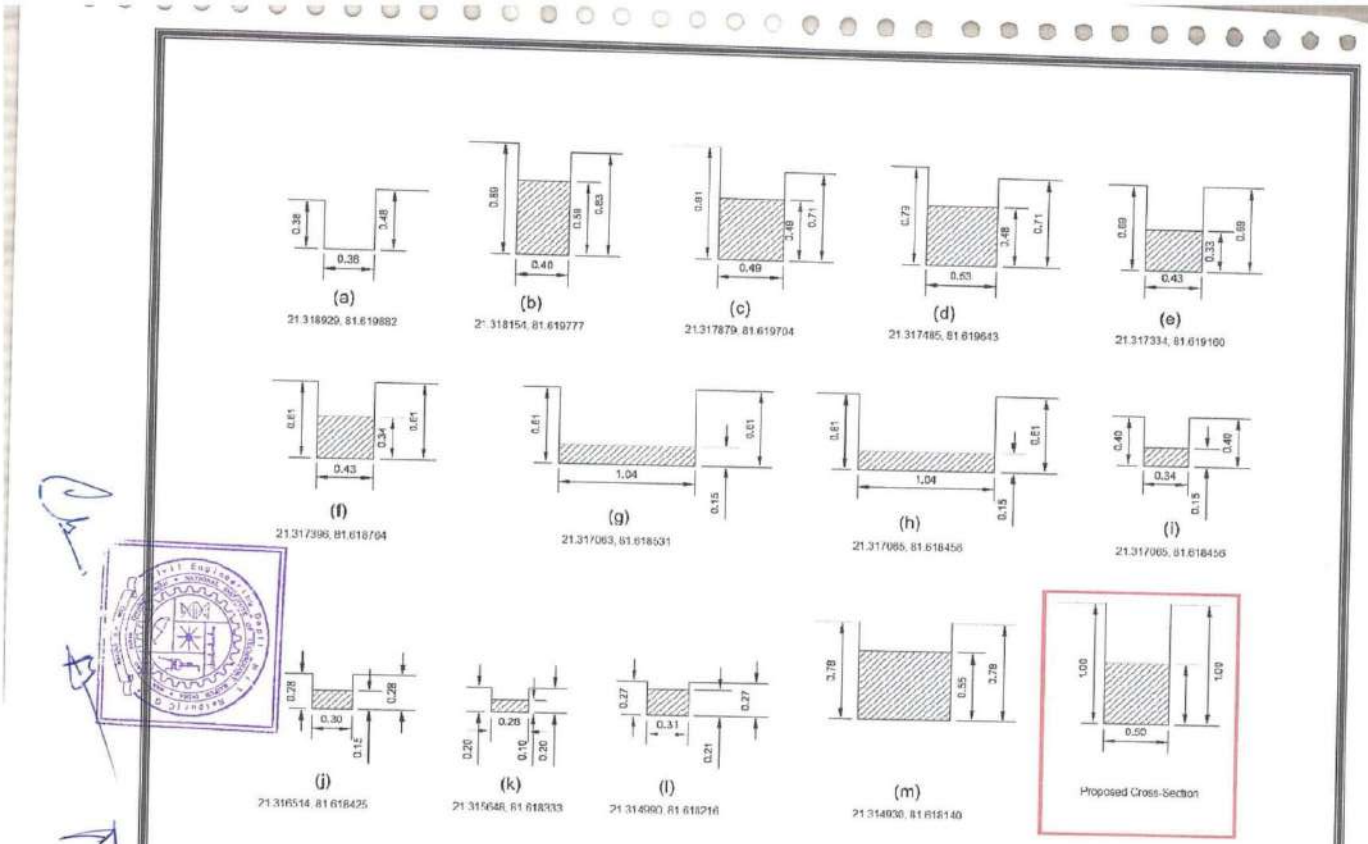


Fig.11. Cross-section of drain provided for each catchment to carry water

7. RAIN WATER HARVESTING SYSTEM AND IDENTIFICATION OF ARTIFICIAL RECHARGE ZONE FOR GROUNDWATER RECHARGE

The term artificial recharge refers to the transfer of surface water to the aquifer by human interference. Artificial recharge provides sustainability to groundwater by restoring supplies to aquifers depleted due to excessive draft and to enhance recharge to the aquifers lacking adequate natural recharge both in space and time. The natural process of recharging the aquifers is accelerated through percolation of stored or flowing surface water otherwise not percolating into the aquifers. Selection of cost-effective and efficient recharge techniques at suitable locations should be the main thrust along with the emphasis on optimum utilization of available hydrological resources in the area through multi-disciplinary scientific investigations.

The continuous decline of groundwater level in the phreatic aquifers in urban areas is of greater concern. As a management measure, further construction of abstraction structures tapping phreatic aquifer should be discouraged and suitable measures should be taken to check the future decline of the water table by implementing suitable artificial recharge scheme on an extensive scale. Adoption of water conservation practices and designing of artificial recharge and rainwater harvesting structures requires enormous scientific inputs for providing an appropriate solution with suitably designed successful water conservation and recharge structures to have a sustainable water supply for future.

Study was undertaken to estimate the rainwater harvesting potential and to ascertain the feasibility of ground water recharge and identification of suitable recharge.

Purpose and Scope:

The Scope of the work included the following:

Feasibility study of groundwater harvesting system for of suitable rainwater harvesting and groundwater recharge system.

Geophysical Investigation:

Geophysical surveys are non-destructive methods that provide subsurface hydrogeological information beneath the earth surface to identify suitable location for deciding proper structure/ design for rainwater harvesting. The investigation was conducted. Total 7 Schlumberger Vertical Electrical Sounding (VES) were conducted at different locations in the premises of study area. Sounding locations are shown in figure.

Fig.12.Sounding locations RS-1 to RS-7

Table 8: Survey point coordinates.

S. No.	Survey Traverse	Coordinates	
		Latitude	Longitude
1	VES1	21.317383	81.618811
2	VES2	21.317369	81.618816
3	VES3	21.317369	81.618876
4	VES4	21.317712	81.618718
5	VES5	21.318465	81.619957
6	VES6	21.318447	81.619971
7	VES7	21.32099	81.621713

Fig.13.Field work photo.

Electrical Resistivity Survey has been carried out at proper places in the study area using the Resistivity meter. Data sets were obtained with the use of the Resistivity meter and the values of the apparent resistivity and the current electrode spacing (AB/2), partial curve matching has been carried out using the standard and the auxiliary curves. The computer interpretation is also carried out on the obtained data using the IPI2WIN software. This software is helpful in interpretation of geophysical data to know the subsurface layer, thicknesses of each layer and the number of layers. In this study about 07 number of Vertical Electrical Sounding has been carried out at suitable places in the study area.

The electrical resistivity method is a useful geophysical tool provides information about the near-surface structures. The Electrical Resistivity method is used to provide reliable information about the subsurface layers. Electrical Profiling (PR) can also be used to determine the aquifer depth, aquifer geometry hydraulic conductivity, the water quality of the aquifer rock, and geological stratigraphy are reported by researchers (Chandra et al., 2008).

In this study, an attempt has been made to infer the fracture zone using the GD-10 Multi-Electrode Resistivity meter and CRM-500 resistivity meter.

Details of Instrumentation and surveying Method

GD-10 Multi-Electrode Resistivity Imaging System

GD-10 is developed based on the latest digital and analog circuitry technique, making it the world-leading multi-functional direct current (DC) method instrument. GD-10 Multi-Electrode Resistivity Imaging System is capable of conducting 2D/3D cross-section profiling of subsurface lithology. Through the array script management in Geomative Studio, we can predefine survey parameters before field surveys. GD-10 is equipped with both centralized cabling and a distributed cabling system to fulfill any complex field environment.

Fig 14.GD-10-multi-electrode resistivity imaging system.

Fig.15.Field survey photograph.

GD-10 generates a well-regulated current (I) to measure the resulting signals voltage ΔV between the two potential electrodes. It then calculates the apparent resistivity R= ΔV/I for the given spacing configuration. The resistivity obtained is the weighted average of all the formations' resistivity through which the current is passing. Apparent resistivity is expressed in Ohm-meter(Ω-m). The analysis of apparent resistivity variations as a function of current electrodes' spacing makes it possible to conclude subsurface geological conditions.

Results and discussions

In this study, four electrical resistivity imaging surveys PR1, PR2, PR3 and PR3 (**Tables10-13**) were carried out using GD-10 multi-Electrode resistivity imaging system to assess the subsurface geological conditions.

The location of survey points are given in **Fig. 15**and **Table 9**.

Table 9: Survey point coordinates.

S. No.	Survey Traverse	Coordinates	
		Latitude	Longitude
1	PR1	21.32099	81.621713
2	PR2	21.320995	81.621711
4	PR3	21.318863	81.621029
4	PR4	21.318447	81.619971

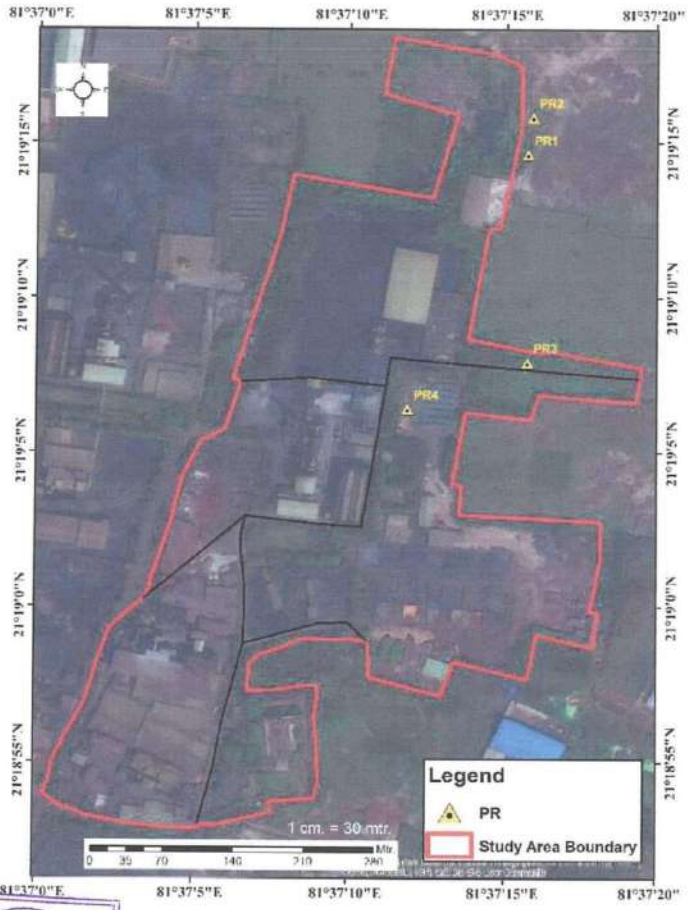


Fig 15.The location of survey points.

Profiling using the Wenner and Schlumberger method of maximum current electrodes spacing of 300 m.The layer parameters are obtained from the recorded field resistivity data using Res2DInv Aarhus GeoSoftware used to assess the subsurface geological heterogeneity are obtained from the recorded field resistivity data (PR). Results from **Figs. 16 - 19** suggest that there is an occurrence of hard rock. There is an occurrence of low resistive layers at the shallow depth and high in the deep.

There is an occurrence of very high resistive layers at a depth of 20 m and greater depth.

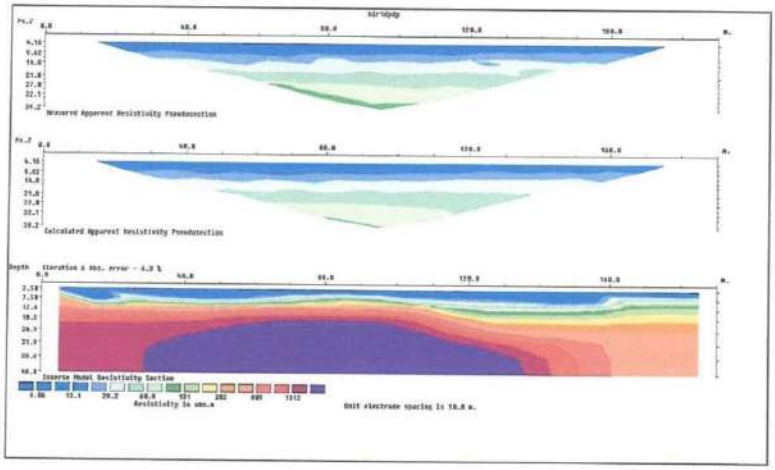


Fig 16.2D Subsurface heterogeneity.

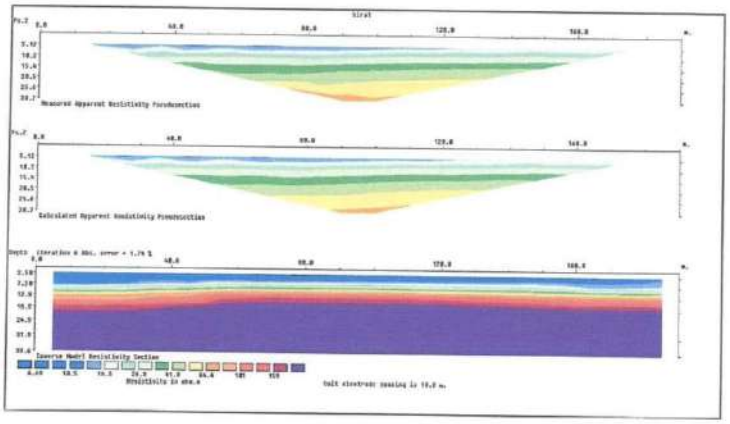


Fig 17.2D Subsurface heterogeneity.

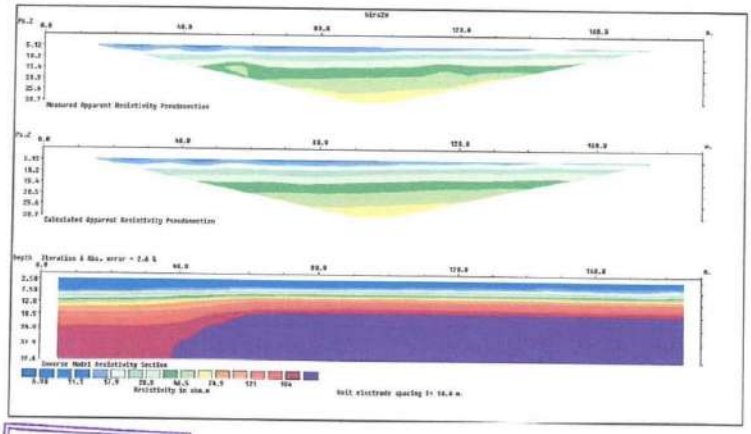


Fig 18. 2D Subsurface heterogeneity

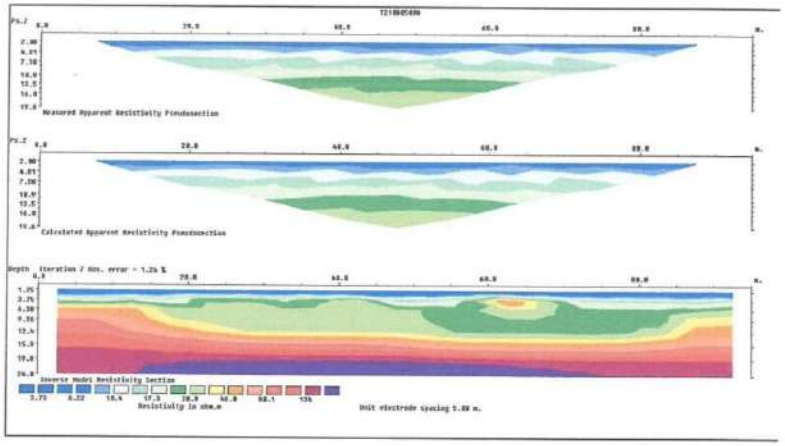


Fig 19. 2D Subsurface heterogeneity.

Table 10. Resistivity data PR-1

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
2	1	3	4	188.50	814.24	38.72	0.05	8.96	-416.13
2	1	4	5	753.98	785.02	18.95	0.02	18.20	284.08
2	1	5	6	1884.96	784.30	8.23	0.01	19.78	6.93
2	1	6	7	3769.91	783.37	5.30	0.01	25.50	-25.54
2	1	7	8	6597.34	782.71	4.73	0.01	39.86	140.34
2	1	8	9	10555.75	782.16	2.73	0.00	36.80	-85.04
3	1	10	12	5442.81	775.20	7.64	0.01	53.65	-241.70
3	1	12	14	10108.07	775.58	8.73	0.01	113.76	46.64
3	1	14	16	16846.79	775.68	5.34	0.01	115.96	-217.57
3	1	11	13	7539.82	775.84	6.10	0.01	59.27	-19.93
3	1	13	15	13194.69	776.05	6.27	0.01	106.69	-92.80
3	1	15	17	21111.50	776.08	5.02	0.01	136.51	-88.74
3	2	4	5	188.50	1039.25	68.72	0.07	12.47	282.77
3	2	5	6	753.98	1039.18	20.73	0.02	15.04	4.84
3	2	6	7	1884.96	1039.15	12.39	0.01	22.48	-22.52
3	2	7	8	3769.91	1039.13	6.98	0.01	25.32	132.15
3	2	8	9	6597.34	1039.13	5.00	0.00	31.73	-74.19
3	2	9	10	10555.75	1039.13	3.80	0.00	38.56	254.51
4	1	17	20	13795.08	410.34	2.98	0.01	100.20	-86.64
4	2	11	13	5442.81	548.61	5.24	0.01	51.94	-15.31
4	2	13	15	10108.07	558.12	3.66	0.01	66.30	-95.29
4	2	15	17	16846.79	550.85	2.60	0.00	79.43	-85.37
4	2	12	14	7539.82	548.52	4.04	0.01	55.52	36.49
4	2	14	16	13194.69	546.95	3.02	0.01	72.83	-212.23
4	2	16	18	21111.50	546.93	2.15	0.00	82.98	-93.87
4	3	5	6	188.50	589.80	26.67	0.05	8.53	3.07
4	3	6	7	753.98	590.37	11.77	0.02	15.03	-19.65
4	3	7	8	1884.96	589.70	5.84	0.01	18.66	124.62
4	3	8	9	3769.91	589.79	3.55	0.01	22.71	-63.91
4	3	9	10	6597.34	589.87	2.31	0.00	25.84	253.71
4	3	10	11	10555.75	590.22	1.81	0.00	32.34	-167.36
5	3	12	14	5442.81	1039.34	9.64	0.01	50.49	32.11
5	3	14	16	10108.07	1039.23	6.68	0.01	64.96	-210.44
5	3	16	18	16846.79	1039.20	4.99	0.00	80.84	-90.44
5	3	13	15	7539.82	1039.20	7.92	0.01	57.48	-96.60
5	3	15	17	13194.69	1039.21	5.85	0.01	74.32	-82.33
5	3	17	19	21111.50	1039.27	4.16	0.00	84.45	-66.68
5	4	6	7	188.50	581.62	32.97	0.06	10.69	-17.27

5	4	7	8	753.98	582.12	10.58	0.02	13.70	118.67
5	4	8	9	1884.96	581.67	5.76	0.01	18.66	-55.90
5	4	9	10	3769.91	581.74	3.90	0.01	25.28	252.76
5	4	10	11	6597.34	580.74	2.82	0.00	32.02	-170.16
5	4	11	12	10555.75	579.95	1.91	0.00	34.80	-63.95
6	4	13	15	5442.81	534.11	4.71	0.01	47.98	-96.94
6	4	15	17	10108.07	533.88	3.25	0.01	61.52	-81.06
6	4	17	19	16846.79	533.84	2.51	0.00	79.06	-65.18
6	4	14	16	7539.82	533.80	3.99	0.01	56.43	-209.11
6	4	16	18	13194.69	533.64	2.76	0.01	68.31	-85.33
6	4	18	20	21111.50	533.42	2.14	0.00	84.57	64.31
6	5	7	8	188.50	1039.19	42.45	0.04	7.70	113.72
6	5	8	9	753.98	1039.11	15.84	0.02	11.49	-48.84
6	5	9	10	1884.96	1039.09	8.91	0.01	16.16	251.84
6	5	10	11	3769.91	1039.09	5.94	0.01	21.54	-171.84
6	5	11	12	6597.34	1039.07	4.51	0.00	28.63	-60.30
6	5	12	13	10555.75	1039.07	3.24	0.00	32.96	53.36
7	5	14	16	5442.81	378.32	3.41	0.01	49.02	-208.76
7	5	16	18	10108.07	382.81	2.16	0.01	56.92	-82.41
7	5	18	20	16846.79	386.66	1.86	0.00	80.86	64.43
7	5	15	17	7539.82	389.04	2.94	0.01	56.96	-79.44
7	5	17	19	13194.69	391.50	1.99	0.01	66.92	-62.76
7	6	8	9	188.50	369.08	17.02	0.05	8.69	-43.84
7	6	9	10	753.98	370.87	6.68	0.02	13.59	250.87
7	6	10	11	1884.96	371.62	3.93	0.01	19.91	-172.63
7	6	11	12	3769.91	372.13	3.06	0.01	30.95	-58.00
7	6	12	13	6597.34	380.70	1.78	0.00	30.86	51.66
7	6	13	14	10555.75	383.86	1.40	0.00	38.47	-27.95
8	6	15	17	5442.81	762.86	7.01	0.01	50.02	-78.81
8	6	17	19	10108.07	764.15	4.75	0.01	62.85	-61.56
8	6	16	18	7539.82	764.71	5.74	0.01	56.57	-79.42
8	6	18	20	13194.69	765.19	3.82	0.00	65.79	64.49
8	7	9	10	188.50	289.84	12.47	0.04	8.11	250.43
8	7	10	11	753.98	292.67	5.12	0.02	13.20	-172.93
8	7	11	12	1884.96	293.48	2.86	0.01	18.36	-56.62
8	7	12	13	3769.91	295.34	1.93	0.01	24.64	50.63
8	7	13	14	6597.34	296.40	1.44	0.00	32.03	-27.85
8	7	14	15	10555.75	297.45	0.92	0.00	32.55	-69.21
9	7	16	18	5442.81	226.83	2.11	0.01	50.64	-77.23
9	7	18	20	10108.07	226.40	1.28	0.01	57.10	64.38
9	7	17	19	7539.82	226.13	1.51	0.01	50.35	-59.99

9	8	10	11	188.50	330.16	15.99	0.05	9.13	-173.05
9	8	11	12	753.98	330.49	6.59	0.02	15.03	-55.79
9	8	12	13	1884.96	330.44	3.46	0.01	19.72	49.92
9	8	13	14	3769.91	330.50	2.29	0.01	26.10	-27.79
9	8	14	15	6597.34	330.44	1.52	0.00	30.43	-69.41
9	8	15	16	10555.75	330.37	1.12	0.00	35.75	-140.34
10	8	17	19	5442.81	303.94	2.62	0.01	46.92	-59.26
10	8	18	20	7539.82	304.22	2.12	0.01	52.62	64.04
10	9	11	12	188.50	231.50	11.02	0.05	8.97	-55.02
10	9	12	13	753.98	231.57	4.27	0.02	13.91	49.24
10	9	13	14	1884.96	231.57	2.53	0.01	20.60	-27.58
10	9	14	15	3769.91	231.56	1.59	0.01	25.81	-69.72
10	9	15	16	6597.34	231.54	1.13	0.00	32.22	-140.48
10	9	16	17	10555.75	231.49	0.83	0.00	37.87	63.44
11	9	18	20	5442.81	389.40	3.07	0.01	42.85	64.12
11	10	12	13	188.50	352.97	16.51	0.05	8.82	48.83
11	10	13	14	753.98	353.36	6.85	0.02	14.61	-27.33
11	10	14	15	1884.96	353.32	3.59	0.01	19.16	-69.88
11	10	15	16	3769.91	353.62	2.64	0.01	28.11	-140.67
11	10	16	17	6597.34	353.72	1.47	0.00	27.40	64.03
11	10	17	18	10555.75	353.78	1.26	0.00	37.60	-136.64
12	11	13	14	188.50	199.80	11.18	0.06	10.54	-27.19
12	11	14	15	753.98	200.17	4.36	0.02	16.41	-70.05
12	11	15	16	1884.96	200.25	2.36	0.01	22.26	-140.84
12	11	16	17	3769.91	200.32	1.53	0.01	28.70	64.53
12	11	17	18	6597.34	200.38	0.91	0.00	30.02	-135.31
12	11	18	19	10555.75	200.41	0.93	0.00	48.79	78.81
13	12	14	15	188.50	146.38	8.39	0.06	10.80	-70.16
13	12	15	16	753.98	146.72	3.46	0.02	17.77	-140.94
13	12	16	17	1884.96	146.69	1.65	0.01	21.26	65.00
13	12	17	18	3769.91	146.83	1.09	0.01	27.97	-135.74
13	12	18	19	6597.34	146.86	0.65	0.00	29.38	78.68
13	12	19	20	10555.75	146.88	0.43	0.00	30.69	-15.03
14	13	15	16	188.50	291.88	19.83	0.07	12.81	-141.02
14	13	16	17	753.98	292.25	6.63	0.02	17.10	65.37
14	13	17	18	1884.96	292.33	3.72	0.01	23.97	-135.28
14	13	18	19	3769.91	292.35	2.10	0.01	27.13	78.68
14	13	19	20	6597.34	292.37	1.40	0.00	31.59	-15.02
15	14	16	17	188.50	447.27	26.22	0.06	11.05	65.80
15	14	17	18	753.98	448.62	10.00	0.02	16.81	-134.87
15	14	18	19	1884.96	448.68	5.31	0.01	22.29	78.65

15	14	19	20	3769.91	448.69	3.02	0.01	25.40	-15.27
16	15	17	18	188.50	769.12	49.96	0.06	12.24	-134.63
16	15	18	19	753.98	768.85	18.67	0.02	18.31	78.62
16	15	19	20	1884.96	769.07	9.35	0.01	22.93	-15.37
17	16	18	19	188.50	1039.50	67.39	0.06	12.22	78.68
17	16	19	20	753.98	1039.42	23.39	0.02	16.97	-15.45
18	17	19	20	188.50	1039.40	58.64	0.06	10.63	-15.48

Table 11: Resistivity data PR-2

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
1	4	2	3	62.83	409.26	97.74	0.24	15.01	41.82
1	7	3	5	125.66	280.58	52.59	0.19	23.55	-133.68
2	5	3	4	62.83	1039.62	206.22	0.20	12.46	-458.36
1	10	4	7	188.50	112.85	23.90	0.21	39.92	163.17
2	8	4	6	125.66	155.59	30.50	0.20	24.63	339.60
3	6	4	5	62.83	1039.56	255.13	0.25	15.42	166.77
1	13	5	9	251.33	139.18	24.62	0.18	44.45	193.07
2	11	5	8	188.50	134.29	25.37	0.19	35.61	55.95
3	9	5	7	125.66	174.75	35.05	0.20	25.21	124.76
4	7	5	6	62.83	236.69	45.74	0.19	12.14	37.92
1	16	6	11	314.16	775.86	162.10	0.21	65.64	-122.92
2	14	6	10	251.33	177.55	32.13	0.18	45.48	139.26
3	12	6	9	188.50	100.70	19.31	0.19	36.14	16.07
4	10	6	8	125.66	104.78	21.32	0.20	25.57	66.73
5	8	6	7	62.83	157.95	35.65	0.23	14.18	12.28
1	19	7	13	376.99	774.86	152.01	0.20	73.96	31.89
2	17	7	12	314.16	1039.56	183.68	0.18	55.51	-191.00
3	15	7	11	251.33	217.99	39.90	0.18	46.00	17.86
4	13	7	10	188.50	126.64	24.18	0.19	35.98	20.77
5	11	7	9	125.66	130.22	27.06	0.20	24.96	17.24
6	9	7	8	62.83	169.53	33.70	0.20	12.49	-39.02
2	20	8	14	376.99	1039.59	183.25	0.18	66.45	103.95
3	18	8	13	314.16	1039.62	191.48	0.18	57.86	70.55
4	16	8	12	251.33	611.69	116.87	0.19	48.02	-76.46
5	14	8	11	188.50	180.84	36.10	0.20	37.63	-82.00
6	12	8	10	125.66	98.98	19.42	0.20	24.66	82.36
7	10	8	9	62.83	93.50	19.70	0.21	13.24	-35.35
4	19	9	14	314.16	622.28	119.39	0.19	60.27	-117.04
5	17	9	13	251.33	1039.63	204.47	0.20	49.43	19.63

3	9	5	7	125.66	454.21	90.99	0.20	25.17	-43.99
4	7	5	6	62.83	241.00	46.31	0.19	12.07	-176.47
1	16	6	11	314.16	780.15	155.98	0.20	62.81	329.64
2	14	6	10	251.33	754.03	139.58	0.19	46.52	442.49
3	12	6	9	188.50	209.39	41.53	0.20	37.39	171.73
4	10	6	8	125.66	256.53	53.02	0.21	25.97	289.08
5	8	6	7	62.83	808.20	195.33	0.24	15.19	-13.53
1	19	7	13	376.99	776.34	145.01	0.19	70.42	241.78
2	17	7	12	314.16	1039.24	183.65	0.18	55.52	108.77
3	15	7	11	251.33	734.92	136.76	0.19	46.77	275.36
4	13	7	10	188.50	248.76	48.16	0.19	36.50	339.41
5	11	7	9	125.66	1038.88	206.88	0.20	25.02	129.59
6	9	7	8	62.83	421.84	85.00	0.20	12.66	247.44
2	20	8	14	376.99	1039.26	183.17	0.18	66.44	-29.76
3	18	8	13	314.16	1039.30	190.48	0.18	57.58	-72.08
4	16	8	12	251.33	602.80	115.28	0.19	48.06	-123.04
5	14	8	11	188.50	807.63	164.42	0.20	38.37	5.18
6	12	8	10	125.66	202.58	40.70	0.20	25.25	111.51
7	10	8	9	62.83	204.33	43.00	0.21	13.22	-123.00
4	19	9	14	314.16	611.17	117.03	0.19	60.16	74.98
5	17	9	13	251.33	1039.38	204.65	0.20	49.48	74.21
6	15	9	12	188.50	654.11	133.12	0.20	38.36	-56.11
7	13	9	11	125.66	199.20	40.53	0.20	25.57	131.95
8	11	9	10	62.83	642.03	135.80	0.21	13.29	210.03
5	20	10	15	314.16	1039.37	205.51	0.20	62.12	-225.03
6	18	10	14	251.33	1039.12	209.76	0.20	50.73	-114.94
7	16	10	13	188.50	389.77	80.98	0.21	39.16	-167.32
8	14	10	12	125.66	488.31	105.59	0.22	27.17	-235.88
9	12	10	11	62.83	150.90	32.92	0.22	13.71	-97.06
7	19	11	15	251.33	394.29	81.67	0.21	52.06	-101.74
8	17	11	14	188.50	768.00	184.57	0.24	45.30	-32.44
9	15	11	13	125.66	307.06	69.57	0.23	28.47	-62.51
10	13	11	12	62.83	210.76	50.44	0.24	15.04	-178.92
8	20	12	16	251.33	796.69	200.68	0.25	63.31	-402.42
9	18	12	15	188.50	462.49	101.64	0.22	41.42	28.65
10	16	12	14	125.66	410.90	94.05	0.23	28.76	177.37
11	14	12	13	62.83	625.41	148.82	0.24	14.95	64.99
10	19	13	16	188.50	414.76	94.64	0.23	43.01	-711.70
11	17	13	15	125.66	1038.92	234.30	0.23	28.34	-37.00
12	15	13	14	62.83	171.77	45.66	0.27	16.70	24.57
11	20	14	17	188.50	1038.91	234.07	0.23	42.47	-535.79

6	15	9	12	188.50	210.32	43.26	0.21	38.77	-233.65
7	13	9	11	125.66	110.06	22.50	0.20	25.69	0.35
8	11	9	10	62.83	74.68	15.56	0.21	13.09	17.92
5	20	10	15	314.16	1039.63	206.28	0.20	62.33	-302.53
6	18	10	14	251.33	1039.37	209.32	0.20	50.62	-15.85
7	16	10	13	188.50	381.69	80.10	0.21	39.56	-148.20
8	14	10	12	125.66	86.56	18.73	0.22	27.20	-178.42
9	12	10	11	62.83	65.18	14.32	0.22	13.80	-131.11
7	19	11	15	251.33	391.53	81.84	0.21	52.54	-54.43
8	17	11	14	188.50	158.61	34.66	0.22	41.19	-38.30
9	15	11	13	125.66	99.79	22.54	0.23	28.38	17.24
10	13	11	12	62.83	69.73	16.72	0.24	15.06	-223.24
8	20	12	16	251.33	158.98	33.88	0.21	53.57	-124.02
9	18	12	15	188.50	175.60	39.39	0.22	42.28	-90.68
10	16	12	14	125.66	123.22	28.12	0.23	28.68	180.35
11	14	12	13	62.83	79.78	19.53	0.24	15.38	59.62
10	19	13	16	188.50	123.56	28.34	0.23	43.24	-473.53
11	17	13	15	125.66	137.95	31.90	0.23	29.05	-104.96
12	15	13	14	62.83	70.22	18.32	0.26	16.39	-72.07
11	20	14	17	188.50	137.74	32.22	0.23	44.09	-244.71
12	18	14	16	125.66	100.85	24.01	0.24	29.92	-308.31
13	16	14	15	62.83	153.90	40.10	0.26	16.37	-240.28
13	19	15	17	125.66	154.51	37.78	0.24	30.72	15.77
14	17	15	16	62.83	183.60	51.61	0.28	17.66	-328.50
14	20	16	18	125.66	183.51	44.81	0.24	30.69	-113.85
15	18	16	17	62.83	220.00	60.29	0.27	17.22	53.69
16	19	17	18	62.83	1039.61	282.65	0.27	17.08	-571.86
17	20	18	19	62.83	1039.54	292.73	0.28	17.69	-247.40

Table 12: Resistivity data PR-3

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
1	4	2	3	62.83	408.53	97.63	0.24	15.01	162.60
1	7	3	5	125.66	288.80	54.61	0.19	23.76	-138.59
2	5	3	4	62.83	1039.23	206.14	0.20	12.46	-564.44
1	10	4	7	188.50	310.27	62.08	0.20	37.71	15.70
2	8	4	6	125.66	781.15	150.37	0.19	24.19	323.21
3	6	4	5	62.83	1039.15	255.04	0.25	15.42	219.25
1	13	5	9	251.33	799.30	58.49	0.18	44.01	135.39
2	11	5	8	188.50	832.66	226.41	0.27	51.25	180.44

12	18	14	16	125.66	212.53	50.96	0.24	30.13	-543.23
13	16	14	15	62.83	393.62	99.73	0.25	15.92	-103.83
13	19	15	17	125.66	397.38	97.82	0.25	30.93	-331.34
14	17	15	16	62.83	824.20	243.95	0.30	18.60	-647.55
14	20	16	18	125.66	770.11	212.04	0.28	34.60	-67.08
15	18	16	17	62.83	758.31	204.56	0.27	16.95	17.97
16	19	17	18	62.83	1039.41	285.46	0.27	17.26	-658.02
17	20	18	19	62.83	1039.38	290.18	0.28	17.54	-222.51

Table13: Resistivity data PR-4

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
2	1	3	4	94.25	1039.65	56.13	0.05	5.09	13.87
2	1	4	5	376.99	1039.53	23.81	0.02	8.64	-54.87
2	1	5	6	942.48	1039.48	11.38	0.01	10.32	-180.47
2	1	6	7	1884.96	1039.47	7.38	0.01	13.38	74.59
2	1	7	8	3298.67	1039.46	4.76	0.00	15.11	-86.59
2	1	8	9	5277.88	1039.45	3.27	0.00	16.62	84.61
3	1	10	12	2721.40	1039.50	7.92	0.01	20.75	311.64
3	1	12	14	5054.04	1039.50	5.29	0.01	25.72	-13.88
3	1	14	16	8423.39	1039.49	3.85	0.00	31.18	-12.82
3	1	11	13	3769.91	1039.49	6.25	0.01	22.66	92.53
3	1	13	15	6597.34	1039.51	4.58	0.00	29.09	-57.46
3	1	15	17	10555.75	1039.52	3.26	0.00	33.06	170.23
3	2	4	5	94.25	1039.57	66.20	0.06	6.00	-54.77
3	2	5	6	376.99	1039.50	23.11	0.02	8.38	-181.50
3	2	6	7	942.48	1039.48	12.98	0.01	11.77	75.50
3	2	7	8	1884.96	1039.48	7.46	0.01	13.52	-87.54
3	2	8	9	3298.67	1039.47	4.84	0.00	15.35	85.42
3	2	9	10	5277.88	1039.47	3.10	0.00	15.75	-246.65
4	1	17	20	6897.54	1039.48	5.61	0.01	37.24	-151.27
4	2	11	13	2721.40	1039.43	7.78	0.01	20.37	96.28
4	2	13	15	5054.04	1039.44	5.52	0.01	26.85	-59.69
4	2	15	17	8423.39	1039.44	3.65	0.00	29.59	171.25
4	2	12	14	3769.91	1039.46	6.53	0.01	23.68	-12.68
4	2	14	16	6597.34	1039.48	4.67	0.00	29.65	0.77
4	2	16	18	10555.75	1039.57	3.09	0.00	31.40	92.66
4	3	5	6	94.25	1039.55	58.82	0.06	5.33	-182.72
4	3	6	7	376.99	1039.52	25.06	0.02	9.09	76.40
4	3	7	8	942.48	1039.51	12.43	0.01	11.27	-88.44

4	3	8	9	1884.96	1039.51	7.27	0.01	13.17	86.10
4	3	9	10	3298.67	1039.51	4.41	0.00	14.01	-229.47
4	3	10	11	5277.88	1039.52	3.49	0.00	17.71	212.98
5	3	12	14	2721.40	1039.51	8.32	0.01	21.79	-12.06
5	3	14	16	5054.04	1039.51	5.80	0.01	28.20	7.51
5	3	16	18	8423.39	1039.51	3.90	0.00	31.64	87.58
5	3	13	15	3769.91	1039.54	6.83	0.01	24.76	-63.03
5	3	15	17	6597.34	1039.55	4.36	0.00	27.66	173.04
5	3	17	19	10555.75	1039.57	3.37	0.00	34.26	10.03
5	4	6	7	94.25	1039.53	72.12	0.07	6.54	76.96
5	4	7	8	376.99	1039.51	26.17	0.03	9.49	-88.96
5	4	8	9	942.48	1039.52	13.01	0.01	11.80	86.89
5	4	9	10	1884.96	1039.51	7.01	0.01	12.71	-215.73
5	4	10	11	3298.67	1039.53	5.35	0.01	16.98	195.75
5	4	11	12	5277.88	1039.52	3.22	0.00	16.56	52.34
6	4	13	15	2721.40	1039.47	8.44	0.01	22.10	-65.19
6	4	15	17	5054.04	1039.49	5.26	0.01	25.59	174.02
6	4	17	19	8423.39	1039.49	3.81	0.00	30.87	8.01
6	4	14	16	3769.91	1039.52	7.00	0.01	25.37	16.90
6	4	16	18	6597.34	1039.54	4.51	0.00	28.63	80.07
6	4	18	20	10555.75	1039.62	3.21	0.00	32.64	-58.86
6	5	7	8	94.25	1039.53	66.07	0.06	5.99	-89.91
6	5	8	9	376.99	1039.52	24.44	0.02	8.86	87.31
6	5	9	10	942.48	1039.51	11.25	0.01	10.20	-203.54
6	5	10	11	1884.96	1039.52	7.59	0.01	13.76	180.61
6	5	11	12	3298.67	1039.51	4.20	0.00	13.33	53.41
6	5	12	13	5277.88	1039.52	3.50	0.00	17.76	53.89
7	5	14	16	2721.40	1039.55	8.60	0.01	22.51	22.28
7	5	16	18	5054.04	1039.53	5.32	0.01	25.88	75.65
7	5	18	20	8423.39	1039.53	3.70	0.00	30.01	-55.42
7	5	15	17	3769.91	1039.57	6.24	0.01	22.64	175.37
7	5	17	19	6597.34	1039.57	4.46	0.00	28.31	5.18
7	6	8	9	94.25	1039.62	67.51	0.06	6.12	87.84
7	6	9	10	376.99	1039.56	23.05	0.02	8.36	-194.47
7	6	10	11	942.48	1039.52	13.27	0.01	12.03	169.18
7	6	11	12	1884.96	1039.52	6.67	0.01	12.10	54.25
7	6	12	13	3298.67	1039.51	5.15	0.00	16.35	55.75
7	6	13	14	5277.88	1039.52	3.35	0.00	16.99	-67.19
8	6	15	17	2721.40	1039.53	8.01	0.01	20.96	176.15
8	6	17	19	5054.04	1039.53	5.27	0.01	25.62	3.88
8	6	16	18	3769.91	1039.53	6.58	0.01	23.86	70.27

8	6	18	20	6597.34	1039.52	4.45	0.00	28.24	-51.14
8	7	9	10	94.25	1039.56	61.13	0.06	5.54	-187.17
8	7	10	11	376.99	1039.57	25.56	0.02	9.27	160.21
8	7	11	12	942.48	1039.63	10.91	0.01	9.89	55.06
8	7	12	13	1884.96	1039.56	7.49	0.01	13.57	57.41
8	7	13	14	3298.67	1039.55	4.54	0.00	14.39	-68.87
8	7	14	15	5277.88	1039.57	3.82	0.00	19.42	-3.57
9	7	16	18	2721.40	1039.54	7.86	0.01	20.57	67.05
9	7	18	20	5054.04	1039.54	5.20	0.01	25.30	-48.50
9	7	17	19	3769.91	1039.53	6.32	0.01	22.93	2.21
9	8	10	11	94.25	1039.54	69.88	0.07	6.34	153.44
9	8	11	12	376.99	1039.54	21.13	0.02	7.66	55.69
9	8	12	13	942.48	1039.54	12.38	0.01	11.22	58.73
9	8	13	14	1884.96	1039.56	6.69	0.01	12.14	-70.23
9	8	14	15	3298.67	1039.57	5.34	0.01	16.93	-3.89
9	8	15	16	5277.88	1039.67	3.17	0.00	16.12	40.40
10	8	17	19	2721.40	1039.64	7.35	0.01	19.24	1.35
10	8	18	20	3769.91	1039.62	5.85	0.01	21.21	-45.76
10	9	11	12	94.25	1039.62	50.74	0.05	4.60	56.17
10	9	12	13	376.99	1039.62	21.72	0.02	7.88	59.88
10	9	13	14	942.48	1039.62	10.10	0.01	9.16	-71.47
10	9	14	15	1884.96	1039.61	7.29	0.01	13.22	-4.10
10	9	15	16	3298.67	1039.62	4.02	0.00	12.74	43.33
10	9	16	17	5277.88	1039.63	2.97	0.00	15.07	134.50
11	9	18	20	2721.40	1039.60	7.25	0.01	18.99	-43.91
11	10	12	13	94.25	1039.65	68.09	0.07	6.17	60.68
11	10	13	14	376.99	1039.66	22.86	0.02	8.29	-72.39
11	10	14	15	942.48	1039.69	14.12	0.01	12.80	-4.23
11	10	15	16	1884.96	1039.67	7.08	0.01	12.83	46.17
11	10	16	17	3298.67	1039.65	4.79	0.00	15.19	132.17
11	10	17	18	5277.88	1039.66	3.27	0.00	16.60	-73.24
12	11	13	14	94.25	1039.62	55.71	0.05	5.05	-73.30
12	11	14	15	376.99	1039.61	25.58	0.02	9.28	-4.36
12	11	15	16	942.48	1039.60	10.85	0.01	9.84	48.12
12	11	16	17	1884.96	1039.61	6.58	0.01	11.93	130.57
12	11	17	18	3298.67	1039.60	4.11	0.00	13.04	-73.18
12	11	18	19	5277.88	1039.60	2.85	0.00	14.45	72.53
13	12	14	15	94.25	1039.67	84.74	0.08	7.68	-4.43
13	12	15	16	376.99	1039.67	26.52	0.03	9.62	50.04
13	12	16	17	942.48	1039.70	13.75	0.01	12.47	120.09
13	12	17	18	1884.96	1039.68	7.83	0.01	14.19	-73.16

13	12	18	19	3298.67	1039.67	4.87	0.00	15.45	72.01
13	12	19	20	5277.88	1039.66	3.24	0.00	16.43	-111.24
14	13	15	16	94.25	1039.55	59.12	0.06	5.36	51.89
14	13	16	17	376.99	1039.55	23.70	0.02	8.60	127.39
14	13	17	18	942.48	1039.55	11.86	0.01	10.76	-73.12
14	13	18	19	1884.96	1039.55	6.66	0.01	12.08	71.61
14	13	19	20	3298.67	1039.55	4.06	0.00	12.88	-109.77
15	14	16	17	94.25	1039.53	69.90	0.07	6.34	126.26
15	14	17	18	376.99	1039.55	26.46	0.03	9.60	-73.07
15	14	18	19	942.48	1039.55	12.79	0.01	11.59	71.31
15	14	19	20	1884.96	1039.63	7.12	0.01	12.90	-108.40
16	15	17	18	94.25	1039.53	61.03	0.06	5.53	-73.10
16	15	18	19	376.99	1039.52	21.89	0.02	7.94	71.01
16	15	19	20	942.48	1039.52	10.22	0.01	9.26	-107.56
17	16	18	19	94.25	1039.69	67.34	0.06	6.10	70.86
17	16	19	20	376.99	1039.68	22.66	0.02	8.22	-107.03
18	17	19	20	94.25	1039.73	60.76	0.06	5.51	-106.83

Vertical Electrical Sounding (VES)

Resistivity sounding is a process by which the depth investigation is made. In this, the center of configuration is kept fixed, and the measurements are made by successively increasing the electrode spacing. The apparent resistivity values obtained with increasing values of electrode separations are used to estimate the thickness and resistivities of the subsurface formations. In Schlumberger sounding arrangement, all the four electrodes are kept in a line symmetrically over a point `0; with inner (Potential) electrodes kept closer. For increasing the depth of investigation, the current electrodes, A and B are moved apart symmetrically about the center point `0' keeping the potential electrodes fixed. The separation between the Potential Electrodes is changed only when the potential between them drops to allow value during the course of sounding. The apparent resistivity for each electrode separation is calculated by multiplying the resistance `R' by Schlumberger configuration factor.

In Schlumberger arrangement, all the four electrodes are kept in a line symmetrically over a point `O' current is sent through outer electrodes are kept in a line symmetrically over a point `0'. Current is sent through outer electrodes AB and potential across MN is measured. The separation between the potential electrodes M & N is kept smaller compared to the current electrode distance AB. The geometric factor `K' for Schlumberger arrangement is given by

$$K = \pi \{(AB/2)^2 - (MN/2)^2\} / MN$$

Where,

AB is current Electrode spacing

MN is potential Electrode spacing

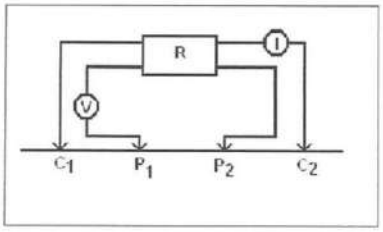


Fig. 20. Schlumberger electrode configuration

Equipment:

The equipment used in this investigation was CRM-500 resistivity meter. This digital resistivity meter has been designed for use in shallow as well as deep resistivity survey. The resistivity meter is powered by 40 V chargeable batteries. Voltage up to 220 volts can be applied and current up to 500 m amp can be sent depending on the ground conditions. The potential can be measured with resolution of up to 0.001 mV. By applying the current into the ground, the equipment provides the direct resistance for particular electrode separation.

Fig.21: Resistivity meter.

Data Analysis and Interpretation

The observed resistance value from instrument was multiplied with geometric factor (K) to get the apparent resistivity values for each electrode spacing. The field apparent resistivity data were plotted on log-log paper against the half current electrode separation to get the VES curves. The apparent resistivity data for different potential dipole were brought to single common potential dipole. The smoothed/corrected apparent resistivity values for each electrode spacing are presented along with VES curves in running text. The VES curves were modeled through conventional curve matching techniques and computer software IPI2WIN. The location map of observed VESs, VES data and VES curves are presented below.

Table 14: Vertical Electrical Sounding (VES) Data

VES-1				
AB/2	App. Rest.		Factor	Remarks
2	96.90	0.00		Probable Fracture Zones in between 30-35m
3	72.90	96.90	0.75232	
4.5	59.20	169.80	0.34865	
6	52.70	229.00	0.23013	
8	49.70	281.70	0.17643	
10	50.10	331.40	0.15118	
12	51.10	381.50	0.13394	
15	54.20	432.60	0.12529	
20	59.80	486.80	0.12284	
25	64.70	546.60	0.11837	
30	71.50	611.30	0.11696	
35	79.70	682.80	0.11673	

Table 15: Vertical Electrical Sounding (VES) Data

VES-2				
AB/2	App. Rest.		Factor	Remarks
2	20.78	0.00		Probable Fracture Zones in-50m
3	21.40	20.78	1.02984	
4.5	23.86	42.18	0.56567	
6	26.60	66.04	0.40279	
8	30.55	92.64	0.32977	
10	33.73	123.19	0.27380	
12	37.23	156.92	0.23725	
15	42.34	194.15	0.21808	
20	47.93	236.49	0.20267	
25	54.20	284.42	0.19056	
30	59.83	338.62	0.17669	
35	64.12	398.45	0.16092	
40	69.39	462.57	0.15001	
45	72.91	531.96	0.13706	
50	76.60	604.87	0.12661	

Table 16: Vertical Electrical Sounding (VES) Data

VES-3				
AB/2	App. Rest.		Factor	Remarks
2	70.60	0		Probable Fracture Zones in between 20-25m,
3	59.73	70.60	0.84606	
4.5	48.70	130.33	0.37363	
6	43.08	179.03	0.24066	
8	44.14	222.11	0.19873	
10	48.64	266.25	0.18267	
12	51.80	314.89	0.16449	
15	60.95	366.68	0.16623	
20	75.23	427.64	0.17593	
25	89.00	502.87	0.17699	
30	102.28	591.07	0.17201	
35	113.92	694.15	0.16412	
40	125.11	808.08	0.15483	

Table 17: Vertical Electrical Sounding (VES) Data

VES-4				
AB/2	App. Rest.		Factor	Remarks
2	6.07	0		Probable Fracture Zones in between 20-25m
3	6.22	6.07	1.02415	
4.5	7.34	12.29	0.59740	
6	8.45	19.63	0.43054	
8	10.03	28.08	0.35724	
10	12.31	38.11	0.32309	
12	13.83	50.42	0.27423	
15	16.52	64.24	0.25721	
20	20.65	80.77	0.25565	
25	25.97	101.42	0.25606	
30	30.38	127.39	0.23846	

Table 18: Vertical Electrical Sounding (VES) Data

VES-5				
AB/2	App. Rest.		Factor	Remarks
2	7.09	0		No Fracture Zones
3	6.81	7.09	0.96051	
4.5	7.32	13.90	0.52662	
6	8.24	21.22	0.38831	
8	9.28	29.46	0.31500	
10	10.60	38.74	0.27362	
12	12.40	49.34	0.25132	
15	14.90	61.74	0.24133	
20	19.50	76.64	0.25444	
25	23.60	96.14	0.24548	
30	26.66	119.74	0.22263	

Table 19: Vertical Electrical Sounding (VES) Data

VES-6				
AB/2	App. Rest.		Factor	Remarks
2	39.10	0		Probable Fracture Zones in between 12-15m
3	34.80	39.10	0.89003	
4.5	31.46	73.90	0.42571	
6	31.79	105.36	0.30173	
8	34.22	137.15	0.24951	
10	40.06	171.37	0.23376	
12	45.45	211.43	0.21496	
15	55.50	256.88	0.21605	
20	73.72	312.38	0.23599	
25	88.15	386.10	0.22831	
30	104.30	474.25	0.21993	

Table 20: Vertical Electrical Sounding (VES) Data

VES-7				
AB/2	App. Rest.		Factor	Remarks
2	33.35	0		No Fracture Zones
3	43.58	33.35	1.30675	
4.5	56.37	76.93	0.73279	
6	70.06	133.30	0.52560	
8	84.54	203.37	0.41568	
10	98.04	287.91	0.34054	
12	111.49	385.95	0.28886	
15	134.51	497.43	0.27041	
20	168.84	631.95	0.26717	
25	191.99	800.79	0.23975	
30	220.47	992.77	0.22208	

Discussion on Geophysical results:

Increasing demand of water for increased infrastructures in the area is resulting in decrease of groundwater resources. To explore the subsurface hydrogeological conditions beneath the area, spot electrical sounding was conducted at 11 locations in the premises of Industry. The current electrodes were spread between 30 m (AB/2) only. The VES curves obtained from the study area indicated the presence of different geoelectrical layers sequence within a maximum depth range of 50 m bgl in the premises. The occurrence of alternate 'low' and 'high' resistivity layers or vice versa, in the study area, indicates the presence of different geoelectrical layer sequences having varied lithological constituents. The moderate range of resistivity with respect to background resistivity may be representing the fracture/weaker zone forming the confined aquifer. The higher range of resistivity may be indicating the presence of hard and compact limestone. Due to limitation of techniques, sometimes the single geoelectrical layer may represent equivalent to more layers of similar electrical characteristics (resistivity and thickness of layers).

Knowledge of overburden thickness (weathered rock formation) is an important component for deciding the suitable location for roof top rainwater harvesting. In this regard, based on the geoelectrical parameter of VESs, it is observed that the overburden thickness in the area vary between 10 to 20 m bgl. The VES investigations could be able to

delineate different geoelectrical layers within the depth range of 50 m below ground level. In this study Some of the VES curves have indicated the presence of aquifer in the different depth ranges below ground level.

Rain Water Harvesting & Artificial Recharge

Artificial recharge systems are engineered systems where surface water is put on or in the ground for infiltration and subsequent movement to aquifers to augment groundwater resources. Other objectives of artificial recharge are to store water, to improve the quality of the water through soil-aquifer treatment or geo-purification, to use aquifers as water conveyance systems, and to make groundwater out of surface water where groundwater is traditionally preferred over surface water for drinking. Artificial recharge is expected to become increasingly necessary in the future as growing populations require more water, and as more storage of water is needed to save water in times of water surplus for use in times of water shortage.

Artificial recharge projects are site specific. The replication of the techniques from similar areas is to be based on the local hydrogeological and hydrological environs. The first step in planning the project is to demarcate the area of recharge. The scheme can be implemented systematically in case a hydrologic unit like watershed is taken for implementation. However, localized schemes are also can be taken to augment the ground water reservoir. Schemes are normally taken in the following areas.

- Areas where ground water levels are declining over a period of time.
- Areas where substantial amount of aquifer has already been desaturated.
- Areas where availability of ground water is in adequate in lean months and there is availability of surface water for recharge during rainy season.
- Areas where salinity ingress is taking place.
- Areas where there is quality problem in ground water

Roof top rain water harvesting can also be adopted to meet domestic water requirements. The roof top rain water can be stored in specifically constructed surface or sub-surface tanks. In these areas dependence on ground water has increased many folds and the natural recharge to ground water has decreased, due to urbanization, construction of buildings and paved area. In urban areas water

falling on roof tops can be collected and diverted to the open wells/ tubewells/ borewells by providing a filter bed.

Roof top rainwater harvesting, which involves the collection of rainwater from the roof of the buildings and its storage in surface tanks or recharge to sub-surface aquifer, can play an important role in conservation of water. Thus, the need for artificial recharge of groundwater is beyond doubt and is the most powerful management strategy available to face the challenge of fast depletion in groundwater storages.

The depth of recharge well may be as follows-

Table 21: Proposed Depth of recharge well.

S.No.	VES Number	Possible fracture zones	Proposed Depth of recharge well
1	RS1	Between 30-35m	35 m
2	RS2	- 50m	- 50m
3	RS3	between 20-25m,	25 m
4	RS4	between 20-25m	25 m
5	RS5	No fracture zone	None
6	RS6	between 12-15m	15 m
7	RS7	No fracture zone	None

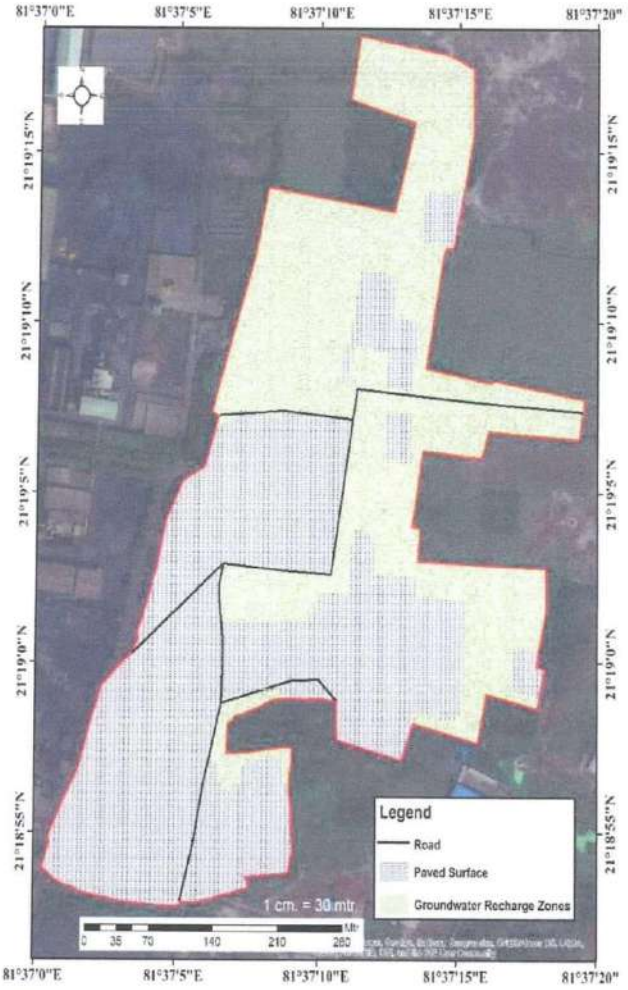
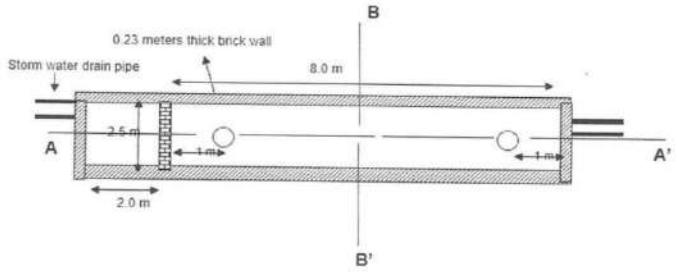


Fig.22: Groundwater Recharge Zone of Study Area

Proposed Plan for Recharge Trench Cum Twin Borewell with Desilting Chamber for the study area-

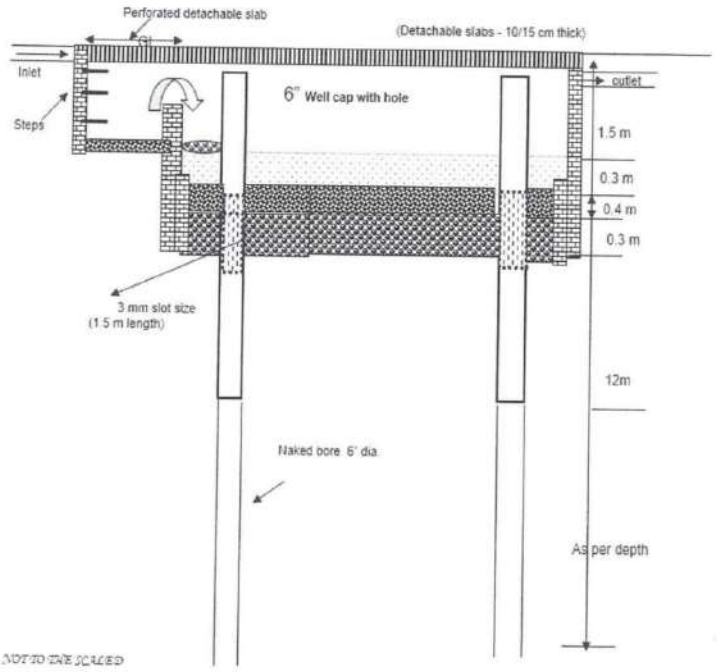
PLAN VIEW



NOT TO BE SCALED

Fig. 23 (a): Plan of proposed recharge structure (not to scale)

SECTION AA'



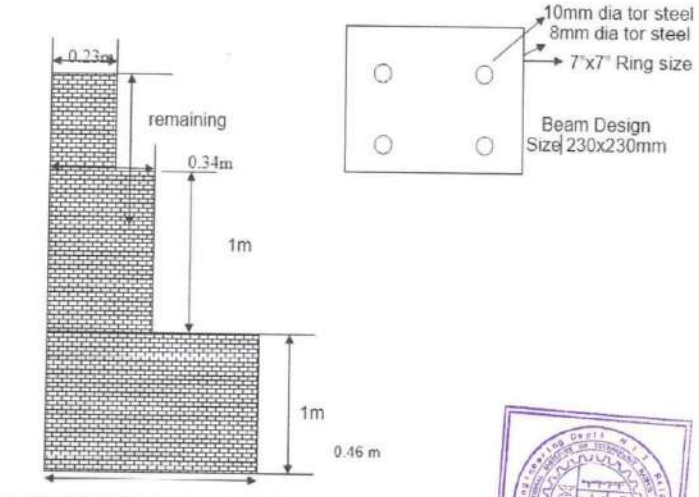
– Pea Gravel (3-6 mm) – Gravel (5 – 10 mm) = Boulder (5 – 15 cm)
Brick wall = Refer Brick Section,
RCC = Refer RCC Slab Design
Height of de silting wall = 1 m from top of the pea gravel
All the measurement dimensions are inner one

Fig. 23 (b): Proposed recharge structure Section A-A (not to scale)

PROPOSED RCC DESIGN & SPECIFICATION

RCC Slab Design

Main Bars: 10mm dia tor steel (cold twisted bars) placed @ 100mm c/c
Distribution Bars: 10mm dia tor steel (cold twisted bars) placed @ 100mm c/c



PROPOSED SECTION OF BRICK WORK

NOT TO THE SCALED

Fig. 23 (c): Proposed RCC Design & Specification (not to scale)

Points to be taken into Consideration for implementation of Artificial Recharge Structures

1. Proposed Structural drawing are shown in Fig. 23(a), (b) and (c)
2. Depth of the retaining capacity of the recharge trenches/ shafts (as per the enclosed designs) is below the existing inlet pipes. All the dimensions indicated in the designs are the inner dimension.
3. All the storm water drains/ catchment area are to be cleaned prior to monsoon. Necessary repair/maintenance needs to be carried out wherever required. Necessary diversions to be provided wherever required so as diverting the runoff to the structures.
4. Care must be taken so that no contaminated water is diverted into the recharge structures. No change in the existing flow path. Necessary peripheral drains may be constructed to divert the runoff to the recharge structures. Provision of oil/ grease separator to be made wherever necessary.
5. Before the onset of the monsoon all the catchment area considered for recharge is to be cleaned.
6. Necessary flow checks may be provided within the storm water drains for settling the silt, if required. A mesh may be provided on the mouth of the inlet to discard the debris entering into the recharge trenches. A sluice/ shutter may be provided to ensure that no water other than the rainwater is diverted to the recharge structures.
7. Depth and location of the recharge wells may vary as per the prevailing site conditions.
8. After the first rains the de-silting pit may be cleaned and subsequently on the onset of next monsoon. Sanitary and hygienic conditions in the study area are required after implementation of artificial recharge structures.
9. Necessary provision to prevent the diversion of the initial runoff to the recharge structures to avoid clogging of the recharge trench may be considered. The initial runoff having excessive silt may be diverted to the culverts and subsequently out of the study area to avoid any water logging.
10. Excess water not envisaged for recharge may be diverted to the pond.
11. Prior to monsoon season the top most layer in the pit may be scrapped and replaced with the fresh & cleaned one, if necessary.
12. On non-acceptance of water by the recharge well, the same may be cleaned using manual method / compressor development.

Step-wise approach for implementation of Artificial Recharge Structures

1. Construct the recharge wells at the pre-determined locations. Depth of the recharge wells may vary as per specific site conditions and depth is to be restricted upto the depth till the well starts giving discharge. This would ensure intake of runoff water.

2. Test all the constructed recharge wells by pouring water from tanker to ensure the intake capacity of each recharge wells. In this regard, slug test may be conducted.

3. The next step would be to go for excavation of recharge trench. If problem is encountered in respect of the specified depth, necessary modification may be made with respect to length and width of the recharge trench.

4. Subsequently PCC footing and rising of brick wall as per the proposed brick wall section may be taken up. If required, necessary weep holes may be provided.

5. In case of two double bore recharge wells in series, the de-silting chamber would be one only and necessary modification in respect of its dimension may be considered.

6. Provision for initial flush and tapping of clean rainfall runoff may be made by providing sluice and shutters in all the recharge structures.

7. Manhole is to be provided at the top of the de-silting chambers, recharge trenches and on the top of all the recharge wells in order to keep provision for maintenance.

8. The inlet and outlet pipes in all recharge structures should be placed so that the level of the bottom of inlet pipe would be the top level of the outlet pipe.

9. RECOMMENDATIONS:

During the site visit existing drainage location of drains, settling pits, type of strata in the area were observed. Surface plan & bore well details were collected. The data collected were also verified in the field to check its correctness and physical location as mentioned in layout etc. The expert team of NIT Raipur also interacted with the officials of HIRA group during the visit for understanding the future proposals of drainage system in the plant. As observed during site visit, there is proper plantation in & around the site. From the site observation, it is found that the drain provided in the plant area is inadequate and cannot sustain peak flow conditions with chances of overflow. It is also observed that the existing recharging structures are obsolete and not in working condition due to huge silt deposition. Based on the data analysis and site visit the following recommendations are made:

1. Without proper treatment, water coming as surface runoff within the industry premises must not be directly allowed for recharging the ground water.
2. A proper treatment unit as proposed in Fig. 10, is required after the sedimentation tank located near the solar plant in the industry premises to treat the surface runoff (contaminated with industrial waste) coming through the existing drainage.
3. The waste water/effluent coming from the adjacent industry must not be allowed within the plant premises. If not possible, then another treatment unit is required to treat the effluent before allowing it to drain inside the plant premises.
4. The treated water is allowed to drain through the proposed drain network towards the existing pond.
5. Regular cleaning of pond bed is required for the efficient natural ground water recharging through the pond bed.
6. The fresh water demand within the plant premises is 600 KLD (as per data provided). As per the observation, it is suggested that the treated water can also be utilized for fulfilling the fresh water demand approximately up to 40 % on yearly basis.
7. As per the hydrogeological study, probable suitable location for ground water recharge is given in **Fig. 10.** Also, the feasible zones for ground water recharge are provided in **Fig. 22** and proposed depth of recharging wells are provided in **Table 21**. It is recommended to provide the recharging structures along the proposed drainage network.
8. Before the onset of the monsoon all the catchment area considered for recharge is to be cleaned.
9. The execution work may be undertaken by the specialized agencies so that the objective of rainwater harvesting / artificial recharge is implemented in true spirit and due benefits are accrued.

REFERENCES:

1. Development of a new high spatial resolution (0.25° X 0.25°) Long period (1901-2010) daily gridded rainfall data set over India and its comparison with existing data sets over the region; MAUSAM, 65, 1(January 2014), pp1-18.
2. NRCS, U., 2007. Chapter 10, part 630–hydrology. Estimation of direct runoff from storm rainfall. In 'National engineering handbook'. (Eds V Mockus, AT Hjelmfelt, HF Moody) pp. 1–79. US Department of Agriculture, Natural Resources Conservation Service: Washington, DC.
3. Subramanya, K., 2009. Flow in open channels. Tata McGraw-Hill Education.
4. Subramanya, K., 2013. Engineering Hydrology, 4e. Tata McGraw-Hill Education.
5. CGWB; 2006; Hydrogeology of Chhattisgarh-State Report (unpublished report); Central Ground Water Board, North Central Chhattisgarh Region, Raipur.
6. CGWB; 2007; Manual on Artificial Recharge of Ground Water, Govt. of India, Central Ground Water Board, Ministry of Water Resources, Govt. of India.

Annexure-VI

Format No. : UES/FORM/09

Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272, Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 I Email : ultimatenviro@gmail.com

Name & Address Of The Customer			
To, **HIRA POWER AND STEEL LTD.** **KHASRA NO.: 511/1, 512/2,** **URLA INDUSTRIAL AREA** **RAIPUR (C. G.) 492003**	REPORT NO.	UES/TR/22-23/02800	
	LAB REF NO.	UES/22-23/ST/07828	
	DATE OF SAMPLING	17/08/2022	
	DATE OF RECEIPT	18/08/2022	
	DATE OF REPORT	22/08/2022	
	DATE OF ANALYSIS	Start:18/08/2022	End:22/08/2022

SAMPLE DETAILS	
Monitoring For	Stack Emission Monitoring
Customer Ref. No. & Date	P.O. NO. 7200004006/U102, DATED: 16/06/2022
Sampling Location	20 MW AFBC
Sample Collected By	Laboratory Chemist
Sampling Procedure	IS 11255 Part 1,2:1985 Reaffirmed 2009; Part 3:2008, Part 7:2005 Reaffirmed 2012, IS 5182 (Part 10) :2003
Sample Quantity/Packing	Thimble: 1 X 1 No., SO_2: 30 ml X 1 No. PVC Bottle, NO_x: 25 ml X 1 No. PVC Bottle, Rubber Bladder: 1 X 1 No.,

TEST REPORT

Stack details

Stack Identity	20 MW AFBC
Stack Attached To	ESP
Material of Construction	RCC
Height of the stack from ground level (Meter)	73.0 MTR
Stack Diameter	2.83 MTR
Stack Shape At Top	CIRCULAR
Type of Fuel	COAL
Total Electrical Load (KW)	20 KW

Parameter	Unit	Method Reference	Limit	Result
Flue Gas Temperature	°C	IS:11255: (Part -3):2008	-	124
Flue Gas Velocity	M/s	IS :11255 :(Part -3):2008	-	21.8
Total Gas Quantity	Nm^3/h	IS :11255: (Part -3):2008	-	370362.7
Sulphur Dioxide (SO_2)	mg/Nm^3	IS 11255 (Part 2):1985, RA 2003	600	246
Oxides of Nitrogen (NOx)	mg/Nm^3	IS 11255 (Part 7):2005, RA 2012	300	123
Total Particulate Matter (TPM)	mg/Nm^3	IS :11255 :(Part -1):1985, RA 2003	50	42.5
Carbon Monoxide (CO)	mg/Nm^3	IS 13270:2019	-	4.8
Hg	mg/Nm^3	USEPA Method No. 29	0.03	N.D.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

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

22/08/22
REVIEWED BY

ULTIMATE ENVIROLYTICAL SOLUTIONS

For ULTIMATE ENVIROLYTICAL SOLUTIONS
22/08/22
AUTHORIZED SIGNATORY

----------End of the test report----------

AN ISO : 9001:2015 / ISO: 14001:2015 / ISO 45001:2018 CERTIFIED LABORATORY

Annexure-VII

Report of energy meter attached to air pollution control device April 2021- March 2022

S.No	Month	Pollution Control Devices Attached to Unit	Power Consumption (KWH)	Remarks
1	April 2021	ID Fan, Cooling Water pump, Air Compressor, Dust Silo Unit, FD Cooler (Axial Flow Fan), Bagfilter Unit, Silo Ash Conditioner Pump.	961627.31	Energy meter, Model-EM6433 & Make-Conzerv
2	May 2021		645953.18	
3	June 2021		919356.11	
4	July 2021		833127.53	
5	August 2021		817546.02	
6	September 2021		868508.00	
7	October 2021		821846.31	
8	November 2021		848765.57	
9	December 2021		971337.17	
10	January 2022		977420.10	
11	February 2022		863634.67	
12	March 2022		959201.43	
TOTAL			10488323.4	

Annexure-VIII

S.No.	Raw Material	Required Qty./ Month in MT	Supplier	Location of Dispatch	Mode of Transport	Distance from HPSL	Specification			
							MN%	Size		
1	Manganese Ore	125000	MOIL	Chandrapur	Rail/Road	370KM	30%MN - 50%MN	0 to 3 MM	0 to 10 MM	6 to 75 MM
			Sandur	Sandur	Rail/Road	1200KM				
			Imported	Vishakhapattnam	Rail/Road	560KM				
							Specification			Size
2	Coal Captive Power Plant Ferro alloyes	18000	SECL	Raigarh	Rail/Road	250KM	Stem Coal 44% FC and above			5-70MM
				Korba	Rail/Road	270KM				
				Ambikapur	Rail/Road	400KM				
				Charcha	Rail	430KM				
			WCL	Nagpur	Rail/Road	300KM	Power Coal 3500 GCV and above			0-100MM
			CCL	Ranchi	Rail/Road	600KM				
			NCL	Singrauli	Rail/Road	475KM	Coal Fines GCV 3000			0-10MM
			Imported	Vishakhapattnam	Rail/Road	560KM				
3	DoloChar Coal	-	Local Sponge Iron	Raipur	Road	25KM	DoloChar GCV 3000			0-10MM
							FC			Size
4	Coke	1200	Luky Coke	Dhanbad	Road	750KM	68 % FC - 80% FC			5-25MM
			Metro Hard	Dhanbad	Road	760KM				
			Adhunik Fuels	Dhanbad	Road	760KM				
			Shubh Sales	Dhanbad	Road	760KM				
			Bangal Energy	Kharagpur	Road	720KM				
							FC	VM	Plasticity	Size
5	Carbon Electrode Paste	200	Maharastra Carbon	Chandrapur	Road	370KM	87% FC	12-15%	35-37%	10-70MM
			Balaji Carbon	Raipur	Road	10KM	87% FC	12-15%	35-37%	10-70MM
							Silica			Size
6	Dolomite	500	Shri Shaym Industries	Durg	Road	60KM	< 5 %			2-8MM
			P.R. Commercial	Bhilai	Road	50KM	< 5 %			2-8MM
							Silica			Size
7	Quartz	-	NC Nahar	Bhilai	Road	50KM	97%			10-60MM
							CAO	MGO	SIO1	Size
8	Lime Calcined	250	Rajasthan Lime	Jodhpur	Road	1400KM	90%Min	1.80%	1.50%	20-60MM
			Raj Chemicals	Nagpur	Road	300KM	90%Min	1.80%	1.50%	20-60MM
							CAO	MGO	SIO2	Size
9	Dolo Calcined	250	Poddar Lime	Chandrapur	Road	370KM	50%Min	30%	3%	10-80MM

Table title: Hira Power And Steel Limited (Source and Mode of transportation along with distance of raw material & its specification)

Annexure-IX

HIRA POWER & STEELS

Ref: 1041/HPSL/U2/CPP/21-22/1041

Dated-16.11.2021

To,
The Member Secretary,
Chhattisgarh Environment Conservation Board,
Paryavas Bhawan, North Block, Sector-19,
Atal Nagar, Pin Code - 492002
District-Raipur (C.G)

Sub: Submission of Environment Audit Report of Hira Power and Steels Limited (Unit-II)

Ref: Consent to Operate Order No. 6947/TS/CECB/2020 Dated 05.11.2020

Respected Sir,

This has reference to the above mentioned subject and consent of the Board issued for Operation for Alumino Thermic Process - 600 Metric Tonnes/Annum for production of Low / Medium Carbon Ferro Manganese (Ferro Alloy), Please find the enclosed herewith Environment Audit Report audited by Ultimate Envirolytical Solutions.

This is for your kind information and record, please.

Kindly acknowledge the receipt of the same.

Yours faithfully,

For, **HIRA POWER AND STEELS LIMITED, UNIT- II**

Authorized Signatory

Copy to: The Regional Officer, Regional Office, Chhattisgarh Environment Conservation Board, Commercial Complex Chhattisgarh Housing Board Colony, Kabir Nagar, Raipur (CG) – 492 001.

ENVIRONMENT AUDIT REPORT

of

M/s Hira Power & Steel Limited

Unit – II

Plot No. 511/1, 511/2,

Urla Industrial Complex

Raipur (C.G.) – 492 003

Audited By

ULTIMATE ENVIROLYTICAL SOLUTIONS

HDD – 272, PHASE – III, NEAR JP SQUARE,

KABIR NAGAR, RAIPUR (C. G.)

Email-id: ultimatenviro@gmail.com

1. INTRODUCTION

M/s Hira Power & Steel Limited is company of **HIRA** group a known group well equipped with technocrats and in-house technology for production of Sponge Iron, Steel, Power, Ferro Alloys, Structural and Mining. The HPSL has its manufacturing units located in the states of Chhattisgarh. Numbers of Engineers, staffs & consultants are on the permanent role of HPSL. has its Corporate office at civil lines Raipur – 492001. The unit had set-up at urla industrial area Raipur, 15 kms away from Raipur the capital city of Chhattisgarh state. The plant is producing ferro alloys as well as generating power for self-utilization, generally used by Ferro Alloy manufacturing Plants.

NAME OF THE INDUSTRY	:	M/s Hira Power & Steel Limited
LOCATION	:	Plot No. 511/1, 511/2, Urla Industrial Area Raipur (C.G.)
LATITUDE	:	21° 18' 53" N
LONGITUDE	:	81° 37' 00" E
ELEVATION	:	276.70 MTRS. (APPROX)
WATER SOURCE	:	CSIDC / BORE WELL
POLLUTION LEVEL	:	WELL WITHIN PRESCRIBED NORMS.
MANPOWER	:	Regular: 567 as on 15.09.2021

2. PRODUCTS & PRODUCTION CAPACITY

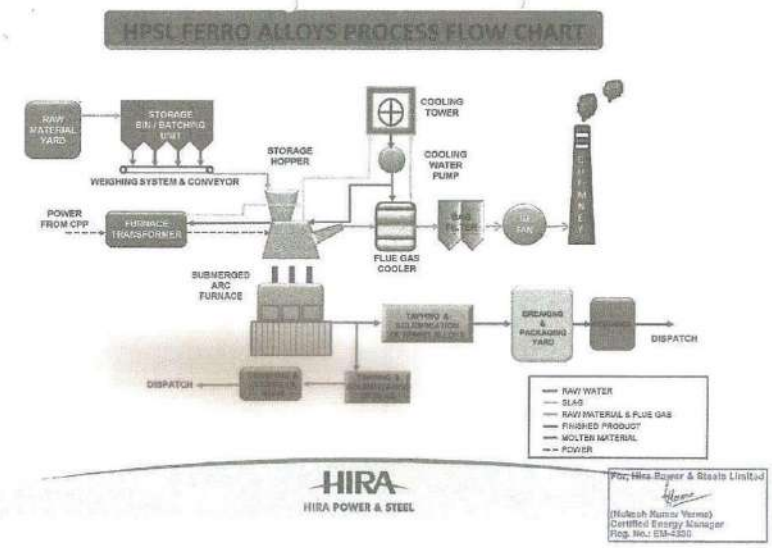
PRODUCTS :

S.N.	UNIT	NAME OF PRODUCT
1.	Captive Power Plant	ELECTRICITY
2.	Ferro Alloy	FERRO & SILCO MANGNESE

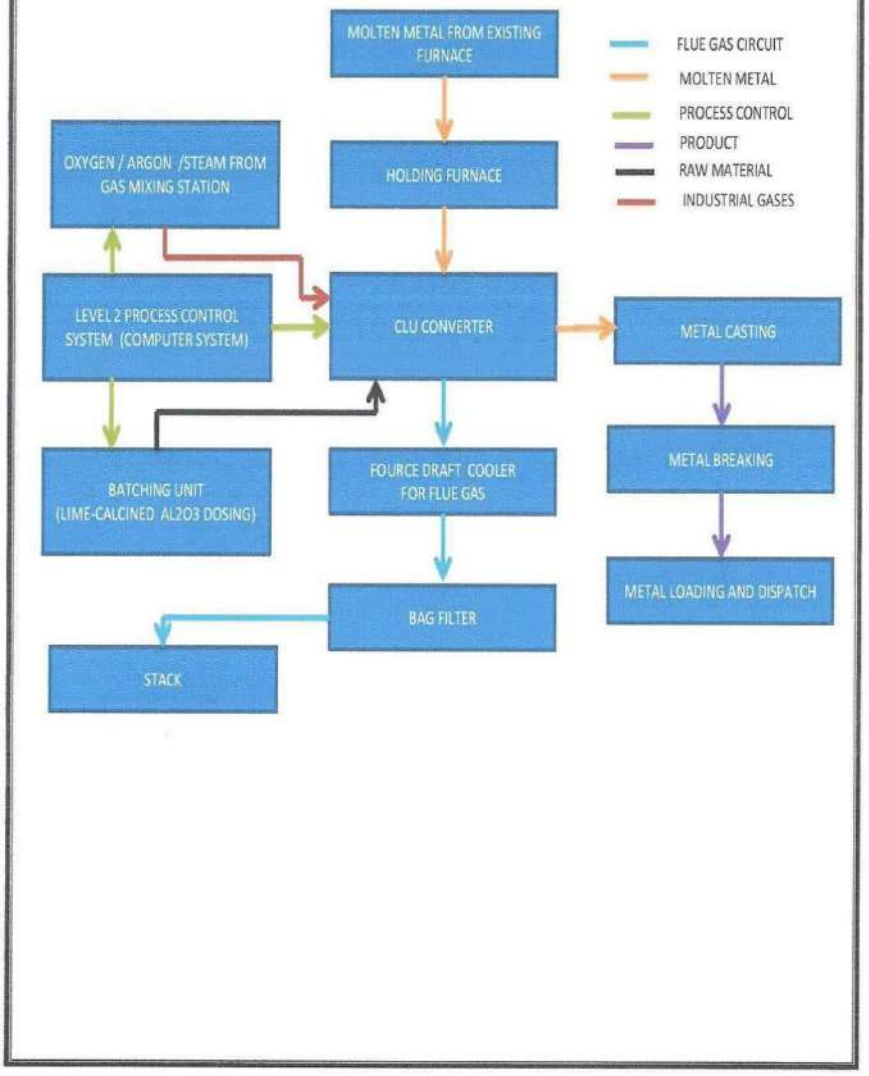
PRODUCTION CAPACITY :

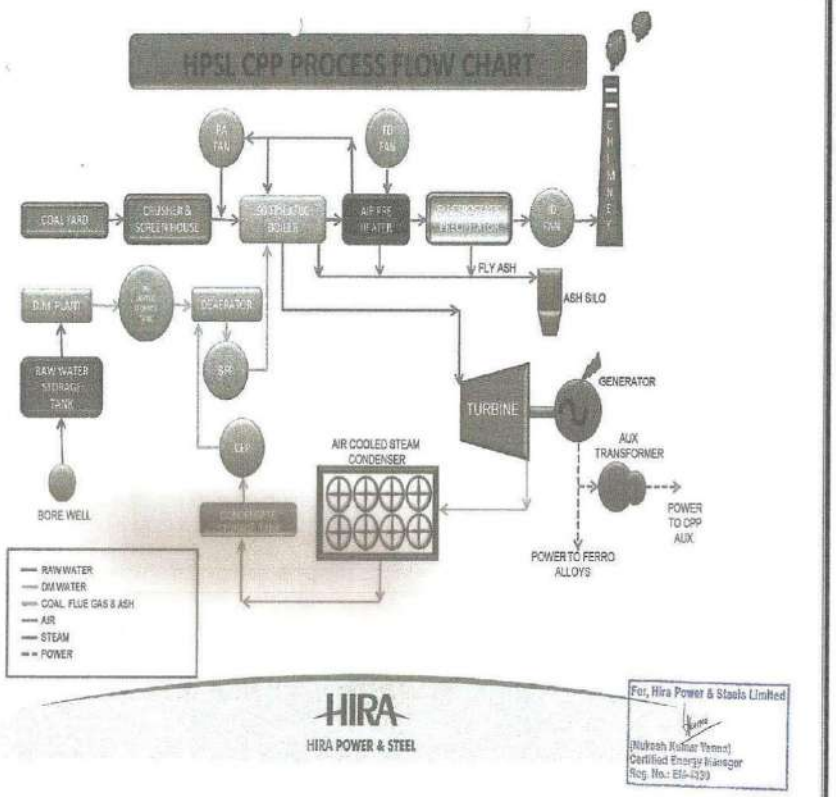
NAME OF PRODUCT	Capacity (MT/Annum)
Electricity	20 MW
Ferro Alloys and Ferro Alloys (Including Low/Medium Carbon) Or Pig Iron	30,000 MTPA And 18,000 MTPA Or 56,000 MTPA

3. PROCESS FLOW CHARTS



Process Flow Chart CLU Converter




HPSL CPP PROCESS FLOW CHART
PA FAN
FD FAN
CHIMNEY
COAL YARD
CRUSHER & SCREEN HOUSE
AIR PRE HEATER
ID FAN
FLY ASH
ASH SILO
D.M PLANT
DEAERATOR
RAW WATER STORAGE TANK
BFP
TURBINE
GENERATOR
AUX TRANSFORMER
AIR COOLED STEAM CONDENSER
BORE WELL
CEP
POWER TO CPP AUX
POWER TO FERRO ALLOYS
RAW WATER
DM WATER
COAL, FLUE GAS & ASH
AIR
STEAM
POWER
HIRA
HIRA POWER & STEEL
For, Hira Power & Steels Limited
(Mukesh Kumar Verma)
Certified Energy Manager
Reg. No.: EM-4339

4. AIR EMISSION SOURCES & CONTROL MEASURES

AIR EMISSION SOURCES

TYPE OF EMISSION	SOURCE OF EMISSION
FUGITIVE EMISSION	1. Raw Material Handling 2. Crusher & Screening 3. Material Transfer Points 4. Loading and Unloading Yard 5. Roads/Vehicle Movements 6. Material Stock Yards 7. Coal Handling area 8. Coal Crushing & Conveying 9. Fly Ash Loading points 10. Slag loading & Handling
STACK EMISSIONS	1. Captive Power Plant (20 MW) 2. Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)

Air Pollution Control Measures

The status of Air Pollution around the Plant is being monitored regularly. The following measures are adopted to keep the ambient air quality as prescribed the limits in National Ambient Air Quality Monitoring Standards.

1. De-dusting and dust suppression systems i.e. Electrostatic Precipitators, Bag Filters with Suction Hoods, Cyclones, Road sweeping machine, Dry Fog systems, Water sprinkling system are installed for control of emission level.
2. Specifically and essentially required dust control systems already installed on Cooler outlet area, Product separation buildings, crushing units, Day bin area, Power Plant Boilers, Ferro Alloy Electric Arc furnaces. These systems are checked regularly and their emission is monitored and maintained within prescribed limits.
3. All the stacks are designed specifically and necessary arrangements for monitoring of PM, SO2 and NOx. On duty personnel is regularly check the process parameters and initiate appropriate control measures in case monitoring highlights non-conformity with limits.
4. The work zone air quality is monitored regularly.
5. All dust suppression systems is being maintained properly and checked on regular intervals to minimize the dust level.

7. Leakages from equipment and ducts are being checked and stopped.
8. Water spraying and sprinkling is being done regularly.
9. Regular Encouraging activities & training is being imparted for workers to understand the importance of these systems so that they pay adequate attention towards the functioning of these systems.
10. Regular log books of Pollution Control equipment are maintained to detect malfunctions.
11. All dusts bends are being cleaned regularly.
12. Each unit head is responsible to have better Environment Management System.

Maintenance/Monitoring for Air Environment

1. Continuous emission monitoring system is installed.
2. Regular Ambient Air Quality is being monitored with ground level concentration inside the factory premises as well as around the plant.
3. Regular stack monitoring (PM, SO2, NOx) is being carried out.
4. ESP is being maintained to give the maximum efficiency.
5. All dust control systems is checked and their emission is being monitored and maintained within the prescribed limits.
6. All dust suppression systems is maintained properly with sprinkling of water to suppress the dust.
7. All fugitive emissions are minimized. If found any leakage in duct, transfer points etc. than same will be stopped.
8. Training of workers through Environmental Protection Cell.

AIR POLLUTION CONTROL EQUIPMENTS WITH CONTINOUS MONITORING SYSTEM

Stack Attached To Plant	Pollution Control Equipment	Monitoring System
Captive Power Plant (20 MW)	Electrostatic Precipitator	Opacity Meter & SOx NOx Analyser
Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)	Bag Filter	Opacity Meter installed

- Monitoring Reports of Air Quality monitoring in enclosed as **Annexure - I**

Air Pollution Control Equipment

ESP attached with Chimney – Power Plant

Bag filters Attached with Chimney – Ferro Alloy Plant

Online Gas Analyzer for continuous emission monitoring at Chimney – Power Plant

5. WATER POLLUTION SOURCES & CONTROL MEASURES

The utilization water for plant consumption is designed on a Zero discharged concept and all cooling water is recirculated. However, 17.18 m3/day of cooling tower blow down & 6.12 m3/day of Boiler blowdown is generated which is utilized for dust suppression at the coal handling area, silo area, raw material yard and road. Effluent from the plant bathrooms & toilets is being treated in septic tank followed by soakage pit.

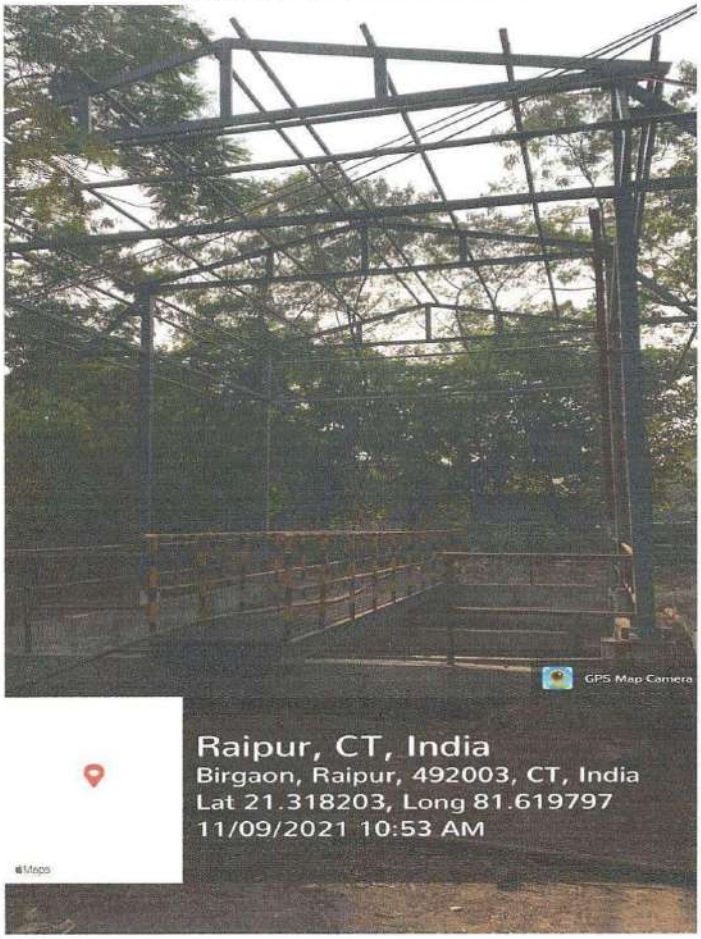
In order to check any discharge of process effluents, the waste water management system encompasses installation of 1 pair settling tanks in plant premises with proper utilization arrangement for horticulture purpose and water sprinkling on roads, yards and ash silo-areas within the plant premises. Septic tanks and soak pits are also provided for treatment of domestic waste water.

Effluent	Generation Quantity	Treatment Arrangement	Mode of Disposal
Cooling Tower Blow Down	17.18 m^3/day	Settling Tanks	Used in dust suppression at the coal handling area, silo area, raw material yard and roads.
Boiler Blowdown	6.12 m^3/day	Settling Tanks	Used in dust suppression at the coal handling area, silo area, raw material yard and roads.
Domestic Waste Water	63.09 m^3/day	Treated through septic tank and followed by soakage pit.	NA

- Monitoring reports of Water Quality is enclosed as **Annexure - II**

Waste Water Treatment Facilities

Settling tanks for collection & treatment of effluent



6. SOLID WASTE GENERATION AND DISPOSAL DETAIL

For Ferro Alloys Manufacturing:

The generated slag from Ferro Alloys manufacturing are being stored in slag yard scientifically and being Recycling/Reuse in manufacturing process.

SOLID WASTE GENERATION DETAIL

Description	Current Metric Tonnes/Month	Method of Collection	Method of Disposal
Fly Ash	6009	Pneumatic Conveyors	Brick/Block/Other Products Manufacturing
Fe Mn Slag	2871	Collected on Sand Bag	Recycling/Reuse in manufacturing process

7. HAZARDOUS WASTE GENERATION AND DISPOSAL DETAIL

As per the Hazardous Waste Authorisation Used Oil & Used Resin are the Hazardous Waste is generated from the plant but Only used oil is being generated from all the units, which is properly being handled and stored at their designated place and being sold to authorized parties or used for manufacturing of copper pad, heating ladle & machine lubrication as per the rules.

Category of Hazardous Waste as per the Schedules I, II and III of these rules	**Authorised mode of disposal or recycling or utilization or co-processing etc.**	Quantity (Tonnes/Annum)
Used/Spent Oil (Schedule-I, Cat.No.- 5.1)	Sold to authorized recyclers	2.320 KL
Spent ion exchange resin containing toxic metals (Schedule-I, Cat.No.- 35.2)	Utilized for energy recovery in boiler for steam or power generation	NIL

Reports of Solid Waste & Hazardous Waste are attached **Annexure – III & IV**

8. HOUSE KEEPING

Good housekeeping contributes greatly to efficient operations, improved employee morale, better productivity and reduction of accidents. Housekeeping standards reflect an organization's work culture.

Good housekeeping can only be achieved by proper planning. This includes a well-planned process layout, orderly arrangement of equipment; systematic material storage stacking and movement; and waste disposal; coupler with day-to-day maintenance of cleanliness and tidiness.

*All the internal roads in the plant premises have been made of concrete (RCC).

*Sufficient no. of water sprinklers has been installed, at required locations.

*Water tanker has also engaged for water spaying round the clock on all the internal road as well outside roads, yards.

RCC Road

Pneumatic Sweeping

Mobile Sprinklers

Static Sprinklers

9. PLANTATION

HPSL is making sincere efforts for conservation and protection of the environment. In this stream greenery is the need of the hour in HSPL and in the past years, it has become the key promising activity in and around the campus and new heights has been attained in this field. All these efforts were made in view to not only reduce the pollution, but also to ensure our commitment towards the betterment of the environment.

The species so far planted in and around campus has shown tremendous vegetative growth, which has contributed, considerably in a quantitative and qualitative increase in greenery.

The selection of species were made by taking into consideration the available resources and limitations *viz.*, type of soil, availability of rain water and sub-surface water (ground water), disease infection and pest infestation, nutrient availability and finally the prevailing climatic conditions, in and around the campus.

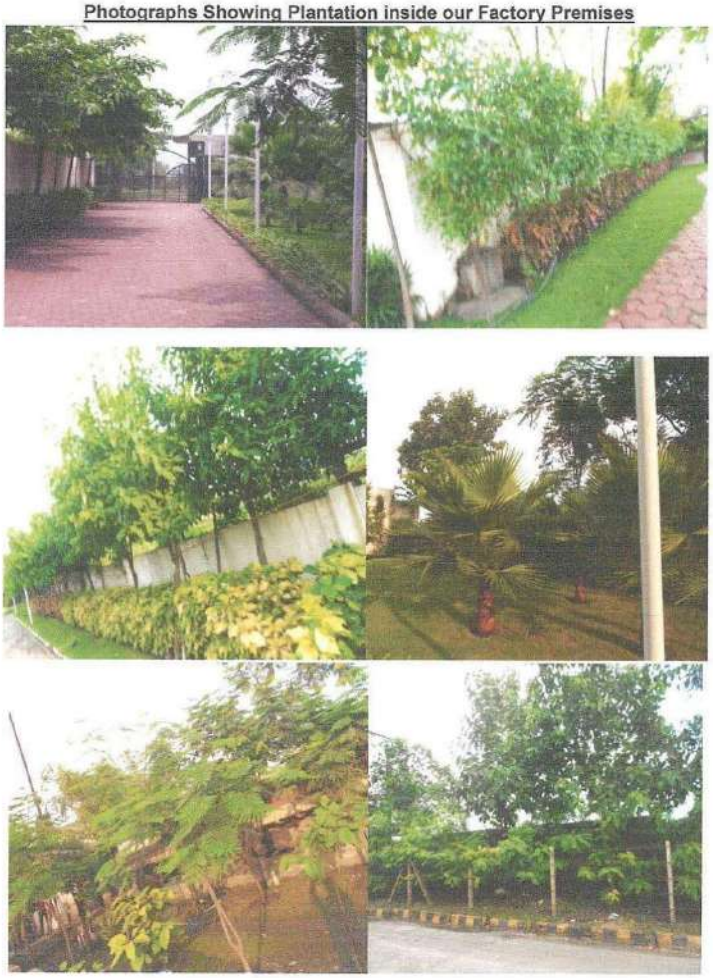
Besides agro-forestry efforts, ornamental efforts were also made in the due course, which is resulting into increasing the total amount of greenery in HSPL campus as well surrounding area.

Plantation efforts will be carried-on to the maximum possible extend in and around HSPL campus. In this direction, we are making efforts for avenue plantation from HSPL besides the road, nearby villages. which shows our sincerity in making efforts for continual improvement in quality of environment not only inside the HSPL campus, but also in the adjacent area as well as district of Raipur. Out all these efforts have been made in totally different manner than the other as we are having a well-developed nursery, inside our campus, where we grows all the spices to be taken up under the plantation program. Our effort is not only economical, but also viable and easily adoptable as the saplings are well familiar to survive and grow in the same atmosphere prevailing in the campus.

Total land area of the industry in acres	According to the consent condition, the area of land reserved for plantation in acres	Total number of plantations done so far on reserved land	Total number of plantations done so far outside the industry premises.
43.49	**14.35**	**16578**	**2600**

Plantation Verification Report is attached **Annexure – V**

Photographs Showing Plantation inside our Factory Premises



10. Brief Detail of Plant

<table>
<tr><td>1.</td><td>Industry Name & Address</td><td colspan="3">M/s Hira Power & Steel Limited
, Plot No. 511/1, 511/2, Urla Industrial Area
Raipur – (C.G.)</td></tr>
<tr><td>2.</td><td>Industry's Occupier/Director /CEO/Authorised Person Name & Address with Contact Number</td><td colspan="3">Name – Mr. Devendra Pratap Singh
Position – Executive Director
Address – Plot No. 511/1,511/2 , Urla Industrial Area, Raipur – (C.G.)

Phone Number: 0771 – 4082500</td></tr>
<tr><td>3.</td><td>Industry's E-Mail, Phone No. & Fax No.</td><td colspan="3">E-Mail : environment@hpslindia.com
Phone Number: 0771 – 4082500
Fax Number: 0771- 4082501</td></tr>
<tr><td>4.</td><td>Products & Production Capacity (As per Consent)</td><td>Products</td><td colspan="2">Production Capacity</td></tr>
<tr><td></td><td></td><td>Electricity (Captive Power Plant)</td><td colspan="2">20 MW</td></tr>
<tr><td></td><td></td><td>Ferro Alloys
and
Ferro Alloys (Including Low/Medium Carbon)
Or
Pig Iron</td><td colspan="2">30,000 MTPA
And
18,000 MTPA
Or
56,000 MTPA</td></tr>
<tr><td>5.</td><td>Consent/Consent Renewal Validity</td><td colspan="3">Consent No. 208/TS/CECB/2018 Dtd 03/04/2018 Valid up to 31/03/2022</td></tr>
<tr><td>6.</td><td>Information regarding water source, water pollution control system and contaminated water treatment system</td><td colspan="3">Source of Water – Chhattisgarh State Industrial Development Corporation (CSIDC)

Source of Water – Borewell (For Domestic Use)</td></tr>
<tr><td></td><td></td><td>Description</td><td>Quantity of water used (in KLD)</td><td>Quantity of effluent water (in KLD)</td></tr>
<tr><td></td><td></td><td>Domestic</td><td>63.09</td><td>50.472</td></tr>
<tr><td></td><td></td><td>Cooling</td><td>324.38</td><td>17.18</td></tr>
<tr><td></td><td></td><td>Boiler</td><td>76.00</td><td>06.12</td></tr>
<tr><td></td><td></td><td>Others (Dust Suppression & Plantation)</td><td>23.30</td><td>00</td></tr>
<tr><td></td><td></td><td colspan="3">Knowledge of domestic contaminated water treatment system including capacity-
Septic Tank & Soak pit is being used for disposal of Domestic effluent in plant.</td></tr>
<tr><td></td><td></td><td colspan="3">Knowledge of industrial contaminated water treatment systems including capacity –
In our Plants, water is being used for cooling purpose in re circulating manner. Two Settling tanks capacity of 178 KL and 150</td></tr>
</table>

		KL are constructed at different location at plant, to utilize the discharge water in Horticulture and for water sprinkling purpose, after filtration. Discharge water quality is being maintained within the prescribed norms.
		Information about number and location of installed water meters – Bore well (For Domestic) Total Flow meter – 4 Nos. Locations – 1. Power Store 2. Raw Material Area 3. Pump House 4. DG Set

7.	Knowledge of unit wise air pollution control system	**Plant Name**	**Pollution Control Equipment**
		AFBC CAPTIVE POWER PLANT (20 MW)	Electrostatic Precipitator
		Ferro Alloy (3.0, 3.6, 5.5, 5.5, 6.0 MVA Submerged Arc Furnace and CLU Converter)	Bag Filters

STACK ATTACHED TO PLANT	EQUIPMENT NAME	DATE OF INSTALLATION	REDUCTION EFFICIENCY GUARANTEED BY MANUFACTURER (IN %)	QUANTITY OF CURRENT /EXPECTED EMISSION (Kg/D)	APPLICATION
3.0 and 3.6 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	23.02.2010	99.8	38.40	Bag Filter Dust
5.5 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	19.05.2006	99.8	72	Bag Filter Dust
5.5 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	19.05.2006	99.8	72	Bag Filter Dust
6.0 MVA Submerged Arc Furnace	PULSE JET BAG FILTER	23.02.2010	99.8	72	Bag Filter Dust
CLU Converter (12 MT/Heat)	PULSE JET BAG FILTER	20.05.2016	99.8	17.10	Bag Filter Dust
CAPTIVE POWER PLANT	ELECTRONIC PRECIPITATOR	19.05.2016	99	223.776	FLY ASH COLLECTION

Information of Fugitive Emission Control System	Fugitive emission reduction measures are taken such as Water sprinkling through sprinklers, water guns & water tankers, dense green belt development, covered storage of raw material, fuels and wastes. Raw material, fuels, finished products and solid wastes are being transported in duly covered vehicle after spraying water on it.

	Information regarding unit-wise chimney height and online monitoring system installed in the chimney along with results	**Plant Name**	**Stack Height**	**Detail of Continuous Emission Monitoring System**
		AFBC CAPTIVE POWER PLANT (20 MW)	72 m	Make- Forbes Marshall Model- DCEM2100 Party- Prima Equipments Instrument-Dust Opacity Meter (PM) Make- PRIMA Model- PSGM-1-D-AGS Party- Prima Equipments Instrument-SOx Nox Analyzers
		3.0 and 3.6 MVA Submerged Arc Furnace 5.5 MVA Submerged Arc Furnace 5.5 MVA Submerged Arc Furnace 6.0 MVA Submerged Arc Furnace CLU Converter (12 MT/Heat)	30 m 35 m 35 m 40 m 35 m	Not Connected
		Stack Monitoring Report is Attached.		
	Information regarding the ambient air quality, including the number and location of the continuous ambient air quality monitoring system and results as per the consent condition	Ambient Air Quality Report is Attached as Annexure-I		
	Information of electricity meters installed for air pollution control	Energy Meter Report is Attached as Annexure-VI		
8.	Unit wise raw material information Information of Raw Material/Fuel/Finished Products	**List of Raw Materials**	**Raw Materials(Consumption per month) TPM**	
		Manganese Ore	120000	
		Pearl Coke	18240	
		Steam Coal	15840	
		Dolomite	3360	
		Iron Ore	3360	

	storage	Electrode Paste		768	
		High Carbon Ferro Manganese		17880	
		Calcined Lime		1152	
		Calcined Dolomite		648	
		Si Mn Fines		1476	
		Fe Mn Fines		4800	
		Raw materials like Coal & Iron Ore and Finished Products are being kept in shed and covered area.			
10.	Information of transportation of raw materials / fuels / finished products	Source and Mode of transportation along with distance of raw material & its specification is attached as Annexure-VII			
11.	Solid waste management system	Recycling/Reuse in the Manufacturing process or sold to Si-Mn Producers.			
12.	Solid waste management system Plantation related information	Power Plant	Type of solid waste	Quantity generated per month	Disposal/Treatment system
		Power Plant Ferro Alloy Plant	Fly Ash	6009	Brick/Block/Other products manufacturing
		Total land area of the industry in acres	Fe Mn Slag	2871	Recycling/Reuse in the Manufacturing process
13.	Plantation related information Rain water harvesting system information	Rainwater Harvesting System	According to the consent condition, the area of land reserved for plantation in acres	Total number of plantations done so far on reserved land	Total number of plantations done so far outside the industry premises.
		Refer Annexure III	**14.35 Acres**	**16,578**	**2600**
15.	Status of internal Roads	All the internal roads are made pucca.			
16.	Information regarding the formation of environment cell and the name and designation of the authorized person involved in it.	**ENVIRONMENT MANAGEMENT CELL** 01) Shri D.P Singh (Executive Director) 02) Mr. Aviral Tiwari (Senior Engineer) 03) Mr. Bhagirati Kaushik (Chemist) 04) Sample Boys (02 Nos)			

17.	Information regarding the amount reserved for the Environment Safeguard	297.03 Lakhs.
18.	Detail of Authorisation under Hazardous & Other Waste (Management & Transboundary Movement) Rule, 2016 with Renewal and Validity.	Hazardous Waste Authorisation No.–3641/HSMD/HO/CECB/2020 dated: 21/07/2020 Attached as Annexure VIII

ANNEXURE- I

AMBIENT AIR & STACK EMISSION MONITORING REPORT

SEPTEMBER – 2021

1. SAMPLING DETAILS

Date of Sampling – 09.09.2021

Date of Analysis – 11.09.2021

Monitored by – Neeraj Arya & Bhagirati Kaushik

Analyzed by – Bhagirati Kaushik

2. AMBIENT AIR MONITORING RESULTS

Parameter	Prescribed limit	Location			
		Main Gate (South)	CHP (North)	Power Store (East)	Power Silo (West)
PM10	100.00 µg/m^3	71.5	73.7	67.6	69.8
PM2.5	60.00 µg/ m^3	31.3	35.2	29.5	32.1
SO2	80.00 µg/ m^3	21.5	25.4	23.3	24.9
NOX	80.00 µg/ m^3	19.7	18.6	18.4	19.5

3. STACK EMISSION MONITORING RESULTS

S.N.	Monitoring Point	Date of Monitoring & Analysis	Prescribed limit	Concentration measured in mg/Nm3
1.	AFBC	09.09.2021	50 mg/Nm^3	38.8
2.	AB Furnace	09.09.2021	50 mg/ Nm^3	30.7
3.	C Furnace	10.09.2021	50 mg/ Nm^3	35.5
4.	D Furnace	10.09.2021	50 mg/ Nm^3	33.6
5.	E Furnace	11.09.2021	50 mg/ Nm^3	32.4
6.	CLU Converter	11.09.2021	40 mg/ Nm^3	26.3

ANNEXURE - II

CENTRE FOR GROUND WATER RECHARGE TESTING LABORATORY

A House of Complete Water Testing

Save Water for the Future Generation | Chhattisgarh First NABL Accreditated Lab in Water & Waste Water Testing
AN ISO 9001:2008 Certified Lab & CRISIL Rating 4*

NABL ACCREDITED
Accreditated Laboratory
Certificate No. - TC-6813

90/A, Sector II, Geetanjali Nagar, Raipur (Chattisgarh) Tel: 0771-4049364 (Laboratory)
Mobile No. : +91 9424203354, +91 7000664898, +91 9424203408
Email : cgwrtestinglab@gmail.com, cgwr.raipur@gmail.com Website : www.cgwr.in

TEST REPORT

ULR - TC6813180000001605F

TEST REPORT NO:CGWR/WLT/4271

Customer Name and Address-
M/S. HIRA POWER AND STEEL LIMITEED
P.H. NO. 100 KH..NO- 19/2, 19/5
VILLAGE- ACHHOLI,
BLOCK- DHARSIWA
DIST- RAIPUR (C.G.) 493221

Date of Reporting : 22/12/2020
SRF No: CGWR/SRF/WTL/1292
Job Order No: CGWR/WTL/4271
Date of receipt sample: 21/12/2020
Start Date of Testing : 22/12/2020
End Date of Testing : 22/12/2020

Sample detail : WATER | Sample ID: BORE WELL WATER | Sample Quantity: 1Ltr | Container : Plastic

Environment Condition -: Temp27°C / Humidity-46%

Sl. No	PARAMETERS	TEST METHOD	UNIT	DRINKING WATER IS:10500-2012		TEST RESULT
				DESIRABLE	MAXIMUM	
A.	*Chemical Parameter*					
1.	pH	APHA 23rd Edition 2017- 4500-H+ A.	-	6.5 to 8.5	No relaxation	7.14
2.	Turbidity	APHA 23rd Edition 2017 -2130 B.	NTU	1	5	0.16
3.	Conductivity	APHA 23rd Edition 2017- 2510 A.	µS/cm	>1000	3200	560
4.	Total Dissolve Solids	APHA 23rd Edition 2017-2540 C.	mg/l	500	2000	364
5.	Total Hardness	APHA 23rd Edition 2017- 2340-C	mg/l	200	600	300
6.	Calcium as Ca	APHA 23rd Edition 2017- 3500-Ca-B	mg/l	75	200	64.12
7.	Magnesium as Mg	APHA 23rd Edition 2017- 2340-C	mg/l	30	100	49.57
8.	Chloride	APHA 23rd Edition 2017- 4500- Cl- B.	mg/l	250	1000	11.99
9.	M- Alkalinity	APHA 23rd Edition 2017 -2320 B.	mg/l	200	600	180
10.	Fluoride as F	APHA 23rd Edition 2017- 4500-F D.	mg/l	1.0	1.5	<0.1
11.	Sulphate as SO4	APHA 23rd Edition 2017- 4500 SO4 - E.	mg/l	200	400	5.66
12.	Iron	APHA 23rd Edition 2017 -3500--B.	mg/l	0.3	No relaxation	<0.1
13.	Nitrate	IS 3025 (Pt.34):1988/RA 2003	mg/l	45	No relaxation	0.85

Reviewed by

Chinmayee Mohanty (Sr.Chemist)

Center For Ground Water Recharge
Testing Laboratory
NABL Accreditated Lab
Certificate No:- TC-6813

Authorized Signature

Sarita Panigrahi (QM)

Statements:
1. This test report refers only to the particular item(s) submitted for testing.
2. The test results reported in this report are valid at the time of and under the stated condition of measurement.
3. Parameters marked with "*" are not covered in scope for NABL accreditation.
4. This particular test report cannot be reproduced expect in full, without prior permission of Quality Manager.

ANNEXURE - III

HIRA

HIRA POWER & STEELS

Ref : 58/HPSL/2021-22/60 Date : 04.05.2021

To,
The Regional Officer,
Regional Office,
Chhattisgarh Environment Conservation Board,
Commercial Complex, Chhattisgarh Housing Board Colony,
Kabir Nagar, Raipur (C.G.)

Sub : Fly Ash Utilization Annual Report/ Return for the Financial Year 2020-21

Respected Sir,

With reference to above cited subject, we are submitting herewith Fly Ash Utilization Annual Report/Return **(Annexure-I)** for the Financial Year 2020-21 (April 1st 2020 to March 31st 2021) for your ready reference and record, please.

Fly Ash is being disposed off by us systematically and scientifically as per Fly Ash Notification dated 14th September, 1999 and its amendments by MoEF & CC.

Kindly acknowledge the receipt of the same.

Thanking you,

Yours faithfully,
For, **HIRA POWER AND STEELS LIMITED, (UNIT-II)**

AUTHORISED SIGNATORY

Enclosed : As above.

Copy to :

01 The Member Secretary, Chhattisgarh Environment Conservation Board, Paryavas Bhavan, North Block, Sector-19, Atal Nagar, District-Raipur (C.G.) 492 002

02 The Regional Director, Central Pollution Control Board, 3rd Floor, Sahkar Bhawan, North TT Nagar, Bhopal-462 003 (M.P.)

03 The Deputy Director General of Forest (C), Ministry of Environment, Forest and Climate Change, Regional Office (WCZ), Ground Floor, East Wing, New Secretariat Building, Civil Lines, NAGPUR-440 001 (M.S.)

ANNEXURE-I

HIRA

HIRA POWER & STEELS

HIRA POWER & STEELS LIMITED

UNIT – II

FLY ASH GENERATION & UTILIZATION REPORT FOR THE FINANCIAL YEAR 2020-21 (April 1st 2020 to March 31st 2021)

Sr. No.	Month	Fly Ash Generation in the Month	Fly Ash Utilization (2020-21)									Stock Available
			Supply to the Cement Plant	Brick Manufacturing	Land Filling	Ash Dyke Raising / Construction	Agriculture	Mine Filling	Any Other Use	Total	Utilization Percentage	
		(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(MT)	(%)	(MT)
1	Apr-20	2839.34	0.00	2839.34	0.00	0.00	0.00	0.00	0.00	2839.34	100.00	0.00
2	May-20	7371.23	0.00	7371.23	0.00	0.00	0.00	0.00	0.00	7371.23	100.00	0.00
3	Jun-20	5712.65	0.00	5712.65	0.00	0.00	0.00	0.00	0.00	5712.65	100.00	0.00
4	Jul-20	7644.05	0.00	7644.05	0.00	0.00	0.00	0.00	0.00	7644.05	100.00	0.00
5	Aug-20	7205.83	0.00	7205.83	0.00	0.00	0.00	0.00	0.00	7205.83	100.00	0.00
6	Sep-20	2709.81	0.00	2709.81	0.00	0.00	0.00	0.00	0.00	2709.81	100.00	0.00
7	Oct-20	86.83	0.00	86.83	0.00	0.00	0.00	0.00	0.00	86.83	100.00	0.00
8	Nov-20	5262.73	0.00	5262.73	0.00	0.00	0.00	0.00	0.00	5262.73	100.00	0.00
9	Dec-20	8037.8	0.00	8037.80	0.00	0.00	0.00	0.00	0.00	8037.80	100.00	0.00
10	Jan-21	9089.38	0.00	9089.38	0.00	0.00	0.00	0.00	0.00	9089.38	100.00	0.00
11	Feb-21	7982.20	0.00	7982.20	0.00	0.00	0.00	0.00	0.00	7982.20	100.00	0.00
12	Mar-21	8166.77	0.00	8166.77	0.00	0.00	0.00	0.00	0.00	8166.77	100.00	0.00
Total		**72108.62**	**0.00**	**72108.62**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**72108.62**	100.00	**0.00**

ANNEXURE - IV

HIRA

HIRA POWER & STEELS

Ref: 246/HPSL/2020-21/259

Date: 29.06.2021

To,

The Regional Officer,
Regional Office,
Chhattisgarh Environment Conservation Board,
Commercial Complex, Chhattisgarh Housing Board Colony,
Kabir Nagar, Raipur (C.G.)

Sub: Submission of Hazardous Waste Annual Return (Form - 4) for the financial year 2020 -21.

Ref:

1. Authorization No. 340/HO/HSMD/CECB/ATAL NAGAR, RAIPUR Dated: 21.07.2020
2. Authorization granted vide letter No. 3641/HSMD/HO/CECB/2020 Dated: 21.07.2020

Respected Sir,

Please find enclosed herewith Hazardous Waste Annual Return in Form – 4 as prescribed under the Hazardous and other Waste (Management and Transboundary Movement) Rules, 2016 for the financial year 2020-21 in respect of Hira Power & Steels Limited, Unit – II.

This is for your kind information and record, please.

Kindly acknowledge the receipt of the same.

Thanking You,

Yours faithfully,
For, **HIRA POWER & STEELS LIMITED, UNIT - II**

Authorized Signatory

Encl: A/a

CC: The Member Secretary, Chhattisgarh Environment Conservation Board, Paryavas Bhawan, North Block, Sector – 19, Atal Nagar, Dist. - Raipur (C.G.) – 492 002

FORM 4

[See rules 6(5), 13(8), 16(6) and 20 (2)]

FORM FOR FILING ANNUAL RETURNS

[To be submitted to State Pollution Control Board by 30th day of June of every year for the preceding period April to March]

1.	Name and address of facility :	Hira Power & Steels Limited, Unit-II Urla Industrial Complex, Dist. : Raipur (C.G.)
2	Authorization No. and Date of issue :	3641/HSMD/HO/CECB/2020 Dated. 21.07.2020
3	Name of the authorized person and full address with telephone, fax number and e-mail:	Shri D.P.Singh Hira Power & Steels Limited, Unit-II Khasra No. 511/1, 512/2, Urla Industrial Complex, Raipur (C.G.) P: +91 771 4082500, 4082600 Fax : +91 771 4082501
4	Production during the year (product wise), wherever applicable.	Ferro Alloys : 39257.954 Metric Tonnes Captive Power Plant : 139990600 KWH

Part A. To be filled by hazardous waste generators

1.	Total quantity of waste generated category wise.	Used / Spent Oil (5.1)	2.320 KL.
		Spent Ion Exchange resin containing toxic metals (35.2)	Nil
2.	Quantity dispatched (I) To disposal facility (II) To recycler or co-processors or pre-processor (III) Others	N.A.	
3.	Quantity utilized in-house, if any -	Used /Spent Oil (5.1)	4.05 KL (For manufacturing of copper pad, heating ladle & machinery lubrication)
		Spent Ion Exchange resin containing toxic metals (35.2)	NIL (Spent ion exchange resin mixed with coal & used as supplementary energy resource in boiler for stream or power generation.)
4.	1. Quantity in storage at the end of the year-	Used /Spent Oil (5.1)	Nil
		Spent Ion Exchange resin containing toxic metals (35.2)	Nil

- 1.735 KL Used / Spent Oil (5.1) was stored at the beginning of 01.04.2020 (1.735 KL carried forward from previous financial year i.e. 2019-20)

Part B. To be filled by Treatment, storage and disposal facility operators

1	Total quantity received -	N.A.
2	Quantity in stock at the beginning of the year –	N.A.
3	Quantity treated –	N.A.
4	Quantity disposed in landfills as such and after treatment –	N.A.
5	Quantity incinerated (if applicable)-	N.A.
6	Quantity processed other than specified above –	N.A.
7	Quantity in storage at the end of the year -	N.A.

Part C. To be filled by recyclers or co-processors or other users

1	Quantity of waste received during the year – (1) Domestic sources (2) Imported (if applicable)	N.A.
2	Quantity in stock at the beginning of the year –	N.A.
3	Quantity recycled or co-processed or used –	N.A.
4	Quantity of products dispatched (whenever applicable)-	N.A.
5	Quantity of waste generated –	N.A.
6	Quantity of waste disposed –	N.A.
7	Quantity re-exported (wherever applicable)-	N.A.
8	Quantity in storage at the end of the year -	N.A.

Signature of the Occupier or
Operator of the disposal facility

Date : 29.06.2021

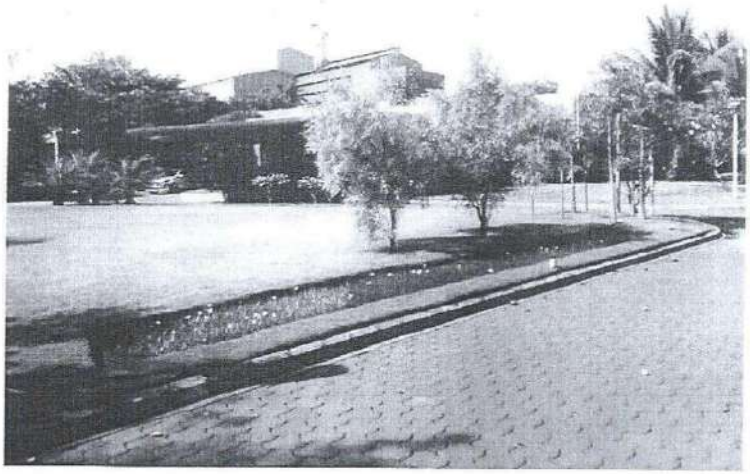
Place : Raipur

ANNEXURE-V

HIRA

HIRA POWER & STEELS

UNIT - II



[PLANTATION SURVEY & EVALUATION REPORT]
2019 – 20, 2020-21

SEIDR

SURVEY & EVALUATION BY - SOCIETY FOR ENVIRONMENT & INTEGRATED DEVELOPMENT RAIPUR

GREENBELT: SURVEY & EVALUATION REPORT OF M/S HIRA POWER & STEEL PVT. UNIT - II

SEIDR

Evaluation of Greenbelt Development

For

M/s HIRA POWER &STEEL LTD. UNIT - II

Plot No. 557, 563 & 564 Urla, Industrial Complex, Urla, Raipur

Survey & Evaluation by -"Society for Environment & Integrated Development Raipur" Raipur (CG)

EXECUTIVE SUMMARY

1. INTRODUCTION

M/s HIRA POWER&STEEL LTD.is working at three places in the state of Chhattisgarh:-

2. Regd. Office / Works – M/s HIRA POWER AND STEEL LIMITED– Unit – II, 511/1, 512/2, Urla Industrial Complex, Raipur, Pin code – 492003 (C. G.)

3. Project Started – As Per information provided by M/s HIRAPOWER&STEEL Ltd. Raipur, Details of Projects are as Under :-

I. HIRA POWER AND STEEL, URLA (Raipur) Plant –

1. EC- F-No. J-11011/836/2008-IA-II (I) MoEF, New Delhi - 11003 for Ferro Alloy plant – 600 MTPA for production of Low Medium Carbon Ferro Manganese (Ferro Alloys) – 18,000 MTPA.
2. Ferro Alloys -30,000 MTPA, Or 56,000 MTPA Pig Iron from 2×5.5 MVA Submerged Arc Furnaces
3. Captive Power Plant – 20 MW

4. Plant Area:-

Hira power & Steel Ltd. Urla (Raipur) Plant – Total Land Area – 17.59 Ha. (Approx) (Plantation Area – 5.86 Hectare Approx)

M/s HIRA POWER&STEEL LTD

The green belt helps to capture the fugitive emission and attenuate the noise apart from improving the aesthetic quality of the region in the total area of the project site (Core Zone). 33% area shall be developed as green belt along the periphery of the plant in Hira Power & Steel – Unit -II whereas 33% (as they come under notified industrial area) plant shall be developed as green belt area. Development of green belt and other forms of greenery at road side and plantation in nearest project affected villages shall also be helpful to improve ecological conditions and biodiversity status of the area.

Survey and Evaluation work was allotted by M/s HIRA POWER&STEEL LTD. to our organization – "SOCIETY FOR ENVIRONMENT & INTEGRATED DEVELOPMENT RAIPUR" for which one work orders was issued dtd.21/12/2020 via S.O. No. 7200003029/U102.

5. PROJECT OBJECTIVE

Plant species act as bio-monitoring agent to monitor the air environment as well as it keeps and maintains the project environment healthy by providing more oxygen. The two areas of air pollution i.e. gases and dust need to be urgently by using plants. Keeping this in mind, alleviate measures have been suggested to develop green belt based on local and physical conditions of the areas by taking the cognizance of "Green with Purpose" drive.

6. PLANTATION DETAILS

7. Area of Plantation (Green Belt):- During the field survey and field study by our technical team it has been found that plantation work was started from start of each project and is continued till date.

A. Urla Plant Unit-2, - 5.86 Ha. (Approx) in Campus Area.
B. Aerodrome Garden development area.
C. Road Side area – 3 ½ K. M. (Approx) in campus Area.

8. Details of Year wise Plantation:-
Road side plantation survey till date as per details given below:-
M/s HIRA POWER&STEEL LTD.

A. Main gate to Jai hind chowk to near Police station and around

s.n.	Species	No. of Survival plants
1.	Kesiasemia, Peltophorum, Gulmohar, Karanj, Sissoo, Alatonia, Pipal,	1434

B. Plantation done by Hira Power & Steel Ltd. up to 2019-20, 2020-21

Year	Unit -2	Road Side	Airport Garden
UP TO 2019-20	14000+1252	2600	2500
2020-21	1326	0	0
Total =	16578	2600	2500

9. Plantation Sites:-

Plantation work is in progress along the plant boundary wall and inside the plant premises. Plantation work has been done along the road side. Plantation survey has been carried out by expert team with the help of officers of M/s HIRA POWER & STEEL Ltd. Following sapling was planted by M/s HIRA POWER & STEEL Ltd.

I. At Unit – 2, plant Campus Area –
   A. Plant premises area.
   B. Admin building (Office area)

II. Road Side area.

III. Airport Garden

- Road side Plantation –

s.n.	Location of plantation	Length in Kilometer
1	Unit –II main gate to Young India Choak, Police Station around Road both side	3 ½ K M (Approx)

Boundary wall has been constructed on the places, Raipur factory, Due to this construction expected damages from cattle and unwanted social elements were controlled.

Irrigation facility was also provided at five places by drip water pipe line and tanker due to this the growth of plants has been observed very well.

10. METHODOLOGY

- All planted areas were inspected.
- All small plants were counted and taken their measurement and same has been recorded.
- Height and girth of plants and saplings have been measured.
- Survival percentage has been recorded.
- Many places were pictures of plantation.

11. M/s HIRA POWER & STEEL LTD.

A. UNIT -II- PLANTATION SPECIES AND MEASUREMENT

S.N	Species	Average		Maximum		Minimum	
		Girth (cm)	Height (m)	Girth (m)	Height (m)	Girth (cm)	Height (m)
1.	Peltophorum	10.5	5.30	80	15	4	4.0
2.	Alastonia	18.4	6.95	54	13	4	3.0
3.	Parkia	5.7	4.1	9	5.50	4	3.0
4.	Kesiasemia	25	5.65	45	10.50	3	0.90
5.	Shisham	40.0	8.04	80	12	20	5
6.	Sirsa	7.5	4.5	12	6.5	4	3.1
7.	Badam	28	6.2	45	8.50	12	2.0
8.	Coconut	40	8.25	60	12	28	5
9.	Karanj	28	3.3	62	47	5	2
10.	Washingtonia	57.8	3.08	90	9.0	40	2
11.	Spethodia	7.30	2.58	14	4.25	2	1.30
12.	Nilgiri	11.61	2.93	20	4.50	4	1.10
13.	Shisham	20.30	4.20	26	5.50	15	3
14.	Gulmohar	9	3.3	12	5	6	1.2
15.	Konocarpes	17.5	5.06	20	6.05	9	2
16.	Neem	11.66	2.61	14	3.10	5	0.95
17.	Karanj	5.12	1.06	10	2.50	2	0.50
18.	Alastonia	13	3.68	16	5	13	2.50
19.	Champa	20.5	5.8	52	12.0	6	3
20.	Sitafal	14.60	4.42	16	5.50	13	4.00
21.	Kaner	7.14	2.98	12	4.00	4	2.00
22.	Kachnar	38.58	10.51	52	13	25	6.50
23.	Areca Pam	14.08	3.52	32	8.00	6	4.00
24.	Bottle brush	8.12	2.13	18	6.50	4	1.20
25.	Kadmba	12.3	5.3	24	7.50	6	4.00
26.	Acacia	6.75	3.65	16	7.50	3	2

D. AIRO DROME GARDEN - PLANTATION SPECIES AND MEASUREMENT

S.N.	Species	Average		Maximum		Minimum	
		Girth (cm)	Height (m)	Girth (cm)	Height (m)	Girth (cm)	Height (m)
1.	Spathodea	45	5.9	65	10	20	4.5
2.	Champa	25	2.7	30	3.5	20	2
3.	Cycus	104	4.16	115	5	75	2.50
4.	Tikoma	6.5	1.75	12	2.6	4	1.20
5.	Akash neem	64.75	14	80	15	45	12
6.	Kaner	8.8	1.75	60	1.80	8	1.75
7.	Bottle palm	34.5	5.6	40	6.5	25	5.00
8.	Arjun	30	7.12	70	12	12	4.00
9.	Peltophorum	54.6	7.6	160	14	20	6
10.	Nilgiri	114.4	17	130	18	1.10	10
11.	Alastonia	41	9.2	50	12	30	6
12.	Gulmohar	61.3	7.6	83	12	40	8
13.	Karanj	20.4	4.9	35	8.00	10	3.5
14.	Kachnar	23.8	4.9	35	8	10	3.5
15.	Coconut	76.4	12.14	115	16	55	6
16.	Bottle brush	34.8	56	40	6.5	25	5
17.	Bottle palm	72.2	5.0	80	5	55	3.5

G. M/s HIRA POWER&STEEL LTD.(Road Side Plantation 3 ½ K M (Approx)

S.N.	Species	Average		Maximum		Minimum	
		Girth (cm)	Height (m)	Girth (cm)	Height (m)	Girth (cm)	Height (m)
1.	Tikoma	9.8	4.08	20	6	3	2.5
2.	Neem	9.7	3.2	15	5.5	5	2.00
3.	Alastonia	42.8	4.5	60	7	20	2.5
4.	Khamar	29.3	6.3	35	10	12	3.00
5.	Kesiyasemia	24.8	8.4	38	2.5	4	1.5
6.	Siras	7.4	3.2	14	5.50	2	1.5
7.	Kadamba	9.3	3.3	14	5.00	5	2.00
8.	Gulmohar	33.4	9	45	12	15	5

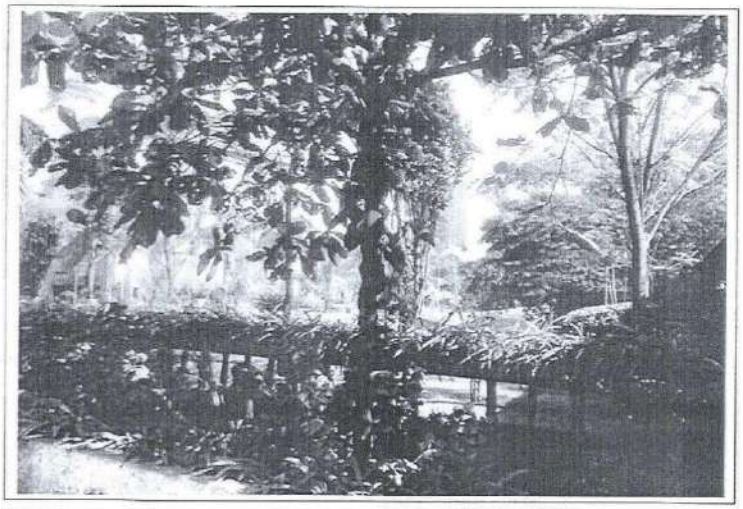
9.	Kaner	20	5.3	28	7.5	10	2.5
10.	Sisoo	28.7	5.54	45	7.00	18	4.5
11.	Arjun	77	10.6	90	12	60	8
12.	Karanj	14	2.4	18	3.50	10	2.00
13.	Kadmba	45	6.2	55	10	55	4
14.	Teek (Sagoun)	12	3.01	30	5.5	6	0.90
15.	Amaltas	12.6	3.5	20	4.5	10	2.00
16.	Gulmohar	53	8.4	65	12	45	4.00

17. Number of Plantation and Survival Percentage

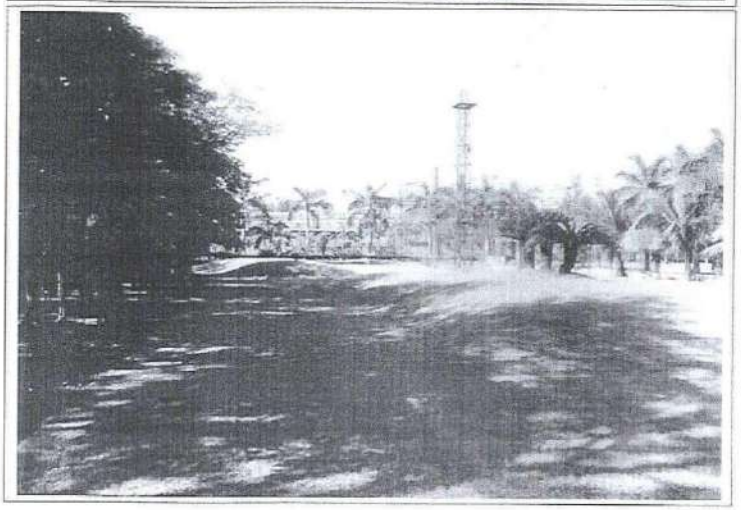
PLANTED SPECIES AND PLANTS NUMBERS				
S. N.	PLANTED SPECIES	PLANTED SPECIES NO.	SURVIVAL PLANTED	SURVIVAL PERCENTAGE
M/s HIRAPOWER&STEEL Ltd.				
1.	**Unit -II (Including Admin Building)**			
	Peltophorum, Alastonia, Parkia, Kesiasemia, Sirsa, Badam, Coconut, Karanj, Washingtonia, Spethodia, Nilgiri, Shisham, Gulmohar, Conocarpes, Neem, Karanj, Alastonia, Champa, Sitafal, Kaner, Kachnar, Areca Pam, Bottle Brush, Kadmba, Acacia, Shoobabul	16578	14428	87%
3.	**Road Side**			
	Neem,Alastonia,Khamar,Kesiyas amia,Siras,Kadamba,Gulmohar, Kaner,Sisoo,Arjun, Karanj etc.	2600	1434	55%
4.	**Air port Garden**			
	Spathodea, Champa, Cycus, Tikoma, Akash neem, Kaner, Bottle palm, Arjun, Peltophorum, Nilgiri, Alatonia, Gulmohar, Karanj, Kachnar, Coconut, Bottlebrush, Bottle Palm etc.	2500	1874	75%
	Grand Total=	21678	17736	

Note : - Coal yard, Crusher yard, Kirtiman van, Near Pond, Near Power store Diesel tank. In the above area mentioned places or area shoobabul are very dense.

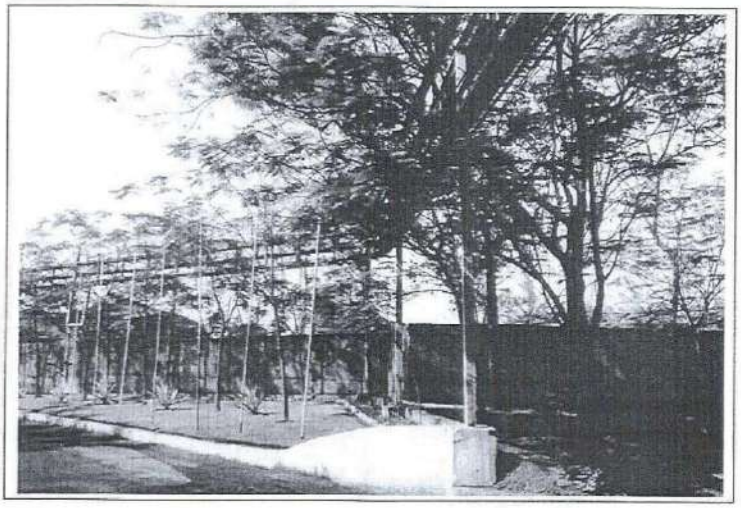
M/s HIRA POWER & STEEL LIMITED.

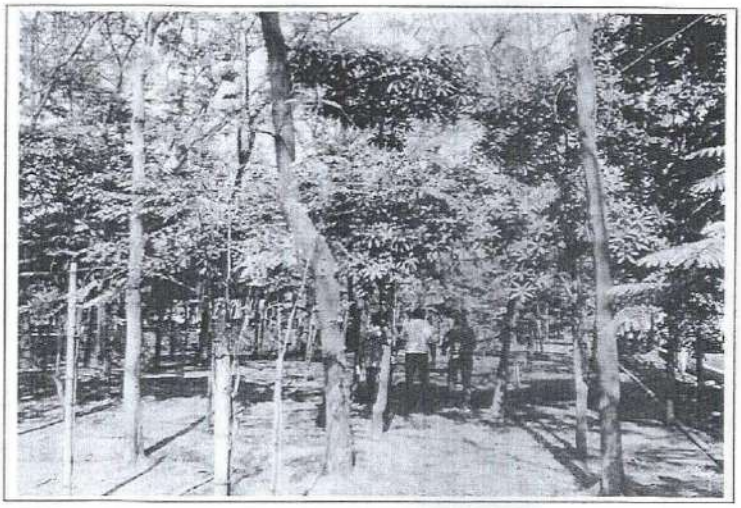


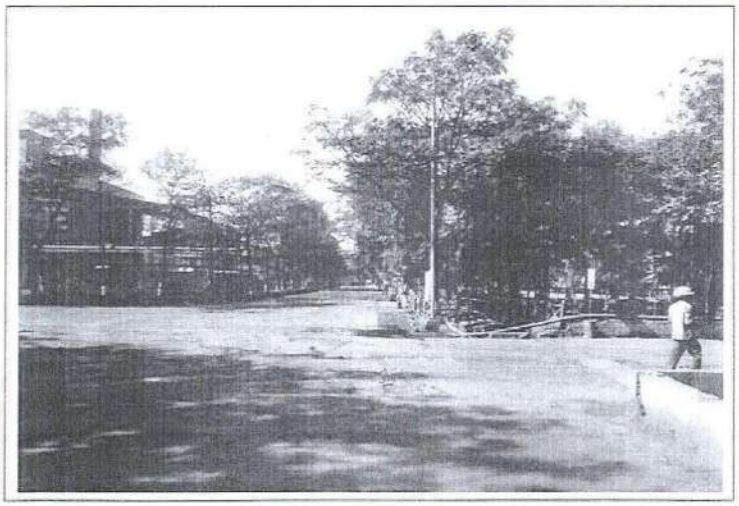
M/s HIRA POWER & STEEL LIMITED.

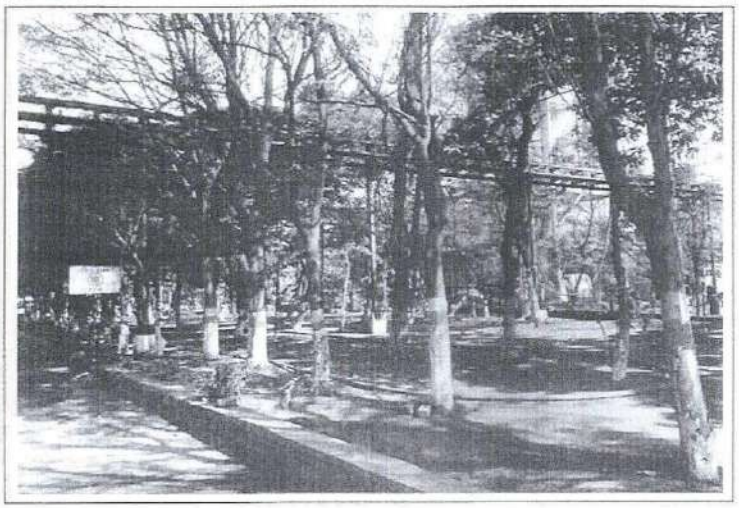


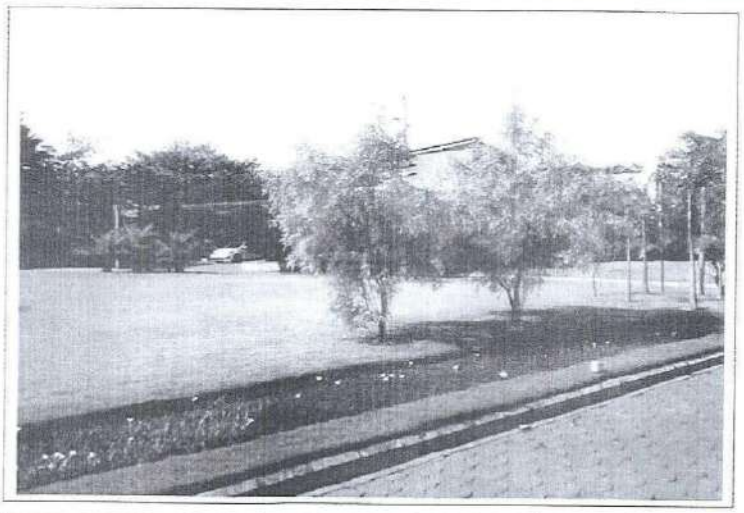
M/s HIRA POWER & STEEL LIMITED.

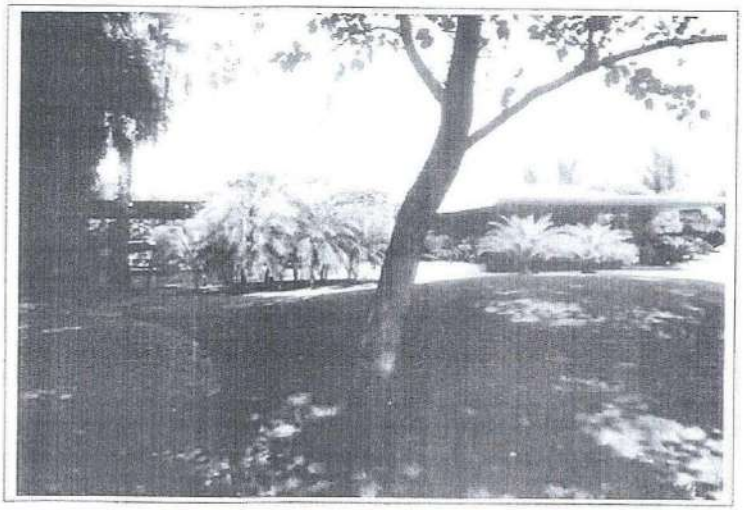




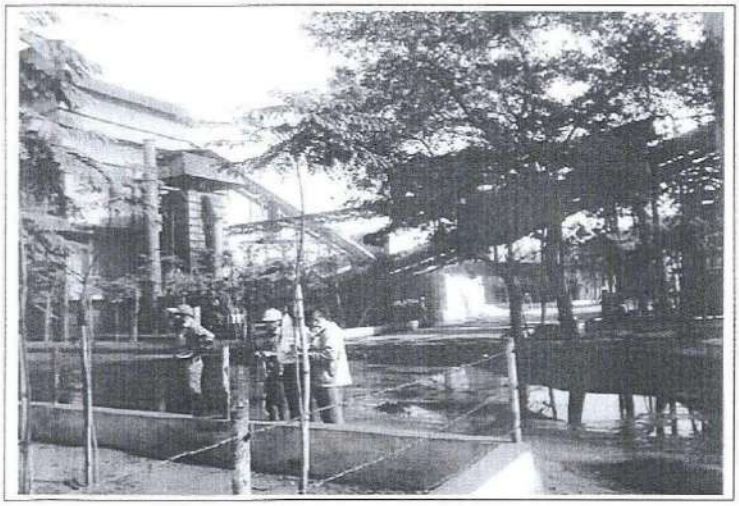






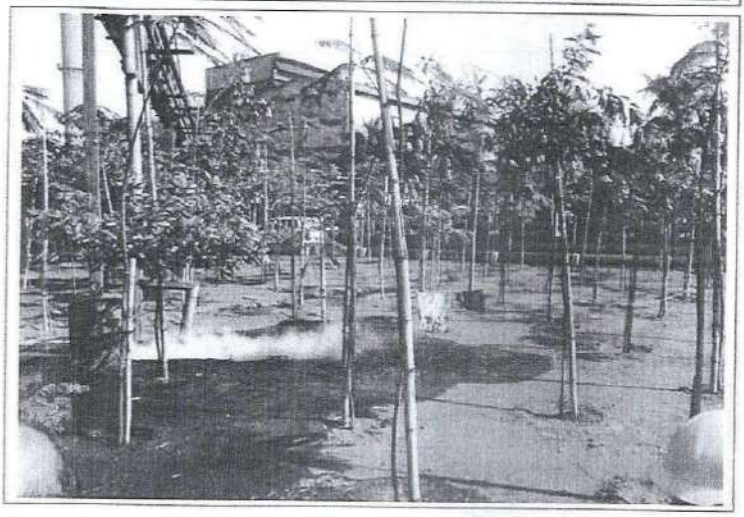


M/s HIRA POWER & STEEL LIMITED.



M/s HIRA POWER & STEEL LIMITED.

M/s HIRA POWER & STEEL LIMITED.



9. GRADING OF PLANTATION

M/s HIRAPOWER&STEEL LTD. – Unit - II

Grading of Plantation on scale of 1 to 10

Qualitative Aspects	Survival	8.50
	Health of Plantation	8.00
	Maintenance	8.00
	Sustainability	8.00

Grading of project plantation on scale 1 to 10

Overall Grading of Plantation	Outstanding (excellent) (8 – 10)	Very Good (5 < 8)	Good (3 < 5)	Poor (> 3)
	8.12			

E. GRADE CARD-

M/s HIRAPOWER&STEEL LTD. – Road Side

Grading of Plantation on scale of 1 to 10

Qualitative Aspects	Survival	6.00
	Health of Plantation	7.00
	Maintenance	6.00
	Sustainability	600

Grading of project plantation on scale 1 to 10

Overall Grading of Plantation	Outstanding (excellent) (8 – 10)	Very Good (5 < 8)	Good (3 < 5)	Poor (> 3)
		6.25		

F. GRADE CARD-

M/s HIRAPOWER&STEEL LTD. – Aerodrome Garden

Grading of Plantation on scale of 1 to 10

Qualitative Aspects	Survival	9.00
	Health of Plantation	9.00
	Maintenance	9.00
	Sustainability	9.00

Grading of project plantation on scale 1 to 10

Overall Grading of Plantation	Outstanding (excellent) (8 – 10)	Very Good (5 < 8)	Good (3 < 5)	Poor (> 3)
	9.00			

CERTIFICATE

CERTIFIED THAT OUR SURVEY AND EVALUATION EXPERT TEAM COUNTED ALL TREE, PLANTS, SAPLING OF M/S HIRA POWER AND STEEL LTD. UNIT -2, RAIPUR, AND FOUND 14428 OF TOTAL 16578 PLANTED PLANTS AND COVERED AS GREEN BELT 14.26 ACRES (APP.) AREAS.

DATE :12/01/2021

"SEIDR"

"SOCIETY FOR ENVIRONMENT & INTEGRATED DEVELOPMENT RAIPUR"

10. DISCUSSION HELD WITH OFFICER AND MANEGMENT OF M/s HIRA POWER&STEEL LTD.AS UNDER –

1. Mr. Rahul Agarwal (President)
2. Mr. Aviral Tiwari (Senior Engineer Environment)
3. Mr. Mahesh Kumar Verma (Senior Officer Horticulture)

11. SUGGESTIONS FOR THE IMPROVEMENT

1. Species – Fast growing species should be planted.
2. Plant should be planted after one year age.Minimum length – 1 meter or above.
3. Irrigation facility should be provided to planted plants.
4. Space should be 2×2, 3×3 and maximum 4×4 according to maximum girth of trees after maturity.
5. Germination time – Humic Oxide should be used for better results.
6. Manure – Compost,Vermi compost for good age Urea, Dap, Zhaim should be used.
7. Priority to broader leaves plants should be planted.
8. Following species may be chosen for plantation – Khamar, Shisham, Teak, Kadamba, Acacia, Pelt form, Arjun, Neem, Semal, Jamun, Karanj, Sissu, Mahuwa, Ashok, Nilgiri, Pipal, Amaltas, Bottlepam, KesiaSamia, etc.
9. Termite& Other pests control should be done by Cholorocyper, Imida combine.
10. Plants should be planted regularly every year.
11. Soil of Pits should be change with manure before plantation.
12. In water locked area Kahua should be planted.
13. Hard and dry area Teak should be planted.
14. For maintain of survival percentage casually replacement should be done every year.

A WORD OF APPRECIATION

We appreciate all management officers and staff of HIRA POWER&STEEL LTD.Who has taken step to develop the green belt & greeneryness of area. We found that sapling has taken care well after plantaion.

We apperciate the commitment and care taken by the management for developing the green belt & greenery within & outside of plant permises.

"Society for Environment & Integrated Development Raipur"

THE TEAM INVOLVED IN SURVEY & EVALUATION

S.n.	Name	Job	Experience
1	Shri D K Tiwari	Team Leader	Self Employ 15years experience of monitoring & evaluation & micro planning
2	Shri Kamlesh Dubey	Coordinator	6 years experience of monitoring & evaluation Industrial Plantation
3	Shri Jasvir Singh Virdi	Investigator	7years experience of monitoring & evaluation Industrial Plantation

EXECUTIVE BODY OF "SEIDR"

NO.	Post	Name	Experience
1	President	Shri S. K. Roy	Retd. A.C.F. C.G. Govt.
2	Vice President	Smt. Shobh Mishra	Professional
3	Secretary	Smt. Asha Tiwari	Teacher (Private)
4	Treasurer	Shri D. K. Tiwari	Professional

ABOUT THE EVALUATION AGENCY

Organization profile

Name of Organization	*Society for Environment & Integrated Development Raipur. Non Government Organization {NGO} And working as Decelopment and welfare.*
No. & Date of registration	*C. G. State – 3270. Date – 01/03/2011*
Registration	*Under Society Registration Act. – 1973.*
Addres	*J-9/A, ShriRam Nagar, Phase –I, Street – II, Post Office Shankar Nagar Raipur, {C.G.} Pin Code – 492007.*
Phone	*+91- 771-3557342*
Chief Functionary	*Mr. S. K. Roy {Retd. Forest S.D.O.} Mob. No. 091255 – 02923*
Contact Person	*Mr. D K Tiwari {Retd. Forest Range Officer} Mob. No. 96695 – 77114, 98261 - 86813*
Mail at	seidraipur@gmail.com
Bank with	*State Bank of India, Vip Estate, Vip colony Raipur (C.G) Account No. – 35731546062 IFS Code - SBI N0013004, SWIFT*

SEIDR MISSION

Is to release the creative energies resources and aspirations of the poor.Especially tribes, equality and women to seek and obtain opportunities for full effective sustainable participation in social, economic, political and cultural life of society and nation.

SEIDR VISION

SEIDR is society based on the values of genuine democracy, equality and peace for all its citizens, where people and government play their respective roles effectively with transparency and accountability.

Area of Operation

Intensively in all districts of Chhattisgarh state, with trained technical and professional staff.

OTHER MEMBER OF EXECUTIVE BODY

No.	Name	Experience
1	Kamlesh Dubey	Professional
2	Prabhat Panday	Electrical Engineer
3	Jasveer Singh Virdi	Professional
4	Varun Tiwari	Labor Court Lawyer
5	Smt. Nirmala	Labor Court Lawyer
6	Prdeep Sahu	Professional
7	Akhil Shrivastava	Professional

THANK YOU.

****

ANNEXURE- VI

REPORT OF ENERGY METER ATTACHED TO AIR POLLUTION CONTROL DEVICE APRIL 2020- MARCH 2021

S.NO	MONTH	POLLUTION CONTROL DEVICES ATTACHED TO UNIT	POWER CONSUMPTION (KWH)	REMARKS
1	April 2020	ID Fan, Cooling Water Pump, Air Compressor, Dust Silo Unit, FD Cooler (Axial Flow Fan), Bag Filter Unit, ESP, Ash Silo Unit, Silo Ash Conditioner Pump.	318149.12	Energy Meter, Model- EM6433 & Make- Conzerv
2	May 2020		917317.04	
3	June 2020		733414.43	
4	July 2020		828991.09	
5	August 2020		953402.10	
6	September 2020		332443.42	
7	October 2020		3021.12	
8	November 2020		623291.16	
9	December 2020		906890.97	
10	January 2021		991431.24	
11	February 2021		918639.10	
12	March 2021		986423.33	
TOTAL			8513414.12	

ANNEXURE - VII

Hira Power And Steel Limited RAW MATERIAL									
S.No.	Raw Material	Supplier	Location of Dispatch	Mode of Transport	Distance from HPSL	Specification			
1	Manganese Ore	MOIL	Chandrapur	Rail/Raod	370KM	MN%	Size		
		Sandur	Sandur	Rail/Raod	1200KM	30%MN -50%MN	0 to 3 MM	0 to 10 MM	6 to 75 MM
		Imported	Vishakhapattnam	Rail/Raod	560KM				
						Specification			Size
2	Coal	SECL	Raigarh	Rail/Raod	260KM	Stem Coal 44% FC and above			5-70MM
			Korba	Rail/Raod	270KM				
			Ambikapur	Rail/Raod	400KM				
			Charcha	Rail	430KM				
		WCL	Nagpur	Rail/Raod	300KM	Power Coal 3500 GCV and above			0-100MM
		CCL	Ranchi	Rail/Raod	600KM				
		NCL	Singrauli	Rail/Raod	475KM	Coal Fines GCV 3000			0-10MM
		Imported	Vishakhapattnam	Rail/Raod	560KM				
3	DoloChar Coal	Local Sponge Iron	Raipur	Raod	25KM	DoloChar GCV 3000			0-10MM
						FC			Size
4	Coke	Luky Coke	Dhanbad	Road	760KM	68 % FC - 80% FC			5-25MM
		Metro Hard	Dhanbad	Road	760KM				
		Adhunik Fuels	Dhanbad	Road	760KM				
		Shubh Sales	Dhanbad	Road	760KM				
		Bangal Energy	Kharagpur	Road	720KM				
						FC	VM	Plasticity	Size
5	Carbon Electrode Paste	Maharastra Carbon	Chandrapur	Road	370KM	87% FC	12-15%	35-37%	10-70MM
		Balaji Carbon	Raipur	Road	10KM	87% FC	12-15%	35-37%	10-70MM
						Silica			Size
6	Dolomite	Shri Shaym Industries	Durg	Road	60KM	< 5 %			2-8MM
		P.R. Commercial	Bhilai	Road	50KM	< 5 %			2-8MM
						Silica			Size
7	Quartz	NC Nahar	Bhilai	Road	50KM	97%			10-60MM
						CAO	MGO	SIO1	Size
8	Lime Calcined	Rajasthan Lime	Jodhpur	Road	1400KM	90%Min	1.80%	1.50%	20-60MM
		Raj Chemicals	Nagpur	Road	300KM	90%Min	1.80%	1.50%	20-60MM
9	Dolo Calcined	Poddar Lime	Chandrapur	Road	370KM	CAO	MGO	SIO2	Size
						50%Min	30%	3%	10-80MM

ANNEXURE- VIII

CHHATTISGARH ENVIRONMENT CONSERVATION BOARD

PARYAVAS BHAWAN, NORTH BLOCK, SECTOR -19, NAVA RAIPUR ATAL NAGAR, RAIPUR (C.G.) 492002
E-mail : hocecb@gmail.com, Ph. No. 0771-2512220

No. 3641/HSMD/HO/CECB/2020 Raipur, Date 21/07/2020

To,

M/s Hira Power And Steels Limited
Unit-II, (Capative Power Plant and Electrosmelting, Divison)
Urla Industrial Area,
Distt. - Raipur(CG)

Sub:- Amendment and renewal of authorization under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.

Ref :-1. Grant of authorization letter no. 1319/ HO / HSMD /CECB/2015 dated 24/06/2015.

2. Your Online application no. 5003249 dated 21/02/2020 & subsequent correspondence ending dated 13/07/2020.

---00---

Chhattisgarh Environment Conservation Board had granted authorization under Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 vide letter no. 1319/ HO / HSMD /CECB/2015 dated 24/06/2015 for following hazardous waste, category and quantity subject to fulfillment of the terms and conditions mentioned therein. :-

Sl.No.	Category of Hazardous Waste as per the Schedules I, II and III of these rules	Cat. No.	Quantity (Tonnes/Annum)
1.	Used or Spent oil	5.1	15 KL/Year
2.	Spent Ion exchange resin containing toxic metals	34.2	0.25 MT/Year

Industry, vide their online application no. 5003249 dated 21/02/2020 has requested for renewal of authorization with respect to hazardous waste corresponding quantity mentioned therein.

Regional Office Raipur has submitted its report and recommended for the renewal of the authorization. The facts submitted by the industry have been examined. After careful consideration of the facts and materials in record, amendment of authorization is granted for following hazardous wastes:-

Sl.No.	Category of Hazardous Waste as per the Schedules I, II and III of these rules	Cat. No.	Quantity (Tonnes/Annum)
1.	Used or Spent oil	5.1	15 KL/Year
2.	Spent Ion exchange resin containing toxic metals	35.2	0.25 MT/Year

3.	Empty barrels/containers/liners contaminated with hazardous chemicals /wastes	Cat. No. 33.1	15 MT/Year

The amendment and renewal of authorization shall be valid five year i.e. from **24/06/2020 to 23/06/2025.** The details of authorization along with terms & conditions are given as per below:-

FORM 2
[See rule 6 (2)]

GRANT OF AMENDMENT AND SUBSEQUENT RENEWAL OF AUTHORIZATION BY STATE POLLUTION CONTROL BOARD TO THE OCCUPIERS, RECYCLERS, REPROCESSORS, REUSERS, USER AND OPERATORS OF DISPOSAL FACILITIES

1. Number of authorization **340 HO/HSMD/CECB/ATAL NAGAR, RAIPUR..**
2. Reference of online application no. **5003249 dated 21/02/2020**
3. The operator of facility i.e. occupier **M/s Hira Power And Steels Limited, Unit-II, (Capative Power Plant and Electrosmelting, Divison) Urla Industrial Area, Raipur, Distt. - Raipur(CG)** is hereby granted an authorization based on the signed inspection report from RO for generation, collection, storage, reuse and disposal of hazardous wastes in the premises situated at **(Capative Power Plant and Electrosmelting, Divison) Urla Industrial Area, Raipur, Distt. - Raipur(CG).**

Detail of Authorisation

Sl.No.	Category of Hazardous Waste as per the Schedules I, II and III of these rules	Authorised mode of disposal or recycling or utilization or co-processing etc.	Quantity (Tonnes/Annum)
1.	Used or Spent oil (Schedule - I, Cat. No. 5.1)	Sell to authorized recyclers	15KL/Year
2.	Spent Ion exchange resin containing toxic metals (Schedule - I, Cat. No.35.2)	Disposal as per SoP issued by CPCB	0.25MT/Year
3.	Empty barrels/containers/liners contaminated with hazardous chemicals /wastes (Schedule - I, Cat. No. 33.1)	Sell to authorized recyclers	15 MT/Year

(1) The amendment and renewal of authorization shall be valid for five year i.e. from **24/06/2020 to 23/06/2025.**
(2) The authorization is subject to the following conditions:

TERMS & CONDITIONS OF AUTHORIZATION

1. The authorization shall comply with the provisions of Environment (protection) Act, 1986 and the rules made there-under.
2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by the Chhattisgarh Environment Conservation Board.
3. The person authorized shall not rent, lend, sell transfer or otherwise transport the hazardous wastes without obtaining prior permission of the Chhattisgarh Environment Conservation Board.
4. Any unauthorized change in personnel, equipment, or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.

5. The person authorised shall implement Emergency Response Procedure (ERP) for which this authorisation is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time.
6. The person authorised shall comply with the provisions outlined in the Central Pollution Control Board guidelines on "Implementing Liabilities for Environmental Damages due to Handling and Disposal of Hazardous Waste and Penalty".
7. It is the duty of the authorized person to take prior permission of the Chhattisgarh Environment Conservation Board to close down the facility.
8. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
9. Industry shall prepare emergency response plan (ERP) and ensure implementation the same at the event of any accident occurs due to handling and transporting of hazardous waste as per CPCB guideline.
10. The hazardous and other waste which gets generated during recycling or reuse or recovery or pre-processing or utilisation of imported hazardous or other wastes shall be treated and disposed of as per standard operating procedures/guidelines issued by CPCB from time to time.
11. An application for the renewal of an authorisation shall be made three months before the expiry of authorization as laid down in the Rules.
12. Annual return in form IV shall be filed by June 30th for the period ending 31st March of the last financial year.
13. The wastes shall be collected and stored properly with adequate safety measures as per rule.
14. Authorized person shall comply with the provisions of rule 17, 18 and 19 for packing, labeling and transport of Hazardous Waste.
15. The authorized person should maintain the record of Hazardous Waste as per Form-3 of Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016.
16. The occupier shall follow the guidelines (if any) issued by Central Pollution Control Board or MoEF & CC for management of Hazardous waste from time to time.
17. The industry shall display data outside factory gate on quantity and nature of hazardous chemicals and wastes being used in the plant, water and air emissions and solid wastes generated within the factory premises.
18. Industry shall ensure disposal of hazardous waste generated during the production process through authorized recycler/Co-processing in cement plant/captive disposal facility/arrangement for sharing of authorized disposal facility/common TSDF as per rule. Failing which this authorization shall be treated as cancelled and appropriate action would be initiated against the industry.
19. Industry shall create new website for Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 and upload all the information above the waste in the website.
20. The waste must be given thermal/biological/physico-chemical treatment; the waste should be completely dewatered, detoxified, and proper conditioned and any possible recovery is made before their disposal.
21. The industry should constitute a hazardous waste management cell to take care of the management aspect to the hazardous waste generated in the plant.
22. An on-site storage of the hazardous wastes for a maximum period of 90 days should be provided and it shall be ensured that there is no leakage or seepage from the surrounding walls or bottom. The site should be covered and properly protected to prevent the entry of rain water in storage area.

23. At least four nos. of peizometric points should be provided around the storage site of H.W. to monitor the leaching of the waste and monitoring report shall be submitted to the board in every six months. Each type of waste shall be stored in a separate storage cell.

24. The discarded containers of Hazardous waste and chemical shall not be used for storage of food grade products. At the storage site "Hazardous waste storage site & danger signboard" shall be provided with all safety devices.

25. In the event of any accident due to handling of hazardous waste the authorized person must inform immediately to the Concerned Regional Office and H.O., Atal Nagar, Raipur of the Board by fax/telephone or by E-mail about the incident and details report be sent in form no. 11 [see rule 22].

26. The authorization obtained by the Chhattisgarh Environment Conservation Board should be prominently displayed.

27. Used batteries shall be disposed of as per the Batteries (Management & Handling) Rules, 2001.

28. Board reserves the right to cancel/amend the above condition and add new conditions as and when deemed necessary.

Member Secretary
C.G. Environment Conservation Board
Nava Raipur Atal Nagar, Raipur (C.G.)

Endt. No. 3642/H.O./HSMD/CECB/2020 Atal Nagar, Raipur, Date 21/07/2020

Copy to :- Regional Officer, Regional office, Chhattisgarh Environment Conservation Board, Raipur (C.G.) please ensure compliance and report, if any condition/conditions are violated by the industry.

Sd/-

Member Secretary
C.G. Environment Conservation Board
Nava Raipur Atal Nagar, Raipur (C.G.)

Validity unknown
Digitally Signed by R P Tiwari MS
Date: 2020.06.29 17:45:51 IST

Annexure-V

राष्ट्रीय प्रौद्योगिकी संस्थान रायपुर
(राष्ट्रीय महत्व का संस्थान)

National Institute of Technology Raipur
(An Institution of National Importance)

Department of Civil Engineering

No. NITRR /Civil /Consultancy/ 2021/ ...197... Raipur, Dated: 11-11-2021

To,

HIRA Power & Steel Ltd., Unit II
Urla Industrial Complex
Raipur (Chhattisgarh) - 492003

Subject: Submission of Report "Planning and Designing for Rain Water Harvesting System in the Industry"

Reference: 1. Service Order No. No. 7200003266/P101; Dated 19.06.2021
2 Tax Invoice No. NITRR/Civil/1981; Dated 09.07.2021

****

Sir,

With reference the planning and Designing for Rain Water Harvesting System in the premises of industry as mentioned above, 01 copy of the detailed report is hereby submitted, inclusive of following items: :

1. Site visit & field observation details
2. Location map of site
3. Rainfall analysis
4. Runoff assessment
5. Adequacy of drainage provided
6. Rain water harvesting system and identification of artificial recharge zone for groundwater recharge
7. Recommendations

Prepared By:

10/11/2021

(Dr. Ishtiyaq Ahmad)
Assistant Professor
Civil Engineering Dept.
N.I.T. Raipur

10/11/2021

(Dr. Manikant Verma)
Assistant Professor
Civil Engineering Dept.
N.I.T. Raipur

Dr. D. C. Jhariya
Assistant Professor
Applied Geology Dept.
N.I.T. Raipur

Forwarded by:

11.11.21

Head, Civil Engg Dept.
N.I.T. Raipur

G.E. ROAD, RAIPUR (Chhattisgarh) 492 010
☎ : 0771-4270336; 2255920 (Dept); 🖷: 2255261; URL: www.nitrr.ac.in

REPORT

Planning And Designing for Rainwater Harvesting System in Hira Power & Steels Ltd., Unit-2, Urla (Raipur)

(Service Order No. 7200003266/P101; Dated 19.06.2021)

Submitted by:

Dr. Ishtiyaq Ahmad

Dr. Mani Kant Verma

Dr. D. C. Jhariya

National Institute of Technology Raipur

Chhattisgarh – 492010

TABLE OF CONTENT

1. SITE VISIT & FIELD OBSERVATIONS:

The site was visited by Dr. Ishtiyaq Ahmad, Dr. Mani Kant Verma [Asstt Prof., Dept. of Civil Engg. NIT Raipur] & Dr. D. C. Jhariya [Asstt Prof., Dept. of Applied Geology, NIT Raipur] along with HIRA Group Officials on **25th June 2021**. The observations and photographs of the important locations were taken during preliminary site visitfor necessary actions. After the preliminary site visit, topographic survey has been performed on the site for obtaining elevation and checking the suitability of the drainage structure provided. The topographic survey was performed using advanced surveying instruments like Differential Global Positioning System (DGPS) & Total Station. The field survey and hydrogeological survey was performed over the site to obtain necessary primary data for further advancement.

Fig. 1. Site visit by officials

Fig. 2. Survey performed on site with various instruments

Following dataset was provided by HIRA group after the visit:

1. Working/surface plan of HIRA Power & Steels Ltd.
2. Bore well detail.
3. Water logging points within the site.

2. OBJECTIVE OF STUDY:

The scope for scientific study on "Planning and Designing for Rainwater Harvesting System in Hira Power & Steels Ltd., Unit-2, Urla (Raipur)" are as follows:

1. Rainfall data assessment with its future trend.
2. Survey of the plant for existing drainage.
3. Survey of the plant for rooftop area estimation.
4. Survey for the slope identification/ flow path.
5. Identification of suitable site for ground water recharge.
6. Identification of rooftop slope/ drainage path draining to the existing drainage system and the section which is not draining to an existing system.
7. Hydrogeological study for identifying suitable site for ground water recharging.
8. Estimation of rainfall and runoff amount with various parts of the year.
9. Design and drawing of rainwater harvesting structures.
10. Feasibility study of rain water harvesting system.

3. LOCATION OF SITE:

The HIRA Power & Steels Ltd. is located in Urla Industrial Complex, Urla, District: Raipur of Chhattisgarh state between latitudes 21°18'52.9236"N to 21°19'18.3828"N and longitudes 81°37'0.2676"E to 81°37'19.4412"E. The location map is shown below as **Fig. 3.** The entire area within the plant has been categorized into various classes based on land use land cover as per the current condition and computed using Google Earth and GIS platform by taking the reference of plant layout provided in the form of AutoCAD drawing. Boundary map is shown in **Fig. 4** & details are given in **Table 1** and **2.**

Table 1. Categorized area within plant into various classes

S. No.	Description of area	Area (in hectares)	Area (%)
1	Roofs	6.21	35.29
2	Pavement (Concrete)	5.43	30.86
3	General unimproved lands	3.56	20.22
4	Parks	0.25	1.42
5	Woodlands with sandy soils	2.15	12.21
	Total =	17.60	100.00

Table 2. Land use around the proposed drainage network

S. No.	Description of area	Area (in hectares)	Area (%)
1	General unimproved lands	3.40	19.31
2	Pavement (Concrete)	1.18	6.70

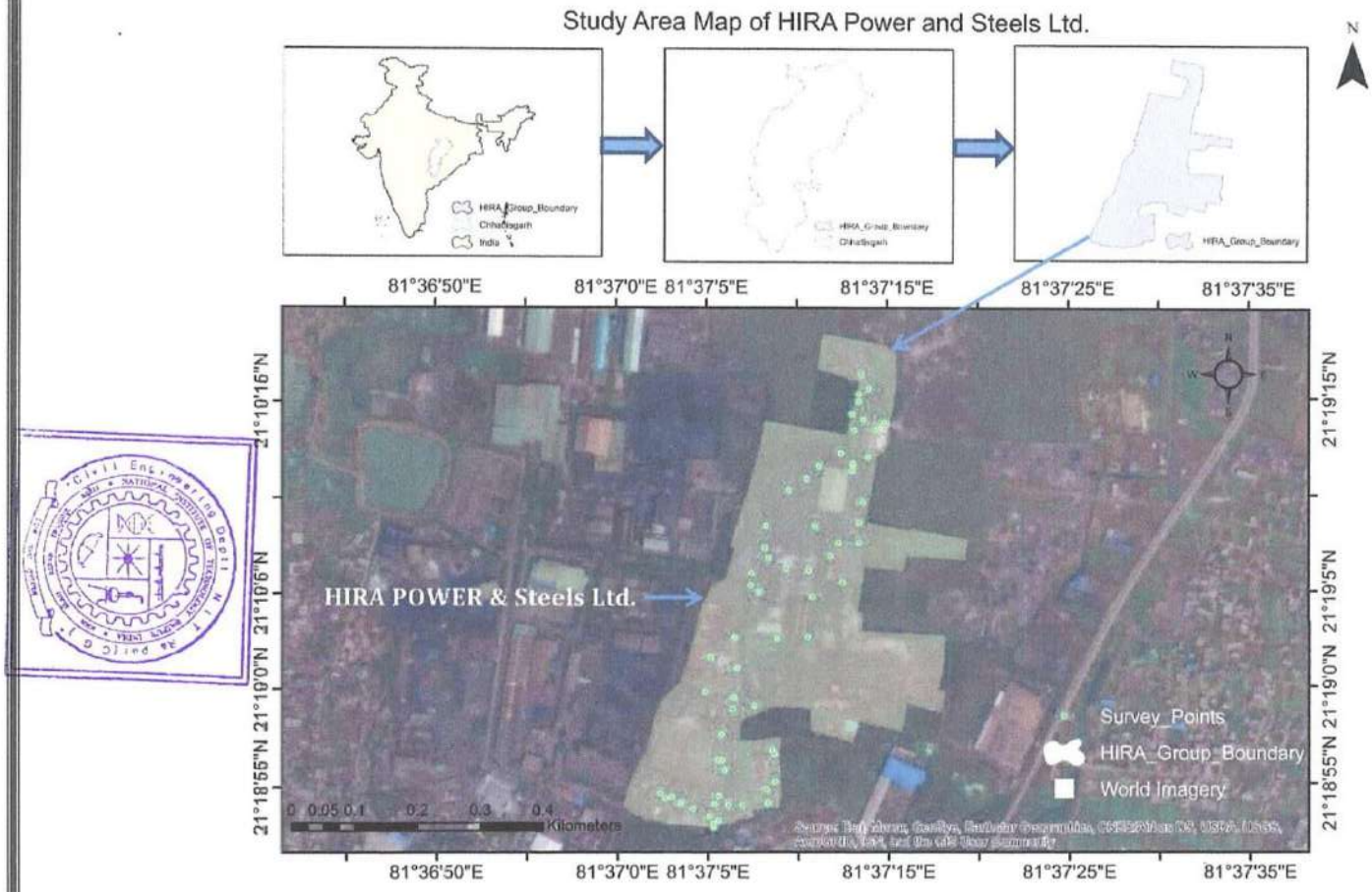


Fig. 3. Location of HIRA Power & Steels Ltd.

S. No.	Description of Area	Area (in hectares)	Area (%)
1	Roofs	9.44	32.40
2	Pavement (Concrete)	5.42	18.95
3	General unimproved lands	5.56	20.23
4	Parks	0.25	1.42
5	Woodlands with sandy soils	2.35	12.22
	Total	17.00	100.00

Fig. 4. Boundary map of HIRA Power & Steels Ltd

4. RAINFALL ANALYSIS:

The daily rainfall data was obtained from Indian Meteorological Department (IMD) gridded data for the period of 1901 to 2017. The monsoon sets in the month of June and continues till October. The graph in **Fig. 5** represents the plot of annual rainfall (mm) for last 117 years. The graph in **Fig.6** represents the plot of annual daily maximum rainfall (mm) for last 30 years. The graph in **Fig.7** represents the plot of annual 5-day maximum rainfall (mm) for last 30 years.The study area is receiving maximum rainfall during monsoon season with mean annual rainfall of **1385.83 mm**. **Fig. 8 and Fig. 9** are the drainage catchment area and contour map of the plant. **Fig. 10** represents proposed drainage network, proposed water treatment plant (WTP) location and proposed probable ground water recharging (GWR) locations.

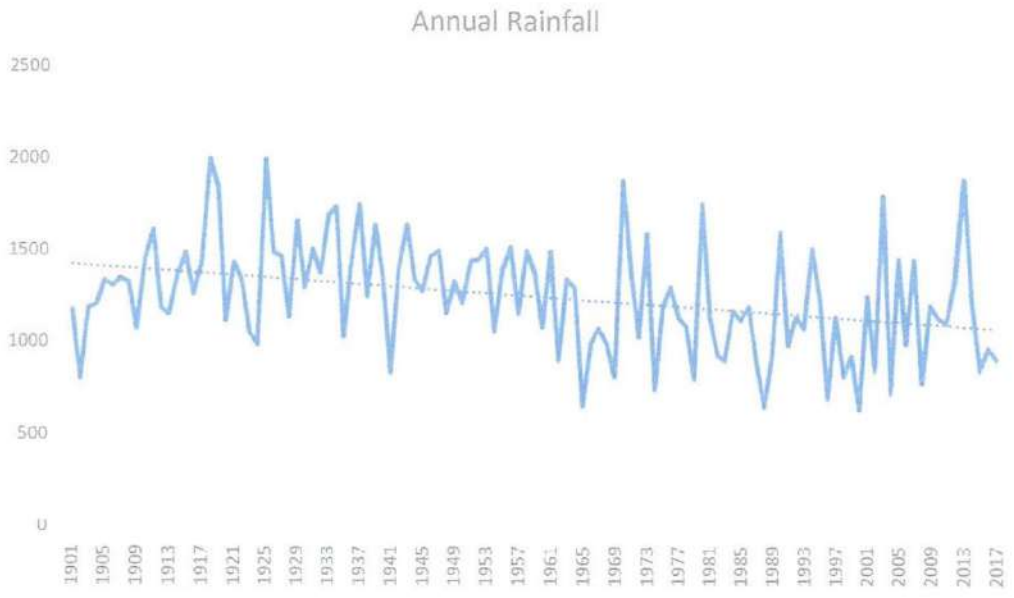


Fig. 5. Plot of Annual rainfall (mm) and Trend for last 117 years

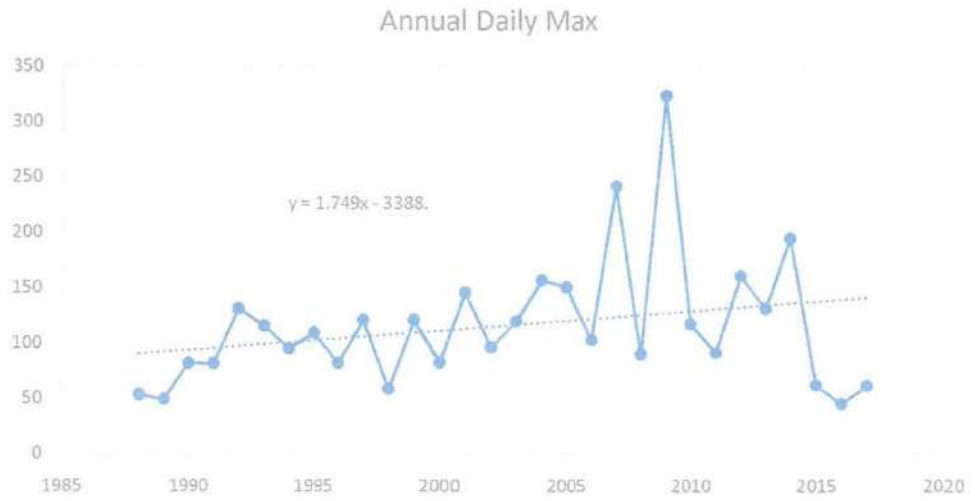


Fig.6. Plot of Annual daily maximum rainfall (mm) and Trend for last 30 years

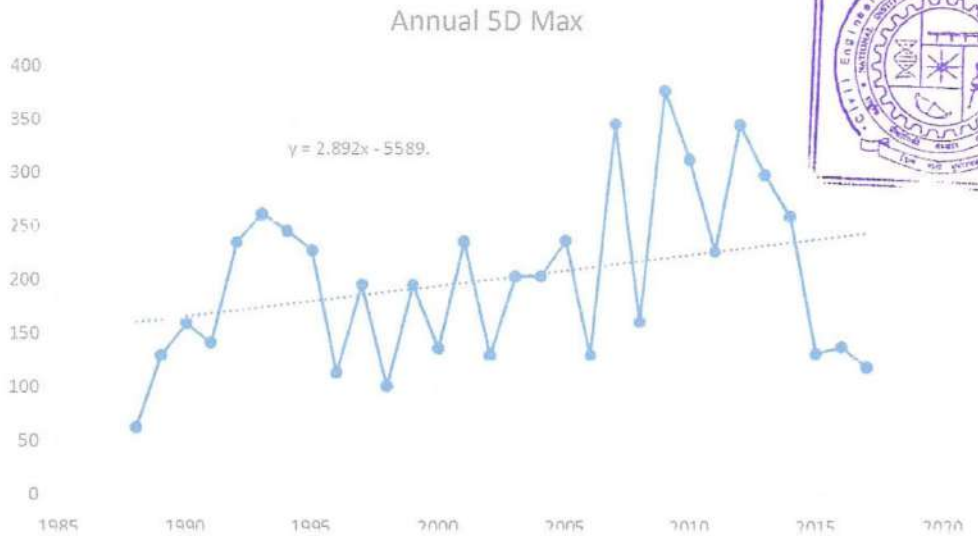


Fig.7. Plot of Annual 5-Day maximum rainfall (mm) and Trend for last 30 years

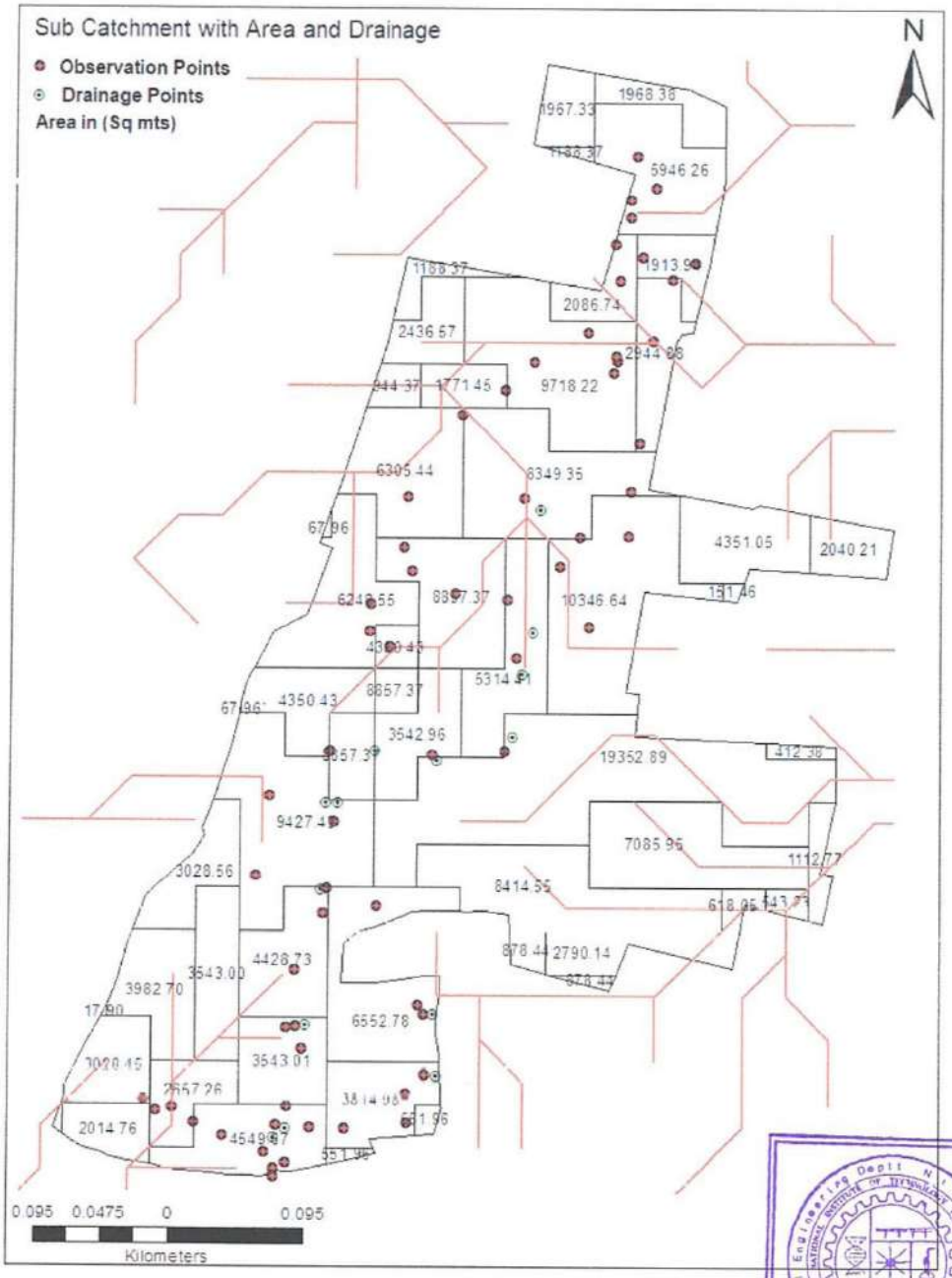


Fig. 8. Drainage catchment area

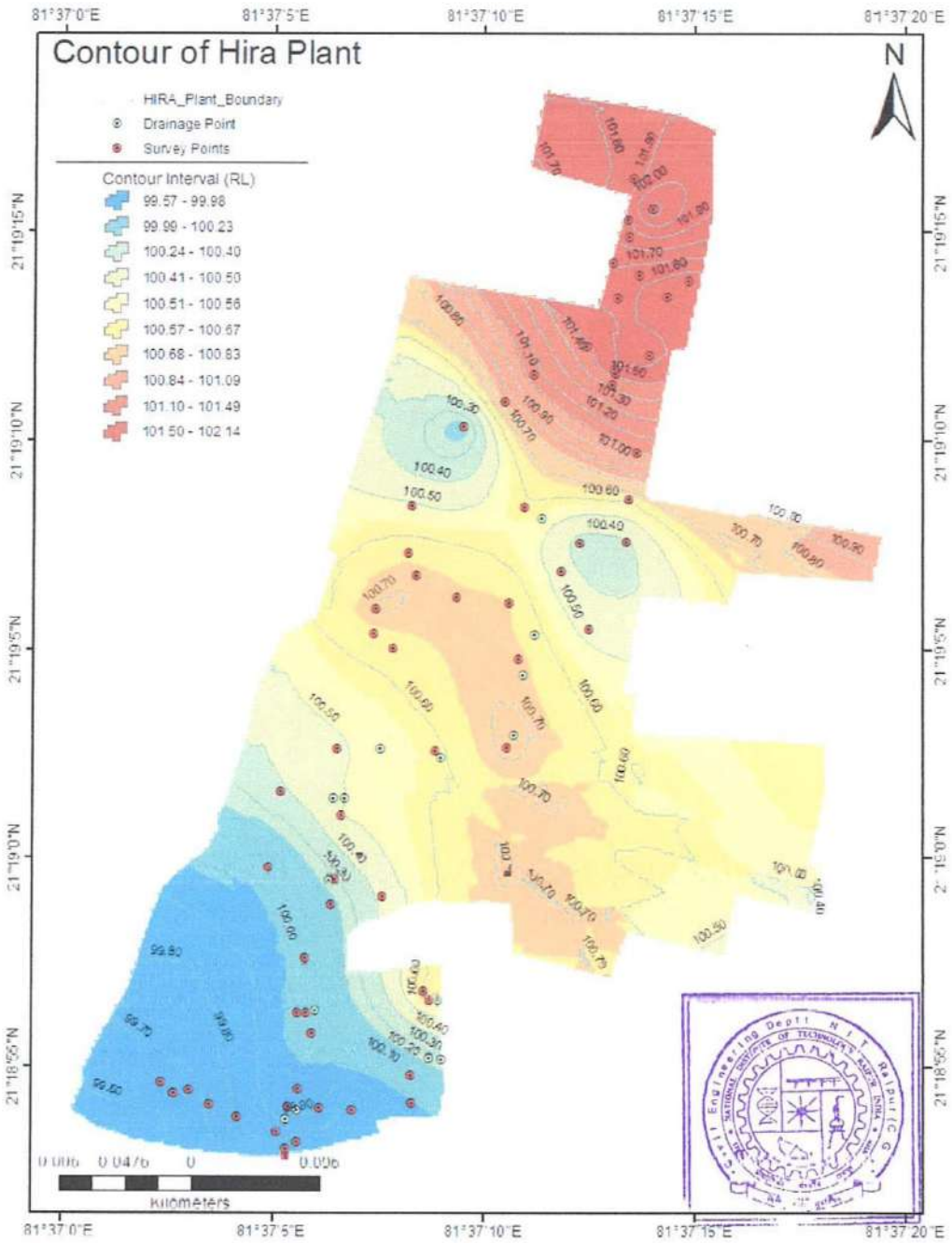


Fig.9. Contour map of Hira Plant

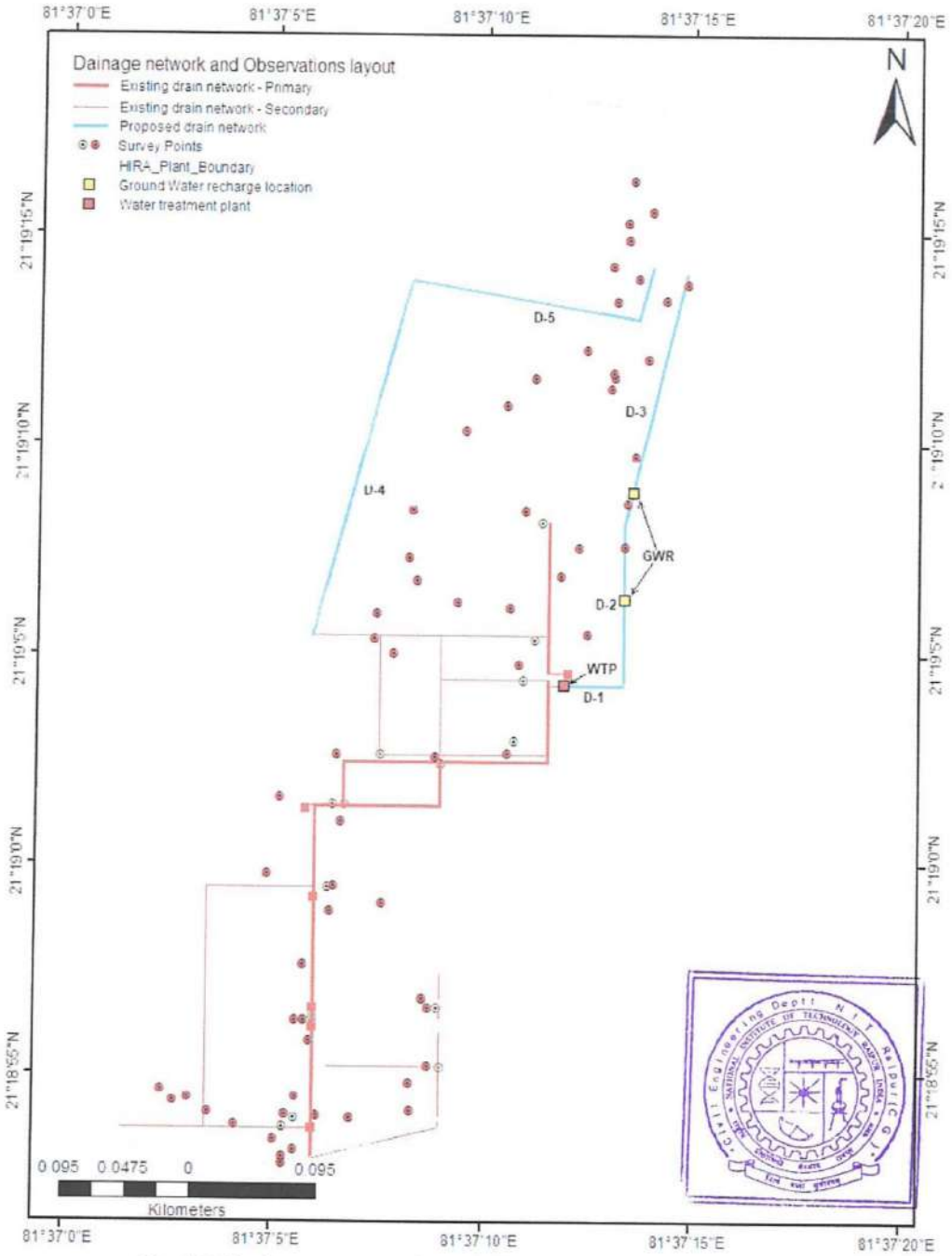


Fig. 10. Drainage network and observational layout diagram

5. RUNOFF ASSESSMENT:

Potential amount of runoff is computed by using rational formula. The runoff is computed using following equation

$$Q = 0.028 * P * A * I_c$$

Where,

Q = max- runoff in m^3/s;
P = co-efficient of runoff for the catchment characteristics;
A = area of catchment in hectares;
I_c = critical intensity of rainfall in cm/hour.

The principal factors governing P are: (i) porosity of the soil, (ii) area, shape and size of the catchment, (iii) vegetation cover, (iv) surface storage viz. existence of lakes and marshes, and (v) initial state of wetness of the soil. Catchments vary so much with regard to these characteristics that it is evidently impossible to do more than generalize on the values of P. Judgment and experience must be used in fixing P.

Table 3: Maximum value of P in the formula $Q = 0.028 * P * A * I_c$

Steep, bare rock and also city pavements	0.90
Rock, steep but wooded	0.80
Plateaus, lightly covered	0.70
Clayey soils, stiff and bare	0.60
lightly covered	0.50
Loam, lightly cultivated or covered	0.40
largely cultivated	0.30
Sandy soil, light growth	0.20
covered, heavy brush	0.10

Based on the catchment characteristics, the value of P is taken respectively.

Table 4: Based on categorization of area within plant value of P is taken as shown

S. No.	Description of area	Value of P	Area (in hectares)	Area (%)
1	Roofs	0.95	6.21	35.29
2	Pavement (Concrete)	0.95	5.43	30.86
3	General unimproved lands	0.4	3.56	20.22
4	Parks	0.25	0.25	1.42
5	Woodlands with sandy soils	0.15	2.15	12.21
		Total =	17.60	100.00

Intensity of rainfall is determined using the equation,

$$i = \frac{KT^x}{(D+a)^n}$$

Where,

i = maximum intensity (cm/h);

T = return period (years);

D = duration (hours);

K, x, a and n are coefficients for the area represented by the station.

Rambabu et al. (1979) have analyzed the self-recording rain gauge rainfall records of 42 stations in the country and have obtained the values of coefficients K, x, a and n. For the central zone of India and with reference to nearest of study area the values are taken as:

K= 11.45, x= 0.156, a=1.25, n=1.032.

Hence the equation gets reduced to:

$$I = \frac{11.45 * T^{0.156}}{(D+1.25)^{1.032}}$$

Determining the critical rainfall intensity for 50 years return period and 24 hours duration using above equation:

$$i = \frac{11.45 * 50^{0.156}}{(3 + 1.25)^{1.032}}$$
$$i = 4.74\ cm/h$$

Taking factor of safety and peak flow conditions into consideration, the value for critical intensity of rainfall $\mathbf{i_c}$ is taken as **5 cm/h.** From IDF curve the maximum intensity of rainfall for 50 years return period is obtained as **6 cm/h.** Therefore, the maximum hourly rainfall is taken as **6 cm/h** and maxima daily rainfall from historical record length is taken as **180 mm/day** for the analysis in the present study.

Thus, runoff generated for different catchments are mentioned as below:

Table.5 Runoff generated for the area categorized within the plant for proposed drainage network

Proposed Drain	Drain Catchment Area (hectare)	Value of P	Intensity of rainfall (cm/h)	Runoff, Q (m^3/s)
D-1	0.2540	0.4	6	0.0170
D-2	0.7806	0.4	6	0.0527
D-3	0.4859	0.4	6	0.0326
D-4	1.8892	0.4	6	0.1269
D-5	1.1804	0.95	6	0.1884
			Total runoff generated=	**0.4176**

6. ADEQUACY OF DRAIN PROVIDED:

In order to cater the drainage of rain water or water accumulated in the site from this categorized area, a series of drains and settling pits have been provided in the plant.

The drain size and its capacity provided to carry out water from each categorized area are mentioned in **Fig.11** and **Table 6** as:

Table. 6 Runoff generated for each catchment

S. No.	Proposed Drain	Depth (m)	Width (m)	Slope	Area (sq. m.)	Perimeter (m)	Hydraulic Mean Depth (m)	Velocity (m/s)	Drain Capacity (m^3/s)
1.	D-1	1.0	0.50	1:944	0.5	2.5	0.2	0.3180	0.1590
2.	D-2	1.0	0.50	1:968	0.5	2.5	0.2	0.3140	0.1570
3.	D-3	1.0	0.50	1:1025	0.5	2.5	0.2	0.3052	0.1526
4.	D-4	1.0	0.50	1:540	0.5	2.5	0.2	0.4204	0.2102
5.	D-5	1.0	0.50	1:654	0.5	2.5	0.2	0.3821	0.1910

Now comparing the runoff generated for each catchment with respect to the drain capacity provided for conveying the water in the form of drain for each categorized area to check its adequacy in the **Table 7** below:

Table. 7 Adequacy of garland drain provided

Proposed Drain	Runoff Generated, Q (m^3/s)	Drain Capacity (m^3/s)	Check (Drain Capacity > Runoff generated)	Status of Garland Drain Provided
D-1	0.0170	0.1590	Yes	adequate
D-2	0.0527	0.1570	Yes	adequate
D-3	0.0326	0.1526	Yes	adequate
D-4	0.1269	0.2102	Yes	adequate
D-5	0.1884	0.1910	Yes	adequate

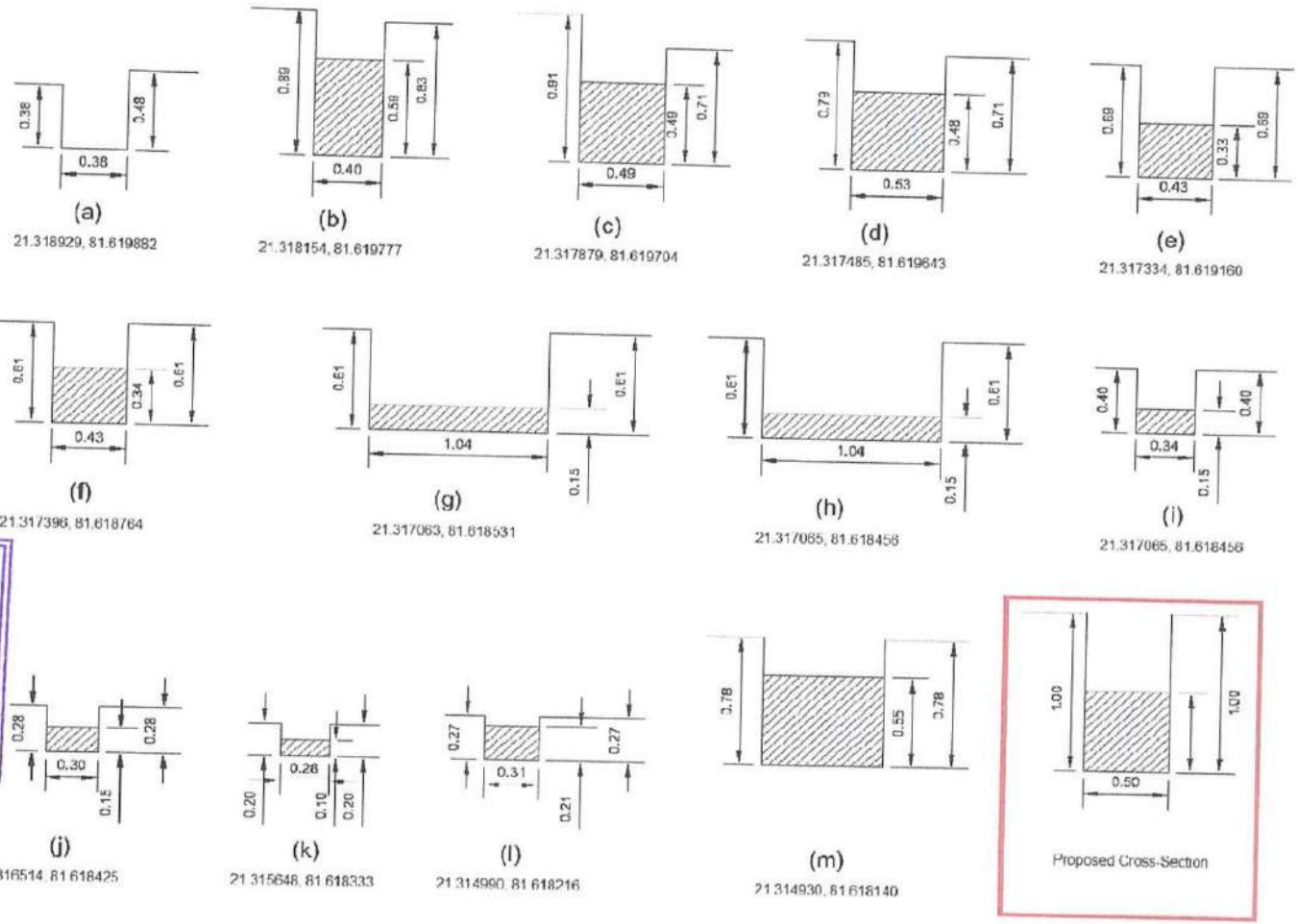


Fig.11. Cross-section of drain provided for each catchment to carry water

7. RAIN WATER HARVESTING SYSTEM AND IDENTIFICATION OF ARTIFICIAL RECHARGE ZONE FOR GROUNDWATER RECHARGE

The term artificial recharge refers to the transfer of surface water to the aquifer by human interference. Artificial recharge provides sustainability to groundwater by restoring supplies to aquifers depleted due to excessive draft and to enhance recharge to the aquifers lacking adequate natural recharge both in space and time. The natural process of recharging the aquifers is accelerated through percolation of stored or flowing surface water otherwise not percolating into the aquifers. Selection of cost-effective and efficient recharge techniques at suitable locations should be the main thrust along with the emphasis on optimum utilization of available hydrological resources in the area through multi-disciplinary scientific investigations.

The continuous decline of groundwater level in the phreatic aquifers in urban areas is of greater concern. As a management measure, further construction of abstraction structures tapping phreatic aquifer should be discouraged and suitable measures should be taken to check the future decline of the water table by implementing suitable artificial recharge scheme on an extensive scale. Adoption of water conservation practices and designing of artificial recharge and rainwater harvesting structures requires enormous scientific inputs for providing an appropriate solution with suitably designed successful water conservation and recharge structures to have a sustainable water supply for future.

Study was undertaken to estimate the rainwater harvesting potential and to ascertain the feasibility of ground water recharge and identification of suitable recharge.

Purpose and Scope:

The Scope of the work included the following:

Feasibility study of groundwater harvesting system for of suitable rainwater harvesting and groundwater recharge system.

Geophysical Investigation:

Geophysical surveys are non-destructive methods that provide subsurface hydrogeological information beneath the earth surface to identify suitable location for deciding proper structure/ design for rainwater harvesting. The investigation was conducted. Total 7 Schlumberger Vertical Electrical Sounding (VES) were conducted at different locations in the premises of study area. Sounding locations are shown in figure.

Fig.12.Sounding locations RS-1 to RS-7

Table 8: Survey point coordinates.

S. No.	Survey Traverse	Coordinates	
		Latitude	Longitude
1	VES1	21.317383	81.618811
2	VES2	21.317369	81.618816
3	VES3	21.317369	81.618876
4	VES4	21.317712	81.618718
5	VES5	21.318465	81.619957
6	VES6	21.318447	81.619971
7	VES7	21.32099	81.621713

Fig.13.Field work photo.

Electrical Resistivity Survey has been carried out at proper places in the study area using the Resistivity meter. Data sets were obtained with the use of the Resistivity meter and the values of the apparent resistivity and the current electrode spacing (AB/2), partial curve matching has been carried out using the standard and the auxiliary curves. The computer interpretation is also carried out on the obtained data using the IPI2WIN software. This software is helpful in interpretation of geophysical data to know the subsurface layer, thicknesses of each layer and the number of layers. In this study about 07 number of Vertical Electrical Sounding has been carried out at suitable places in the study area.

The electrical resistivity method is a useful geophysical tool provides information about the near-surface structures. The Electrical Resistivity method is used to provide reliable information about the subsurface layers. Electrical Profiling (PR) can also be used to determine the aquifer depth, aquifer geometry hydraulic conductivity, the water quality of the aquifer rock, and geological stratigraphy are reported by researchers (Chandra et al., 2008).

In this study, an attempt has been made to infer the fracture zone using the GD-10 Multi-Electrode Resistivity meter and CRM-500 resistivity meter.

Details of Instrumentation and surveying Method

GD-10 Multi-Electrode Resistivity Imaging System

GD-10 is developed based on the latest digital and analog circuitry technique, making it the world-leading multi-functional direct current (DC) method instrument. GD-10 Multi-Electrode Resistivity Imaging System is capable of conducting 2D/3D cross-section profiling of subsurface lithology. Through the array script management in Geomative Studio, we can predefine survey parameters before field surveys. GD-10 is equipped with both centralized cabling and a distributed cabling system to fulfill any complex field environment.

Fig 14.GD-10-multi-electrode resistivity imaging system.

Fig.15.Field survey photograph.

GD-10 generates a well-regulated current (I) to measure the resulting signals voltage ΔV between the two potential electrodes. It then calculates the apparent resistivity R= ΔV/I for the given spacing configuration. The resistivity obtained is the weighted average of all the formations' resistivity through which the current is passing. Apparent resistivity is expressed in Ohm-meter(Ω-m). The analysis of apparent resistivity variations as a function of current electrodes' spacing makes it possible to conclude subsurface geological conditions.

Results and discussions

In this study, four electrical resistivity imaging surveys PR1, PR2, PR3 and PR3 (**Tables10-13**) were carried out using GD-10 multi-Electrode resistivity imaging system to assess the subsurface geological conditions.

The location of survey points are given in **Fig. 15**and **Table 9**.

Table 9: Survey point coordinates.

S. No.	Survey Traverse	Coordinates	
		Latitude	Longitude
1	PR1	21.32099	81.621713
2	PR2	21.320995	81.621711
4	PR3	21.318863	81.621029
4	PR4	21.318447	81.619971

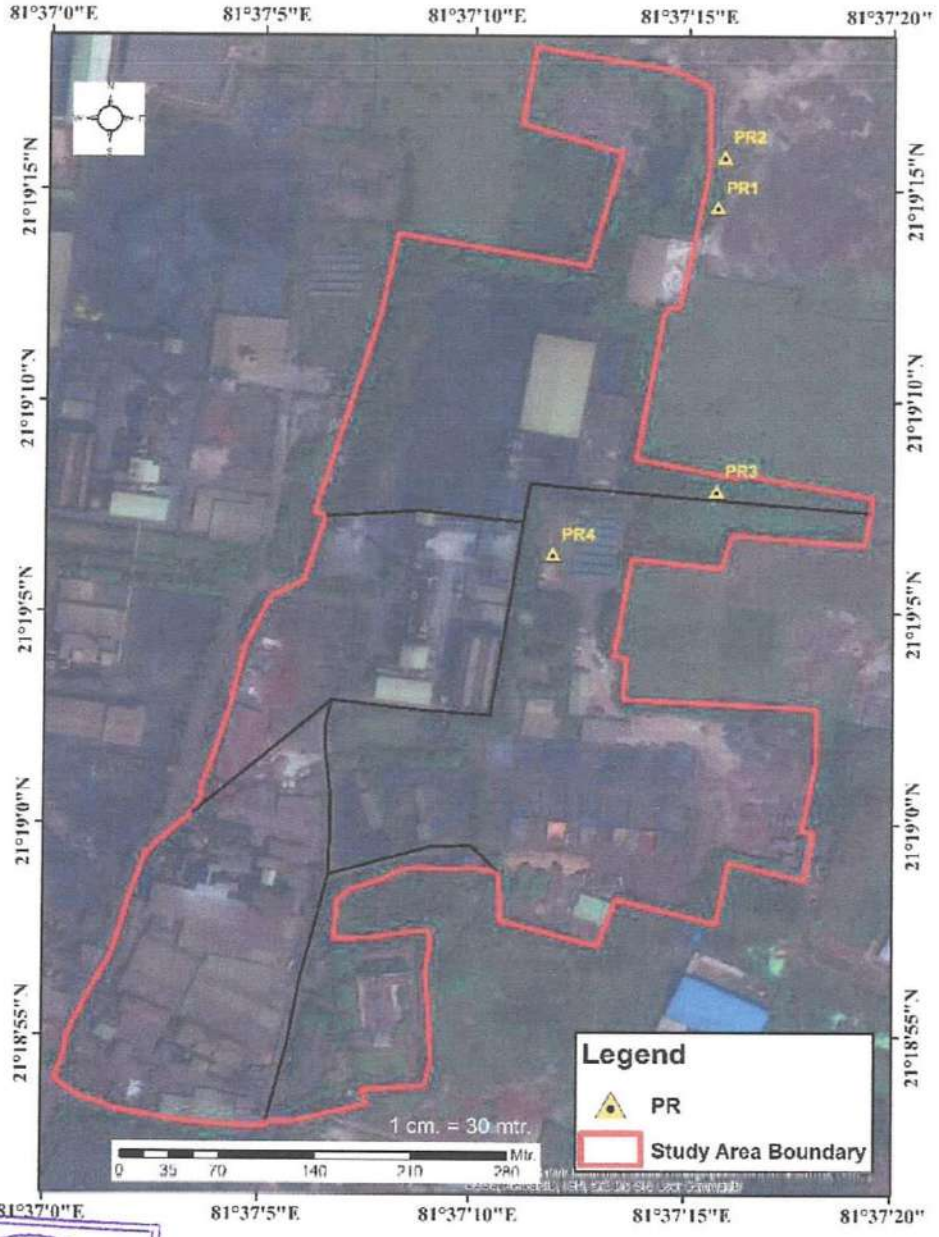


Fig 15.The location of survey points.

Profiling using the Wenner and Schlumberger method of maximum current electrodes spacing of 300 m.The layer parameters are obtained from the recorded field resistivity data using Res2DInv Aarhus GeoSoftware used to assess the subsurface geological heterogeneity are obtained from the recorded field resistivity data (PR). Results from **Figs. 16 - 19** suggest that there is an occurrence of hard rock. There is an occurrence of low resistive layers at the shallow depth and high in the deep.

There is an occurrence of very high resistive layers at a depth of 20 m and greater depth.

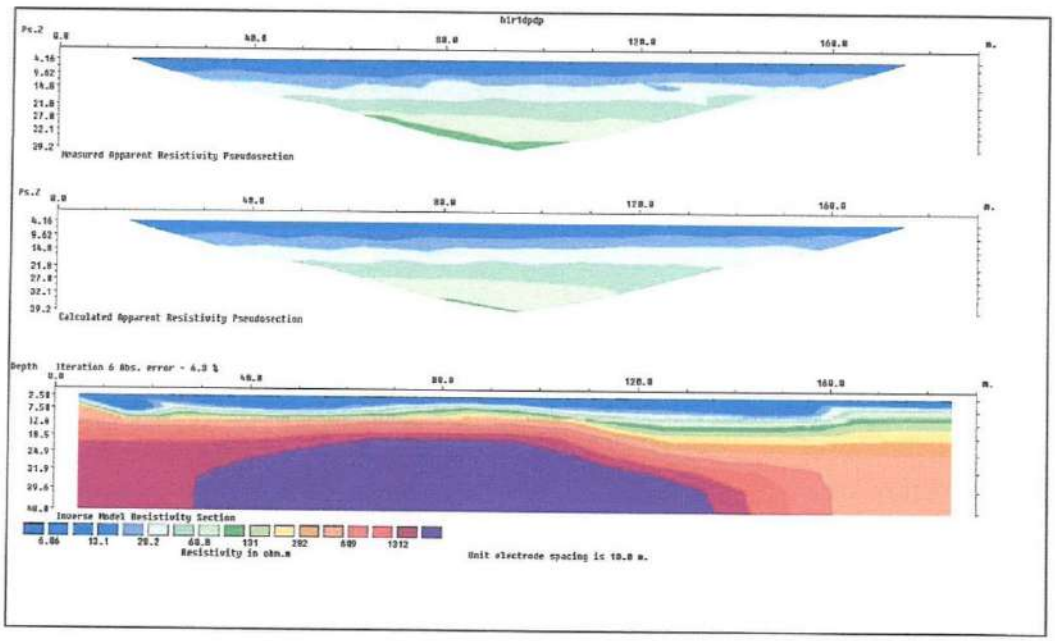


Fig 16.2D Subsurface heterogeneity.

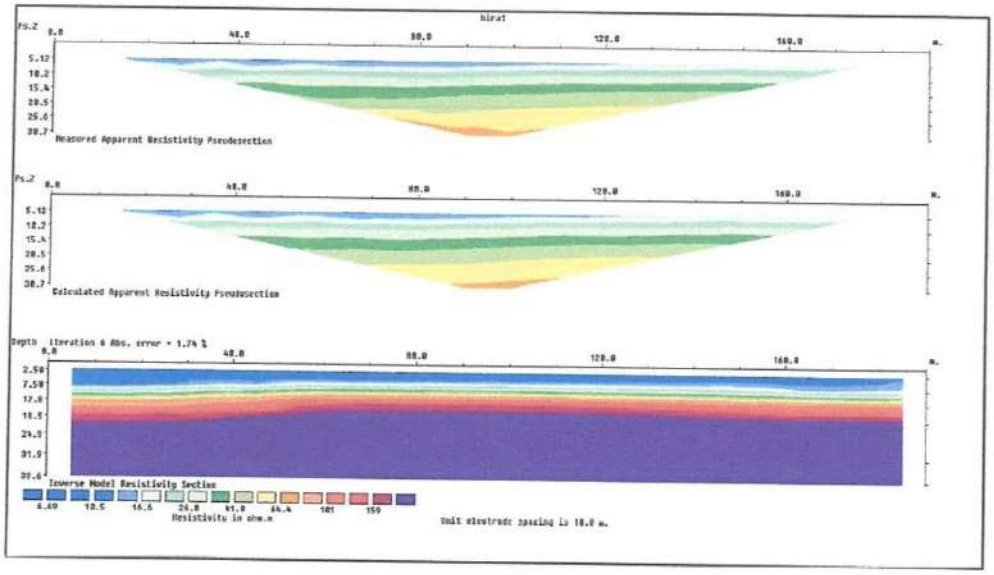


Fig 17.2D Subsurface heterogeneity.

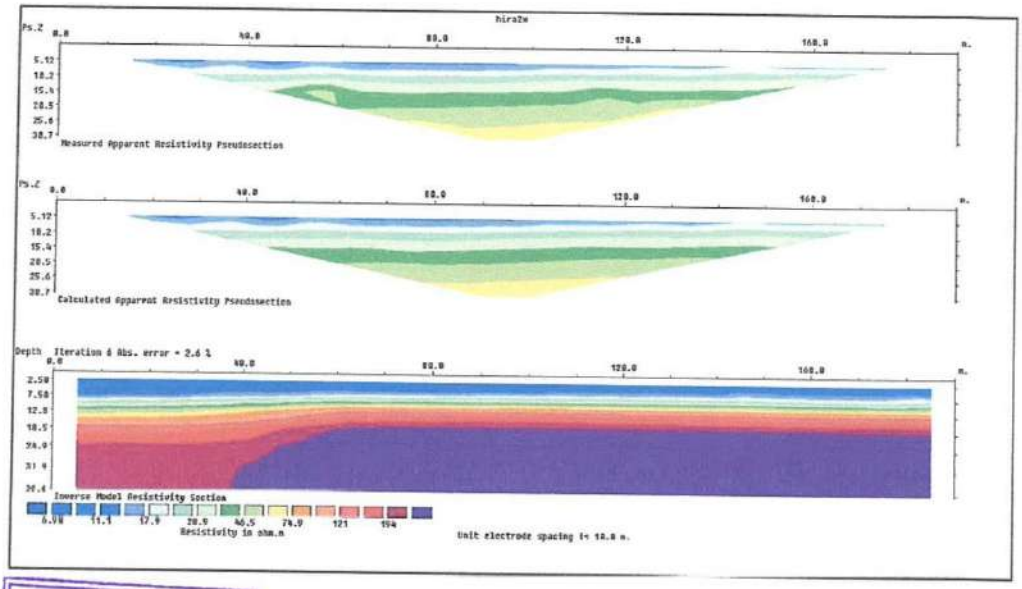


Fig 18. 2D Subsurface heterogeneity

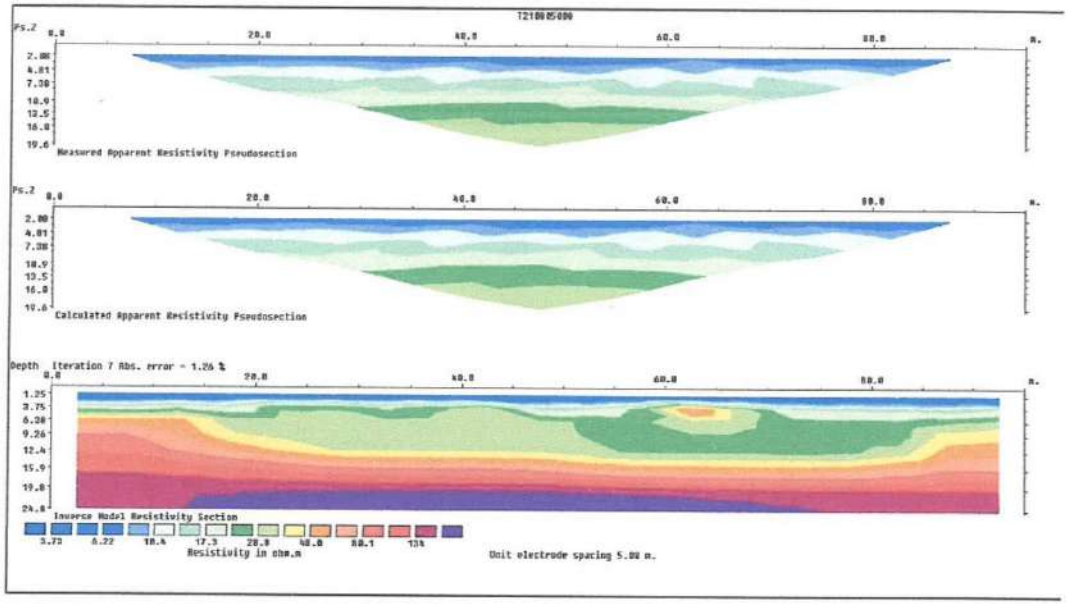


Fig 19. 2D Subsurface heterogeneity.

Table 10. Resistivity data PR-1

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
2	1	3	4	188.50	814.24	38.72	0.05	8.96	-416.13
2	1	4	5	753.98	785.02	18.95	0.02	18.20	284.08
2	1	5	6	1884.96	784.30	8.23	0.01	19.78	6.93
2	1	6	7	3769.91	783.37	5.30	0.01	25.50	-25.54
2	1	7	8	6597.34	782.71	4.73	0.01	39.86	140.34
2	1	8	9	10555.75	782.16	2.73	0.00	36.80	-85.04
3	1	10	12	5442.81	775.20	7.64	0.01	53.65	-241.70
3	1	12	14	10108.07	775.58	8.73	0.01	113.76	46.64
3	1	14	16	16846.79	775.68	5.34	0.01	115.96	-217.57
3	1	11	13	7539.82	775.84	6.10	0.01	59.27	-19.93
3	1	13	15	13194.69	776.05	6.27	0.01	106.69	-92.80
3	1	15	17	21111.50	776.08	5.02	0.01	136.51	-88.74
3	2	4	5	188.50	1039.25	68.72	0.07	12.47	282.77
3	2	5	6	753.98	1039.18	20.73	0.02	15.04	4.84
3	2	6	7	1884.96	1039.15	12.39	0.01	22.48	-22.52
3	2	7	8	3769.91	1039.13	6.98	0.01	25.32	132.15
3	2	8	9	6597.34	1039.13	5.00	0.00	31.73	-74.19
3	2	9	10	10555.75	1039.13	3.80	0.00	38.56	254.51
4	1	17	20	13795.08	410.34	2.98	0.01	100.20	-86.64
4	2	11	13	5442.81	548.61	5.24	0.01	51.94	-15.31
4	2	13	15	10108.07	558.12	3.66	0.01	66.30	-95.29
4	2	15	17	16846.79	550.85	2.60	0.00	79.43	-85.37
4	2	12	14	7539.82	548.52	4.04	0.01	55.52	36.49
4	2	14	16	13194.69	546.95	3.02	0.01	72.83	-212.23
4	2	16	18	21111.50	546.93	2.15	0.00	82.98	-93.87
4	3	5	6	188.50	589.80	26.67	0.05	8.53	3.07
4	3	6	7	753.98	590.37	11.77	0.02	15.03	-19.65
4	3	7	8	1884.96	589.70	5.84	0.01	18.66	124.62
4	3	8	9	3769.91	589.79	3.55	0.01	22.71	-63.91
4	3	9	10	6597.34	589.87	2.31	0.00	25.84	253.71
4	3	10	11	10555.75	590.22	1.81	0.00	32.34	-167.36
5	3	12	14	5442.81	1039.34	9.64	0.01	50.49	32.11
5	3	14	16	10108.07	1039.23	6.68	0.01	64.96	-210.44
5	3	16	18	16846.79	1039.20	4.99	0.00	80.84	-90.44
5	3	13	15	7539.82	1039.20	7.92	0.01	57.48	-96.60
5	3	15	17	13194.69	1039.21	5.85	0.01	74.32	-82.33
5	3	17	19	21111.50	1039.27	4.16	0.00	84.45	-66.68
5	4	6	7	188.50	581.62	32.97	0.06	10.69	-17.27

5	4	7	8	753.98	582.12	10.58	0.02	13.70	118.67
5	4	8	9	1884.96	581.67	5.76	0.01	18.66	-55.90
5	4	9	10	3769.91	581.74	3.90	0.01	25.28	252.76
5	4	10	11	6597.34	580.74	2.82	0.00	32.02	-170.16
5	4	11	12	10555.75	579.95	1.91	0.00	34.80	-63.95
6	4	13	15	5442.81	534.11	4.71	0.01	47.98	-96.94
6	4	15	17	10108.07	533.88	3.25	0.01	61.52	-81.06
6	4	17	19	16846.79	533.84	2.51	0.00	79.06	-65.18
6	4	14	16	7539.82	533.80	3.99	0.01	56.43	-209.11
6	4	16	18	13194.69	533.64	2.76	0.01	68.31	-85.33
6	4	18	20	21111.50	533.42	2.14	0.00	84.57	64.31
6	5	7	8	188.50	1039.19	42.45	0.04	7.70	113.72
6	5	8	9	753.98	1039.11	15.84	0.02	11.49	-48.84
6	5	9	10	1884.96	1039.09	8.91	0.01	16.16	251.84
6	5	10	11	3769.91	1039.09	5.94	0.01	21.54	-171.84
6	5	11	12	6597.34	1039.07	4.51	0.00	28.63	-60.30
6	5	12	13	10555.75	1039.07	3.24	0.00	32.96	53.36
7	5	14	16	5442.81	378.32	3.41	0.01	49.02	-208.76
7	5	16	18	10108.07	382.81	2.16	0.01	56.92	-82.41
7	5	18	20	16846.79	386.66	1.86	0.00	80.86	64.43
7	5	15	17	7539.82	389.04	2.94	0.01	56.96	-79.44
7	5	17	19	13194.69	391.50	1.99	0.01	66.92	-62.76
7	6	8	9	188.50	369.08	17.02	0.05	8.69	-43.84
7	6	9	10	753.98	370.87	6.68	0.02	13.59	250.87
7	6	10	11	1884.96	371.62	3.93	0.01	19.91	-172.63
7	6	11	12	3769.91	372.13	3.06	0.01	30.95	-58.00
7	6	12	13	6597.34	380.70	1.78	0.00	30.86	51.66
7	6	13	14	10555.75	383.86	1.40	0.00	38.47	-27.95
8	6	15	17	5442.81	762.86	7.01	0.01	50.02	-78.81
8	6	17	19	10108.07	764.15	4.75	0.01	62.85	-61.56
8	6	16	18	7539.82	764.71	5.74	0.01	56.57	-79.42
8	6	18	20	13194.69	765.19	3.82	0.00	65.79	64.49
8	7	9	10	188.50	289.84	12.47	0.04	8.11	250.43
8	7	10	11	753.98	292.67	5.12	0.02	13.20	-172.93
8	7	11	12	1884.96	293.48	2.86	0.01	18.36	-56.62
8	7	12	13	3769.91	295.34	1.93	0.01	24.64	50.63
8	7	13	14	6597.34	296.40	1.44	0.00	32.03	-27.85
8	7	14	15	10555.75	297.45	0.92	0.00	32.55	-69.21
9	7	16	18	5442.81	226.83	2.11	0.01	50.64	-77.23
9	7	18	20	10108.07	226.40	1.28	0.01	57.10	64.38
9	7	17	19	7539.82	226.13	1.51	0.01	50.35	-59.99

9	8	10	11	188.50	330.16	15.99	0.05	9.13	-173.05
9	8	11	12	753.98	330.49	6.59	0.02	15.03	-55.79
9	8	12	13	1884.96	330.44	3.46	0.01	19.72	49.92
9	8	13	14	3769.91	330.50	2.29	0.01	26.10	-27.79
9	8	14	15	6597.34	330.44	1.52	0.00	30.43	-69.41
9	8	15	16	10555.75	330.37	1.12	0.00	35.75	-140.34
10	8	17	19	5442.81	303.94	2.62	0.01	46.92	-59.26
10	8	18	20	7539.82	304.22	2.12	0.01	52.62	64.04
10	9	11	12	188.50	231.50	11.02	0.05	8.97	-55.02
10	9	12	13	753.98	231.57	4.27	0.02	13.91	49.24
10	9	13	14	1884.96	231.57	2.53	0.01	20.60	-27.58
10	9	14	15	3769.91	231.56	1.59	0.01	25.81	-69.72
10	9	15	16	6597.34	231.54	1.13	0.00	32.22	-140.48
10	9	16	17	10555.75	231.49	0.83	0.00	37.87	63.44
11	9	18	20	5442.81	389.10	3.07	0.01	42.85	64.12
11	10	12	13	188.50	352.97	16.51	0.05	8.82	48.83
11	10	13	14	753.98	353.36	6.85	0.02	14.61	-27.33
11	10	14	15	1884.96	353.32	3.59	0.01	19.16	-69.88
11	10	15	16	3769.91	353.62	2.64	0.01	28.11	-140.67
11	10	16	17	6597.34	353.72	1.47	0.00	27.40	64.03
11	10	17	18	10555.75	353.78	1.26	0.00	37.60	-136.64
12	11	13	14	188.50	199.80	11.18	0.06	10.54	-27.19
12	11	14	15	753.98	200.17	4.36	0.02	16.41	-70.05
12	11	15	16	1884.96	200.25	2.36	0.01	22.26	-140.84
12	11	16	17	3769.91	200.32	1.53	0.01	28.70	64.53
12	11	17	18	6597.34	200.38	0.91	0.00	30.02	-135.31
12	11	18	19	10555.75	200.41	0.93	0.00	48.79	78.81
13	12	14	15	188.50	146.38	8.39	0.06	10.80	-70.16
13	12	15	16	753.98	146.72	3.46	0.02	17.77	-140.94
13	12	16	17	1884.96	146.69	1.65	0.01	21.26	65.00
13	12	17	18	3769.91	146.83	1.09	0.01	27.97	-135.74
13	12	18	19	6597.34	146.86	0.65	0.00	29.38	78.68
13	12	19	20	10555.75	146.88	0.43	0.00	30.69	-15.03
14	13	15	16	188.50	291.88	19.83	0.07	12.81	-141.02
14	13	16	17	753.98	292.25	6.63	0.02	17.10	65.37
14	13	17	18	1884.96	292.33	3.72	0.01	23.97	-135.28
14	13	18	19	3769.91	292.35	2.10	0.01	27.13	78.68
14	13	19	20	6597.34	292.37	1.40	0.00	31.59	-15.02
15	14	16	17	188.50	447.27	26.22	0.06	11.05	65.80
15	14	17	18	753.98	448.62	10.00	0.02	16.81	-134.87
15	14	18	19	1884.96	448.68	5.31	0.01	22.29	78.65

15	14	19	20	3769.91	448.69	3.02	0.01	25.40	-15.27
16	15	17	18	188.50	769.12	49.96	0.06	12.24	-134.63
16	15	18	19	753.98	768.85	18.67	0.02	18.31	78.62
16	15	19	20	1884.96	769.07	9.35	0.01	22.93	-15.37
17	16	18	19	188.50	1039.50	67.39	0.06	12.22	78.68
17	16	19	20	753.98	1039.42	23.39	0.02	16.97	-15.45
18	17	19	20	188.50	1039.40	58.64	0.06	10.63	-15.48

Table 11: Resistivity data PR-2

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
1	4	2	3	62.83	409.26	97.74	0.24	15.01	41.82
1	7	3	5	125.66	280.58	52.59	0.19	23.55	-133.68
2	5	3	4	62.83	1039.62	206.22	0.20	12.46	-458.36
1	10	4	7	188.50	112.85	23.90	0.21	39.92	163.17
2	8	4	6	125.66	155.59	30.50	0.20	24.63	339.60
3	6	4	5	62.83	1039.56	255.13	0.25	15.42	166.77
1	13	5	9	251.33	139.18	24.62	0.18	44.45	193.07
2	11	5	8	188.50	134.29	25.37	0.19	35.61	55.95
3	9	5	7	125.66	174.75	35.05	0.20	25.21	124.76
4	7	5	6	62.83	236.69	45.74	0.19	12.14	37.92
1	16	6	11	314.16	775.86	162.10	0.21	65.64	-122.92
2	14	6	10	251.33	177.55	32.13	0.18	45.48	139.26
3	12	6	9	188.50	100.70	19.31	0.19	36.14	16.07
4	10	6	8	125.66	104.78	21.32	0.20	25.57	66.73
5	8	6	7	62.83	157.95	35.65	0.23	14.18	12.28
1	19	7	13	376.99	774.86	152.01	0.20	73.96	31.89
2	17	7	12	314.16	1039.56	183.68	0.18	55.51	-191.00
3	15	7	11	251.33	217.99	39.90	0.18	46.00	17.86
4	13	7	10	188.50	126.64	24.18	0.19	35.98	20.77
5	11	7	9	125.66	136.22	27.06	0.20	24.96	17.24
6	9	7	8	62.83	169.53	33.70	0.20	12.49	-39.02
2	20	8	14	376.99	1039.59	183.25	0.18	66.45	103.95
3	18	8	13	314.16	1039.62	191.48	0.18	57.86	78.55
4	16	8	12	251.33	611.69	116.87	0.19	48.02	-76.46
5	14	8	11	188.50	180.84	36.10	0.20	37.63	-82.00
6	12	8	10	125.66	98.98	19.42	0.20	24.66	82.36
7	10	8	9	62.83	93.50	19.70	0.21	13.24	-35.35
4	19	9	14	314.16	622.28	119.39	0.19	60.27	-117.04
5	17	9	13	251.33	1039.63	204.47	0.20	49.43	19.63

6	15	9	12	188.50	210.32	43.26	0.21	38.77	-233.65
7	13	9	11	125.66	110.06	22.50	0.20	25.69	0.35
8	11	9	10	62.83	74.68	15.56	0.21	13.09	17.92
5	20	10	15	314.16	1039.63	206.28	0.20	62.33	-302.53
6	18	10	14	251.33	1039.37	209.32	0.20	50.62	-15.85
7	16	10	13	188.50	381.69	80.10	0.21	39.56	-148.20
8	14	10	12	125.66	86.56	18.73	0.22	27.20	-178.42
9	12	10	11	62.83	65.18	14.32	0.22	13.80	-131.11
7	19	11	15	251.33	391.53	81.84	0.21	52.54	-54.43
8	17	11	14	188.50	158.61	34.66	0.22	41.19	-38.30
9	15	11	13	125.66	99.79	22.54	0.23	28.38	17.24
10	13	11	12	62.83	69.73	16.72	0.24	15.06	-223.24
8	20	12	16	251.33	158.98	33.88	0.21	53.57	-124.02
9	18	12	15	188.50	175.60	39.39	0.22	42.28	-90.68
10	16	12	14	125.66	123.22	28.12	0.23	28.68	180.35
11	14	12	13	62.83	79.78	19.53	0.24	15.38	59.62
10	19	13	16	188.50	123.56	28.34	0.23	43.24	-473.53
11	17	13	15	125.66	137.95	31.90	0.23	29.05	-104.96
12	15	13	14	62.83	70.22	18.32	0.26	16.39	-72.07
11	20	14	17	188.50	137.74	32.22	0.23	44.09	-244.71
12	18	14	16	125.66	100.85	24.01	0.24	29.92	-308.31
13	16	14	15	62.83	153.90	40.10	0.26	16.37	-240.28
13	19	15	17	125.66	154.51	37.78	0.24	30.72	15.77
14	17	15	16	62.83	183.60	51.61	0.28	17.66	-328.50
14	20	16	18	125.66	183.51	44.81	0.24	30.69	-113.85
15	18	16	17	62.83	220.00	60.29	0.27	17.22	53.69
16	19	17	18	62.83	1039.61	282.65	0.27	17.08	-571.86
17	20	18	19	62.83	1039.54	292.73	0.28	17.69	-247.40

Table 12: Resistivity data PR-3

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
1	4	2	3	62.83	408.53	97.63	0.24	15.01	162.60
1	7	3	5	125.66	288.80	54.61	0.19	23.76	-138.59
2	5	3	4	62.83	1039.23	206.14	0.20	12.46	-564.44
1	10	4	7	188.50	310.27	62.08	0.20	37.71	15.70
2	8	4	6	125.66	781.15	150.37	0.19	24.19	323.21
3	6	4	5	62.83	1039.15	255.04	0.25	15.42	219.25
1	13	5	9	251.33	299.30	53.49	0.18	44.01	135.39
2	11	5	8	188.50	832.66	226.41	0.27	51.25	180.44

3	9	5	7	125.66	454.21	90.99	0.20	25.17	-43.99
4	7	5	6	62.83	241.00	46.31	0.19	12.07	-176.47
1	16	6	11	314.16	780.15	155.98	0.20	62.81	329.64
2	14	6	10	251.33	754.03	139.58	0.19	46.52	442.49
3	12	6	9	188.50	209.39	41.53	0.20	37.39	171.73
4	10	6	8	125.66	256.53	53.02	0.21	25.97	289.08
5	8	6	7	62.83	808.20	195.33	0.24	15.19	-13.53
1	19	7	13	376.99	776.34	145.01	0.19	70.42	241.78
2	17	7	12	314.16	1039.24	183.65	0.18	55.52	108.77
3	15	7	11	251.33	734.92	136.76	0.19	46.77	275.36
4	13	7	10	188.50	248.76	48.16	0.19	36.50	339.41
5	11	7	9	125.66	1038.88	206.88	0.20	25.02	129.59
6	9	7	8	62.83	421.84	85.00	0.20	12.66	247.44
2	20	8	14	376.99	1039.26	183.17	0.18	66.44	-29.76
3	18	8	13	314.16	1039.30	190.48	0.18	57.58	-72.08
4	16	8	12	251.33	602.80	115.28	0.19	48.06	-123.04
5	14	8	11	188.50	807.63	164.42	0.20	38.37	5.18
6	12	8	10	125.66	202.58	40.70	0.20	25.25	111.51
7	10	8	9	62.83	204.33	43.00	0.21	13.22	-123.00
4	19	9	14	314.16	611.17	117.03	0.19	60.16	74.98
5	17	9	13	251.33	1039.38	204.65	0.20	49.48	74.21
6	15	9	12	188.50	654.11	133.12	0.20	38.36	-56.11
7	13	9	11	125.66	199.20	40.53	0.20	25.57	131.95
8	11	9	10	62.83	642.03	135.80	0.21	13.29	210.03
5	20	10	15	314.16	1039.37	205.51	0.20	62.12	-225.03
6	18	10	14	251.33	1039.12	209.76	0.20	50.73	-114.94
7	16	10	13	188.50	389.77	80.98	0.21	39.16	-167.32
8	14	10	12	125.66	488.31	105.59	0.22	27.17	-205.88
9	12	10	11	62.83	150.90	32.92	0.22	13.71	-97.06
7	19	11	15	251.33	394.29	81.67	0.21	52.06	-101.74
8	17	11	14	188.50	768.00	184.57	0.24	45.30	-32.44
9	15	11	13	125.66	307.06	69.57	0.23	28.47	-62.51
10	13	11	12	62.83	210.76	50.44	0.24	15.04	-178.92
8	20	12	16	251.33	796.69	200.68	0.25	63.31	-402.42
9	18	12	15	188.50	462.49	101.64	0.22	41.42	28.65
10	16	12	14	125.66	410.90	94.05	0.23	28.76	127.37
11	14	12	13	62.83	625.41	148.82	0.24	14.95	64.99
10	19	13	16	188.50	414.76	94.64	0.23	43.01	-711.70
11	17	13	15	125.66	1038.92	234.30	0.23	28.34	-37.00
12	15	13	14	62.83	171.77	45.66	0.27	16.70	24.57
11	20	14	17	188.50	1038.91	234.07	0.23	42.47	-535.79

12	18	14	16	125.66	212.53	50.96	0.24	30.13	-543.23
13	16	14	15	62.83	393.62	99.73	0.25	15.92	-103.83
13	19	15	17	125.66	397.38	97.82	0.25	30.93	-331.34
14	17	15	16	62.83	824.20	243.95	0.30	18.60	-647.55
14	20	16	18	125.66	770.11	212.04	0.28	34.60	-67.08
15	18	16	17	62.83	758.31	204.56	0.27	16.95	17.97
16	19	17	18	62.83	1039.41	285.46	0.27	17.26	-658.02
17	20	18	19	62.83	1039.38	290.18	0.28	17.54	-222.51

Table13: Resistivity data PR-4

A(C1)	B(C2)	M(P1)	N(P2)	K	I(mA)	V(mV)	R(Ohm)	R0	SP
2	1	3	4	94.25	1039.65	56.13	0.05	5.09	13.87
2	1	4	5	376.99	1039.53	23.81	0.02	8.64	-54.87
2	1	5	6	942.48	1039.48	11.38	0.01	10.32	-180.47
2	1	6	7	1884.96	1039.47	7.38	0.01	13.38	74.59
2	1	7	8	3298.67	1039.46	4.76	0.00	15.11	-86.59
2	1	8	9	5277.88	1039.45	3.27	0.00	16.62	84.61
3	1	10	12	2721.40	1039.50	7.92	0.01	20.75	311.64
3	1	12	14	5054.04	1039.50	5.29	0.01	25.72	-13.88
3	1	14	16	8423.39	1039.49	3.85	0.00	31.18	-12.82
3	1	11	13	3769.91	1039.49	6.25	0.01	22.66	92.53
3	1	13	15	6597.34	1039.51	4.58	0.00	29.09	-57.46
3	1	15	17	10555.75	1039.52	3.26	0.00	33.06	170.23
3	2	4	5	94.25	1039.57	66.20	0.06	6.00	-54.77
3	2	5	6	376.99	1039.50	23.11	0.02	8.38	-181.50
3	2	6	7	942.48	1039.48	12.98	0.01	11.77	75.50
3	2	7	8	1884.96	1039.48	7.46	0.01	13.52	-87.54
3	2	8	9	3298.67	1039.47	4.84	0.00	15.35	85.42
3	2	9	10	5277.88	1039.47	3.10	0.00	15.75	-246.65
4	1	17	20	6897.54	1039.48	5.61	0.01	37.24	-151.27
4	2	11	13	2721.40	1039.43	7.78	0.01	20.37	96.28
4	2	13	15	5054.04	1039.44	5.52	0.01	26.85	-59.69
4	2	15	17	8423.39	1039.44	3.65	0.00	29.59	171.25
4	2	12	14	3769.91	1039.46	6.53	0.01	23.68	-12.68
4	2	14	16	6597.34	1039.48	4.67	0.00	29.65	0.77
4	2	16	18	10555.75	1039.57	3.09	0.00	31.40	92.66
4	3	5	6	94.25	1039.55	58.82	0.06	5.33	-182.72
4	3	6	7	376.99	1039.52	25.06	0.02	9.09	76.40
4	3	7	8	942.48	1039.51	12.43	0.01	11.27	-88.44

4	3	8	9	1884.96	1039.51	7.27	0.01	13.17	86.10
4	3	9	10	3298.67	1039.51	4.41	0.00	14.01	-229.47
4	3	10	11	5277.88	1039.52	3.49	0.00	17.71	212.98
5	3	12	14	2721.40	1039.51	8.32	0.01	21.79	-12.06
5	3	14	16	5054.04	1039.51	5.80	0.01	28.20	7.51
5	3	16	18	8423.39	1039.51	3.90	0.00	31.64	87.58
5	3	13	15	3769.91	1039.54	6.83	0.01	24.76	-63.03
5	3	15	17	6597.34	1039.55	4.36	0.00	27.66	173.04
5	3	17	19	10555.75	1039.57	3.37	0.00	34.26	10.03
5	4	6	7	94.25	1039.53	72.12	0.07	6.54	76.96
5	4	7	8	376.99	1039.51	26.17	0.03	9.49	-88.96
5	4	8	9	942.48	1039.52	13.01	0.01	11.80	86.89
5	4	9	10	1884.96	1039.51	7.01	0.01	12.71	-215.73
5	4	10	11	3298.67	1039.53	5.35	0.01	16.98	195.75
5	4	11	12	5277.88	1039.52	3.22	0.00	16.86	52.34
6	4	13	15	2721.40	1039.47	8.44	0.01	22.10	-65.19
6	4	15	17	5054.04	1039.49	5.26	0.01	25.59	174.02
6	4	17	19	8423.39	1039.49	3.81	0.00	30.87	8.01
6	4	14	16	3769.91	1039.52	7.00	0.01	25.37	16.90
6	4	16	18	6597.34	1039.54	4.51	0.00	28.63	80.07
6	4	18	20	10555.75	1039.62	3.21	0.00	32.64	-58.86
6	5	7	8	94.25	1039.53	66.07	0.06	5.99	-89.91
6	5	8	9	376.99	1039.52	24.44	0.02	8.86	87.31
6	5	9	10	942.48	1039.51	11.25	0.01	10.20	-203.54
6	5	10	11	1884.96	1039.52	7.59	0.01	13.76	180.61
6	5	11	12	3298.67	1039.51	4.20	0.00	13.33	53.41
6	5	12	13	5277.88	1039.52	3.50	0.00	17.76	53.89
7	5	14	16	2721.40	1039.55	8.60	0.01	22.51	22.28
7	5	16	18	5054.04	1039.53	5.32	0.01	25.88	75.65
7	5	18	20	8423.39	1039.53	3.70	0.00	30.01	-55.42
7	5	15	17	3769.91	1039.57	6.24	0.01	22.64	175.37
7	5	17	19	6597.34	1039.57	4.46	0.00	28.31	5.18
7	6	8	9	94.25	1039.62	67.51	0.06	6.12	87.84
7	6	9	10	376.99	1039.56	23.05	0.02	8.36	-194.47
7	6	10	11	942.48	1039.52	13.27	0.01	12.03	169.18
7	6	11	12	1884.96	1039.52	6.67	0.01	12.10	54.25
7	6	12	13	3298.67	1039.51	5.15	0.00	16.35	55.75
7	6	13	14	5277.88	1039.52	3.35	0.00	16.99	-67.19
8	6	15	17	2721.40	1039.53	8.01	0.01	20.96	176.15
8	6	17	19	5054.04	1039.53	5.27	0.01	25.62	3.88
8	6	16	18	3769.91	1039.53	6.58	0.01	23.86	70.27

8	6	18	20	6597.34	1039.52	4.45	0.00	28.24	-51.14
8	7	9	10	94.25	1039.56	61.13	0.06	5.54	-187.17
8	7	10	11	376.99	1039.57	25.56	0.02	9.27	160.21
8	7	11	12	942.48	1039.63	10.91	0.01	9.89	55.06
8	7	12	13	1884.96	1039.56	7.49	0.01	13.57	57.41
8	7	13	14	3298.67	1039.55	4.54	0.00	14.39	-68.87
8	7	14	15	5277.88	1039.57	3.82	0.00	19.42	-3.57
9	7	16	18	2721.40	1039.54	7.86	0.01	20.57	67.05
9	7	18	20	5054.04	1039.54	5.20	0.01	25.30	-48.50
9	7	17	19	3769.91	1039.53	6.32	0.01	22.93	2.21
9	8	10	11	94.25	1039.54	69.88	0.07	6.34	153.44
9	8	11	12	376.99	1039.54	21.13	0.02	7.66	55.69
9	8	12	13	942.48	1039.54	12.38	0.01	11.22	58.73
9	8	13	14	1884.96	1039.56	6.69	0.01	12.14	-70.23
9	8	14	15	3298.67	1039.57	5.34	0.01	16.93	-3.89
9	8	15	16	5277.88	1039.67	3.17	0.00	16.12	40.40
10	8	17	19	2721.40	1039.64	7.35	0.01	19.24	1.35
10	8	18	20	3769.91	1039.62	5.85	0.01	21.21	-45.76
10	9	11	12	94.25	1039.62	50.74	0.05	4.60	56.17
10	9	12	13	376.99	1039.62	21.72	0.02	7.88	59.88
10	9	13	14	942.48	1039.62	10.10	0.01	9.16	-71.47
10	9	14	15	1884.96	1039.61	7.29	0.01	13.22	-4.10
10	9	15	16	3298.67	1039.62	4.02	0.00	12.74	43.33
10	9	16	17	5277.88	1039.63	2.97	0.00	15.07	134.50
11	9	18	20	2721.40	1039.60	7.25	0.01	18.99	-43.91
11	10	12	13	94.25	1039.65	68.09	0.07	6.17	60.68
11	10	13	14	376.99	1039.66	22.86	0.02	8.29	-72.39
11	10	14	15	942.48	1039.69	14.12	0.01	12.80	-4.23
11	10	15	16	1884.96	1039.67	7.08	0.01	12.83	46.17
11	10	16	17	3298.67	1039.65	4.79	0.00	15.19	132.17
11	10	17	18	5277.88	1039.66	3.27	0.00	16.60	-73.24
12	11	13	14	94.25	1039.62	55.71	0.05	5.05	-73.30
12	11	14	15	376.99	1039.61	25.58	0.02	9.28	-4.36
12	11	15	16	942.48	1039.60	10.85	0.01	9.84	48.12
12	11	16	17	1884.96	1039.61	6.58	0.01	11.93	130.57
12	11	17	18	3298.67	1039.60	4.11	0.00	13.04	-73.18
12	11	18	19	5277.88	1039.60	2.85	0.00	14.45	72.53
13	12	14	15	94.25	1039.67	84.74	0.08	7.68	-4.43
13	12	15	16	376.99	1039.67	26.52	0.03	9.62	50.04
13	12	16	17	942.48	1039.70	13.75	0.01	12.47	120.09
13	12	17	18	1884.96	1039.68	7.83	0.01	14.19	-73.16

13	12	18	19	3298.67	1039.67	4.87	0.00	15.45	72.01
13	12	19	20	5277.88	1039.66	3.24	0.00	16.43	-111.24
14	13	15	16	94.25	1039.55	59.12	0.06	5.36	51.89
14	13	16	17	376.99	1039.55	23.70	0.02	8.60	127.39
14	13	17	18	942.48	1039.55	11.86	0.01	10.76	-73.12
14	13	18	19	1884.96	1039.55	6.66	0.01	12.08	71.61
14	13	19	20	3298.67	1039.55	4.06	0.00	12.88	-109.77
15	14	16	17	94.25	1039.53	69.90	0.07	6.34	126.26
15	14	17	18	376.99	1039.55	26.46	0.03	9.60	-73.07
15	14	18	19	942.48	1039.55	12.79	0.01	11.59	71.31
15	14	19	20	1884.96	1039.63	7.12	0.01	12.90	-108.40
16	15	17	18	94.25	1039.53	61.03	0.06	5.53	-73.10
16	15	18	19	376.99	1039.52	21.89	0.02	7.94	71.01
16	15	19	20	942.48	1039.52	10.22	0.01	9.26	-107.56
17	16	18	19	94.25	1039.69	67.34	0.06	6.10	70.86
17	16	19	20	376.99	1039.68	22.66	0.02	8.22	-107.03
18	17	19	20	94.25	1039.73	60.76	0.06	5.51	-106.83

Vertical Electrical Sounding (VES)

Resistivity sounding is a process by which the depth investigation is made. In this, the center of configuration is kept fixed, and the measurements are made by successively increasing the electrode spacing. The apparent resistivity values obtained with increasing values of electrode separations are used to estimate the thickness and resistivities of the subsurface formations. In Schlumberger sounding arrangement, all the four electrodes are kept in a line symmetrically over a point `0; with inner (Potential) electrodes kept closer. For increasing the depth of investigation, the current electrodes, A and B are moved apart symmetrically about the center point `0' keeping the potential electrodes fixed. The separation between the Potential Electrodes is changed only when the potential between them drops to allow value during the course of sounding. The apparent resistivity for each electrode separation is calculated by multiplying the resistance `R' by Schlumberger configuration factor.

In Schlumberger arrangement, all the four electrodes are kept in a line symmetrically over a point `O' current is sent through outer electrodes are kept in a line symmetrically over a point `0'. Current is sent through outer electrodes AB and potential across MN is measured. The separation between the potential electrodes M & N is kept smaller compared to the current electrode distance AB. The geometric factor `K' for Schlumberger arrangement is given by

$$K = \pi \{(AB/2)^2 - (MN/2)^2\} / MN$$

Where,

AB is current Electrode spacing

MN is potential Electrode spacing

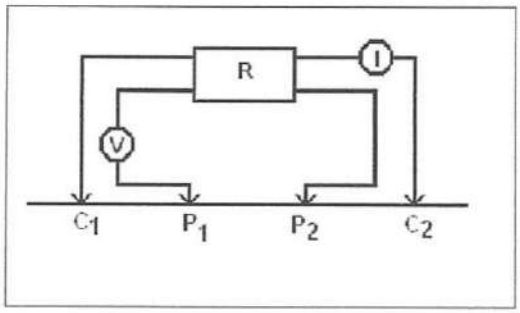


Fig. 20. Schlumberger electrode configuration

Equipment:

The equipment used in this investigation was CRM-500 resistivity meter. This digital resistivity meter has been designed for use in shallow as well as deep resistivity survey. The resistivity meter is powered by 40 V chargeable batteries. Voltage up to 220 volts can be applied and current up to 500 m amp can be sent depending on the ground conditions. The potential can be measured with resolution of up to 0.001 mV. By applying the current into the ground, the equipment provides the direct resistance for particular electrode separation.

Fig.21: Resistivity meter.

Data Analysis and Interpretation

The observed resistance value from instrument was multiplied with geometric factor (K) to get the apparent resistivity values for each electrode spacing. The field apparent resistivity data were plotted on log-log paper against the half current electrode separation to get the VES curves. The apparent resistivity data for different potential dipole were brought to single common potential dipole. The smoothed/corrected apparent resistivity values for each electrode spacing are presented along with VES curves in running text. The VES curves were modeled through conventional curve matching techniques and computer software IPI2WIN. The location map of observed VESs, VES data and VES curves are presented below.

Table 14: Vertical Electrical Sounding (VES) Data

VES-1				
AB/2	App. Rest.		Factor	Remarks
2	96.90	0.00		Probable Fracture Zones in between 30-35m
3	72.90	96.90	0.75232	
4.5	59.20	169.80	0.34865	
6	52.70	229.00	0.23013	
8	49.70	281.70	0.17643	
10	50.10	331.40	0.15118	
12	51.10	381.50	0.13394	
15	54.20	432.60	0.12529	
20	59.80	486.80	0.12284	
25	64.70	546.60	0.11837	
30	71.50	611.30	0.11696	
35	79.70	682.80	0.11673	

Table 15: Vertical Electrical Sounding (VES) Data

VES-2				
AB/2	App. Rest.		Factor	Remarks
2	20.78	0.00		Probable Fracture Zones in~50m
3	21.40	20.78	1.02984	
4.5	23.86	42.18	0.56567	
6	26.60	66.04	0.40279	
8	30.55	92.64	0.32977	
10	33.73	123.19	0.27380	
12	37.23	156.92	0.23725	
15	42.34	194.15	0.21808	
20	47.93	236.49	0.20267	
25	54.20	284.42	0.19056	
30	59.83	338.62	0.17669	
35	64.12	398.45	0.16092	
40	69.39	462.57	0.15001	
45	72.91	531.96	0.13706	
50	76.60	604.87	0.12664	

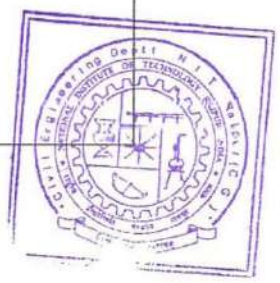


Table 16: Vertical Electrical Sounding (VES) Data

VES-3				
AB/2	App. Rest.		Factor	Remarks
2	70.60	0		Probable Fracture Zones in between 20-25m,
3	59.73	70.60	0.84606	
4.5	48.70	130.33	0.37363	
6	43.08	179.03	0.24066	
8	44.14	222.11	0.19873	
10	48.64	266.25	0.18267	
12	51.80	314.89	0.16449	
15	60.95	366.68	0.16623	
20	75.23	427.64	0.17593	
25	89.00	502.87	0.17699	
30	102.28	591.87	0.17201	
35	113.92	694.15	0.16412	
40	125.11	808.08	0.15483	

Table 17: Vertical Electrical Sounding (VES) Data

VES-4				
AB/2	App. Rest.		Factor	Remarks
2	6.07	0		Probable Fracture Zones in between 20-25m
3	6.22	6.07	1.02415	
4.5	7.34	12.29	0.59740	
6	8.45	19.63	0.43054	
8	10.03	28.08	0.35724	
10	12.31	38.11	0.32309	
12	13.83	50.42	0.27423	
15	16.52	64.24	0.25721	
20	20.65	80.77	0.25565	
25	25.97	101.42	0.25606	
30	30.38	127.39	0.23846	

Table 18: Vertical Electrical Sounding (VES) Data

VES-5				
AB/2	App. Rest.		Factor	Remarks
2	7.09	0		No Fracture Zones
3	6.81	7.09	0.96051	
4.5	7.32	13.90	0.52662	
6	8.24	21.22	0.38831	
8	9.28	29.46	0.31500	
10	10.60	38.74	0.27362	
12	12.40	49.34	0.25132	
15	14.90	61.74	0.24133	
20	19.50	76.64	0.25444	
25	23.60	96.14	0.24548	
30	26.66	119.74	0.22263	

Table 19: Vertical Electrical Sounding (VES) Data

VES-6				
AB/2	App. Rest.		Factor	Remarks
2	39.10	0		Probable Fracture Zones in between 12-15m
3	34.80	39.10	0.89003	
4.5	31.46	73.90	0.42571	
6	31.79	105.36	0.30173	
8	34.22	137.15	0.24951	
10	40.06	171.37	0.23376	
12	45.45	211.43	0.21496	
15	55.50	256.88	0.21605	
20	73.72	312.38	0.23599	
25	88.15	386.10	0.22831	
30	104.30	474.25	0.21993	

Table 20: Vertical Electrical Sounding (VES) Data

VES-7				
AB/2	App. Rest.		Factor	Remarks
2	33.35	0		No Fracture Zones
3	43.58	33.35	1.30675	
4.5	56.37	76.93	0.73279	
6	70.06	133.30	0.52560	
8	84.54	203.37	0.41568	
10	98.04	287.91	0.34054	
12	111.49	385.95	0.28886	
15	134.51	497.43	0.27041	
20	168.84	631.95	0.26717	
25	191.99	800.79	0.23975	
30	220.47	992.77	0.22208	

Discussion on Geophysical results:

Increasing demand of water for increased infrastructures in the area is resulting in decrease of groundwater resources. To explore the subsurface hydrogeological conditions beneath the area, spot electrical sounding was conducted at 11 locations in the premises of Industry. The current electrodes were spread between 30 m (AB/2) only. The VES curves obtained from the study area indicated the presence of different geoelectrical layers sequence within a maximum depth range of 50 m bgl in the premises. The occurrence of alternate 'low' and 'high' resistivity layers or vice versa, in the study area, indicates the presence of different geoelectrical layer sequences having varied lithological constituents. The moderate range of resistivity with respect to background resistivity may be representing the fracture/weaker zone forming the confined aquifer. The higher range of resistivity may be indicating the presence of hard and compact limestone. Due to limitation of techniques, sometimes the single geoelectrical layer may represent equivalent to more layers of similar electrical characteristics (resistivity and thickness of layers).

Knowledge of overburden thickness (weathered rock formation) is an important component for deciding the suitable location for roof top rainwater harvesting. In this regard, based on the geoelectrical parameter of VESs, it is observed that the overburden thickness in the area vary between 10 to 20 m bgl. The VES investigations could be able to

delineate different geoelectrical layers within the depth range of 50 m below ground level. In this study Some of the VES curves have indicated the presence of aquifer in the different depth ranges below ground level.

Rain Water Harvesting & Artificial Recharge

Artificial recharge systems are engineered systems where surface water is put on or in the ground for infiltration and subsequent movement to aquifers to augment groundwater resources. Other objectives of artificial recharge are to store water, to improve the quality of the water through soil-aquifer treatment or geo-purification, to use aquifers as water conveyance systems, and to make groundwater out of surface water where groundwater is traditionally preferred over surface water for drinking. Artificial recharge is expected to become increasingly necessary in the future as growing populations require more water, and as more storage of water is needed to save water in times of water surplus for use in times of water shortage.

Artificial recharge projects are site specific. The replication of the techniques from similar areas is to be based on the local hydrogeological and hydrological environs. The first step in planning the project is to demarcate the area of recharge. The scheme can be implemented systematically in case a hydrologic unit like watershed is taken for implementation. However, localized schemes are also can be taken to augment the ground water reservoir. Schemes are normally taken in the following areas.

- Areas where ground water levels are declining over a period of time.
- Areas where substantial amount of aquifer has already been desaturated.
- Areas where availability of ground water is in adequate in lean months and there is availability of surface water for recharge during rainy season.
- Areas where salinity ingress is taking place.
- Areas where there is quality problem in ground water

Roof top rain water harvesting can also be adopted to meet domestic water requirements. The roof top rain water can be stored in specifically constructed surface or sub-surface tanks. In these areas dependence on ground water has increased many folds and the natural recharge to ground water has decreased, due to urbanization, construction of buildings and paved area. In urban areas water

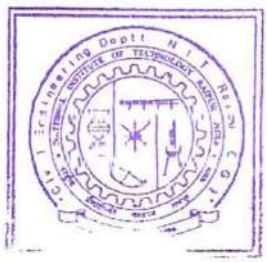
falling on roof tops can be collected and diverted to the open wells/ tubewells/ borewells by providing a filter bed.

Roof top rainwater harvesting, which involves the collection of rainwater from the roof of the buildings and its storage in surface tanks or recharge to sub-surface aquifer, can play an important role in conservation of water. Thus, the need for artificial recharge of groundwater is beyond doubt and is the most powerful management strategy available to face the challenge of fast depletion in groundwater storages.

The depth of recharge well may be as follows-

Table 21: Proposed Depth of recharge well.

S.No.	VES Number	Possible fracture zones	Proposed Depth of recharge well
1	RS1	Between 30-35m	35 m
2	RS2	~ 50m	~ 50m
3	RS3	between 20-25m,	25 m
4	RS4	between 20-25m	25 m
5	RS5	No fracture zone	None
6	RS6	between 12-15m	15 m
7	RS7	No fracture zone	None



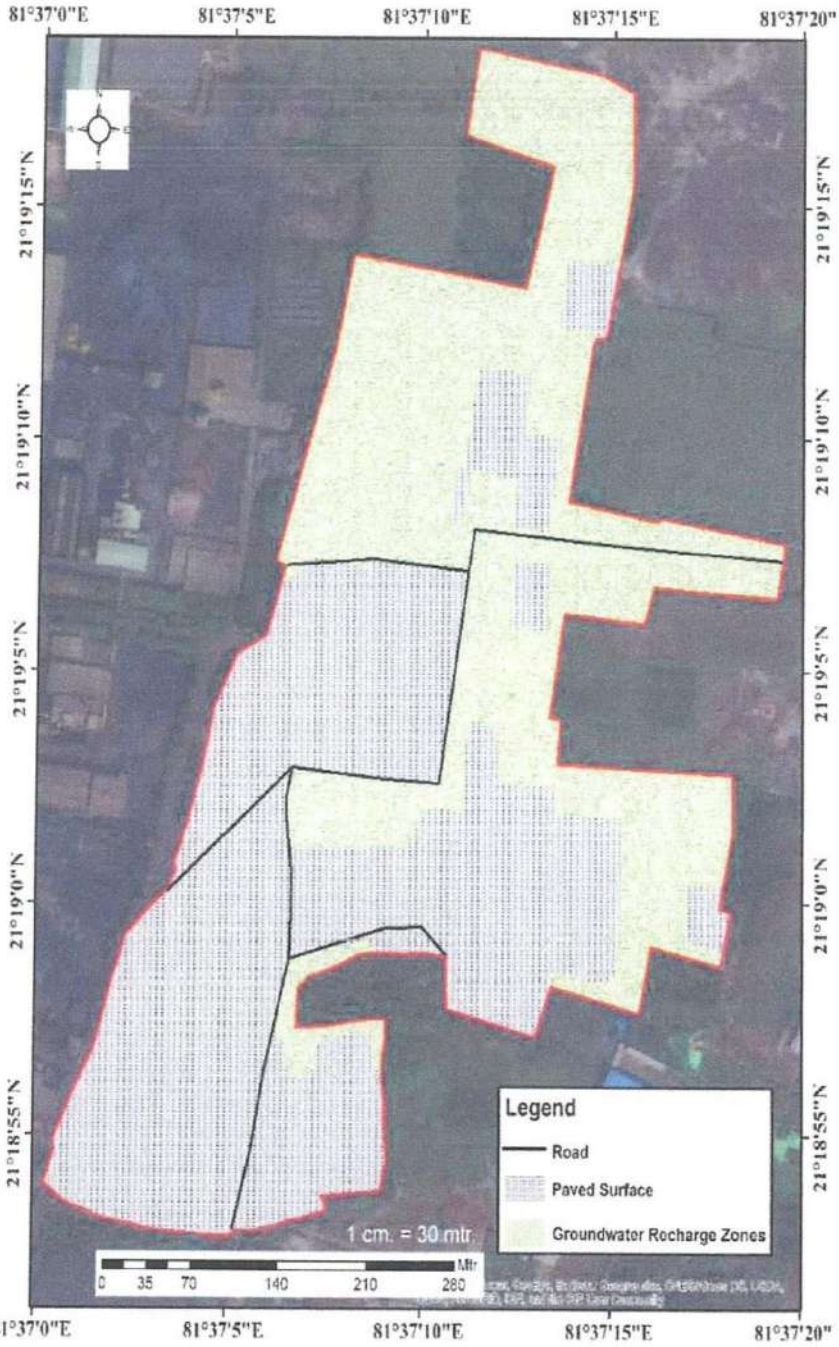
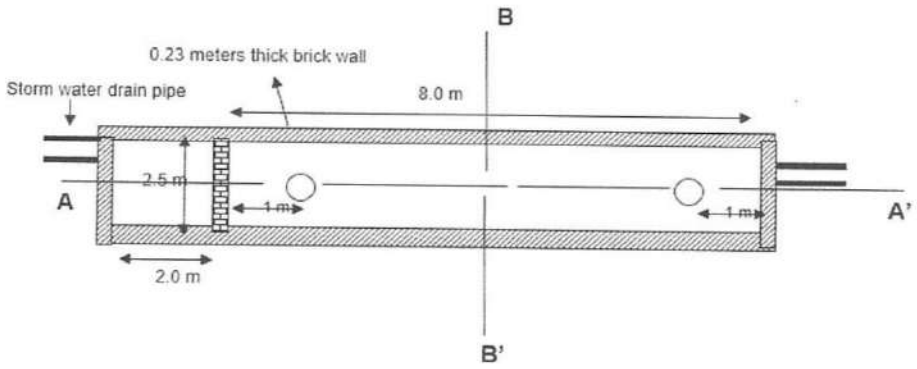


Fig.22: Groundwater Recharge Zone of Study Area

Proposed Plan for Recharge Trench Cum Twin Borewell with Desilting Chamber for the study area-

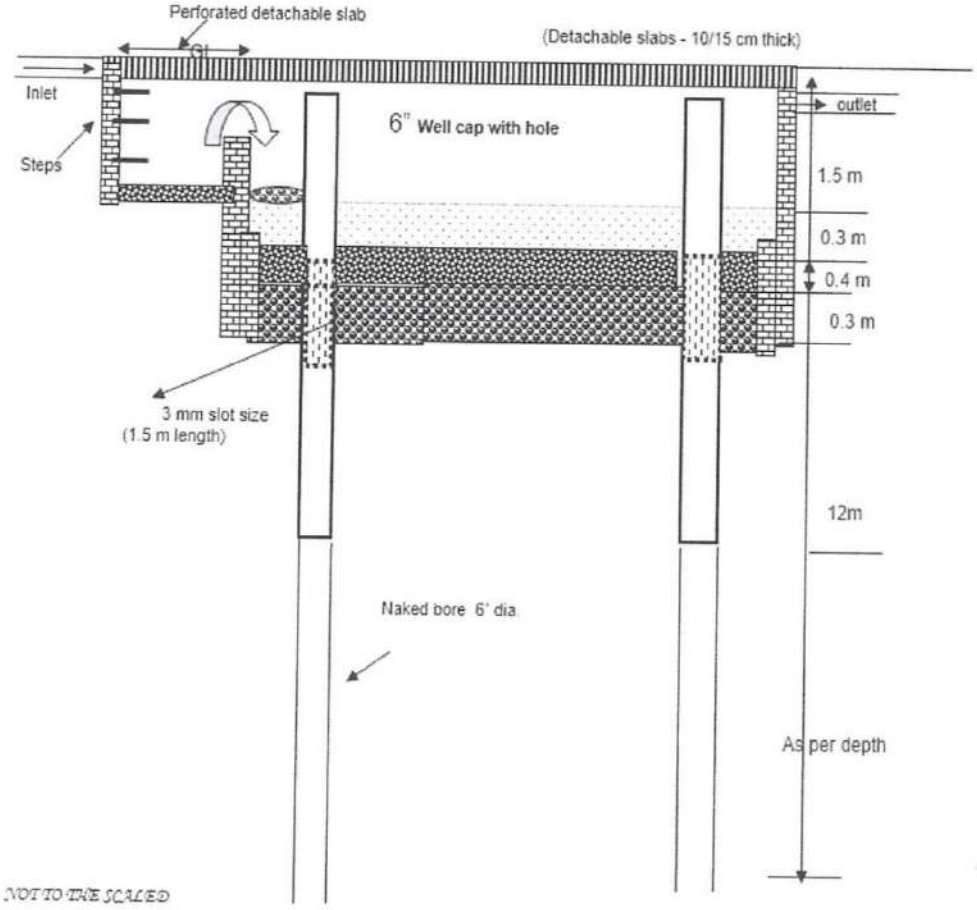
PLAN VIEW



NOT TO THE SCALED

Fig. 23 (a): Plan of proposed recharge structure (not to scale)

SECTION AA'



– Pea Gravel (3-6 mm) – Gravel (5 – 10 mm) = Boulder (5 – 15 cm)

Brick wall = Refer Brick Section,

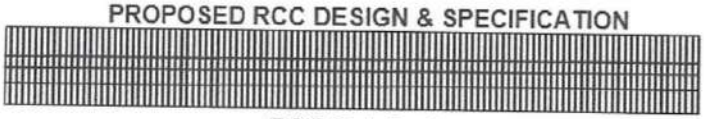
RCC = Refer RCC Slab Design

Height of de silting wall = 1 m from top of the pea gravel

All the measurement dimensions are inner one

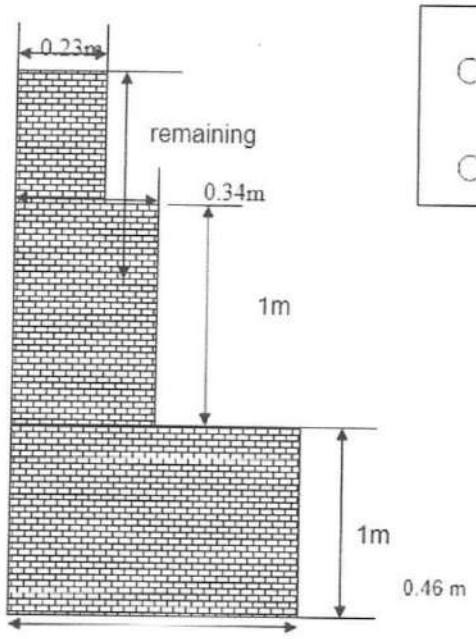
Fig. 23 (b): Proposed recharge structure Section A-A (not to scale)

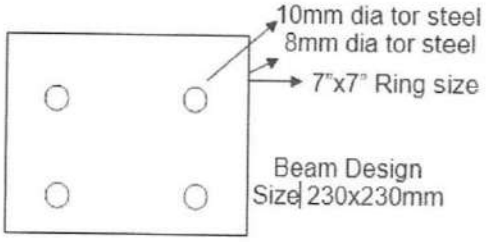
PROPOSED RCC DESIGN & SPECIFICATION



RCC Slab Design

Main Bars: 10mm dia tor steel (cold twisted bars) placed @ 100mm c/c
Distribution Bars: 10mm dia tor steel (cold twisted bars) placed @ 100mm c/c





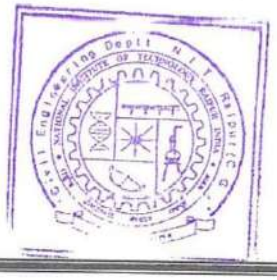
PROPOSED SECTION OF BRICK WORK

NOT TO THE SCALED

Fig. 23 (c): Proposed RCC Design & Specification (not to scale)

Points to be taken into Consideration for implementation of Artificial Recharge Structures

1. Proposed Structural drawing are shown in Fig. 23(a), (b) and (c)
2. Depth of the retaining capacity of the recharge trenches/ shafts (as per the enclosed designs) is below the existing inlet pipes. All the dimensions indicated in the designs are the inner dimension.
3. All the storm water drains/ catchment area are to be cleaned prior to monsoon. Necessary repair/maintenance needs to be carried out wherever required. Necessary diversions to be provided wherever required so as diverting the runoff to the structures.
4. Care must be taken so that no contaminated water is diverted into the recharge structures. No change in the existing flow path. Necessary peripheral drains may be constructed to divert the runoff to the recharge structures. Provision of oil/ grease separator to be made wherever necessary.
5. Before the onset of the monsoon all the catchment area considered for recharge is to be cleaned.
6. Necessary flow checks may be provided within the storm water drains for settling the silt, if required. A mesh may be provided on the mouth of the inlet to discard the debris entering into the recharge trenches. A sluice/ shutter may be provided to ensure that no water other than the rainwater is diverted to the recharge structures.
7. Depth and location of the recharge wells may vary as per the prevailing site conditions.
8. After the first rains the de-silting pit may be cleaned and subsequently on the onset of next monsoon. Sanitary and hygienic conditions in the study area are required after implementation of artificial recharge structures.
9. Necessary provision to prevent the diversion of the initial runoff to the recharge structures to avoid clogging of the recharge trench may be considered. The initial runoff having excessive silt may be diverted to the culverts and subsequently out of the study area to avoid any water logging.
10. Excess water not envisaged for recharge may be diverted to the pond.
11. Prior to monsoon season the top most layer in the pit may be scrapped and replaced with the fresh & cleaned one, if necessary.
12. On non-acceptance of water by the recharge well, the same may be cleaned using manual method / compressor development.



Step-wise approach for implementation of Artificial Recharge Structures

1. Construct the recharge wells at the pre-determined locations. Depth of the recharge wells may vary as per specific site conditions and depth is to be restricted upto the depth till the well starts giving discharge. This would ensure intake of runoff water.

2. Test all the constructed recharge wells by pouring water from tanker to ensure the intake capacity of each recharge wells. In this regard, slug test may be conducted.

3. The next step would be to go for excavation of recharge trench. If problem is encountered in respect of the specified depth, necessary modification may be made with respect to length and width of the recharge trench.

4. Subsequently PCC footing and rising of brick wall as per the proposed brick wall section may be taken up. If required, necessary weep holes may be provided.

5. In case of two double bore recharge wells in series, the de-silting chamber would be one only and necessary modification in respect of its dimension may be considered.

6. Provision for initial flush and tapping of clean rainfall runoff may be made by providing sluice and shutters in all the recharge structures.

7. Manhole is to be provided at the top of the de-silting chambers, recharge trenches and on the top of all the recharge wells in order to keep provision for maintenance.

8. The inlet and outlet pipes in all recharge structures should be placed so that the level of the bottom of inlet pipe would be the top level of the outlet pipe.

9. RECOMMENDATIONS:

During the site visit existing drainage location of drains, settling pits, type of strata in the area were observed. Surface plan & bore well details were collected. The data collected were also verified in the field to check its correctness and physical location as mentioned in layout etc. The expert team of NIT Raipur also interacted with the officials of HIRA group during the visit for understanding the future proposals of drainage system in the plant. As observed during site visit, there is proper plantation in & around the site. From the site observation, it is found that the drain provided in the plant area is inadequate and cannot sustain peak flow conditions with chances of overflow. It is also observed that the existing recharging structures are obsolete and not in working condition due to huge silt deposition. Based on the data analysis and site visit the following recommendations are made:

1. Without proper treatment, water coming as surface runoff within the industry premises must not be directly allowed for recharging the ground water.
2. A proper treatment unit as proposed in Fig. 10, is required after the sedimentation tank located near the solar plant in the industry premises to treat the surface runoff (contaminated with industrial waste) coming through the existing drainage.
3. The waste water/effluent coming from the adjacent industry must not be allowed within the plant premises. If not possible, then another treatment unit is required to treat the effluent before allowing it to drain inside the plant premises.
4. The treated water is allowed to drain through the proposed drain network towards the existing pond.
5. Regular cleaning of pond bed is required for the efficient natural ground water recharging through the pond bed.
6. The fresh water demand within the plant premises is 600 KLD (as per data provided). As per the observation, it is suggested that the treated water can also be utilized for fulfilling the fresh water demand approximately up to 40 % on yearly basis.
7. As per the hydrogeological study, probable suitable location for ground water recharge is given in **Fig. 10**. Also, the feasible zones for ground water recharge are provided in **Fig. 22** and proposed depth of recharging wells are provided in **Table 21**. It is recommended to provide the recharging structures along the proposed drainage network.
8. Before the onset of the monsoon all the catchment area considered for recharge is to be cleaned
9. The execution work may be undertaken by the specialized agencies so that the objective of rainwater harvesting / artificial recharge is implemented in true spirit and due benefits are accrued.

REFERENCES:

1. Development of a new high spatial resolution (0.25° X 0.25°) Long period (1901-2010) daily gridded rainfall data set over India and its comparison with existing data sets over the region; MAUSAM, 65, 1(January 2014), pp1-18.
2. NRCS, U., 2007. Chapter 10, part 630–hydrology. Estimation of direct runoff from storm rainfall. In 'National engineering handbook'. (Eds V Mockus, AT Hjelmfelt, HF Moody) pp. 1–79. US Department of Agriculture, Natural Resources Conservation Service: Washington, DC.
3. Subramanya, K., 2009. Flow in open channels. Tata McGraw-Hill Education.
4. Subramanya, K., 2013. Engineering Hydrology, 4e. Tata McGraw-Hill Education.
5. CGWB; 2006; Hydrogeology of Chhattisgarh-State Report (unpublished report); Central Ground Water Board, North Central Chhattisgarh Region, Raipur.
6. CGWB; 2007; Manual on Artificial Recharge of Ground Water, Govt. of India, Central Ground Water Board, Ministry of Water Resources, Govt. of India.

Annexure -VI

HIRA

GROWING STRONGER TOGETHER

HIRA Power & Steel Limited

FY 2021-2022

SEIDR

RAIPUR

Survey & Evaluation By :-
Society for Environment & Integrated Development Raipur

Green Belt & Evaluation REPORT

PLANTATION: SURVEY & EVALUATION REPORT OF M/s HIRA POWER & STEEL LTD. UNIT-II

INDEX

Evaluation of Greenbelt Development

For

M/s HIRA POWER & STEEL LTD. UNIT-II

KHASRA No. 511/1, 512/2, URLA INDUSTRIAL COMPLEX, URLA, RAIPUR (C. G.)

Survey & Evaluation by –"Society for Environment & Integrated Development Raipur" Raipur (CG)

PART - A

EXECUTIVE SUMMARY

INTRODUCTION:

M/s HIRA POWER & STEEL LIMITED is located at Urla industrial area, Raipur. District - Raipur (C.G.)

❖ Regd. office - M/s Hira Power & Steel Limited- Unit - II, 511/1,512/2, Urla Industrial Complex, Raipur, Pin code - 492003 (C. G.)

1. ABOUT PROJECT

As per information provided by **M/s Hira Power & Steel Limited** Raipur, Details of project are as under:-

I. EC-F-No. J-11011/836/2008-IA-II(I) MoEF, New Delhi-11003 for Ferro Alloy plant-600 MTPA for production of Low Medium Carbon Ferro Manganese (Ferro Alloys) -18,000 MTPA.
II. Ferro Alloys - 30,000 MTPA, Or 56,000 MTPA Pig Iron from 2×5.5 MVA Submerged Arc Furnaces.
III. Captive Power Plant - 20 MW

Three rows of plantation of native species have been developed all along the periphery of plant. Tree density is approximate 2500 per ha. Development of green belt and other forms of greenery like road side and village level plantation in the nearest village shall also help in improve ecological conditions and biodiversity status of the study area. Green belt helps to capture the fugitive emission and attenuate the noise apart from improving the aesthetic quality of the region.

Plantation species act as bio-monitoring agent and helps in maintaining the project environment healthy by provide more oxygen. The two areas of air pollution by gases and by dust need to be urgently attended to, using plants. Keeping this in mind, mitigation measures have been suggested to develop green belt based on spatial and physical conditions of the areas "Green with Purpose" Drives.

Survey & Evaluation work was allotted by M/s HIRA POWER STEEL LTD. to our organization "Society for Environment & Integrated Development Raipur" Raipur (CG), work order was issued by M/s Hira Power & SteelLtd. vide S.O. No.**7200003880/1/102Dated:25th April 2022** Plantation survey has been carried out by expert team with the help of M/s Hira Power & Steel Ltd. management and office staffs.

2. PROJECT OBJECTIVE

I. Field Survey
II. Verification of Plantation area
III. Evaluation of Plantation area within and outside of plant premises.

3. AREA DESCRIPTION:

Hira Power & Steel Ltd. (Raipur) Plant – Total Land Area – 17.60 Ha. (Approx) (Plantation Area – 5.86 Hectare Approx)

4. YEAR WISE PLANTATION DESCRIPTION

During the field survey and field study by our technical team found that, plantation work was started from the year 1994-95 and is continued till date. The tree plantation has been carried out in a phased manner with local species. M/s HIRA POWER AND STEEL LTD. has planted 5.86 Hectare area which is 33.30% of total project area (17.60Hectare)

Plantation work was carried out within and outside of plant premises by the M/s HIRA POWER AND STEEL LTD. Year wise plantation is given in the Chart as per information provided by M/s HIRA POWER AND STEEL LTD.

5. PLANTATION SITES

Plantation work has been along the plant boundary, inside the plant premises, roadside and aerodrome garden development area. Plantation area in the **Table: No. -1.** The information provided by M/s Hira Power & Steel Ltd.

Table: No. -1.

S. n.	Year	Unit - II	Roadside	Aerodrome Garden
1.	Up to 2019-20	14000+1252	2600	2500
2.	2020-21	1326	0	0
3.	Gape Filings, 2021-22	500	480	0
4.	Total=	17078	3480	2500

I. At Unit -2, Plant Campus area.
   a. Plant premises area.
   b. Admin building (Office area)
II. Roadside area.
III. Airport Garden

- Roadside Plantation:

Table: No. -2.

S n.	Location of plantation	Length in Kilometer
1.	Unit –II main gate to Young India choak, Police Station around road both side	3½ K.M. (Approx)

Boundary wall has been constructed on the places factory, Due to this construction expected damage from cattle were controlled.

Irrigation facility was also provided at five places by drip water pipe line and tanker due to this the growth of plants has observed very well.

PART - B

1. PHYSICAL VERIFICATION AND EVALUATION OF PLANTATION (GREENBELT) (Casualty replacement (Gap filing) REPORT YEAR OF 2021-22.

Table No. 3. Species wise measurement

SN	Species	Average		Maximum		Minimum	
		Girth (cm)	Height (m)	Girth (cm)	Height (m)	Girth (cm)	Height (m)
1.	Peltophorum	7.7	2.56	14	4.20	3	1.35
2.	MoulShri (Bakul)	5.92	1.56	10	3	2	0.20
3.	Badam	2.19	7.33	8	2.40	6	1.90
4.	Cassia siamea	7.3	2.25	14	4	4	0.45
5.	Arjun (Kahuwa)	8.89	1.04	28	2.50	2	0.45
6.	Neem	6.44	2	10	3	5	1.20
7.	Karanj	8.09	1.71	12	2.00	2	0.30
8.	Akash Neem	7.66	2.05	10	2.40	6	1.90
9.	Alastoia	11.85	2.35	14	2.50	2	2.10
10.	Amaltas	3.4	1.57	7	9.50	2	0.20
11.	Conocarpes	5.06	1.62	8	2.20	3	0.40
12.	Arjun (Kahuwa)	6.89	1.04	15	2.50	4	0.45
13.	Bogunvelia	6.15	1.5	8	2.70	5	0.70
14.	Rain tree	8.05	1.58	12	2.50	3	0.60
15.	PultanJiva	7.66	2.05	10	2.40	6	1.90
16.	Kadamba	6.75	0.96	14	3.50	4	0.45
17.	Pipal	5.10	1.34	8	1.80	5	1.00
18.	Kaner	4.60	0.68	12	2.80	4	0.50

कृते एन्वायरमेंट एंड इन्टीग्रेटेड डेवलपमेंट रायपुर

Table: No. -4. Evaluation – Plantation and Causality Replacements

PLANTATION AREA	FINANCIAL YEAR	Planted Plants No.
Plant premises and admin building area	2019-20	15252
Aerodrome area	2019-20	2500
Roadside area	2020-21	3926
		21678
Causality Replacements (Survived Plants during survey 2021-22)		
Plantation area	**Financial Year**	**Planted Plants No.**
Plant premises Unit- II	**2021-22**	**500**
Road Side (3½ K.M. (Approx)	**2021-22**	**480**

Table: No. -5.

Total Plantation Area	Planted Plants	Survival as per survey	Survival %
5.86ha. +Road Side (3½ k.m. (Approx) and Aerodrome garden area	22658	18650	82%

2. METHODOLOGY

I. Counting - All Plants, Trees and Sapling of all sites are counted.
II. Measurements – Height and Girth of Trees, Plants and Sapling are taken randomly.
III. Measurements are recorded.
IV. Survival percentage was recorded.
V. All planted areas were inspected.
VI. Photographs have been taken so as to show real picture of plantation at the site details of species.

सोसायटी फॉर इन्वायरमेंट एंड
इन्टीग्रेटेड डेव्लपमेंट रायपुर

3. GRADING OF PLANTATION

GradeCard Year –2021-22

A. Grading of Plantation on scale of 1 to 10

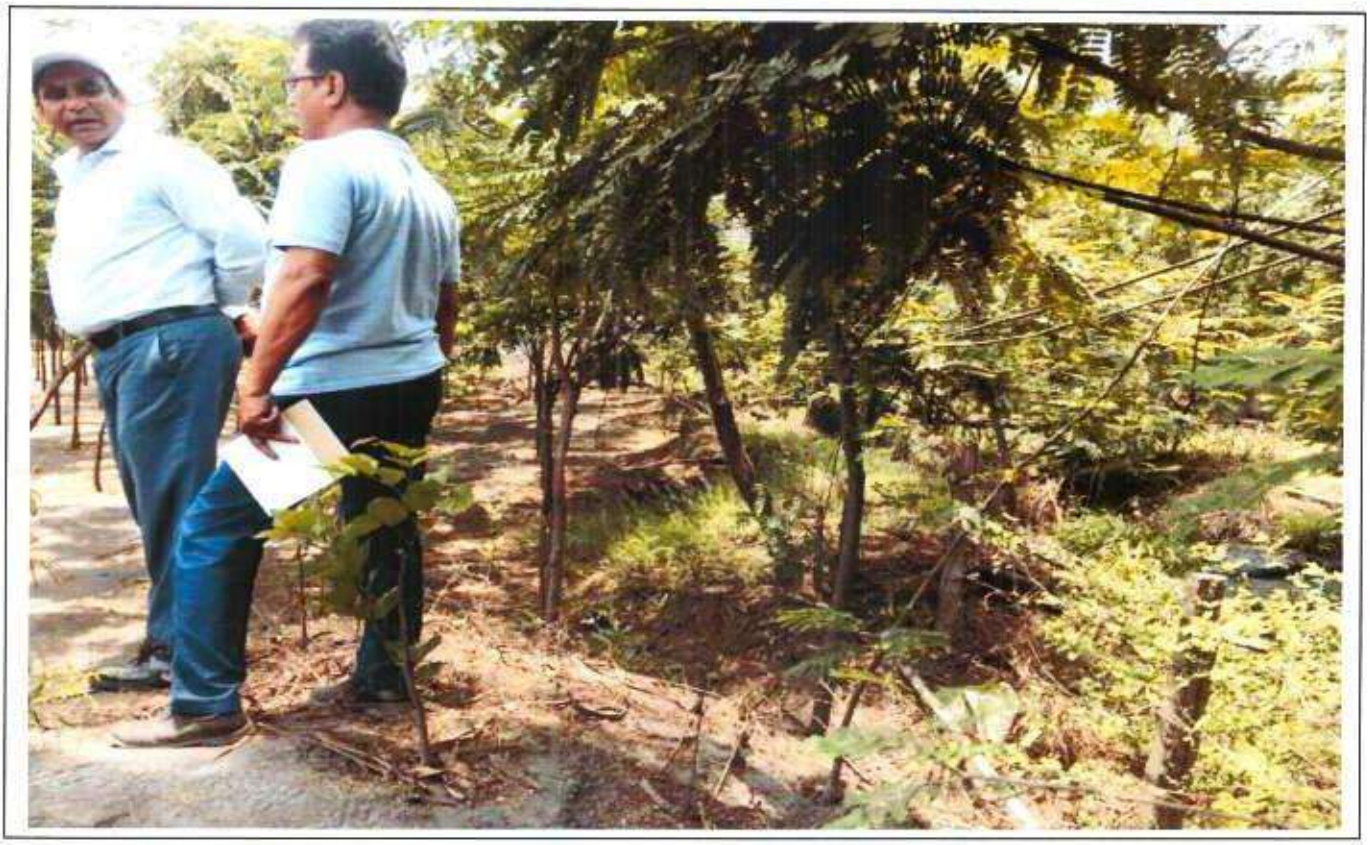
Qualitative Aspects	Survival	9.00
	Health of Plantation	8.00
	Maintenance	8.50
	Sustainability	8.00

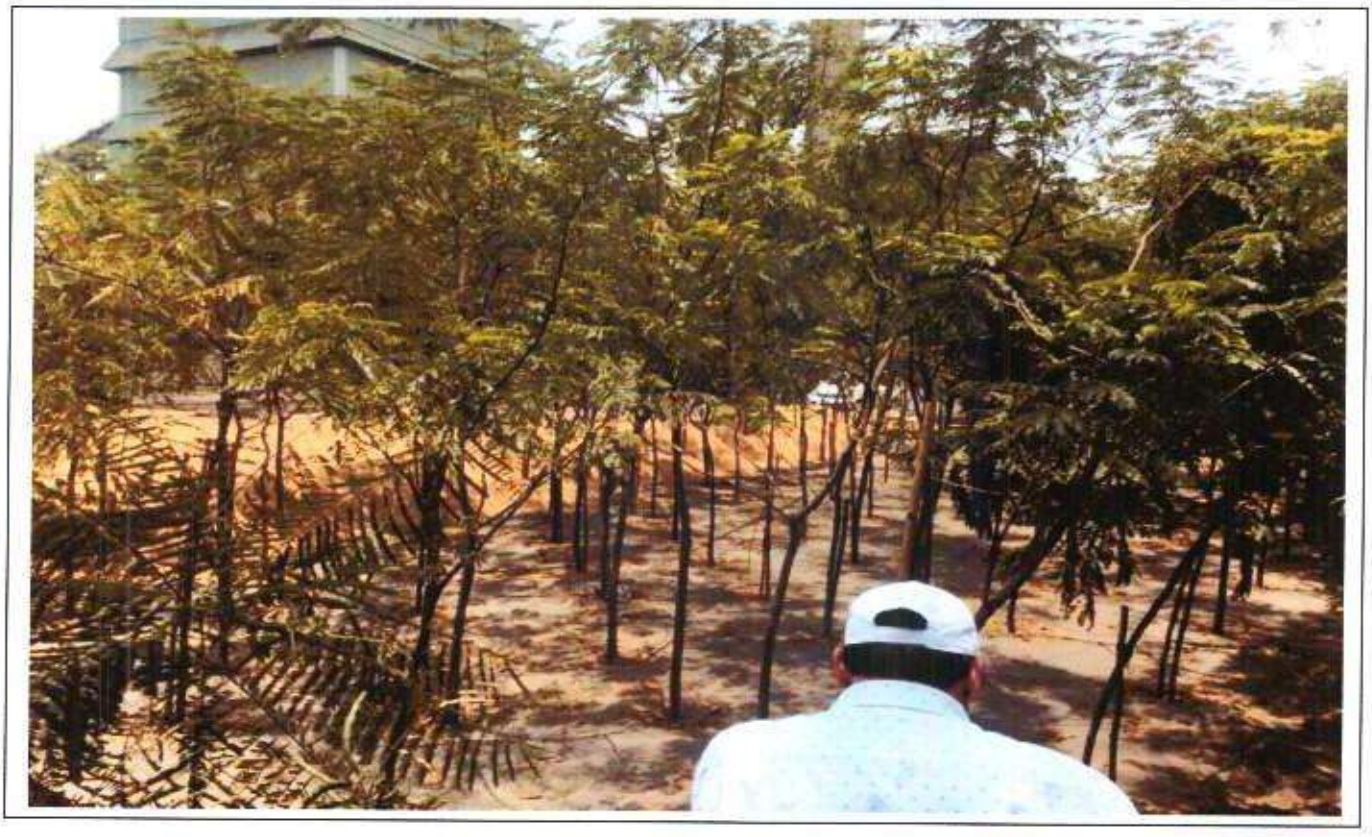
B. Grading of Project plantation on scale 1 to 10

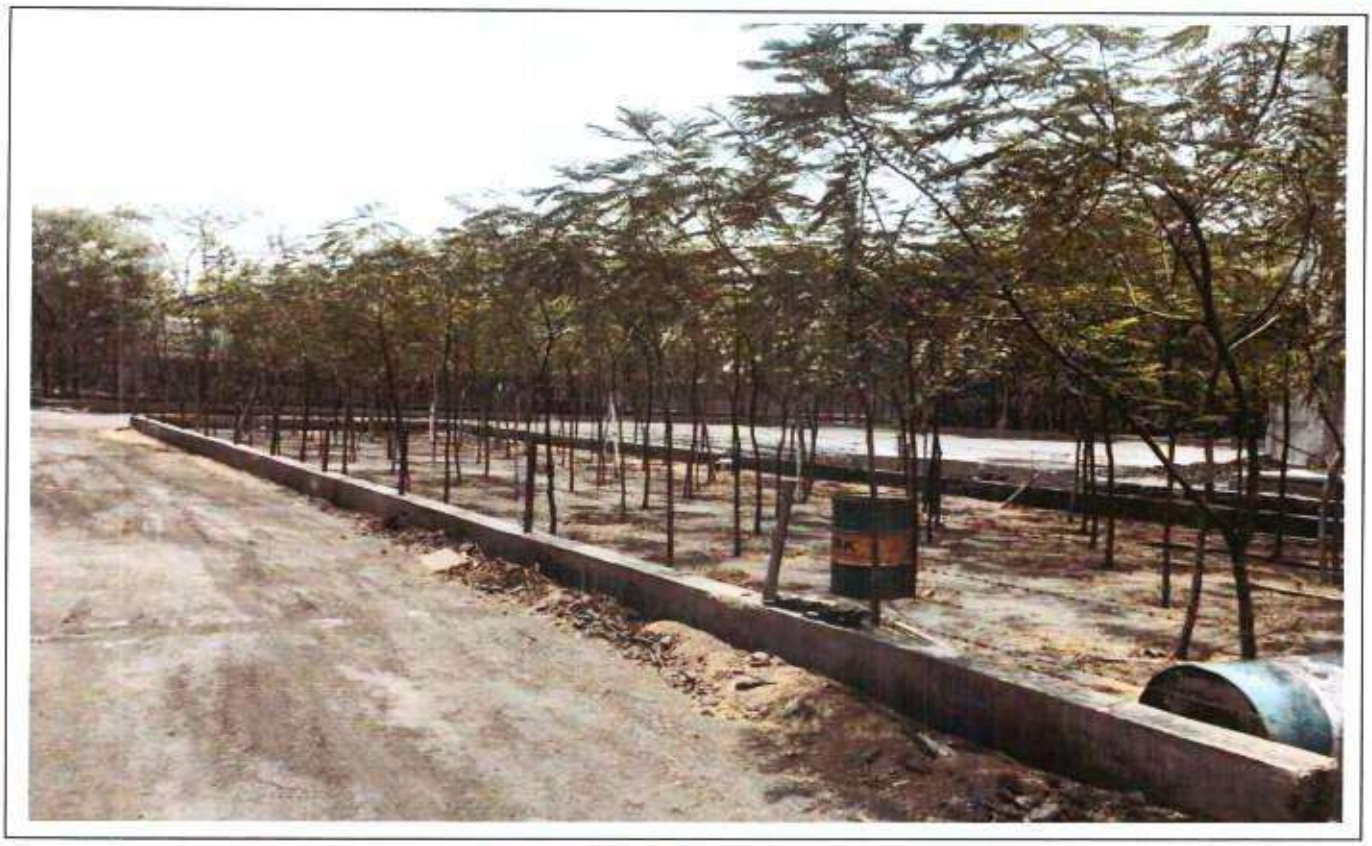
Overall Grading of Plantation	Outstanding (Excellent) (8<10)	Very Good (5<8)	Good (3<5)	Poor (>3)
		8.37		

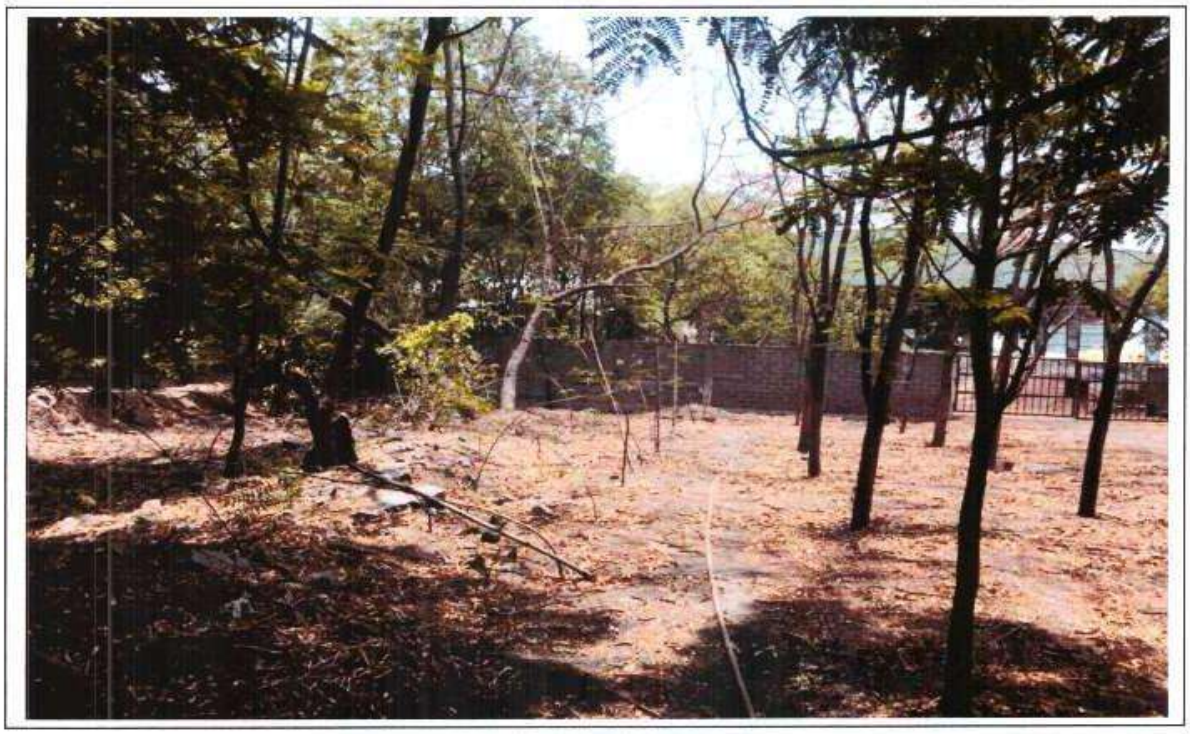
4. Picture of Plantation

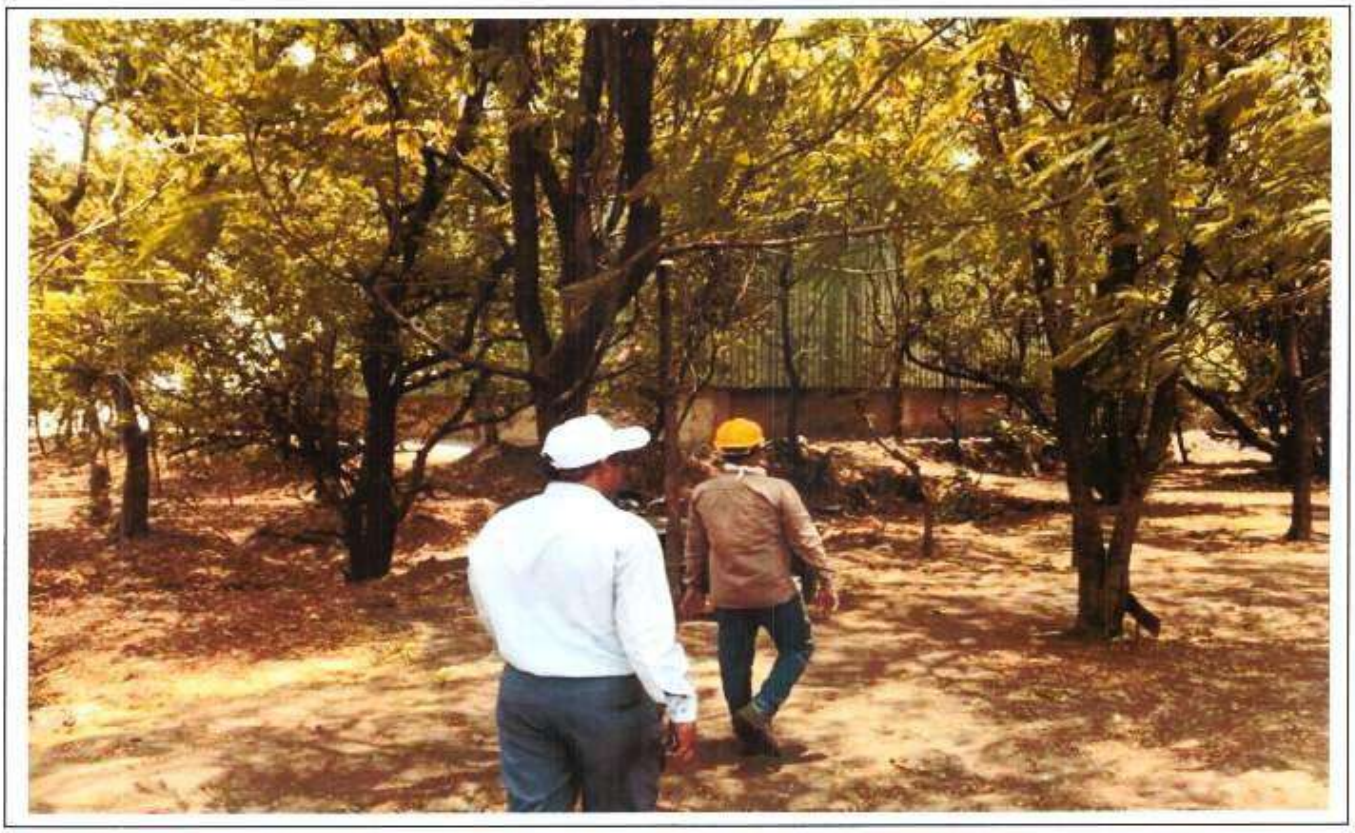
सोसायटी फॉर इन्वायरमेंट एंड इन्टीग्रेटेड डेवलपमेंट, रायपुर











CERTIFICATE

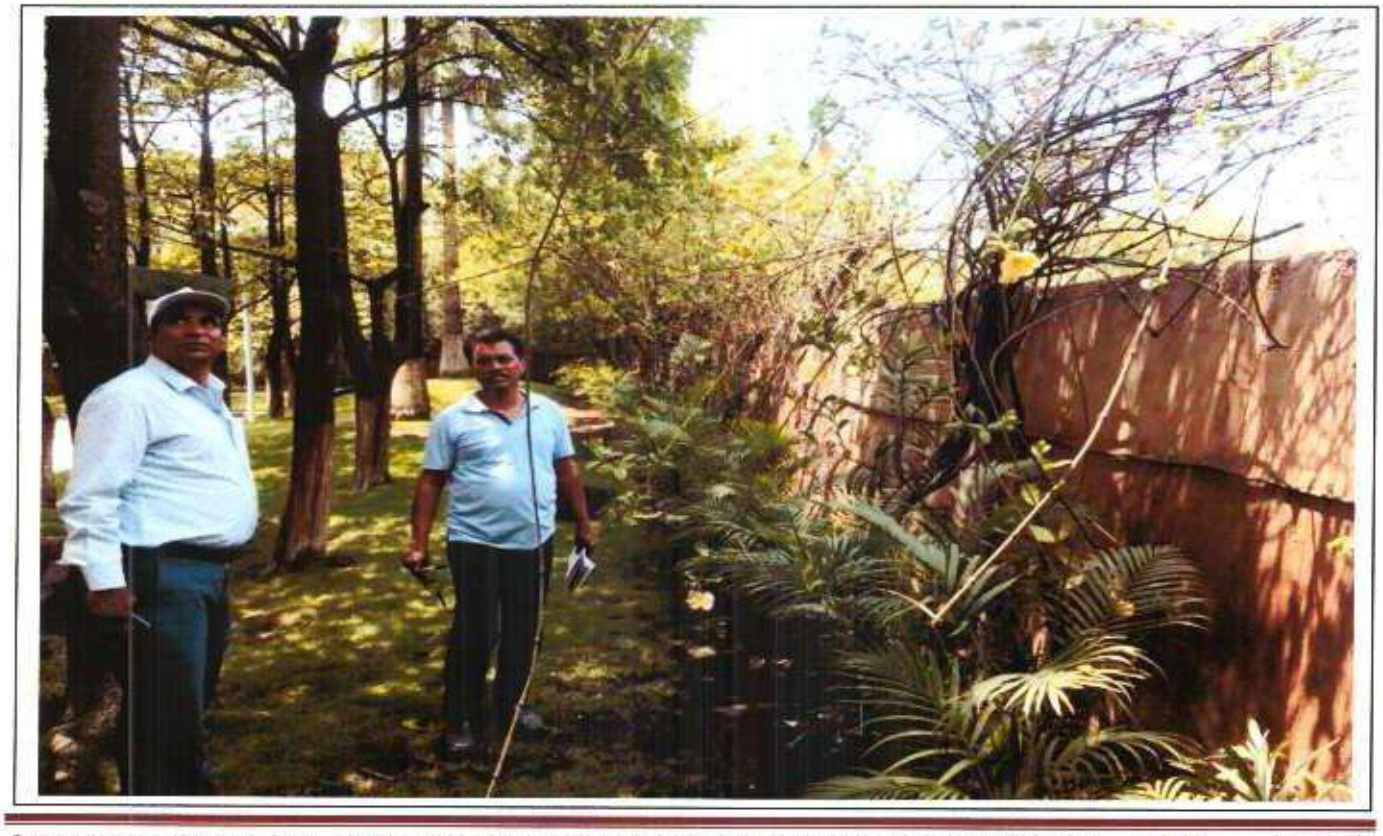
Certified that our Survey and Evaluation Expert Team Counted all Trees, Plants, Saplings of M/s HIRA POWER & STEEL Ltd., Industrial Complex, Urla, Raipur and Found18650of Total 22658 Planted Plants and Covered as Green Belt 7.46 Ha. (app.) Area.

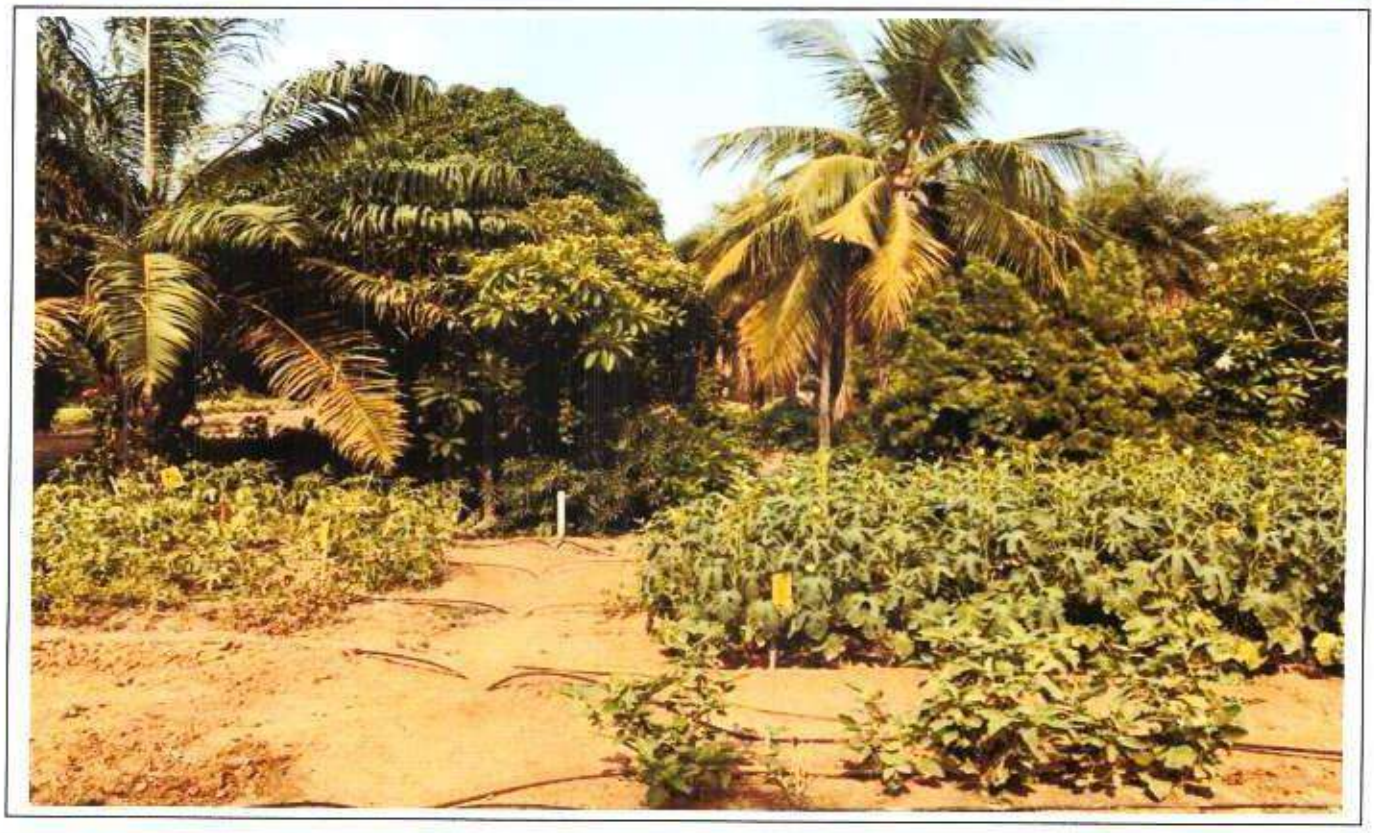
DATE :18/05/2022

"SEIDR" सोसायटी फॉर इन्वायरमेंट एंड इन्टीग्रेटेड डेवलपमेंट रायपुर

"SOCIETY FOR ENVIRONMENT & INTEGRATED DEVELOPMENT RAIPUR"

6. Pictures of Plantation





7. DISCUSSION WITH MANAGEMENT AND STAFF NAME AS UNDER :

1. Shri Aviral Tiwari : Senior Manager Environment
2. Shri Mahesh Verma : Senior Officer Horticulture

8. SUGGESTION FOR IMPROVEMENT :

1. Species – Fast growing to be planted.
2. Given priority to broader leaves plants.
3. Plant to be not less than one year in age and 1 meter height.
4. Space 2x2, 3x3 and maximum 4x4 according to maximum girth of trees after maturity.
5. Species may be chosen as under – Teak, Khamar, Kadamba, Acacia, Peltophorum,Conocarpus,Shisham, Pipal, Neem, Amaltas, Gulmohar, Karanja, Jamun, Bargad, Palm, Badam, Mahaneem, Bamboo etc.
6. Increase irrigation facility more to plants.
7. Soil of pits should be changed in hard soil area.
8. In waterlogged area "Kahuwa" (Arjun) should be planted.
9. Teak should be planted in hard soil area.
10. Plants to be planted regularly every year including mortality replacement.
11. Germination Time – Humic Oxide can be used for better results.
12. Manure – Compost, Vermi compost, DAP, Zhaim also to be used.
13. Termite and other pets control – Cholorocyper, Imida combine.
14. Planting work to be done in June and July.
15. Mortality should not be counted for increase in area.
16. It is compulsory to have a water pipe line for the proper growth of the planted plants.
17. Compound wall is very necessary for protection of plants. Damage by human and animal
18. Grazing should be prohibited strictly.

सोसायटी फॉर इन्वायरमेंट एंड
इन्टीग्रेटेड डेव्लपमेंट रायपुर

A WORD OF APPRECIATION

We appreciate all management officers and staff of M/s HIRA POWER &STEEL LTD. Who has taken step to develop the greenbelt & greenness of the area we found that sapling has been taken care well after plantation.

We appreciate the commitment and their efforts taken by the management for developing the greenbelt & greenery within & outside of plant premises.

"SEIDR" सोसायटी फॉर इन्वायरमेंट एंड इन्टीग्रेटेड डेव्लपमेंट रायपुर

(Society for Environment & Integrated Development Raipur)

Chhattisgarh

THE TEAM INVOLVED IN SURVEY & EVALUATION

No.	Name	JOB	EXPERIENCE
1.	Mr. D.K. Tiwari	Coordinator	14yrs Experience of monitoring & Evaluation work
2.	Shri Kamlesh Dubey	Investigator	6 yrs experience of field survey of organizational work
3.	Mr. Jasvir Singh Virdi	Investigator	5 yrs Experience of field survey of organizational work

'EXECUTIVE BODY OF 'SEIDR'

No.	Post	Name	Experience
1.	President	Mr. S. K. Roy	Retd. A.C.F. C.G Govt.
2.	Vice President	Smt. Shobha Mishra	Professional
3.	Secretary	Smt. Asha Tiwari	Professional
4.	Joint Secretary	Mr. Kamlesh Duey	Self Employed
5.	Treasurer	Mr. D.K. Tiwari	Professional

सोसायटी फॉर इन्वायरमेंट ऐंड
इन्टीग्रेटेड डेव्लपमेंट रायपुर

ABOUT THE EVALUATION AGENCY

Organization Profile

Name of Organization	*Society for Environment & Integrated Development Raipur.(SEIDR)*
Status	*Non Government Organization (NGO) And working as development and welfare facilitator.*

Registration Detail

No.& Date of registration	*C.G. State – 3270, Date – 01.03.2011, Registration under Society RegistrationAct 1973.*
Resource center Address	*J – 9/A, ShriRamnagar, phase – I Street – II. P.O. – Shankar nagar Raipur (C.G.) Pin – 492004.*
Phone	*+91 -771 – 3587611*
Chief Functionary	*Mr. S. K. ROY (Retd. ACF Chhattisgarh Forest)*
Contact Person	*Mr. D. K. Tiwari Mobile – 098261_86813, 096695_77114*
Mail at	*seidraipur@gmail.com*
Bank with	*State Bank of India, Vip Estate, colony Raipur (C.G.)*
Bank Account No.	*Current A/C: 35731546062*
Branch IFSC Code:	*SBIN0013004, SWIFT*
PAN	*AAHAS3608L*

SEIDR MISSION

Is to release the creative energies resources and aspirations of the poor, especially tribes, dalits and women to seek and obtain opportunities for full effective sustainable participation in social, economic, political and cultural life of society and nation.

SEIDR VISION

SEIDR*is society based on the values of gamine democracy, equality and peace for all its citizens, where people and government play their respective roles effectively with transparency and accountability.*

Area of Operation

Intensively in all districts of Chhattisgarh state, with trained technical and professional staff.

सोसायटी फॉर इन्वायरमेंट एंड इन्टीग्रेटेड डेवलपमेंट, रायपुर

OTHER MEMBER OF EXECUTIVE BODY

NO.	NAME	EXPERIENCE
1.	Mr. Varun Tiwari	Advocate
2.	Mr. PrabhatPanday	Electrical Engineer
3.	Mr. Jasveer sing	Professional
4.	Mr. AsheeshShrivastav	Businessman
5.	Mr. M.A. Sidqki	Retd. Forest Range Asst.
6.	Mr. Laxmi Prasad Murchulia	Retd. Forester
7.	Smt. Nirmala Tiwari	Advocate
8.	Mr. Rahul Dubey	Wax chemist
9.	Mr. AkhilShrivastav	Professional
10.	Mr. Kamles Dubey	Professional

MEMBER OF ADVISORY COMMITTEE

No.	Name	Experience
1.	Mr. D. P. Varma	Hydro Geologist
2.	Mr. S. K. Shrivastava	Civil Engineer
3.	Mr. Varun Tiwari	Labor Court Advocate
4.	Mr. DilipShrivastava	Income tax Advisor

THANK YOU.

****

सोसायटी फॉर इन्वायरमेंट एंड
इन्टीग्रेटेड डेव्लपमेंट रायपुर

Annexure-VII

HIRA POWER & STEELS

Ref: 438 /HPSL/2020-21/452 Date: 16.09.2021

To,

The Member Secretary,
Chhattisgarh Environment Conservation Board,
Paryavas Bhavan, North Block Sector - 19,
Naya Raipur (C.G.) – 492 002

Sub: Submission of Environmental Statement (Form-V) for the Financial Year 2020-21.

Ref: 1. Consent of Board issued under Section 25/26 of the Water (Prevention & Control of Pollution) Act 1974 vide letter No. 208/TS/CECB/2018, Naya Raipur Dated 03.04.2018

2. Consent of Board issued under Section 21 of the Air (Prevention & Control of Pollution) Act 1981 vide letter No. 210/TS/CECB/2018, Naya Raipur Dated 03.04.2018

Respected Sir,

With reference to the subject mentioned, please find enclosed herewith Environmental Statement in Form – V as prescribed under Rule 14 of the EPA Act, 1986 for the Financial Year 2020-21 of Hira Power & Steels Limited, Unit-II, Urla Industrial Complex, Raipur (C.G.)

Submitted for your kind information & record please.

Thanking You

Yours faithfully,
For, **HIRA POWER & STEELS LIMITED, Unit – II**

AUTHORIZED SIGNATORY

Encl: A/a

CC to: The Regional Officer, Regional Office, Chhattisgarh Environment Conservation Board, Commercial Complex, Chhattisgarh Housing Board Colony, Kabir Nagar, Raipur (C.G.)

ENVIRONMENTAL STATEMENT

(FORM – V)

FOR THE FINANCIAL YEAR ENDING MARCH 31ST 2021 (2020-21)

HIRA POWER AND STEELS LIMITED

UNIT - II

URLA INDUSTRIAL COMPLEX

RAIPUR (C.G.) – 492 003

HIRA POWER & STEELS

Environmental Statement

(See Rule 14)

Environmental Statement for the financial year ending the 31st March 2021

Part – A

<table>
<tr><td>Name and address of the owner/ Occupier of the industry operation or process.</td><td>Hira Power & Steels Limited,
Unit – II,
Urla Industrial Complex,
District - Raipur (C.G.)– 492003</td></tr>
<tr><td>Industry category Primary-(STC Code) Secondary- (STC Code)</td><td>Red</td></tr>
<tr><td>Production Capacity- Units</td><td><table>
<tr><td>1 X 3.0 MVA Submerged Arc Furnace
1 X 3.6 MVA Submerged Arc Furnace
2 X 5.5 MVA Submerged Arc Furnace
1 X 6.0 MVA Submerged Arc Furnace
12 MT/Heat CLU Converter</td><td>48,000 MTPA Ferro Alloys (including low / medium carbon ferro alloys)
Or
56,000 MTPA Pig Iron</td></tr>
<tr><td>Captive Power Plant</td><td>20 MW</td></tr>
</table></td></tr>
<tr><td>Year of establishment</td><td><table>
<tr><td>1 X 3.0 MVA Submerged Arc Furnace</td><td>02.02.1994</td></tr>
<tr><td>1 X 3.6 MVA Submerged Arc Furnace</td><td>15.01.1996</td></tr>
<tr><td>2 X 5.5 MVA Submerged Arc Furnace</td><td>19.05.2006</td></tr>
<tr><td>1 X 6.0 MVA Submerged Arc Furnace</td><td>23.02.2010</td></tr>
<tr><td>12 MT/Heat CLU Converter</td><td>24.09.2016</td></tr>
<tr><td>Captive Power Plant</td><td>25.03.2006</td></tr>
</table></td></tr>
<tr><td>Date of the last environmental statement submitted.</td><td>05.10.2019</td></tr>
</table>

HIRA POWER AND STEELS LTD. RAIPUR UNIT No.-2

HIRA POWER & STEELS

Part – B

Water and Raw Material Consumption

i. Water consumption in m^3/d

Process & Cooling	:	401.07 KLD
Domestic	:	63.09 KLD
Other	:	23.30 KLD

Name of the product	Process water consumption per unit of product	
	During the Current previous year (2019-2020)	During the Current financial year (2020-2021)
1. Ferro Alloys	Ferro Alloys (Including Low/Medium Carbon) – 2.78 CPP – 0.337	Ferro Alloys (Including Low/Medium Carbon) – 2.61 CPP – 0.300

ii. Raw material consumption

Name of the Raw Materials	Name of the Products	Consumption of raw material per unit of Output	
		During the Current previous year (2019-2020)	During the Current financial year (2020-2021)
Ferro Alloys (including low / medium carbon ferro alloys)	Ferro Alloys (including low / medium carbon ferro alloys)		
1. Manganese Ore		2.171	2.584
2. Carbonaceous		0.799	0.725
3. Dolomite		0.025	0.061
4. Quartz		0.011	0.011
5. Iron Ore		0.025	0.011
6. Mill scale		0.00016	0.00849
7. Carbon electrode paste		0.016	0.016
8. Ferro Silicon		0.017	0.020
9. Ferro Manganese		0.561	0.749
10. Silico Manganese		0.088	0.104
11. Calcined Dolomite		0.054	0.051
12. Calcined Lime		0.068	0.061
13. Fe-Mn Slag (Used in manufacturing of Si-Mn)		0.108	0.247
Pig Iron	Pig Iron	Not Produced	Not Produced
1. Iron Ore		NA	NA
2. Sinter		NA	NA
3. Coke		NA	NA
4. Limestone		NA	NA
Power Generation	Captive power generation	1.259	1.122
1. Coal & Dolochar			

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

HIRA POWER AND STEELS LTD. UNIT NO-2

HIRA POWER & STEELS

PART-C

Pollution discharged to environment/unit of output

(Parameter as specified in the consent issued)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water	➢ Effluent generated from process, Softener backwash & CT Blow down water is being used for different purpose like sprinkling to control fugitive dust emission (Road, Unloading, All around stockpiles & raw materials etc.) after primary treatment. ➢ Domestic waste water is being treated through septic tank and followed by soak pit		
(b) Air	1. Ambient Air Quality Report – Please refer to Annexure-I		
	2. Stack Emission Report – Please refer to Annexure-II		

PART – D

Hazardous Waste

(As specified under Hazardous waste, Management, Handling & Transboundary Movement Rules, 2008)

Authorization under Hazardous Waste (Management, Handling& Trans Boundary Movement) Rules, 2008 & as Amended Rules, 2010 has been granted (Authorization No. 340/HO/HSMD/CECB/ATAL NAGAR, RAIPUR) vide letter No. 3641/HO/HSMD/CECB/2020 Dated: 21.07.2021.

Hazardous Waste	Total Quantity (Ltr)	
	During the Previous Financial Year (2019-2020)	During the Current Financial Year (2020-2021)
(a) From Process	1915 (From Unit – I & Unit – II)	2320 (From Unit – I & Unit – II)
(b) From Pollution Control Facilities.	Nil	NIL

HIRA POWER AND STEELS LTD. UNIT No. 2 RAIPUR

HIRA

HIRA POWER & STEELS

Part – E

Solid Waste

Solid Waste		Total Quantity (MT)	
		During the Current previous year (2019-2020)	During the Current financial year (2020-2021)
(a)	From Process		
	i. Si-Mn Slag	7033.200	2686.705
	ii. Fe-Mn Slag	30489.45	34453.871
	iii. Fly Ash	85399.31	72108.62
(b)	From Pollution Control facilities	Bag Filter dust is recycled in the manufacturing process of Si-Mn & Fe-Mn	
	i. Bag filter dust	1282.525 (GCP Dust)	1684.445
	ii. Fly Ash	85399.31	72108.62
(c)	i. Qty. recycled or reused within the unit.	Fe-Mn Slag is used as raw material for Si-Mn production.	
	a. Fe-Mn Slag	3375.2	1171.145
	b. Bag filter dust	2389.950 (Mn_3O_4 Dust)	2718.693 (Mn_3O_4 Dust)
	ii. Sold		
	a. Si-Mn Slag	0.00	0.00
	b. Fe-Mn Slag	30293.220	26869.59
	c. Mn_3O_4 Dust	0.00	0.00
	d. Fly Ash (At zero value)	85399.31	72108.62
	iii. Disposed	➢ Fly ash supplied to Cement & Bricks Manufacturers and used in environment friendly manner. ➢ Si-Mn slag used as aggregate for civil work (sales) & filling of low lying area.	
	a. Si-Mn Slag	13884.354	3649.340
	b. Fly Ash	0.00	0.00

*Sent for conversion into briquettes & reused in manufacturing process as raw material.

HIRA

HIRA POWER & STEELS

Part-F

Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

Hazardous Waste: No hazardous waste is generated from process except used oil which is drained from machineries / equipment.
Solid Waste: ➢ Fly ash supplied to Cement & Bricks Manufacturers and used in environment friendly manner. ➢ Bag filter dust is recycled in the manufacturing process of Si-Mn & Fe-Mn. ➢ Slag generated is non-hazardous in nature. ➢ Fe-Mn slag is used as raw material for Si-Mn production ➢ Si-Mn slag is used as aggregate for civil work & filling of low lying area.

Part-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.

1. Extensive tree plantation, development of green belt & lawns in the factory premises which control the impact of air pollution & optimize the Ambient temperature of surrounding
2. Blow down water is being used for different purpose like floor washing & sprinkling to control the fugitive dust emission (like road, unloading area, raw material yard etc.)
3. Domestic waste water is being treated through septic tank and followed by soak pit.

Part-H

Additional measures/investment proposal for environmental protection including abatement of pollution.

1. For better control on fugitive emission pneumatic sweeping machine and water sprinkling on road.
2. Extensive plantation, development of green belt & lawns in plant premises.
3. Adaptation of good housekeeping practices.
4. Surface rain water has been developed.
5. 100% internal roads are constructed by concrete.
6. More than 14000 trees have been planted in premises and 2610 outside the factory premises.
7. Online stack monitoring system have been installed in all stacks.
8. Raw material handling sections have been provided with dust suppression / dust collection system.
9. Acoustic hoods have been provided to most of the noise generating equipment & covered in closed structures; the noise transmitted outside would be still lower.
10. Plant operators working in high level noise zone have provided with ear plug / muff.

HIRA POWER AND STEELS LTD. UNIT NO.-2

HIRA

HIRA POWER & STEELS

Part-I

MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatement of pollution.

1. Training on EMS to all employees and contract labors to create awareness.
2. Further green belt under process.
3. Good housekeeping practices have been adopted.
4. Only PUC certified vehicles engaged.
5. Air, water noise level monitoring is being done by MoEF & NABL accredited lab.
6. Celebration of environmental promotional activities (Environment Day).
7. Horticulture section is taking care of tree plantation & green belt development.

HIRA

HIRA POWER & STEELS

Annexure - I

Ambient Air Quality Monitoring Report
(April 2020 – March 2021)

Sr. No.	Month	Date of Sampling	Power Store (South)			
			PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_X (µg/m^3)
1	Apr-20	19.04.2020	62.8	29.4	11.7	9.8
2	May-20	15.05.2020	76.4	31.8	14.6	12.7
3	Jun-20	05.06.2020	72.0	32.8	12.0	10.6
4	Jul-20	11.07.2020	68.2	30.4	10.5	9.8
5	Aug-20	10.08.2020	60.4	26.8	11.6	10.5
6	Sep-20	11.09.2020	78.6	33.4	13.5	11.6
7	Oct-20	11.10.2020	69.0	29.4	15.6	13.5
8	Nov-20	15.11.2020	65.1	24.6	11.3	10.6
9	Dec-20	10.12.2020	73.5	29.4	14.6	13.4
10	Jan-21	10.01.2021	70.5	31.5	12.5	10.6
11	Feb-21	09.02.2021	61.3	25.4	13.4	11.4
12	Mar-21	17.03.2021	65.8	26.5	15.7	12.6

Sr. No.	Month	Date of Sampling	Power Plant Silo (North)			
			PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_X (µg/m^3)
1	Apr-20	19.04.2020	67.3	28.6	14.2	11.6
2	May-20	15.05.2020	82.6	34.2	16.2	14.3
3	Jun-20	05.06.2020	76.5	35.6	13.2	11.1
4	Jul-20	11.07.2020	60.7	28.9	11.8	9.4
5	Aug-20	10.08.2020	69.3	30.2	10.5	8.6
6	Sep-20	11.09.2020	70.2	29.8	11.5	10.2
7	Oct-20	11.10.2020	75.6	36.7	18.4	14.2
8	Nov-20	15.11.2020	72.4	30.1	12.5	11.8
9	Dec-20	10.12.2020	84.7	32.6	16.7	14.8
10	Jan-21	10.01.2021	80.2	35.1	15.8	12.9
11	Feb-21	09.02.2021	75.9	32.6	16.2	15.0
12	Mar-21	17.03.2021	73.2	29.8	17.5	14.8

HIRA POWER AND STEELS LTD. RAIPUR UNIT No. 2

HIRA

HIRA POWER & STEELS

Annexure - 1

Ambient Air Quality Monitoring Report
(April 2020 – March 2021)

Sr. No.	Month	Date of Sampling	CHP (East)			
			PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_X (µg/m^3)
1	Apr-20	19.04.2020	70.1	30.8	12.3	9.4
2	May-20	15.05.2020	78.5	30.6	15.2	11.0
3	Jun-20	05.06.2020	69.7	29.7	14.1	12.5
4	Jul-20	11.07.2020	70.6	33.4	12.8	10.3
5	Aug-20	10.08.2020	74.2	35.4	11.0	9.5
6	Sep-20	11.09.2020	69.2	25.6	14.3	12.8
7	Oct-20	11.10.2020	71.2	30.5	15.9	14.2
8	Nov-20	15.11.2020	68.7	30.5	11.9	10.5
9	Dec-20	10.12.2020	72.6	31.4	13.0	12.5
10	Jan-21	10.01.2021	70.3	31.4	11.9	9.4
11	Feb-21	09.02.2021	68.0	30.8	12.8	10.6
12	Mar-21	17.03.2021	69.5	33.4	14.2	13.7

Sr. No.	Month	Date of Sampling	Main Gate (West)			
			PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NO_X (µg/m^3)
1	Apr-20	19.04.2020	72.6	31.3	10.4	9.0
2	May-20	15.05.2020	79.2	29.8	12.8	9.8
3	Jun-20	05.06.2020	73.2	26.5	11.8	10.5
4	Jul-20	11.07.2020	71.8	35.4	10.5	8.5
5	Aug-20	10.08.2020	70.6	33.1	9.8	7.5
6	Sep-20	11.09.2020	71.4	31.6	12.0	10.8
7	Oct-20	11.10.2020	76.2	33.4	14.8	11.0
8	Nov-20	15.11.2020	70.3	29.4	12.9	11.6
9	Dec-20	10.12.2020	69.3	25.7	11.8	10.5
10	Jan-21	10.01.2021	65.9	23.4	10.6	8.4
11	Feb-21	09.02.2021	73.8	33.9	14.0	12.2
12	Mar-21	17.03.2021	77.6	33.9	14.1	18.3

HIRA POWER AND STEELS LTD. RAIPUR UNIT NO 2

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	AB Furnace (3.0 & 3.6 MVA Submerged Arc Furnace)	Apr-20	19.04.2020	50	11.00
2		May-20	15.05.2020	50	13.70
3		Jun-20	05.06.2020	50	11.80
4		Jul-20	11.07.2020	50	10.60
5		Aug-20	10.08.2020	50	12.90
6		Sep-20	11.09.2020	50	14.50
7		Oct-20	PLANT SHUTDOWN		
8		Nov-20	15.11.2020	50	15.6
9		Dec-20	10.12.2020	50	13.4
10		Jan-21	10.01.2021	50	12.5
11		Feb-21	09.02.2021	50	27.8
12		Mar-21	17.03.2021	50	28.6

HIRA POWER AND STEELS LTD RAIPUR UNIT No-2

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	C Furnace (5.5 MVA Submerged Arc Furnace)	Apr-20	19.04.2020	50	13.4
2		May-20	15.05.2020	50	14.5
3		Jun-20	05.06.2020	50	13.6
4		Jul-20	12.07.2020	50	12.8
5		Aug-20	11.08.2020	50	10.6
6		Sep-20	12.09.2020	50	12.1
7		Oct-20	PLANT SHUTDOWN		
8		Nov-20	15.11.2020	50	13.9
9		Dec-20	10.12.2020	50	15.7
10		Jan-21	10.01.2021	50	14.0
11		Feb-21	09.02.2021	50	24.9
12		Mar-21	18.03.2021	50	27.2

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	D Furnace (5.5 MVA Submerged Arc Furnace)	Apr-19	20.04.2020	50	12.7
2		May-19	16.05.2020	50	15.3
3		Jun-19	06.06.2020	50	14.2
4		Jul-19	11.07.2020	50	15.3
5		Aug-19	11.08.2020	50	14.8
6		Sep-19	12.09.2020	50	14.0
7		Oct-19	PLANT SHUTDOWN		
8		Nov-19	16.11.2020	50	12.5
9		Dec-19	11.12.2020	50	14.2
10		Jan-20	11.01.2021	50	13.4
11		Feb-20	10.02.2021	50	29.6
12		Mar-20	18.03.2021	50	28.9

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	E Furnace (6.0 MVA Submerged Arc Furnace)	Apr-20	20.04.2020	50	14.2
2		May-20	16.05.2020	50	12.7
3		Jun-20	06.06.2020	50	15.1
4		Jul-20	13.07.2020	50	14.7
5		Aug-20	12.08.2020	50	15.0
6		Sep-20	13.09.2020	50	13.4
7		Oct-20	PLANT SHUTDOWN		
8		Nov-20	16.11.2020	50	14.8
9		Dec-20	11.12.2020	50	15.0
10		Jan-21	12.01.2021	50	16.8
11		Feb-21	11.02.2020	50	25.5
12		Mar-21	19.03.2021	50	26.4

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	CLU Converter (12 MT/Heat)	Apr-20	20.04.2020	40	12
2		May-20	16.05.2020	40	13.8
3		Jun-20	06.06.2020	40	16.7
4		Jul-20	13.07.2020	40	13.2
5		Aug-20	12.08.2020	40	13.5
6		Sep-20	13.09.2020	40	11.5
7		Oct-20	PLANT SHUTDOWN		
8		Nov-20	16.11.2020	40	13.0
9		Dec-20	11.12.2020	40	16.9
10		Jan-21	12.01.2021	40	14.7
11		Feb-21	11.02.2021	40	22.3
12		Mar-21	19.03.2021	40	23.5

HIRA POWER AND SPECIALITY UNIT NO-2

HIRA

HIRA POWER & STEELS

Annexure - II

Stack Emission Monitoring Report

(April 2020 – March 2021)

Sr. No.	Monitoring Stack	Month	Date of Monitoring	Prescribed Standard (mg/Nm^3)	Measured Concentration (mg/Nm^3)
1	Captive Power Plant (AFBC) (20 MW)	Apr-20	19.04.2020	50	38.6
2		May-20	15.05.2020	50	42.8
3		Jun-20	05.06.2020	50	39.7
4		Jul-20	11.07.2020	50	35.4
5		Aug-20	10.08.2020	50	30.8
6		Sep-20	11.09.2020	50	36.4
7		Oct-20	PLANT SHUTDOWN		
8		Nov-20	15.11.2020	50	41.2
9		Dec-20	10.12.2020	50	38.5
10		Jan-21	10.01.2021	50	32.6
11		Feb-21	09.02.2021	50	36.7
12		Mar-21	17.03.2021	50	39.3

HIRA POWER AND STEELS (P) LTD. RAIPUR

Annexure-VIII

Annexure - I

Measures taken to control the fugitive emission

1. Fogging system on conveyor belts and transfer points



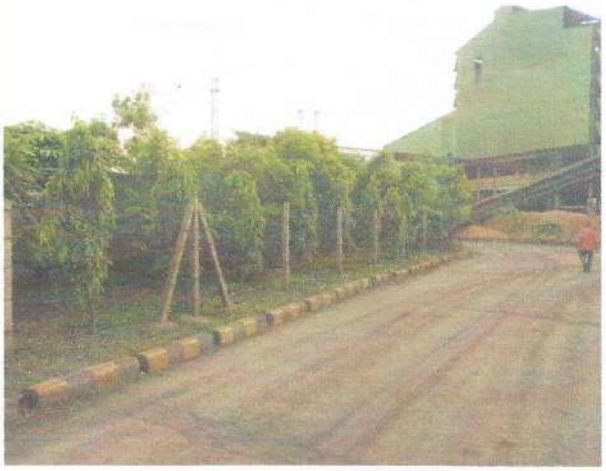

2. Covered shed for crusher

3. RCC Road, Pneumatic sweeping and water sprinkling

RCC Road

Pneumatic Sweeping

RCC Road



RCC Road

Static Sprinklers

Mobile Sprinklers

Annexure XI

Format No. : UES/FORM/09

Ultimate
ENVIROLYTICAL SOLUTIONS

HDD-272, Phase III - Near JP Chowk
Ring Road No.-2, Kabir Nagar, Raipur (C.G.) - 492099
Ph : 0771 - 4027777 I Email : ultimatenviro@gmail.com

Name & Address Of The Customer			
To, **HIRA POWER AND STEEL LTD.** **KHASRA NO.: 511/1, 512/2,** **URLA INDUSTRIAL AREA** **RAIPUR (C. G.) 492003**	REPORT NO.	UES/TR/22-23/02800	
	LAB REF NO.	UES/22-23/ST/07828	
	DATE OF SAMPLING	17/08/2022	
	DATE OF RECEIPT	18/08/2022	
	DATE OF REPORT	22/08/2022	
	DATE OF ANALYSIS	Start:18/08/2022	End:22/08/2022

SAMPLE DETAILS	
Monitoring For	Stack Emission Monitoring
Customer Ref. No. & Date	P.O. NO. 7200004006/U102, DATED: 16/06/2022
Sampling Location	20 MW AFBC
Sample Collected By	Laboratory Chemist
Sampling Procedure	IS 11255 Part 1,2:1985 Reaffirmed 2009; Part 3:2008, Part 7:2005 Reaffirmed 2012, IS 5182 (Part 10) :2003
Sample Quantity/Packing	Thimble: 1 X 1 No., SO_2: 30 ml X 1 No. PVC Bottle, NO_X: 25 ml X 1 No. PVC Bottle, Rubber Bladder: 1 X 1 No.,

TEST REPORT

Stack details	
Stack Identity	20 MW AFBC
Stack Attached To	ESP
Material of Construction	RCC
Height of the stack from ground level (Meter)	73.0 MTR
Stack Diameter	2.83 MTR
Stack Shape At Top	CIRCULAR
Type of Fuel	COAL
Total Electrical Load (KW)	20 KW

Parameter	Unit	Method Reference	Limit	Result
Flue Gas Temperature	°C	IS:11255: (Part -3):2008	-	124
Flue Gas Velocity	M/s	IS :11255 :(Part -3):2008	-	21.8
Total Gas Quantity	Nm^3/h	IS :11255: (Part -3):2008	-	370362.7
Sulphur Dioxide (SO_2)	mg/Nm^3	IS 11255 (Part 2):1985, RA 2003	600	246
Oxides of Nitrogen (NOx)	mg/Nm^3	IS 11255 (Part 7):2005, RA 2012	300	123
Total Particulate Matter (TPM)	mg/Nm^3	IS :11255 :(Part -1):1985, RA 2003	50	42.5
Carbon Monoxide (CO)	mg/Nm^3	IS 13270:2019	-	4.8
Hg	mg/Nm^3	USEPA Method No. 29	0.03	N.D.

REMARKS: RESULTS ARE AS ABOVE

Terms & conditions

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

22/08/22
REVIEWED BY

ULTIMATE ENVIROLYTICAL SOLUTIONS PHASE-3, KABIR NAGAR RING ROAD NO-2 RAIPUR (C.G.)

For ULTIMATE ENVIROLYTICAL SOLUTIONS

22/08/22
AUTHORIZED SIGNATORY

----------End of the test report----------