# CHAPTER 13: DAMAGE ASSESSMENT, REMEDIATION PLAN AND NATURAL & COMMUNITY RESOURCE AUGMENTATION PLAN (NCRAP)

## 13.1 INTRODUCTION

The assessment of environmental damage caused due to an industrial activity under violation of a regulatory framework needs to be measured across different aspects viz. natural resource degradation, socio-economic effects versus the economic benefits gained at the cost of environmental damage.

For estimation of environmental damage, all causes/aspects of the project which may interact with environmental components (air, water, soil, land, Biota etc.) are identified / evaluated and the resultant degradation / deterioration / damage attributed to the activity is assessed. An impact that poses risks to human health or degradation of environmental quality is considered as a significant damage due to the project activity carried out during violation.

To compensate the degradation / deterioration / damage, remedial measures are identified based on the severity of the damage to the vulnerable environmental components (air, water, soil, land, biota etc.) of the environmental attribute (natural resource, community, infrastructure etc.).

In the present study for M/s ESL Steel Limited (formerly M/s Electrosteel Steels Limited) Integrated Steel Plant in Bokaro District of Jharkhand, the environmental damage has been scientifically analysed / assessed considering various environmental indicators and the negative changes which would have taken place due to violation of the provisions of the EIA Notification, 2006 which mandates all applicable industrial activities to obtain Environmental Clearance (EC) prior to the installation of the facility.

M/s ESL Steel Limited presented the present proposal at the 35$^{th}$ meeting of Expert Appraisal Committee (EAC) of MoEFCC for the proposals involving violation of EIA Notification, 2006 held on 6$^{th}$ -7$^{th}$ August 2020.

The EAC observed that M/s ESL has violated the General Condition No. ii of the Environmental Clearance (EC) dated 21$^{st}$ February, 2008 and also violated the provisions of the EIA Notification, 2006. EAC further observed that CTE was granted to the project by the Jharkhand State Pollution Control board on 05$^{th}$ May, 2008 and construction work was started then, hence unit is in violation since 2008.

The EAC identified the following violations in the project

1. M/s. ESL has violated the General Condition No. ii of the EC dated 21$^{st}$ February, 2008 and also violated the provisions of the EIA Notification, 2006. Further, as per the Google Earth image, the steel plant is located approximately 5.3 km from the above original co-ordinate i.e., 23º40" N & 86 º 20" E as mentioned in the EIA report. Such, shift in project location will be deemed to be a new proposal and mandates fresh appraisal as per the procedure prescribed under EIA Notification, 2006.

2. M/s ESL has encroached without prior of the Competent Authorities concerned. The Company has not so far applied for diversion of notified forest land for non-forestry purpose. Thus, M/s ESL has violated the provisions of Indian (Forest) Act, 1927 and Forest (Conservation) Act, 1980.

3. M/s ESL has encroached pure Govt. land in Chas circle and Govt. land in Chandakyari circle apart from the encroachment of Forest land.

4. M/s ESL is yet to comply with the several environmental clearance conditions inter-alia including fugitive dust control measures, green belt development, utilization/disposal of fly ash, rain water harvesting, and non-adherence to the recommendations of EIA/EMP etc. Further, M/s ESL has acquired 2667.51 acres beyond 1350 acres stipulated in the environmental clearance

The Terms of Reference (ToR) have been accorded by MoEFCC for preparation of EIA/EMP report and Damage assessment studies for the present project vide letter no F.No. J-11011/137/2006-IA.II(I) dated 25th August, 2020.

Based on the observations of the EAC damage assessment has been carried and subsequently damage cost estimated considering the following

A. Violation is considered since 2008 to 2020
B. Damage due to change of location
C. Damage due to encroachment/use of forest land without prior approval
D. Damage due to construction & operation of plant

M/s ESL has also proposed installation of remaining units / facilities for increasing/attaining the plant"s capacity to 3.0 MTPA of crude steel which was the capacity specified in the original EC. The overall impact of the ESL"s 3.0 MTPA (Crude Steel) capacity Integrated Steel plant has been presented in Chapter 4 of this EIA/EMP report.

The environmental damages caused due to the project activities during the construction and operation period under which the plant was under violation is presented here.

The damage analysis has been carried out and presented here in line with the provisions of MoEFCC"s notification vide S.O. 804 (E) dated 14th March, 2017 and OM dated 16th March, 2018.

This covers the Remediation Plan to ameliorate the environmental damage and Natural & Community Resource Augmentation Plan (NCRAP) for providing economic benefits to the local community to compensate the damages to the environmental component(s) from which the local community was deriving socio-economic benefits.

The objective of the study is to carry out:

Ecological Damage Assessment: Assess / analyse the environmental impacts / ecological damage with respect to land, air, water, soil and other environmental attributes due to project construction and operation activities during violation period.

Formulation of Remediation Plan (RP): To identify the corrective measures to compensate or restore or replace the damaged natural resources such as “Land, Biota, Air, Water, etc. to mitigate the adverse impacts on such resources”.
Formulation of Natural & Community Resource Augmentation Plan (NCRAP): Remedial measures to compensate for the damaged / vulnerable natural resource, community resource and health, infrastructure etc., which were providing socio-economic benefit to local community.

## 13.2 DETAILS OF COURT CASES

The details of court cases are given in Table 13.1 below.

Table 13.1: Details of Court Cases

| S.N | Details of Court Cases | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|---|
| a. | Name of the Court (Districts Court / High Court / NGT / Tribunals / Supreme Court of India) | District Court of Bokaro | Supreme Court of India,<br>High Court of Jharkhand | District Court of Bokaro | High Court of Jharkhand |
| c. | Name of the Sub-court | Chief Judicial Magistrate | - | Principal District and Sessions Judge | - |
| d. | Case No. | Complaint Case 941/2020 | WPC 4850 of 2018 and WPC 1873 of 2018.<br>SLP 11226 &11227 of 2020. | Title Appeal 33/2007 | WPC 2685 of 2020 |
| e. | Orders / Directions of the court | Cognizance order of 21.12.2020 | The writs are pending for final disposal.<br><br>Interim orders have been vacated, but have been stayed by the Hon"ble Supreme Court in the SLP. | Land in suit held to be Raiyati Land and not Forest Land. This land and such other similar patches of land are within the plant premises, where the Forest Department claims to be forest land. | Currently pending for bench allotment. |
| f. | Case Details | U/S 15 of the Environment (Protection) Act, 1986 | Writ case filed against EC revocation order and non-acceptance of CTO application.<br>Stay orders have been granted from 2018 till 2020, and the main writ is under adjudication. | Title Suit in favour of the Company and Raiyats. Divisional Forest Officer has filed an appeal, which is pending adjudication. No stay order has been granted. | Writ Petition filed for expunging specific comments from ToR which prescribe that the management is a willful defaulter. |
| g. | Court Order | Annexure 13.1 | Annexure 13.2 | Annexure 13.3 | - |

The JSPCB has undertaken credible action against ESL Steel Ltd. under the provisions of Environment (Protection) Act, 1986, the copy of the same is attached as Annexure 13.1.

## 13.3 BRIEF DESCRIPTION OF THE VIOLATION

### A. Violation period

Site activities commenced at the ESL plant site in 2008. The first BF was installed in 2010, however, other units capable of producing 1.5 MTPA crude steel could be commissioned only in 2016. Hence, partial production from the plant started from 2010 onwards.

The year wise production details of the plant for different products during the violation period is given in Table 13.2.

Table 13.2: Year-wise production status of the plant since 2008

| | Coke Oven | Sinter plant | Blast Furnace | SMS | Rebar | WR | DIP | Lime Plant | Dolo Plant | Pig Iron | CPP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Product | Gross coke, T | Gross Sinter, T | Hot metal, T | Crude Steel, T | Bars, T | Wire, T | DI, T | Calcined lime, T | Calcined dolo, T | Pig Iron , T | Power, MWh |
| Annual Capacity | 500,000 | 27,44,300 | 1,568,000 | 1,500,000 | 700,000 | 500,000 | 2,20,000 | 2,37,600 | 49,400 | - | 120 MW |
| 2008-09 | Construction Phase | | | | | | | | | | |
| 2009-10 | | | | | | | | | | | |
| 2010-11 | 0 | 0 | 6236 | 0 | 0 | 0 | 0 | 0 | 0 | 6236 | 0 |
| 2011-12 | 0 | 0 | 28671 | 0 | 0 | 0 | 0 | 0 | 0 | 28671 | 0 |
| 2012-13 | 98209.6 | 96478 | 78903 | 1169 | 2114.8 | 0 | 0 | 0 | 0 | 75103 | 0 |
| 2013-14 | 177321 | 560915 | 301849 | 47844 | 36647 | 0 | 0 | 4886 | 2535 | 249639 | 0 |
| 2014-15 | 342042.5 | 1176819 | 716239 | 368794.9 | 160739.5 | 0 | 16800.1 | 48504 | 10990 | 329378 | 0 |
| 2015-16 | 595222.7 | 1944746 | 1217123 | 562866.5 | 325170.6 | 17449.3 | 96332.3 | 81248 | 32211.1 | 543266 | 0 |
| 2016-17 | 525210.9 | 1480666 | 972255 | 501462.8 | 206197.8 | 207156 | 146969 | 65952 | 19744 | 252946 | 0 |
| 2017-18 | 549830.7 | 1725837 | 1122680 | 740852.7 | 300124.2 | 359325.8 | 138043 | 108028 | 26096 | 179465 | 577974 |
| 2018-19 | 598583.5 | 1948307 | 1267974 | 922944 | 441256.2 | 426876.5 | 158967.8 | 115474 | 37895.4 | 141549 | 566623 |
| 2019-20 | 644610.4 | 2264567 | 1337438 | 936043 | 468393 | 412950.3 | 166227 | 120190 | 43048 | 169341 | 539541 |
| 2020-21 (April to Aug) | 291528 | - | 577304 | 376648 | 95498 | 139830 | 47451 | - | - | 83730 | 284686 |
| TOTAL | 3822559.3 | 11198335 | 7626672 | 4458624.9 | 2036141.1 | 1563587.9 | 770790.2 | 544282 | 172519.5 | 2059324 | 1968824 |

Thus during the violation period, a total of approximately 7.6 million tonnes (MT) of Hot Metal, 4.46 MT of Crude steel, 3.6 MT of Saleable steel products, 0.77 MT of DI products, 2.06 MT of Pig Iron and 1.96 million MWh of power has been produced by the plant.

## 13.4 ECONOMIC BENEFITS DERIVED

As elaborated in preceding paragraphs, the ESL plant has been in operation since 2010. The plant came under the ownership of ESL Steel Limited, Vedanta Group only in 2018, before which the plant was operational under the ownership of M/s Electrosteel Steel Limited. All profit/loss accrued till 2016-17 has been accrued by the erstwhile management.

The maximum Hot metal (HM) production and Crude Steel (CS) production were achieved in 2019-20 and were 1,337,438 Tonnes (T) HM and 936,043 Tonnes (T) CS, respectively. The maximum saleable steel production achieved in 2019-20 was 881,343 T and maximum DI production achieved in 2017-18 was 577,974 T. The details of the profit and loss accrued from the plant during the violation period as certified by the Chief Finance Officer, Finance dept., ESL is as given in Table 13.3. The copy of the certified report is attached as Annexure 13.4.

Table 13.3: Profit/loss (P&L) accrued during violation period

| Sl. No. | Financial year | Profit/loss (in INR Lakhs) |
|---|---|---|
| 1 | 2010-11 | (-)613.35 |
| 2 | 2011-12 | (-)14981.7 |
| 3 | 2012-13 | (-)28001.3 |
| 4 | 2013-14 | (-)29113.2 |
| 5 | 2014-15 | (-)62404.2 |
| 6 | 2015-16 | (-)32654.7 |
| 7 | 2016-17 | (-)146348 |
| 8 | 2017-18 | (-)613885 |
| 9 | 2018-19 | 118680.3 |
| 10 | 2019-20 | (-)2180.92 |
| | Total P/L | (-)811502 |

The above P&L statement indicates that the plant has been under loss for since inception 2010-11 to 2017-18 and has been under an overall loss during the violation period.

Although, during the violation period the EMP was carried out by the erstwhile management and all the statutory requirements were compiled for the period. However, an additional amount of 3% of the EMP during the violation period (during the erstwhile management) has been considered as damage cost and will be spent for the Community Resource Augmentation Plan. After the takeover of the plant, M/s ESL Steel limited, has undertaken all initiatives to improve the environmental condition of the region.

Estimated expenditure on environmental management including maintenance of pollution control equipment and Online Continuous Monitoring Systems (OCEMS), regular ambient environmental monitoring in order to monitor their performance for adequacy and regular check on ambient environmental quality has been calculated.

The average annual cost of maintenance of pollution control equipment and monitoring of ambient & work zone environmental quality is estimated as Rs. 24.292 Crores per year and the annual expenditure on Environmental Monitoring is estimated as Rs. 20 lakhs per year

are considered as the cost on account of environmental management. The 3% of the total amount spend under the EMP has been considered in the Damage Assessment cost.

Additionally, EMP cost considered during violation of the ESL plant from 2008-09 to 2019-20 is given in Table 13.4.

Table 13.4: Expenditures made for environmental management during operation of the plant

| Year | Regular Environmental Monitoring Cost, Rs. | Cost of Maintenance of Pollution control equipment, Rs. | Estimated EMP Cost spent, Rs. |
|---|---|---|---|
| 2008-09 | 5,00,000 | *Period of installation of Pollution control equipment* | 5,00,000 |
| 2009-10 | 5,00,000 | | 5,00,000 |
| 2010-11 | 20,00,000 | | 20,00,000 |
| 2011-12 | 20,00,000 | | 20,00,000 |
| 2012-13 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2013-14 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2014-15 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2015-16 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2016-17 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2017-18 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2018-19 | 20,00,000 | 24,29,20,000 | 24,49,20,000 |
| 2019-20 | 5,00,000 | 6,07,30,000 | 24,49,20,000 |
| TOTAL | 1,75,00,000 | 1,51,82,50,000 | 1,53,57,50,000 |
| | | 3% (in Rs.) | 4,60,72,500 |
| | | 3% (in Crores) | 4.61 |

## 13.5 ASSESSMENT OF ENVIRONMENTAL / ECOLOGICAL DAMAGE

As per the earlier accorded Environmental Clearance, M/s ESL had proposed setting up the 3.0 MTPA ISP at Parbatpur in the Chandankiyari block of Bokaro district whereas M/s ESL has set up and is operating the Integrated Steel Plant at villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar of Chas and Chandankiyari block of Bokaro District of Jharkhand. In the succeeding paragraphs damage due to both construction of plant at the changed location and operation of the plant are addressed.

### 13.5.1 Land Environment

Presently 374.81 ha of land is under ESL"s possession. Of this 184.23 ha has been demarcated as Forest Land by Jharkhand State Forest Department and remaining 190.58 ha area is non forest area.

The Stage I Forestry Clearance for diversion of 184.23 ha of Forest land in favour of ESL Steel Limited has been accorded by MoEFCC vide letter no. F.No. 8-21/2019-FC dated 17th December 2019.

The details of the land type and land use as per the records is given in Table 13.5 and Table 13.6, respectively.

The year-wise Build-up area/ Un-disturbed Area of the project during the construction and operation phase is given in Table 13.7.

Table 13.5: Land Type & Status of project area 374.81 ha

| S.N | Land Type (as per record) | Area (ha) | Present Status |
|---|---|---|---|
| 1 | Forest land | 184.23 | Stage-I FC for 184.23 ha accorded by MoEFCC (F.No.8-21/2019-FC dtd. 17.12.2019) |
| 2 | Government land (Total Non-agriculture use as per land records) | 30.01 | ESL deposited the amount against Demand Note raised by the State Govt. for the settlement of Government land on lease |
| 3 | Private land (Non-agriculture use: 101.00677ha & Agriculture use: 59.56 ha as per land records) | 160.57 | Under Possession of ESL |
| | Total | 374.81 | |

Table 13.6: Land Use Type of project area 374.81 ha (as per Land Records)

| S.N | Land Use (as per record) | Area (ha) | Present Status/ Remarks |
|---|---|---|---|
| 1 | Forest land | 184.23 | Stage-I FC for 184.23 ha accorded by MoEFCC |
| 2 | Agricultural Land | 59.56 | Under Possession of ESL (Private Land) |
| 3 | Non-Agricultural Land | 131.01677 | Private Land (Under possession of ESL) + Govt. land (under process of lease) |
| | Total | 374.81 | |

Table 13.7: Year-wise Build-up area/ Un-disturbed Area during the Construction and Operation Phase

| | Year | Year-wise area under Construction including Slag Dump, Roads & Drains | Year-wise area under Construction excluding Slag Dump, Roads & Drains | Cumulative disturbed area including Buildings, pavements, Slag Dump, Roads & Drains | Undisturbed Area (Including Green Belt) | Total Project Area |
|---|---|---|---|---|---|---|
| | | (ha) | (ha) | (ha) | (ha) | (ha) |
| Construction & operation of some units | 2008-09 | 0.06 | 0.00 | 0.06 | 374.75 | 374.81 |
| | 2009-10 | 4.41 | 3.53 | 4.47 | 370.34 | 374.81 |
| | 2010-11 | 28.32 | 22.66 | 32.79 | 342.02 | 374.81 |
| | 2011-12 | 33.15 | 26.52 | 65.94 | 308.87 | 374.81 |
| | 2012-13 | 17.39 | 13.91 | 83.33 | 291.48 | 374.81 |
| | 2013-14 | 65.66 | 13.13 | 148.99 | 225.82 | 374.81 |
| | 2014-15 | 26.79 | 5.36 | 175.78 | 199.03 | 374.81 |
| | | | | | | |
| Full Operation phase | 2015-16 | 0.00 | 0.00 | 175.78 | 199.03 | 374.81 |
| | 2016-17 | 0.00 | 0.00 | 175.78 | 199.03 | 374.81 |
| | 2017-18 | 0.00 | 0.00 | 175.78 | 199.03 | 374.81 |
| | 2018-19 | 0.00 | 0.00 | 175.78 | 199.03 | 374.81 |
| | 2019-20 | 0.00 | 0.00 | 175.78 | 199.03 | 374.81 |
| | | 175.78 | 85.11 | - | - | 374.81 |

A. Damage Assessment due to Change in Land Use

Change in Land Use during Construction Phase

From historical LULC images of BHUVAN, ISRO for the year 2005-06 (prior to establishment of plant) and 2011-12 (during construction period) was compared. It was observed that Forest Land and Non-Forest (agricultural land and scrub land) were present before construction of the plant. However, after construction of the plant, the LULC has changed to built-up area.The changes in distribution of Land use/Land cover pattern of the area for before and after construction have been shown in Fig. 13.1 and Fig. 13.2 respectively.

Fig. 13.1: Land use Land Cover (LULC) before Construction
Source: Imagery Bhuvan, 2005-06

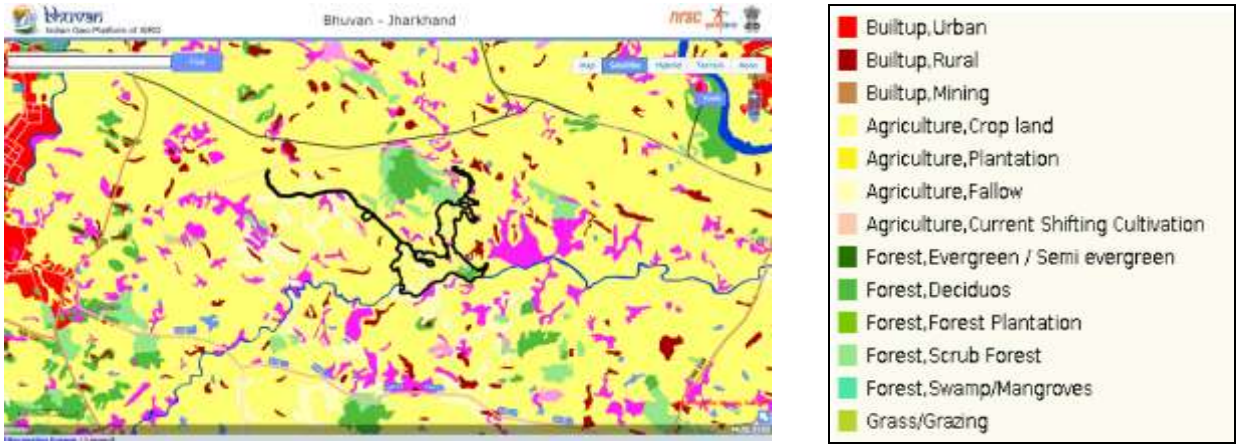
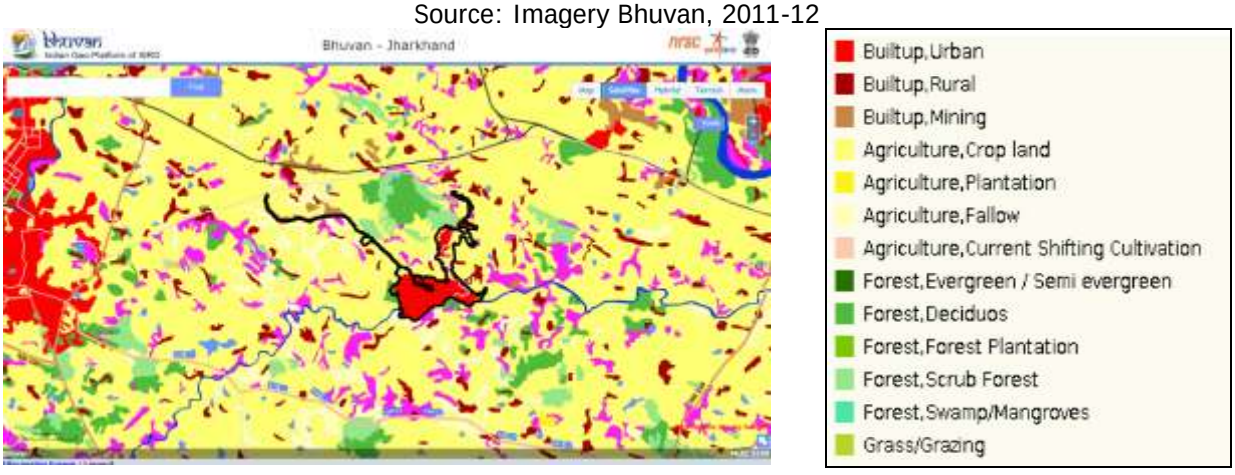



Fig. 13.2: Land use Land Cover (LULC) after Construction
Source: Imagery Bhuvan, 2011-12




It can be seen from Fig. 13.1 and Fig. 13.2, that between years 2005-06 to 2012-12 there has been increase build-up area, settlement and roads etc. and similarly there is decrease in the agricultural land and forest land. Changes in land use pattern have been observed after 2010 due to construction of the Integrated Steel plant, roads and other associated facilities. Within the core zone, the land use has changed primarily to build-up (industrial land) from agricultural and forest land.

There are two seasonal nallahs passing through the plant area. One seasonal nallah originates from the northern side of plant and flows through the plant on eastern side up to the southern boundary and finally joins Ijri river on southern side. Another seasonal nallah also originates from the northern-western side of plant and flows through the western side of the plant and finally joins Ijri river on the southern side. The Ijri river flows eastwards along the plant"s southern boundary and ultimately joins the Damodar river ~17 km east of the plant boundary.

Due to location of the site, major there have been significant changes in land use pattern due to conversion of agricultural, forest & grass lands to build-up area (ISP), decrease in forest cover and impact on drainage pattern of the area.

Due to change of location of the plant area, there is a change the drainage pattern of the present location and change in runoff and also impacted on ground water regimes. The damage due to location of plant at the present area on drainage pattern is discussed under Water Environment / Resource clause.

Change in Land Use during Operation Phase

To depict the overall change from Pre-construction Stage to preset stage Land-use, Satellite imagery from NRSC, Hyderabad was procured for the year 2008 and 2020, and a comparison between change in physiography, drainage and landuse in 10 km area of the project boundary in 2008 and 2020 has been carried out.

Comparison between change in physiography in 10 km area of the project boundary in 2008 and 2020 is shown in drawing no. MEC/Q7MM/11/S2/2.1 and MEC/Q7MM/11/S2/2.2, respectively.

Comparison between change in drainage in 10 km area of the project boundary in 2008 and 2020 is shown in drawing no. MEC/Q7MM/11/S2/3.1 and MEC/Q7MM/11/S2/3.2, respectively.

Comparison between change in landuse in 10 km area of the project boundary in 2008 and 2020 is shown in drawing no. MEC/Q7MM/11/S2/4.1 and MEC/Q7MM/11/S2/4.2, respectively.

It was observed that during the construction phase of Integrated Steel plant, there have been significant changes in land use pattern due to conversion of agricultural, forest etc. to build-up area (ISP) and decrease in agricultural area and forest cover. However, due to operation of the Integrated Steel plant, there have not been significant changes in land use pattern, as the conversion of the land-use has already undertaken during construction phase only.

B. Damage Assessment due Change in Location

As has been mentioned earlier in this report, out of 374.81 ha land under the possession of ESL, 184.23 ha is Forest Land and. The forest land was utilized without obtaining prior Forest Clearance (FC) for setting up the plant and associated facilities.

Out of Remaining 190.58 ha non-forest area, as per the land records, comprised of 59.56 ha of agricultural land and 131.02 ha of non-agricultural land.

Construction Phase

Damage due to use of Forest Land (184.23 ha)

Jharkhand State Forest Department has surveyed the project area over which the steel plant has been set up and found that 184.23 ha of Forest Land is present within the project area of 374.81 ha, for which prior Forest Clearance has not been sought.

Government of India has accorded post-facto "in-principle" approval under Section-2 of the Forest (Conservation) Act, 1980 for diversion of 184.23 ha of forest land (174.39 ha encroached (ex-post facto) and 9.84 ha virgin land) in favour of M/s Electrosteel Steels Limited in the State of Jharkhand subject to fulfilment of certain conditions vide letter F.No.8-21/2019- FC dated 17th December 2019 (copy attached as Annexure 1.3).

The conditions include:

Legal status of the diverted forest land shall remain unchanged.

Compensatory afforestation:

(a) Compensatory afforestation over non forest land, equal in extent, or over Jungle Jhari land, double in extent to the forest land being diverted, shall be raised by the Forest Department at the cost of user Agency. As far as practicable a mixture of local indigenous species will be planted and monoculture of a species has to be avoided.

(b) User agency shall provide non forest land equivalent to five times the forest land encroached for the purpose of Compensatory afforestation, in addition to normal CA as proposed under 2(a) above. The CA scheme shall be prepared and approved by competent authority. The non-forestland shall be mutated and declared as RF/PF prior to stage II approval. Shape file of the area shall be submitted.

(c) The non-forest land/Jungle Jhari land proposed for CA and Penal CA shall be transferred and mutated in the name of Forest Department and notified as RF/PF prior to Stage-II approval. A copy of the original notification declaring the non-forest land under Section 4 or Section 29 of the Indian Forest Act, 1927, or under the relevant section of the State Forest Act as the case may be, will be submitted by the State Government prior to Stage-II approval.

The cost of compensatory afforestation and Penal CA at the prevailing wage rates as per compensatory afforestation scheme and the cost of survey, demarcation and erection of permanent pillars if required on the CA land shall be deposited in advance with the Forest Department by the project authority. The CA will be maintained for 10 years. The scheme may include appropriate

provision for anticipated cost increase for works scheduled for subsequent years.

Net Present Value (NPV):

(a) The State Government shall charge the Net Present Value(NPV) for the 184.23 ha of forest area to be diverted under this proposal from the User Agency as per the orders of the Hon'ble Supreme Court of India dated 30/10/2002, 01/08/2003, 28/03/2008, 24/04/2008 and 09/05/2008 in IA No. 566 in WP (C) No. 202/1995 and as per the guidelines issued by the Ministry vide letters No. 5-1/1998-FC (Pt.II) dated 18/09/2003, as well as letter No. 5-2/2006-FC dated 03/10/2006 and 5-3/2007-FC dated 05/02/2009 in this regard.

(b) User agency shall pay five times of applicable NPV for the area used under encroachment.

(c) Additional amount of the NPV of the diverted forest land, if any, becoming due after finalization of the same by the Hon'ble Supreme Court of India on receipt of the report from the Expert Committee, shall be charged by the State Government from the User Agency. The User Agency shall furnish an undertaking to this effect.

The State Forest department has surveyed the area and raised demand for NPV including penalty of Rs.66,11,68,680/- (Rs.11,53,27,980/- +54,58,40,700/-) for the forest area diverted. The amount is being paid by the ESL.

NPV covers all the damages associated with forest land and hence no additional cost is not being included in the damage remediation cost.

### Damage due to use of Non-Forest Land (190.58 ha)

As stated above, ESL Plant has been constructed in an area for which EC had not been granted. The project area is 374.81 ha, out of which 184.23 ha area is Forest Land and 190.58 ha is Non-Forest land. For use of forest land, the State Forest department has surveyed the area and raised demand for Net Present Value (NPV) for the forest area diverted. The NPV covers all the damages associated with forest. The damage due to construction of plant over non-forest land has been assessed here.

Topsoil depletion not only results in depletion of nutrients, but also affects the soil biota and soil structure. It is assumed that the topsoil over an area of 190.58 ha non-forest lands have been lost totally and hence the damage will be derived by calculating the entire 190.58 ha.

The damage has been estimated indirect way method that the amount money required by farmer or any agency/organization would have to spend to replenish the nutrients lost by use of inorganic fertilizers. It was estimated else ware[1] that approximately by Rs. 8893/ ha (estimated in 2012) would be required to replace the lost macro-nutrients through in organic fertilizers alone.

Considering the inflation factor the cost as on date comes to be about Rs. 14,830 per ha and based on same the damage cost will be Rs.14,830/ha x 190.58 ha = Rs.

[1] *publication „Cost estimation of Soil Erosion and Nutrient Loss from a Watershed of the Chotanagpur Plateau, India (Gulati and Rai, 2015; Current science, 107(4):670-674, August 2014)*

28,26,301/-. Hence, the damage cost due to loss of topsoil is estimated to be Rs. 28.26 lakhs.

Operation Phase

During operation of plant as per earlier EC of MoEFCC stipulates that 33% of project area should be utilised for development of green belt & plantations. As per the observations of concerned Regional Officer of MoEFCC green belt & plantations developed by the project authorities falls short of the stipulation.

Keeping in view of the above, damage assessment for operation phase has been carried assessed.

In the project area, 123.69 ha (33% of 374.81 ha) of green belt & plantations had to be developed. At present a total of 74 ha (1,18,400 number of trees) of green belt has been developed.

However, to estimate the damage cost, the total number of the trees required to be planted as per the statutory requirement is considered as the damage cost.

Therefore, considering tree density of 2500 trees/ha, the total number of trees required to be planted for complying the 33% requirement is 123.69 ha x 2500 trees /ha i.e. 3,09,218 trees.

Considering cost of plantation and post-plantation care @ Rs. 500 per tree. The Cost of planting 3,09,218 trees comes to be 3,09,218 tree x Rs. 500/tree i.e. Rs. 15,46,09,000/-.

Thus, the total Estimated Damage Cost (Land Environment) for which Damage Remediation is estimated as Rs. 0.28 Crores + Rs. 15.46 Crores = Rs. 15.74 Crores.

13.5.2 Air Environment

a) Delineation of Impacted Areas

The existing plant at 1.5 MTPA (Crude Steel) capacity has never achieved its rated production. Therefore, in order to identify the impacted area, the following hypothetical scenario has been assumed i.e.

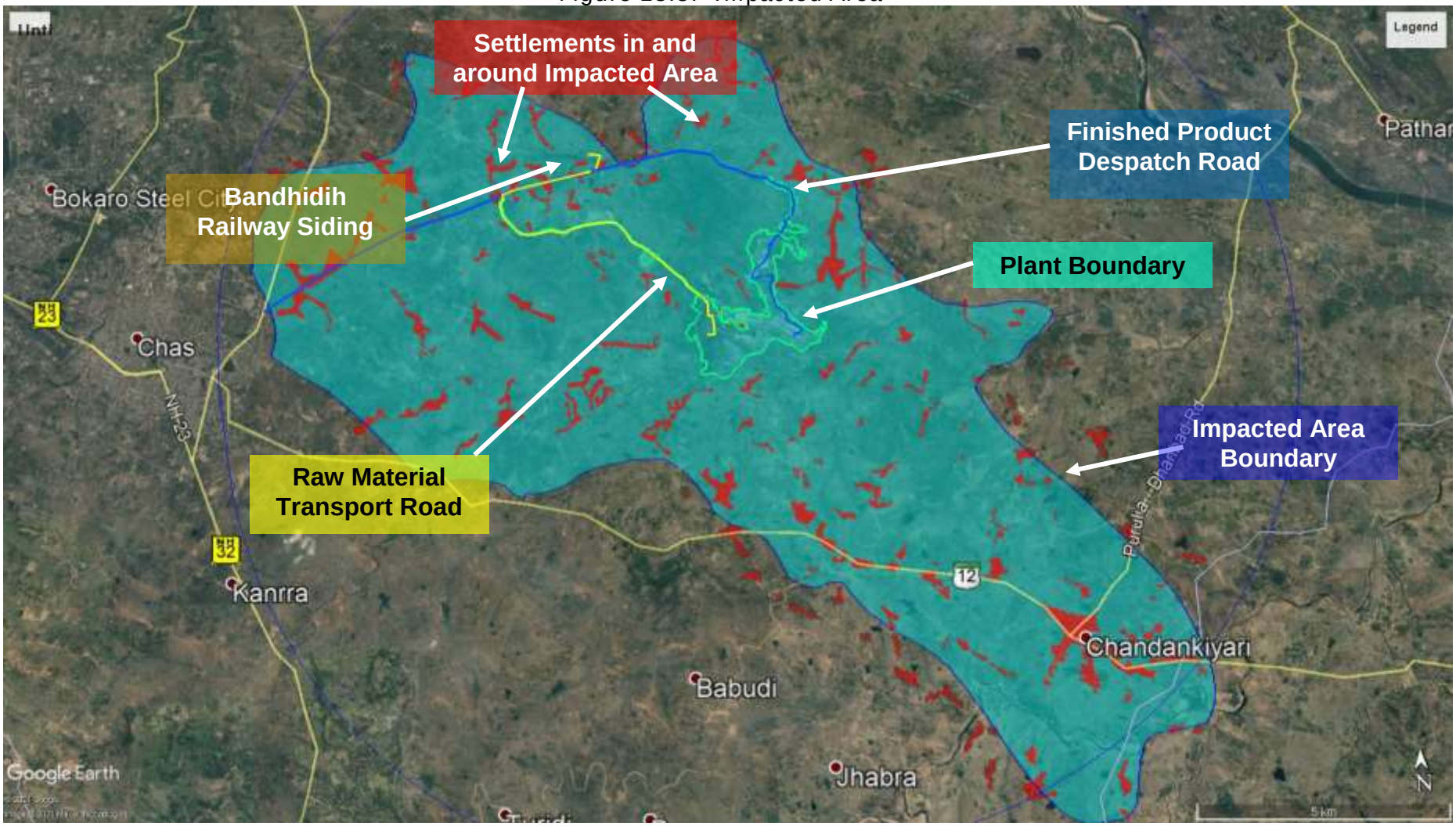
100% production from all existing units.
Maximum design flows of all stack emissions.
Maximum Permissible PM emission concentration from all plant stacks.
Transportation of all the finished products by Roads towards NH32.
Handling and transportation of all the required raw material from Bandhidih Railway Siding to plant via Road.

Based on the above factors, the estimated emissions due to various plant processes, material handling and transportation activities due to maximum production have been calculated.

The study area has seasonal change in wind direction pattern during winter and post monsoon. The predominant winds are from NW and SE during winter and post monsoon seasons respectively.

In order to consider the impact areas in the both season and based on the emission values estimated conservative way as indicated above, impacted areas are identified using windrose of both the seasons. AERMOD dispersion model is used to identify impacted area around the plant. The same is also shown in Fig. 13.3 below.

Figure 13.3: Impacted Area



The total impacted area comes to be ~14,429 ha, which comprises of about ~8,396 ha of Agricultural land, ~374.8 ha of Industrial area of ESL, ~1,169 ha of settlements and 4488.6 ha of other areas is present.

b) Methodology

In order to quantify the direct resulting from the construction and operation of ESL"s integrated steel plant during the violation period, estimation of actual contribution to the degradation of air environment during the violation period and corresponding costs of damage to the air environment have been estimated using Impact Pathway Approach. The impact pathway approach involves following steps:

Step 1: Source-Emissions

This step identifies, within a geographical grid, all relevant emission sources.

ESL"s Integrated Steel Plant was a green field project. As discussed in the previous paragraphs, the construction of the plant was started after getting CTE from JSPCB and thereafter the initial production from BF3 was started from FY 2010-11. The construction activities of several units went on up to 2015. The plant has been in operation for over 10 years.

The raw material for the plant are sourced from the nearby Bandhidih Railway siding. The raw material is transported via 10 km stretch of road from Bandhidih Railway siding to Plant"s Raw Material Yard. A small part of the road is public while the balance is owned by ESL. All the finished products are despatched by trucks towards Bokaro through a public road leading to NH 32.

Step 2: Dispersion-Receptor sites

This step translates emissions into concentrations at specific, geographically diversified receptor points. Using dispersion model and prevailing meteorological conditions, Source-receptor matrices have been derived which allowed a change in concentration or deposition to be attributed to each unit of emission.
Based on the year wise activities taken place from 2008, emissions have been estimated due to construction period and operation as well as Raw material and finished goods transportation activities has been estimated. Based on the estimated emission values, the Ground Level Concentrations (GLCs) were estimated using dispersion model on the receptors in the impacted area.

In order to estimate the impacts of steel plant activities, the settlements are clubbed together in several clusters.
From above, one get pollutant concentrations (ug/m3) at each cluster. In order to obtain emissions loads(g/s) at these clusters due to plant activities, emission loads at these each cluster have been estimated using average mixing height(m), area of the cluster(m2) and air replacement factor. Similarly the emission loads have estimated at these clusters year wise based on the estimated emission values of individual year.

Step 3: Dose-response functions and impacts

This step establishes the relationship between pollution concentration and physical impacts at the endpoint level.

Step 4: Monetary valuation

The final step is monetary valuation. For monetary valuation Environmental Prices Handbook EU28 version 2018 have been considered. Considering the Indian Scenario, Cost of damage has been considered as 30% of the cost in European Currency. Based on the above and considering Euro exchange rate of present day (Rs 86.4 per Euro), the values for the Environmental Prices for average air emissions are as follows:

1. $PM_{10}$ – Rs 689.47 /Kg Emissions
2. $PM_{2.5}$ – Rs 1003.10 /Kg Emissions
3. $SO_2$ – Rs 298.08 /Kg Emissions
4. NOx – Rs 383.62 /Kg Emissions

c) Damage Assessment

Construction Phase

The construction and other associated activities may have lead to emission of different pollutants, viz. particulate matter and gaseous pollutants ($SO_2$, $NO_x$, and CO) from construction activities, machinery and vehicles. Particulate matter being the main pollutant and hence has been considered for prediction of air quality during construction stage. As plant will be constructed in stages, construction activity covering a large area is not expected.

Intensive construction is a source of fugitive dust emissions that may have temporary impact on surrounding air quality. Construction comprises of a series of different operations, each with its own duration and potential for dust generation. Emissions during the construction are associated with civil works (i.e., earth moving) and construction of a particular facility itself. A large portion of the emissions are generated due to equipment traffic over temporary roads at the construction site.

Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing micro-meteorological conditions. The quantity of dust emissions from intensive construction operations is proportional to the area of land being worked and to the level of construction activity. Emissions from intensive construction operations is directly proportional to the silt content of the soil as well as with the speed and weight of the average vehicle and is inversely proportional to the soil moisture content.

The emission factors for estimation of Construction PM Emissions were taken from the US EPA„s *Compilation of Air Pollutant Emission Factors* (AP- 42). For gaseous emissions, emission factors have been calculated based on the percentage of sulphur present in diesel and the emission factors developed by ARAI for NOx emissions.

Following activities have been considered for estimation of emissions during construction phase:

1. Demolition and Debris Removal Phase
    a. Land Clearing
    b. Truck Loading with debris
    c. Transport of debris on unpaved road
    d. Truck Unloading debris
2. Site Preparation (Levelling/Filling)
    a. Bulldozing

b. Top Soil Removal by Scrapper
c. Scrapper in travel
d. Top Soil scrapper unloading
e. Truck Loading with Excavated material
f. Truck Unloading of Excavated material
g. Compacting
h. Motor grading

3. General Construction
   a. Large Vehicular traffic carrying laborers and material to and from site
   b. Small Vehicular Traffic carrying other personnel and equipment to and from site
   c. General Construction Activities like cutting, welding, Fine Screening, etc.

It has been assumed that Demolition and Debris Removal Activities and Site Preparation activities has continued at the initial 2 months of construction. After this period, general construction activities were started. The activities are considered to be carried out for 24 hrs a day and 365 days a year except for the initial year.

Operation Phase

The existing plant units were commissioned over several years starting with Blast furnace 3 in 2010-11. In the following years, other units were also added. The year wise-production data from each unit was provided in Table 13.2 above. In all the units, air pollutants were generated at different stages of production. Major air pollutants are particulate matter, sulphur dioxide, oxides of nitrogen, etc. These pollutants were released as point source emissions or fugitive emissions.

In order to estimate the impacts of ongoing plant operations for each year, emissions from individual units have been estimated based on their production data.

Based on the above estimated emission values, GLCs have been estimated due to the plant"s Construction and operation activities in impact area for each year of violation separately.

The year wise estimated emission loads from various sources due to construction and plant operation activities and the respective incremental GLCs for $PM_{10}$, $PM_{2.5}$, $SO_2$ and NOx at various receptor locations located near the impacted areas have been shown in Table 13.8. The Cost of Environmental damage has also been calculated and provided in the table below.

Table 13.8: Year wise estimated Cost of Damage to Air Environment

a. Damage during Construction phase of ISP

| Sl No | Year | Activity at site | Pollution load in Impacted Areas (Receptor Pollution Load) (g/s) | | | | Damage Cost (in Crore Rs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | Total |
| 1. | 2008-09 | Demolition and Debris Removal (30 days) | 0.33 | 0.03 | 0.09 | 0.30 | 0.83 | 0.12 | 0.08 | 0.37 | 1.28 |
| | | Site Preparation (30 days) | 2.05 | 0.20 | 0.09 | 0.30 | | | | | |
| | | General Construction | 0.22 | 0.02 | 0.09 | 0.30 | | | | | |
| 2. | 2009-10 | General Construction | 0.22 | 0.02 | 0.09 | 0.30 | 0.49 | 0.07 | 0.08 | 0.37 | 0.93 |
| 3. | 2010-11 | General Construction | 0.22 | 0.02 | 0.09 | 0.30 | 0.49 | 0.07 | 0.08 | 0.37 | 0.93 |
| 4. | 2011-12 | General Construction | 0.22 | 0.02 | 0.09 | 0.30 | 0.48 | 0.07 | 0.08 | 0.36 | 0.92 |
| 5. | 2012-13 | General Construction | 0.06 | 0.01 | 0.05 | 0.18 | 0.14 | 0.02 | 0.05 | 0.22 | 0.41 |
| 6. | 2013-14 | General Construction | 0.06 | 0.01 | 0.05 | 0.17 | 0.13 | 0.02 | 0.05 | 0.21 | 0.39 |
| 7. | 2014-15 | General Construction | 0.05 | 0.01 | 0.05 | 0.17 | 0.11 | 0.02 | 0.05 | 0.20 | 0.36 |
| | | | | | | Grand Total | 2.7 | 0.4 | 0.5 | 2.1 | 5.6 |
| Note: Only Damage due to construction of units is considered under this table. | | | | | | | | | | | |

b. Damage during Operation phase of ISP

| Sl No | Year | Units in Operation | Source Pollution Load (g/s) | | | | Pollution load in Impacted Areas (Receptor Pollution Load) (g/s) | | | | Damage Cost (in Crore Rs) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | *$PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | Total |
| 1. | 2010-11 | BF3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.03 | 0.0 | 0.0 | 0.04 |
| 2. | 2011-12 | BF3 | 0.7 | 0.6 | 0.1 | 0.1 | 0.05 | 0.04 | 0.01 | 0.01 | 0.03 | 0.2 | 0.0 | 0.0 | 0.2 |
| 3. | 2012-13 | RMHS,CO,SP,BF3,SMS,Bar,O2 | 4.0 | 3.0 | 1.3 | 0.7 | 0.41 | 0.24 | 0.08 | 0.12 | 0.4 | 0.8 | 0.1 | 0.1 | 1.3 |
| 4. | 2013-14 | All Except WRM,DIP,CPP | 19.6 | 14.1 | 5.7 | 3.1 | 1.41 | 0.81 | 0.28 | 0.44 | 1.3 | 2.6 | 0.3 | 0.5 | 4.7 |
| 5. | 2014-15 | All Except WRM | 49.5 | 36.6 | 15.4 | 7.4 | 2.86 | 1.54 | 0.57 | 0.95 | 2.9 | 4.9 | 0.5 | 1.1 | 9.4 |
| 6. | 2015-16 | All Units | 84.5 | 62.7 | 26.3 | 12.6 | 4.53 | 2.42 | 2.39 | 1.66 | 4.6 | 7.7 | 2.2 | 2.0 | 16.5 |
| 7. | 2016-17 | All Units | 69.2 | 51.8 | 20.9 | 10.0 | 3.86 | 2.13 | 0.82 | 1.46 | 3.8 | 6.7 | 0.8 | 1.8 | 13.0 |
| 8. | 2017-18 | All Units | 87.8 | 65.6 | 45.4 | 19.3 | 4.72 | 2.57 | 1.31 | 1.92 | 4.7 | 8.1 | 1.2 | 2.3 | 16.4 |
| 9. | 2018-19 | All Units | 101.3 | 75.9 | 48.3 | 20.7 | 5.37 | 2.91 | 1.45 | 2.21 | 5.3 | 9.2 | 1.4 | 2.7 | 18.6 |
| 10. | 2019-20 | All Units | 131.0 | 97.2 | 110.6 | 48.2 | 6.00 | 3.25 | 2.17 | 2.66 | 6.0 | 10.3 | 2.0 | 3.2 | 21.5 |
| 11. | 2020-21 (April- Aug) | All Units | 131.0 | 97.2 | 110.6 | 48.2 | 6.00 | 3.25 | 2.17 | 2.66 | 2.4 | 4.1 | 0.8 | 1.3 | 8.7 |
| | | | | | | | | | | Grand Total | 31.3 | 54.5 | 9.3 | 15.1 | 110.2 |
| *Cost of $PM_{2.5}$ excluded from calculations as it is calculated separately | | | | | | | | | | | | | | | |
| *BF: Blast Furnace; WRM: Wire Rod Mill; CO: Coke Oven; DIP: Ductile Iron Pipe Plant; LIME: Lime Kiln; DOLO: Dolomite Kiln; CPP: Captive Power Plant* | | | | | | | | | | | | | | | |

Based on the above, the estimated environmental cost of damage to air quality at surrounding villages is coming to be Rs 115.8 Crores.

Example of Calculation of Cost of Damage to Air Environment

1. Unit wise emission flow rates have been estimated for individual year of plant operation. The estimated stack emissions for the year 2019-20 are provided in Table 13.9 below.

Table 13.9: Estimated stack emissions for the year 2019-20

| Sl. No. | Stack Details | Flow Rates $Nm^3/hr$ | Pollutant Load (g/s) | | | |
|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx |
| 1 | Coke Oven (V) Flue1 | 815206 | 5.12 | 5.12 | 8.33 | 4.39 |
| 2 | Coke Oven (V) Flue2 | 857663 | 6.38 | 6.38 | 7.48 | 5.17 |
| 3 | Sinter Plant process | 1014180 | 24.79 | 15.27 | 13.76 | 7.65 |
| 4 | Sinter Plant SDD 1 | 610092 | 13.49 | 8.31 | 0.00 | 0.00 |
| 5 | Sinter Plant SDD 2 | 581927 | 13.53 | 8.33 | 0.00 | 0.00 |
| 6 | BF2 Stove Flue | 112687 | 0.53 | 0.53 | 0.71 | 0.48 |
| 7 | BF2 Cast House | 416020 | 7.59 | 6.26 | 0.00 | 0.00 |
| 8 | BF2 Stock House | 641420 | 12.35 | 10.19 | 5.43 | 2.92 |
| 9 | BF3 Stove Flue | 35215 | 0.17 | 0.17 | 0.22 | 0.15 |
| 10 | BF3 Cast House | 150792 | 2.38 | 1.96 | 0.64 | 0.36 |
| 11 | BF3 Stock House | 167158 | 2.78 | 2.29 | 0.00 | 0.00 |
| 12 | SMS SDD1 | 687585 | 8.19 | 6.76 | 0.00 | 0.00 |
| 13 | SMS SDD2 | 827011 | 11.58 | 9.55 | 0.00 | 0.00 |
| 14 | SMS Stock house | 61861 | 0.75 | 0.62 | 0.00 | 0.00 |
| 15 | Rebar Mill | 73821 | 0.38 | 0.38 | 0.48 | 0.16 |
| 16 | WRM | 52134 | 0.25 | 0.25 | 0.33 | 0.22 |
| 17 | DIP Induction | 102335 | 1.22 | 1.01 | 0.00 | 0.00 |
| 18 | DIP Mg Melter | 27255 | 0.32 | 0.27 | 0.00 | 0.00 |
| 19 | DIP Annealing Furnace | 46934 | 0.43 | 0.35 | 0.35 | 0.22 |
| 20 | DIP Zn Dedusting 1 | 90413 | 1.26 | 1.04 | 0.00 | 0.00 |
| 21 | DIP Zn Dedusting 2 | 90413 | 1.26 | 1.04 | 0.00 | 0.00 |
| 22 | Lime Kiln | 178471 | 3.89 | 3.21 | 6.72 | 1.33 |
| 23 | Dolo Kiln | 66707 | 1.28 | 1.06 | 1.79 | 0.60 |
| 24 | CPP | 924637 | 11.10 | 6.83 | 64.37 | 24.50 |
| | | Total | 131.02 | 97.18 | 110.62 | 48.15 |

2. Based on the above estimated emission values along with estimated emissions due to transportation and handling of raw material and finished goods, Ground level concentrations have been predicted at various receptor points in the impacted area. In order to calculate GLCs at individual residential area, nearby residential areas are clubbed together to form clusters and GLC values are predicted for each cluster reference point. A total of 21 cluster points were formed for such calculations. GLC values obtained for the year 2019-20 on such cluster points is provided in Table 13.10 below.

Table 13.10: GLC values obtained on cluster points for the year 2019-20

| Cluster Ref | GLCs ($\mu g/m^3$) | | | |
|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx |
| C1 | 16.7 | 9.6 | 6.0 | 6.6 |
| C2 | 6.5 | 3.9 | 2.7 | 2.5 |
| C3 | 5.4 | 2.9 | 2.6 | 2.5 |
| C4 | 2.9 | 1.9 | 1.1 | 0.9 |
| C5 | 8.0 | 4.3 | 3.2 | 3.5 |
| C6 | 6.8 | 4.0 | 2.0 | 2.3 |
| C7 | 3.2 | 2.0 | 1.3 | 1.1 |
| C8 | 4.5 | 2.4 | 1.5 | 2.6 |
| C9 | 4.2 | 2.3 | 1.9 | 1.9 |
| C10 | 3.7 | 2.4 | 1.1 | 1.2 |
| C11 | 14.1 | 5.5 | 3.4 | 7.2 |
| C12 | 7.0 | 3.3 | 2.1 | 4.3 |
| C13 | 3.8 | 2.3 | 1.9 | 1.6 |
| C14 | 3.6 | 2.0 | 1.7 | 1.6 |
| C15 | 3.9 | 2.6 | 1.7 | 1.3 |
| C16 | 2.6 | 1.7 | 1.1 | 0.9 |
| C17 | 3.1 | 2.1 | 1.4 | 1.0 |
| C18 | 4.0 | 2.7 | 1.8 | 1.3 |
| C19 | 2.5 | 1.7 | 1.1 | 0.7 |
| C20 | 2.6 | 1.8 | 0.9 | 0.7 |
| C21 | 3.6 | 2.2 | 1.7 | 1.4 |

3. Based on above values, the pollutant mass over the residential areas have been calculated as per CPCB guidelines. Average ceiling height (A) and wind speed (B) are taken as 544 m and 1 m/s respectively. Air replacement factor (C) is calculated as 15.32 per day.

   For example: as per the above table, for C1 cluster the GLC is 16.7 $\mu g/m^3$ (D) the area of the cluster is measured as 73000 m2 (E) then pollution load at that particular cluster would be 10.17 kg/day (D x E x A x C x $10^{-9}$).

   Similarly, pollution loads at all clusters are from C1 to C11 has been obtained.

   Then total pollution load = $\sum \{D_{1-11} \times E_{1-11} \times A \times C\} \times 10^{-9}$ kg /Day = 518.64

| | |
|---|---|
| Total Pollution Load (Kg/day) | 518.64 |
| Total Pollution Load (g/s) | 6.0 |

4. Based on the above methodology, total Pollution loads have been estimated over residential areas for $PM_{10}$, $PM_{2.5}$, $SO_2$ and NOx. The estimated values are as follows-

   $PM_{10}$ – 6.0 g/s
   $PM_{2.5}$ – 3.25 g/s
   $SO_2$ – 2.17 g/s
   $NO_x$ – 2.66 g/s

5. The rate of cost of damage to Air Quality for individual Pollutant after considering 30% rebate for Indian conditions is as follows:
    1. $PM_{10}$ – Rs 689.47 /Kg Emissions
    2. $PM_{2.5}$ – Rs 1003.10 /Kg Emissions
    3. $SO_2$ – Rs 298.08 /Kg Emissions
    4. NOx – Rs 383.62 /Kg Emissions

6. Using the above values, the cost of damage to Air Quality for the year 2019-20 is obtained as follows-

PM10 – Rs 6.0 Cr
PM2.5 – Rs 10.3 Cr
SO2 – Rs 2.0 Cr
NOx – Rs 3.2 Cr
Total – Rs 21.5 Cr

Note: For calculation of cost of $PM_{10}$, only the load of pollutants having particle size of 2.5 micron + is considered by subtracting $PM_{2.5}$ pollutant load from $PM_{10}$ load and cost of $PM_{2.5}$ is being calculated separately with higher rate of damage.

#### 13.5.2.1 Agriculture Production Loss due to Air Emissions

In the preceding paragraphs, damages caused to residential areas due to air emission from plant activities have been estimated. These also include damage caused to human health in surrounding areas.

The impacted area also consists of about 8396 ha of agricultural land. Exposure to airborne dust particles originating due to plant activities of ESL may have resulted in the loss of crop productivity in the nearby areas. Therefore, in order to estimate the same, damage assessment has been carried out in line with the “Mechanism developed by CPCB for assessment of damage to the air quality, public health and agriculture production loss” dated 19/02/2020.

The principal crops in the District are Arhar/Tur Dal, Gram, Maize, Rapeseed/Mustard, Rice, Ragi, Wheat, Onion and Potato. However, in the study area only paddy is grown. The annual and average yield values in the impact area have been obtained from “Website of Ministry of Agriculture and Farmers Welfare”. The same is provided in Table 13.11 below.

Table 13.11: Crop Production Data as per Ministry’s Website

| Year | Production of Paddy (T/ha) |
|---|---|
| 2008-09 | 0.92 |
| 2009-10 | 0.47 |
| 2010-11 | - |
| 2011-12 | 1.55 |
| 2012-13 | 1.80 |
| 2013-14 | 2.13 |
| 2014-15 | 1.71 |
| 2015-16 | 0.65 |
| 2016-17 | 1.43 |
| 2017-18 | 2.67 |
| Avg | 1.29 |

To estimate the Agricultural Productivity Loss (APL), following steps have been taken-

Estimation of shortfalls in annual crop yield with respect to Average yield for each year for individual crop. (Ref. Website of Ministry of Agriculture and Farmers Welfare)

Estimation of total shortfall in the Agriculture Production Loss in impact area using the latest MSP values for individual crops for Bokaro District. (Rs.12,500/- per acre)

Estimation of ESL"s percentage contribution in yield loss (25%).

Based on the above, the total cost of Agriculture Production Loss due to ESL is estimated around Rs 9.10 Crores.

### 13.5.2.2 Air Pollution Control Measures Installed in Existing Plant Units

Table 13.12: Air Pollution Control Measures Installed in Existing Plant Units

| S.N. | Unit | Details of Air Pollution Control Measures | Design Limit |
|---|---|---|---|
| 1. | Raw Material Handling System | Covered conveyors.<br>Dry Fog Dust Suppression (DFDS) Systems<br>Dust Extraction (DE) systems at material transfer points<br>Sprinklers in Storage Yard | DE stack outlet <50 mg/Nm3 |
| 2. | Sinter Plant | ESP based Process Flue gas cleaning.<br>Stock House de-dusting<br>Sinter cooler DE system | Dedusting Stack level < 50 mg/Nm3<br>Process stack emissions <100 mg/Nm3 |
| 3. | Coke Ovens | Charging & Pushing emissions control<br>Waste heat recovery | DE stack outlet <50 mg/Nm3 |
| 4. | Blast Furnace | Bag Filter based Cast House and Stock House de-dusting | Stack dust level < 50 mg/Nm3 |
| 5. | Steel Melting Shops | Secondary emission control | Stack dust level < 50 mg/Nm3 |
| 6. | Lime & Dolo Kilns | Process Flue gas cleaning | Stack dust level < 100 mg/Nm3 |
| 7. | DIP Plant | Use of cleaned fuel gas for reheating.<br>Bag Filter based dedusting system for Induction furnace, Mg Melter Mixer & Space Dedusting. | Stack dust level < 50 mg/Nm3 |
| 8. | Rolling Mills | Use of cleaned fuel gas for reheating | Stack dust level <50 mg/Nm3 |
| 9. | CPP Boilers | ESP based Process Flue gas cleaning | Stack dust level < 50 mg/Nm3 |

Other control measures followed during construction and operation phases are as following.

During construction phase for dust suppression water sprinkling, wind barriers, dust control fences around construction area, trucks covered with tarpaulin during transport of debris and raw materials, etc. were used.

Proper & prior planning, appropriate sequencing & scheduling of all major activities is followed.

Materials are stored in covered warehouses or enclosed spaces to prevent the windblown fugitive emissions.
Stringent Material handling / overhauling procedures is followed.
Trucks are duly covered to avoid spilling & fugitive dust emissions.
Adequate dust suppression measures such as regular water sprinkling is undertaken.
Low emission equipment, vehicles and generator sets is used.
All Equipment - working condition & maintained periodically.
Machineries - regularly maintained - emissions conform to standards of Central Pollution Control Board.
Monitoring of air quality at regular intervals carried out.
Workers are provided with masks and PPE Kit.

### 13.5.3 Water Environment / Resource

#### 13.5.3.1 Ground Water resources (natural Groundwater recharge)

Major construction activities for ESL plant had commenced from FY 2008-09 and lasted till FY 2014-15 with partial operation of few units. The plant as-on-today was completely constructed since FY 2015-16.

The construction activities may have obstructed rainfall infiltration due to increase in built-up area within the project site which would obstruct natural groundwater recharge. The decrease in natural groundwater recharge could have been mitigated if adequate number of groundwater recharging structures would have been installed in the area.

The potential damage to groundwater resources is evaluated considering the shortfall in natural groundwater recharge due to the project activities. The same has been considered to estimate the damage cost on account of damage to Groundwater resources. For the same, natural groundwater recharge during the pre-construction as well as post-construction scenarios have been computed and considering the recharge structures/ponds installed now, the overall shortfall in the natural groundwater recharge has been calculated. However, the damage to ground water resources because of disturbance to forest areas within the project site has already been accounted in the penalty imposed by State Forest Department, Jharkhand. In view of the foregoing, the damage calculations have been done excluding the forest areas within the project site.

Pre-construction groundwater recharge

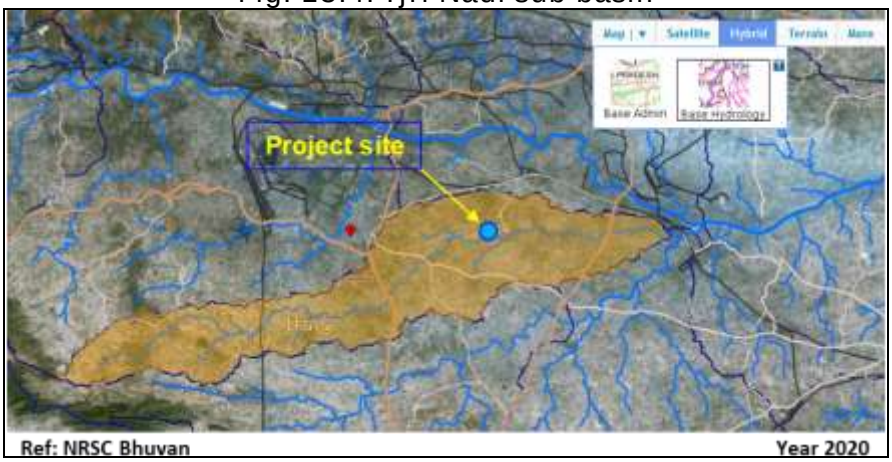
On studying the water shed lithology of the virgin area, out of 374.81 ha of project site, it is observed that 49.2% of project site (about 184.23 ha) is covered by forests and 49.8% of the project site (about 184.98 ha) is non-forest areas, covered mostly with scanty cultivations as well as shrubs. The project site also had 04 nos. of natural ponds of total area of ~5.6 ha, along with two major streams flowing across the project site. The water shed area is covered by permeable soil. Further, the total stream catchment area including the project site is nearly 1244 ha and the groundwater recharge accounted due to these have also been taken into account.

Pre-construction GW Recharge – due to stream catchment area

The project site falls in Damodar river, Ijri nadi sub basin. The Ijri nadi flows south of the plant and joins in Damodar river in the east at about 22 km from the plant site. About 3.3

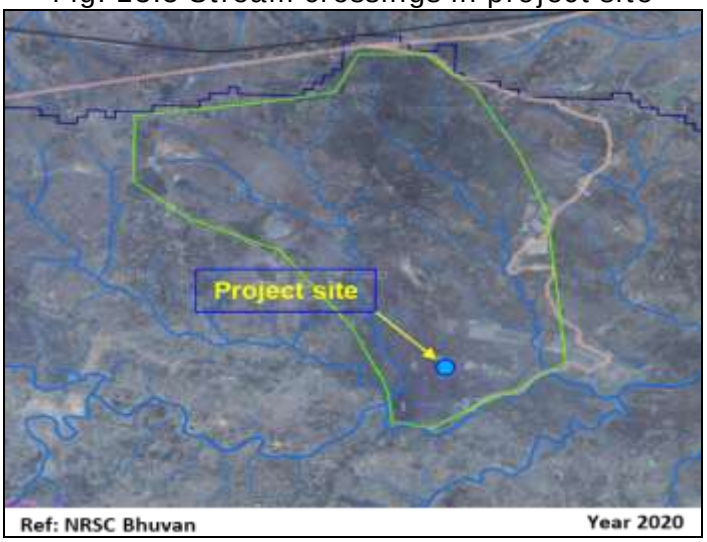
km of Ijri nadi flows adjacent to project site. The Ijri nadi sub basin is shown in following figure.

Fig. 13.4. Ijri Nadi sub basin




The total catchment area of Ijri nadi is about 397.04 $km^2$. Two water sheds have been identified with two streams which are passing through the site and join in Ijri nadi and the same is shown in following figure.

Fig. 13.5 Stream crossings in project site




Each water shed is having a spread area of about 6.22 $km^2$ and amounting to 12.44 $km^2$ contributing about 3.2% of Ijri nadi catchment area. The project area was demarcated with dentritic drainage pattern with a density of about 0.55 km/sq.km. From the drainage pattern and density, it can be deduced that the lithology belongs to hard rock area and bestowed with good drainage pattern.

The estimated pre-construction run-off from the above two streams catchment area of 1244 ha excluding project area of 374.81 Ha (i.e. net stream catchment area of 869.19 Ha) is about 41,34,215 $m^3$ which is inclusive of run-off generated from project site.

The annual avg. rainfall of 1189.1[2] mm is considered for groundwater recharge calculations. The groundwater recharge of pre-construction of the water shed and the project area is as follows:

Table 13.13: Pre-construction groundwater recharge

| S. N. | Description | Area in (ha) | Groundwater recharge co-efficient | Groundwater recharge, $m^3/y$ |
|---|---|---|---|---|
| 1 | Project site: | | | |
| | Forest areas | 184.23 | Damage already accounted in penalty by State Forest Dept., Jharkhand | |
| | Non-forest areas (open areas) excluding natural water bodies | 184.98 | 0.5 | 1099799 |
| | Natural Ponds (04 in nos.) | 5.6 | (1.44 mm/day)* | 4312 |
| 2 | Stream catchment area excluding project site | 869.19 | 0.4 | 4134215 |
| | Total groundwater recharge (excl. forest area within project site) | | | 52,38,326 |
| *As per GEC 2015, recharge through tanks/ponds to be considered as 1.4 mm/day. | | | | |

From the above table, in can be seen that the estimated total natural groundwater recharge during pre-construction stage from the watershed area (exc. Forest area of project site) is about 52,38,326 $m^3$ in a year.

Post-construction groundwater recharge

The plant occupies about 374.81 ha, out of which 175.778 ha is completely constructed (including built-up areas) by FY 2015-16. It implies that area of 175.778 ha is not available for natural recharge during both construction period till FY 2014-15 as well as during the operation period since 2015-16 till present. Also, of the 183.4 ha of Forest land, about 123.68 ha of area has been disturbed for greenbelt plantations. Hence the above area is deducted from the recharge calculation to estimate the groundwater recharge.

The 04 natural ponds of ~5.6 ha within the project area have also been disturbed, with 01 pond being reduced in size and 03 ponds relocated due to construction of the plant. The total area of 04 ponds is reduced to 2.08 ha. Further, ESL has constructed Artificial Rainwater harvesting structure of total potential recharge capacity of 44259 $m^3$/yr.

The post construction groundwater recharge during the construction & operation period is as follows:

Table 13.14: Post construction & Operation groundwater recharge

| S. N. | Description | Area in (ha) | | GW recharge co-efficient | Groundwater recharge, $m^3/y$ | |
|---|---|---|---|---|---|---|
| | | Construction | Operation | | Construction | Operation |
| 1 | Project site: | | | | | |
| | Disturbed area - Built-up areas | 85.1056 | 85.1056 | 0.1 | 101199 | 101199 |
| | Disturbed area - Areas under slag dump, roads & drains etc. | 90.6724 | 90.6724 | 0.1 | 107819 | 107819 |
| | Forest areas | 61.19 | 61.19 | Damage already accounted in penalty by State Forest Dept., Jharkhand | | |
| | Non-forest areas (open spaces) excluding natural water bodies | 135.77 | 135.77 | 0.5 | 807193 | 807193 |
| | Natural Ponds (04 in nos.) | 2.08 | 2.08 | 0.06475 | 1602 | 1602 |

[2]Observed Rainfall Variability and Changes over Jharkhand State, by Climate Research And Services India Meteorological Department Ministry Of Earth Sciences Pune - 2020

| S. N. | Description | Area in (ha) | | GW recharge co-efficient | Groundwater recharge, $m^3/y$ | |
|---|---|---|---|---|---|---|
| | | Construction | Operation | | Construction | Operation |
| | | | | (1.44 mm/day)* | | |
| 2 | Stream catchment area excluding project site | 869.19 | 869.19 | 0.4 | 4134215 | 4134215 |
| 3 | Additional GW recharge from artificial RWH structures | - | - | - | - | 44259 |
| | Total groundwater recharge (excl. forest area in project site) | | | | (1)+(2) 5152028 | (1)+(2)+3) 5196287 |
| *As per GEC 2015, recharge through tanks/ponds to be considered as 1.4 mm/day. | | | | | | |

From the above table, it can be seen that the estimated total groundwater recharge after construction is about 51,52,028 $m^3$/yr and 51,96,287 $m^3$/yr during operation period.

### Estimation of shortfall in natural Groundwater recharge due to obstruction by the project

As per the foregoing, there is a net reduction in the natural groundwater recharge due to the project activities during both the construction as well as operation period from the pre-construction stage of the project area.

However, ESL has installed artificial groundwater recharging structures which contribute about 44,259 $m^3$ per year during the operation period. In addition, there are natural ponds which are retaining the surface water and recharging through seepage. Thus, the total additional groundwater recharge is slightly improved during the operation period than in the construction period. However, there is an overall reduction in the natural GW recharge from the pre-construction stage as shown below.

Table 13.15: Reduction in natural GW recharge due to construction & operation of the plant compared to pre-construction groundwater recharge

| Sn. | Particulars | Quantity (in $m^3$/yr) |
|---|---|---|
| 1 | Pre-construction GW recharge ($m^3$/yr) – [A] | 52,38,326 |
| 2 | Post-construction GW recharge ($m^3$/yr) | |
| | i. During construction (FY 2008 to FY 2014) – [B1] | 51,52,028 |
| | ii. During operation (FY 2015 to FY 2019) – [B2] | 51,96,287 |
| 3 | Reduction in GW recharge due to project activities ($m^3$/yr) | |
| | i. During construction (FY 2008 to FY 2014) – [A]-[B1] | 86,298 |
| | ii. During operation (FY 2015 to FY 2019) – [A]-[B2] | 42,039 |

The cost for the direct damage that may have been caused to the groundwater regime of the area has been considered to be equal to the cost saved on installation of groundwater recharging structures to meet the shortfall in natural groundwater recharge in the area, and additionally, an amount equivalent to the penal cost on account of non-installation of adequate groundwater harvesting structures, as per provisions defined in *S.O. 3289(E) dated 24th Sept. 2020 of Ministry of Jal Shakti, Dept. of Water Resources, River development and Ganga Rejuvenation for Guidelines to regulate and control ground water extraction in India (with immediate effect)*" has also been included as part of the damage cost. The same has been evaluated as follows.

Table 13.16: Damage on account of obstruction to natural ground water recharge

| Period of violation | Reduction in GW recharge due to violation ($m^3$/yr) | Additional GW recharging structures required to meet the shortfall in GW recharge, (Nos.) | | Cost saved on installation of recharging structures for the total violation period (Rs.)* | | Fixed Penalty cost on non-installation of adequate RWH structures (Rs.)** | Total damage cost (Rs.) |
|---|---|---|---|---|---|---|---|
| | | 50% by GW recharge structures @12000 $m^3$/yr per structure | 50% by converting dry ponds to percolation ponds@12128 $m^3$/yr per pond | Cost of additional GW recharge structures @Rs. 3.5 lakhs unit rate | Cost of developing percolation ponds @ Rs. 27.75 lakhs unit rate | | |
| | a | b | c | I=b x unit rate | II=c x unit rate | III | IV =I+ II+III |
| Construction | 86,298 | 3 | 3 | 1,050,000 | 8,325,000 | 5,00,000 | 9,875,000 |
| Operation | 42,039 | 1 | 1 | 350,000 | 2,775,000 | 5,00,000 | 3,625,000 |
| | | | | | | Total damage cost (in Rs.) | 1.35 Cr. |

Note:
*Unit rates for Artificial recharge structures as per CGWB's Master Plan for Artificial Recharge to Ground Water in India (Bihar & Jharkhand)
**As per Notification S.O. 3289(E) dated 24th Sept. 2020

The total damage on account of obstructing groundwater recharge in the area and causing disturbance to the existing groundwater recharge due to industrial activity of ESL during construction period is Rs. 0.99 Cr. and during operation period is Rs. 0.36 Cr., totaling to Rs. 1.35 Crores during the overall violation period.

i) Ground Water consumption

Ground water abstraction has been done for construction activities, during the construction period from FY 2008-09 to FY 2014-15. The same has been shown as follows.

Table 13.17: Groundwater drawl during Violation period

| | Sl. No. | Period of violation (Year) | No. of labours employed | Annual Groundwater drawl ($m^3$) | | |
|---|---|---|---|---|---|---|
| | | | | For domestic consumption by personnel, $m^3$ | For other purposes, $m^3$ | Overall water consumed ($m^3$) |
| CONSTRUCTION | 1. | FY 08-09 | 568 | 1534 | 730 | 2264 |
| | 2. | FY 09-10 | 696 | 11432 | 52885 | 64317 |
| | 3. | FY 10-11 | 3893 | 63943 | 339885 | 403828 |
| | 4. | FY 11-12 | 4917 | 80983 | 397821 | 478804 |
| | 5. | FY 12-13 | 4804 | 78906 | 208640 | 287546 |
| | 6. | FY 13-14 | 0 | 0 | 0 | 0 |
| | 7. | FY 14-15 | 0 | 0 | 0 | 0 |
| | | | | SUBTOTAL (for construction in $m^3$) – [A] | | 12,36,759 |
| OPERATION | 8. | FY 15-16 | 0 | 0 | 0 | 0 |
| | 9. | FY 16-17 | 0 | 0 | 0 | 0 |
| | 10. | FY 17-18 | 0 | 0 | 0 | 0 |
| | 11. | FY 18-19 | 0 | 0 | 0 | 0 |
| | 12. | FY 19-20 | 0 | 0 | 0 | 0 |
| | | | | SUBTOTAL (for operation in $m^3$) – [B] | | 0 |

A total of about 1.24 million $m^3$ of groundwater has been abstracted for the period of 5 years during construction of the plant. The maximum annual water demand during the violation period is observed to be 1308 KLD. Since no groundwater is used for operation for the plant, the damage to the groundwater resources due to the plant during the violation period is considered to be the quantity of water used for construction activities during the violation period. Accordingly, cost of damage on account of damage to groundwater resources is estimated.

Environmental compensation for illegal extraction of ground water has been calculated as per the *"Report of the CPCB in-house committee on methodology for assessing environmental compensation and action plan to utilize the fund"* read along with *"Notf. S.O. 3289(E) dated 24th Sept. 2020 of Ministry of Jal Shakti"*. As per the Notification dated 24.09.2020, the total environmental compensation for illegal use of groundwater will include

Penalty for illegal groundwater abstraction, and
Cost of groundwater abstraction for consumed groundwater.

The Environmental Compensation Rate ($ECR_{GW}$) for calculating penalty on account of illegal use of groundwater for industrial activity is reproduced in following table for ready reference.

Table 13.18: $ECR_{GW}$ for Industrial Units

| Sl. No. | Area Category | Water Consumption ($m^3$/day) | | | |
|---|---|---|---|---|---|
| | | <200 | 200 to <1000 | 1000 to <5000 | 5000 & above |
| | | Environmental Compensation Rate ($ECR_{GW}$) in Rs./$m^3$ | | | |
| 1 | Safe | 20 | 30 | 40 | 50 |
| 2 | Semi Critical | 40 | 60 | 80 | 100 |
| 3 | Critical | 60 | 80 | 110 | 150 |
| 4 | Over-Exploited | 80 | 120 | 160 | 200 |
| Minimum $EC_{GW}$=Rs 1,00,000/- | | | | | |
| *Source:* As per Notification S.O. 3289(E) dated 24th Sept. 2020 of Ministry of Jal Shakti | | | | | |

Further, a deterrence factor has been defined by Central Ground Water Authority (CGWA) vide S.O. 3289(E) dated 24th September 2020 to be levied on industries/activities based on the duration of illegal ground water extraction to compensate for the losses and environmental damages as follows:

Table 13.19: Deterrent factor based on quantum of ground water withdrawal & no. of years of illegal withdrawal

| Sl. No. | Water consumption | Deterrence factor | | |
|---|---|---|---|---|
| | | <2 years | 2-5 years | >5 years |
| 1. | <1000 KLD | 1 | 1 | 1.25 |
| 2. | 1000-5000 KLD | 1 | 1 | 1.5 |
| 3. | >5000 KLD | 1 | 1.25 | 2 |
| Note: KLD – Kilo litre per day | | | | |

ESL plant is located in Chas block, which falls under the category of "Semi Critical" as per "Ground Water Information Booklet, Bokaro District" published by CGWB. Accordingly, the Environmental Compensation Rate ($ECR_{GW}$) considered for penalty on ground water consumption by ESL during the violation period of 5 years for 1308 KLD (i.e. 1000 to 5000 KLD) is considered as Rs. 80 per $m^3$. Further, based on the quantum of water abstracted and the duration of violation of 05 years, a deterrence factor of 1.0 has been also applied to the estimated cost of penalty.

The charges for groundwater abstraction on account of industrial consumption as part of violation production has also been considered as part of the overall damage cost. The rates of ground water abstraction charges for other industries & infrastructure projects as defined in S.O. 3289(E) dated 24.09.2020 are reproduced as follows for ready reference.

Table 13.20: Rates of ground water abstraction charges for industries

| Sl. No. | Area Category | Quantum of ground water withdrawal ($m^3$/day) | | | |
|---|---|---|---|---|---|
| | | <200 | 200 to <1000 | 1000 to <5000 | 5000 & above |
| | | Rate of abstraction in Rs./$m^3$ | | | |
| 1 | Safe | 1 | 2 | 3 | 5 |
| 2 | Semi Critical | 2 | 3 | 5 | 8 |
| 3 | Critical | 4 | 6 | 8 | 10 |
| *Source:* Notification S.O. 3289(E) dated 24th Sept. 2020 | | | | | |

The rate of water abstraction for ESL"s groundwater consumption in Chas block (semi-critical) has been considered as Rs. 5.0 per $m^3$.

For estimating the overall damage cost of illegal ground water consumed for industrial purpose used on account of violation, the Penalty for illegal groundwater abstraction based on Environmental Compensation Rate ($ECR_{GW}$) and the Charges for groundwater

abstraction has been taken together for the total ground water used and presented as follows.

Table 13.21: Damage on account of Groundwater (GW) use for industrial activity during violation period

| Sn | Period of violation (Year) | Annual GW consumed ($m^3$) | Env. Compensation Rate ($ECR_{GW}$), Rs./$m^3$ | Deterrent factor | Environmental compensation for GW consumed, Rs. | GW Abstraction rate, Rs./$m^3$ | Charges for GW abstraction, Rs. | Total Damage cost, Rs. |
|---|---|---|---|---|---|---|---|---|
| | | A | b | c | D =A x b x c | e | F = A x e | G = D + F |
| 1. | Construction | 1236759 | 80 | 1 | 98940720 | 5.0 | 6183795 | 105,124,515 |
| 2. | Operation | 0.0 | 80 | 1 | 0.0 | 5.0 | 0.0 | 0.0 |
| | | | | | | | Total damage cost (Rs.) | 105,124,515 (~ 10.51 Cr.) |

The total damage on account of using groundwater for industrial activity by ESL plant during construction period is Rs. 10.51 Cr. and as no groundwater was abstracted during the operation period, the damage cost during operation period is Rs. 0.0 Cr. The overall damage cost for the violation period is estimated to be about Rs. 10.51 Cr.

ii) Impact on Ground water quality

In order to identify the impacts on ground water quality of the study area caused due to the plant construction phase activities, the ground water quality of post-monsoon season 2006 was compared with that of 2020 at three common locations in the study area, viz. Near Bansa village, near Udalbani village and near Udalbani village. The comparative water quality data for the same locations is given as follows.

Table 13.22: Comparison of Groundwater quality before and after the violation period

| Parameters | Norms* | | Near Bansa village | | Near Udalbani village | | Near Modidih village | |
|---|---|---|---|---|---|---|---|---|
| | Desirable | Permissible | 2006 | 2020 | 2006 | 2020 | 2006 | 2020 |
| Colour, Hazen Units (max) | 5 | 15 | - | <5 | - | <5 | - | <5 |
| Odour | Agreeable | Agreeable | - | Agreeable | - | Agreeable | - | Agreeable |
| pH value | 6.5 to 8.5 | No Relaxation | 7.2 | 6.64 | 6.4 | 6.74 | 6.9 | 6.58 |
| Taste | Agreeable | Agreeable | - | Agreeable | - | Agreeable | - | Agreeable |
| Turbidity, NTU, Max. | 1 | 5 | 2.1 | <1 | 2.1 | <1 | 1.9 | <1 |
| Total Dissolved Solids, mg/l, max. | 500 | 2000 | 427 | 194 | 93 | 554 | 307 | 378 |
| Total Hardness(as CaCO3), mg/l, max | 200 | 600 | 348 | 84 | 68 | 340 | 184 | 212 |
| General Parameters Concerning Substances Undesirable in Excessive Amounts | | | | | | | | |
| Aluminium (as Al ), mg/l, Max | 0.03 | 0.2 | - | 0.418 | - | 0.060 | - | 0.232 |
| Boron (as B), mg/l, max. | 0.5 | 1 | - | 0.055 | - | 0.069 | - | <0.05 |
| Calcium (as Ca), mg/l, max. | 75 | 200 | - | 14 | - | 79 | - | 61 |
| Chloride (as Cl),mg/l, max. | 250 | 1000 | 18 | 18 | 10 | 46 | 25 | 42 |
| Copper (as Cu), mg/l, max. | 0.05 | 1.5 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoride (as F), mg/l, max. | 1 | 1.5 | 0.21 | 1.35 | 0.17 | 0.908 | 0.1 | 0.801 |
| Iron (as Fe), mg/l, max. | 1 | No Relaxation | <0.01 | 0.764 | 0.29 | 1.03 | 0.4 | 1.625 |
| Magnesium (as Mg), mg/l, max. | 30 | 100 | - | 12 | - | 35 | - | 15 |
| Manganese (as Mn), mg/l, max. | 0.1 | 0.3 | 0.03 | 0.643 | 0.09 | 0.164 | 0.57 | 0.457 |
| Nitrate (as NO3), mg/l, max. | 45 | No Relaxation | 0.31 | 9 | 2.59 | <1 | 1.01 | <1 |
| Phenolic compounds, mg/l, max. | 0.001 | 0.002 | - | <0.001 | - | <0.001 | - | <0.001 |
| Sulphate (as $SO_4$), mg/l, max. | 200 | 400 | 29 | 10 | 10 | 18 | 29 | 12 |
| Total Alkalinity( as CaCO3), mg/l | 200 | 600 | 414 | 68 | 52 | 302 | 250 | 180 |
| Zinc (as Zn), mg/l, max. | 5 | 15 | 1.17 | <0.05 | 0.02 | 0.125 | 0.27 | <0.05 |
| Parameters Concerning Toxic Substances | | | | | | | | |
| Cyanide (as CN), mg/l, max. | 0.05 | No relaxation | - | <0.01 | - | <0.01 | - | <0.01 |

| Parameters | Norms* | | Near Bansa village | | Near Udalbani village | | Near Modidih village | |
|---|---|---|---|---|---|---|---|---|
| | Desirable | Permissible | 2006 | 2020 | 2006 | 2020 | 2006 | 2020 |
| Lead (as Pb), mg/l, max. | 0.01 | No relaxation | 0.04 | <0.01 | 0.02 | <0.01 | 0.03 | <0.01 |
| Mercury,(as Hg), mg/l, max. | 0.001 | No relaxation | - | <0.0005 | - | <0.0005 | - | <0.0005 |
| Nickel (as Ni ), mg/l, max. | 0.02 | No relaxation | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Total Arsenic (as As), mg/l, max. | 0.01 | No relaxation | - | <0.01 | - | <0.01 | - | <0.01 |
| Total Chromium (as Cr), mg/l, Max. | 0.05 | No relaxation | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

The data above indicates that the concentration of Al and Mn are slightly exceeding the permissible limits of IS:10500 for drinking water, especially in the post-violation period. All other parameters are within the permissible limits, even during the post-violation period and it is observed that the natural ground water quality of the area has been fairly consistent before and after the violation period. Based on these findings, no significant impact on the groundwater quality is anticipated due to the project. This is also supported by the fact that the plant treats and recycles all the wastewater generated and there is no outside discharge of water from the plant.

### 13.5.3.2 Surface Water resources

The potential damage on surface water due to violation activities are as given below:

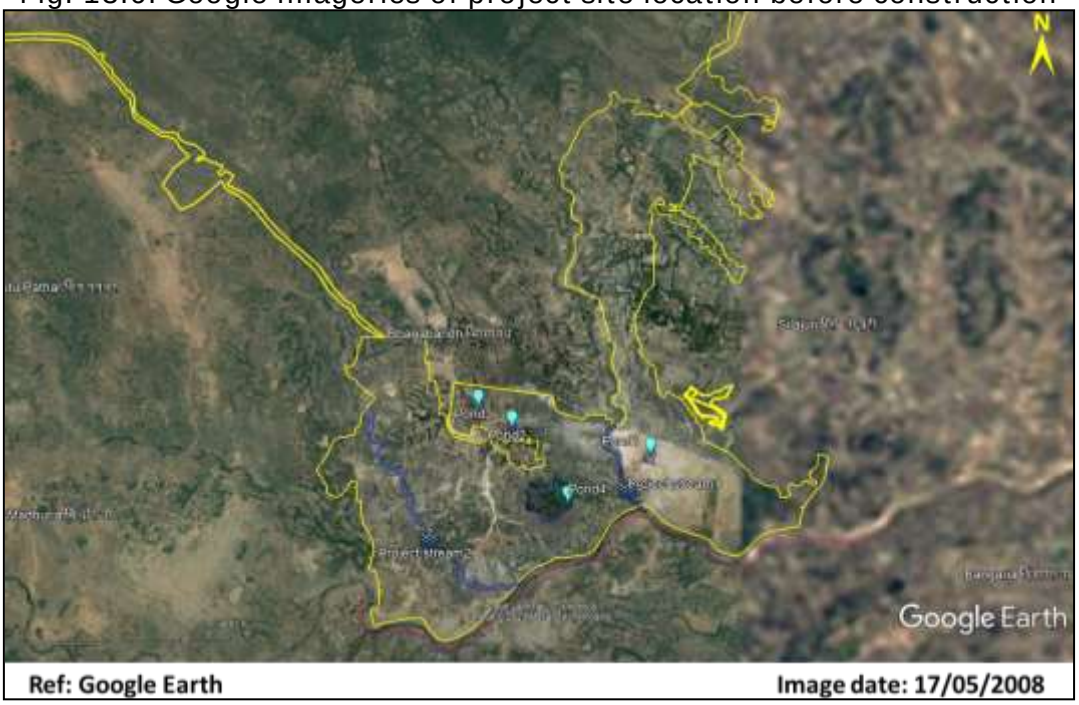
Disturbance to existing area drainage as indicated by change in surface runoff before and after the violation period.
Surface Water consumption for industrial use
Impact on surface water quality.

#### i) Surface Water Flow (Area Drainage)

Pre-construction stage Hydrology

The pre-construction project site of Google imageries (2008) have been captured and shown in following figure. There are four surface monsoonal ponds that have been identified before construction in an area of about 5.6 Ha and two major streams flow across the project site. Also, about 18.23 ha of Forest land and ~184.98 ha of open spaces were present within the project site, besides water bodies.

Fig. 13.6. Google imageries of project site location before construction




Pre-construction surface runoff

On studying the water shed lithology of the virgin area, out of 374.81 ha of project site, it is observed that 49.2% of project site (about 184.23 ha) is covered by forests and 49.8% of the project site (about 184.98 ha) is non-forest areas, covered mostly with scanty cultivations as well as shrubs. The project site also had 04 nos. of natural ponds of total area of ~5.6 ha, along with two major streams flowing across the project site. The water shed area is covered by permeable soil.

The annual avg. rainfall of 1189.1 mm is considered for runoff calculations. The surface runoff generated from the virgin project area is as follows:

Table 13.23 : Estimated run-off volume for Pre-construction project site

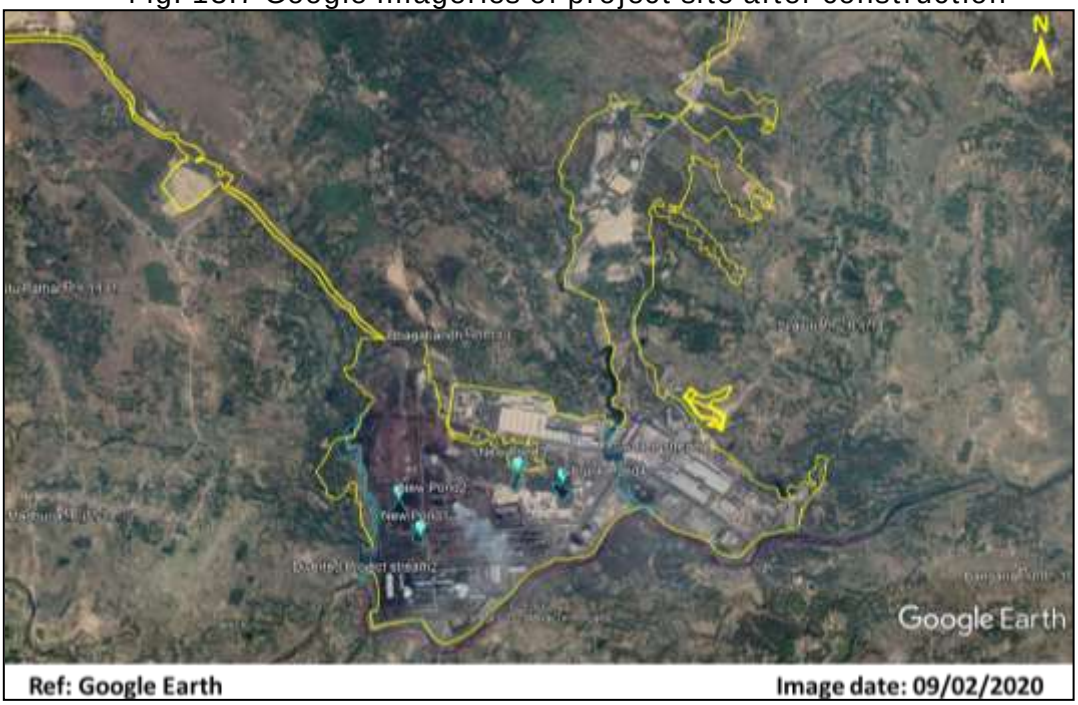
| S. N. | Description | Area in (ha) | Surface runoff co-efficient* | Surface runoff, $m^3/y$ |
|---|---|---|---|---|
| 1 | Project site: | | | |
| | Forest areas | 184.23 | 0.2 | 438136 |
| | Non-forest areas (open spaces) excluding natural water bodies | 184.98 | 0.45 | 989819 |
| 2 | Surface runoff harvested by 4 Natural Ponds (i.e. 80% of storage volume) | 5.6 | - | 179200 |
| | Net surface runoff generated from virgin site (1-2), $m^3/yr$ | | | 1248755 |
| *CGWB manual on Artificial Recharge | | | | |

From the above table, it can be seen that the estimated total natural surface runoff during pre-construction stage from the project site is about 12,48,755 $m^3$ in a year.

Post construction Hydrology:

The post construction project site of Google imageries (year 2020) have been captured and shown in following figure.

Fig. 13.7 Google imageries of project site after construction




From the above figure, it is evident that there are 4 ponds within the plant site of which Ponds 1, 2 & 3 have been shifted to the southern side of project site along the path of the stream to collect the surface run-off and pond-4 has shrunk in size. The total area of the 04 ponds after construction of the plant is about 2.08 ha, which is a reduction of 3.52 ha when compared to pre-construction due to plant footprints.

The two streams as identified in the pre-construction stage remains with minor alteration and joins in Ijri nadi at the same place. However, a swelling is observed in the eastern stream which indicates the stream is not properly strengthened to accommodate the surface run-off. The western stream is observed to change its flow route but is still joining the Ijri Nadi. It is also observed that the branches of the streams have not been disturbed as they are not falling in the project site. The project site run-off have been collected by designing a proper storm water network and joins in the Ijri nadi through rainwater harvesting pond.

The surface water streams in the area before the construction of the plant is shown in following figure and the surface water streams as observed today are given in Fig. 13.9.

Fig. 13.8: Google Earth Image of Site, May, 2008


Fig. 13.9: Google Earth Image of Site, 2020


Estimation of surface runoff discharges during post construction scenario

To estimate the run-off in post construction scenarios (construction & operation phases) for the site, the changed surface features and land use have been used along with runoff coefficients as per different land uses and annual average rainfall of 1189.1 mm is considered for surface runoff calculation.

The total disturbed area due to the project"s construction & operation included 85.1056 ha of built-up area and 90.6724 ha of disturbed area under slag dumps, roads & drains etc. As all construction activities were completed during the construction phase, the total disturbed area of 175.778 ha including 85.1056 ha of built-up area remained same during the operation phase also. Considering the above, the following table shows the estimated run-off volume for post construction scenarios for project site.

Table 13.24: Estimated run-off volume for post construction scenario

| S. N. | Description | Area in (ha) | | Surface runoff co-efficient | Surface runoff, $m^3/y$ | |
|---|---|---|---|---|---|---|
| | | Construction | Operation | | Construction | Operation |
| 1 | Project site: | | | | | |
| | Disturbed areas - Built-up areas | 85.1056 | 85.1056 | 0.8 | 809593 | 809593 |
| | Disturbed areas - Areas under slag dump, roads & drains | 90.6724 | 90.6724 | 0.45 | 485183 | 485183 |
| | Forest areas | 61.19 | 61.19 | 0.2 | 145514 | 145514 |
| | Non-forest areas (open spaces) excluding natural water bodies | 61.19 | 61.19 | 0.45 | 726474 | 726474 |
| | Sub-total (surface runoff from project site), $m^3/yr$ | | | | 2166764 | 2166764 |
| 2 | Surface runoff harvested by 4 Natural Ponds (i.e. 80% of storage volume) | 2.08 | 2.08 | - | 66560 | 66560 |
| 3 | Net surface runoff generated in post-construction scenario, $m^3/yr$ | | | | (1)-(2) 2100204 | (1)-(2) 2100204 |

*As per GEC 2015, recharge through tanks/ponds to be considered as 1.4 mm/day.

### Estimation of net increase in surface runoff discharges during post construction scenario

As per the foregoing, there is a net increase in the surface runoff due to the project activities during both the construction as well as operation period compared to the pre-construction stage of the project area. As the total built-up areas within the project site did not change during the operation phase of the project from that which were built during the construction phase, no additional increase in surface runoff during operation stage is considered. Accordingly, the overall increase in surface runoff due to the project is considered to completely occur by the time all the units had been constructed i.e. after completion of the construction phase.

However, ESL has installed artificial groundwater recharging structures which contribute to harvesting of about 44,259 $m^3$ per year of this increased surface runoff. Thus, the total increase in surface runoff is slightly decreased. However, there is an overall increase in the surface runoff from the pre-construction stage as shown below.

Table 13.25: Increase in surface runoff due to construction & operation of the plant compared to pre-construction runoff

| Sn. | Particulars | Quantity (in $m^3/yr$) |
|---|---|---|
| 1 | Pre-construction surface runoff – [A] | 1248755 |
| 2 | Post-construction surface runoff | |
| | i. During construction (FY 2008 to FY 2014) – [B1] | 2100204 |
| | ii. During operation (FY 2015 to FY 2019) – [B2] | 2100204 |
| 3 | Quantity of Surface runoff harvested through artificial rainwater harvesting structures - [C] | 44,259 |
| 4 | Net increase in surface runoff due to project activities | |
| | i. During construction (FY 2008 to FY 2014) – [B1]-[A]-[C] | 807190 |
| | ii. During operation (FY 2015 to FY 2019)* | 0 |

*Note:*
**As there is no increase in built-up areas during operation phase, no additional increase in surface runoff during operation phase and the total increase in surface runoff has been considered to have been completely accrued during the construction phase.*

The net increase in surface runoff as estimated above is due to the project activities carried out during the construction as well as operation phase both. However, as the total disturbed area due to the built-up areas and other features were completely constructed during the construction phase and no additional construction activities were carried out during the operation phase, the overall damage on account of increase in surface runoff was considered to be completely accrued during the construction period and no additional damage was accrued during the operation period.

To estimate the damage on account of the above estimated increase in surface runoff, the cost saved on recharging the additional surface runoff generated from the project activities has been calculated, considering the potential rechargeable fraction of the increased surface runoff generated equivalent to potential water that could not be recharged into the ground. Accordingly, cost of damage has been calculated and the same has been given as follows.

The cost saved on installation of required Rainwater harvesting (RWH) structures is considered as a part of the damage cost. It is considered that 50% of the available water for recharge will be recharged via Rainwater recharging structures and remaining 50% will be recharged by converting existing dry ponds into percolation ponds. The cost saved on installing the RWH structures is calculated as follows.

Table 13.26: Estimation of cost saved on non-installation of adequate RWH structures to recharge increased surface runoff generated

| Period of violation | Net increase in surface runoff due to project activities, $m^3$/yr | Recharge potential of increased runoff | Available runoff that could be potentially recharged, $m^3$/yr | Cost saved on additional RWH structures (considering 50% by RWH structures & 50% by converting dried ponds to percolation ponds) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Reqd. RWH structures @Rs. 3.5 Lakhs/unit | | Reqd. Percolation ponds @Rs. 27.75 Lakhs/ unit | | Total (in Rs.) |
| | | | | No. of units | Cost in Rs. | No. of units | Cost in Rs. | |
| | *A* | | *B=0.8 x A* | *C = B*0.5/12000* | *D=C*3.5 lakhs* | *E = B*0.5/12128* | *F=E*27.75 Lakh* | *G = D+F* |
| Construction | 807,190 | 0.8 | 645752 | 26 | 9100000 | 26 | 72150000 | 81250000 |
| Operation | 0 | 0.8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total Cost of RWH structures as part of Damage cost (Rs.) | | | | | | | ~8.13 Cr. |

As estimated above, the cost saved on installation of RWH structures to restore the increased surface runoff generated due to the project totals to Rs. 8.13 Crores during the overall violation period.

The total cost of damage on account of damage to surface drainage due to the project has been estimated to be Rs. 8.13 Crores.

Additional runoff management measures

ESL has already provided 0.5 km of garland drains along the existing Stacker reclaimer area and 0.5 km along the south western boundary, remaining 1.5 km drain has been proposed. Additional, ~3.5 km of drain shall has been proposed alongside the stacker reclaimer area where material shall be stacked after commissioning of proposed stacker reclaimer. The estimated cost for construction of 5 km of Garland drain is Rs. 2.5 Crores, which has been considered already under the EMP. Thus, no additional cost for construction of the Garland drains considered here.

### ii) Surface Water consumption

Surface water has been drawn from River Damodar for the project since December 2012. Water Resource Department (WRD), Jharkhand has granted ESL permission to withdraw 36.50 MCM water from the river Damodar vide Agreement no. B758440 dated 21/01/2012.

The amount of surface water consumed by ESL during the violation period and the permitted amount of Water drawl by WRD, Jharkhand is given as follows.

Table 13.27: Surface water drawn from River Damodar by ESL during Violation

| | Sl. No. | Period of violation (Year) | Annual Surface water drawl ($m^3$/yr) | | | Water drawl permitted by WRD, Jharkhand ($m^3$) | Excess drawl ($m^3$) |
|---|---|---|---|---|---|---|---|
| | | | Industrial use | Domestic use | Total | | |
| CONSTRUCTION OND OPERATION OF SOME UNITS | 1 | FY 08-09 | - | - | - | | - |
| | 2 | FY 09-10 | - | - | - | | - |
| | 3 | FY 10-11 | - | - | - | | - |
| | 4 | FY 11-12 | - | - | - | | - |
| | 5 | FY 12-13 | 141883.6 | - | 141883.6 | 3,65,00,000 | *Not exceeding* |
| | 6 | FY 13-14 | 753529.9 | - | 753529.9 | 3,65,00,000 | *Not exceeding* |
| | 7 | FY 14-15 | 3956608 | - | 3956608 | 3,65,00,000 | *Not exceeding* |
| | | | | | | | |
| FFULL OPERATION PHASE | 8 | FY 15-16 | 4958404 | - | 4958404 | 3,65,00,000 | *Not exceeding* |
| | 9 | FY 16-17 | 3627114 | 1,71,970 | 3799084 | 3,65,00,000 | *Not exceeding* |
| | 10 | FY 17-18 (upto Aug. 17) | 4074644 | 216271 | 4290915 | 3,65,00,000 | *Not exceeding* |
| | 11 | FY 18-19 | 5008733 | - | 5008733 | 3,65,00,000 | *Not exceeding* |
| | 12 | FY 19-20 | 5448267 | - | 5448267 | 3,65,00,000 | *Not exceeding* |
| Total surface water drawl during violation period ($m^3$) | | | | | 2,79,69,184 | | |

As per the above, no excess surface water was drawn as against the permitted quantity of surface water by ESL during the violation period. Hence, no damage cost has been considered due to surface water consumption and the damage on account of using surface water for industrial activity by ESL plant during construction period and operation period is Rs. 0.0 Cr.

### iii) Impact on Surface water quality

ESL plant treats and recycles all of the wastewater generated within the plant. There is no wastewater discharge into any nearby streams/rivers, which indicates that the Surface water quality of the two prominent rivers viz. River Damodar and River Ijri should remain fairly consistent before and after the construction & operation of the plant.

In order to identify the impacts on surface water quality of streams/rivers in the study area caused due to the plant activities, the surface water quality of Rivers Damaodar and Ijri are compared for water quality in 2006 (prior to violation) and 2020 (after violation). The surface water quality in 2006 has been sourced from the baseline data collected during post-monsoon season, 2006 included as part of Rapid EIA conducted by NEERI in the area. The present data has been collected in post monsoon season, 2020 and details of the same are mentioned in Chapter-3 of this report. The water quality data before and after violation for Damodar River & Ijri Nadi are reproduced as follows.

Table 13.28: Comparison of Surface water quality of Damodar river & Ijri nadi before & after violation period

| Sl. No. | Parameters | Damodar river near Telmucha bridge | | Intake point – Damador river | | Ijri nadi near bridge gate | |
|---|---|---|---|---|---|---|---|
| | | 2006 | 2020 | 2006 | 2020 | 2006 | 2020 |
| 1 | pH Value | 7.8 | 6.77 | 7.4 | 6.97 | 7.9 | 7.28 |
| 2 | Dissolved Oxygen (as $O_2$), mg/l | 8.3 | 5.4 | 7.9 | 6.6 | 8.5 | 6.1 |
| 3 | BOD, 3 days at 27°C, mg/l | 1.8 | 3 | 2.4 | 4 | 1.3 | 2 |
| 4 | Iron (as Fe), mg/l, Max. | 0.21 | 6.78 | 0.02 | 9.07 | <0.01 | 0.713 |
| 5 | Chloride (as Cl), mg/l, Max. | 14 | 20 | 19 | 18 | 24 | 12 |
| 6 | Fluoride (as F) mg/L, Max. | 0.24 | 0.79 | 0.16 | 0.70 | 0.11 | 0.65 |
| 7 | Calcium (as Ca), mg/l, Max. | 68 | 30 | 60 | 24 | 92 | 26 |
| 8 | Magnesium (as Mg), mg/l, Max. | - | 19 | - | 19 | - | 19 |
| 9 | Sodium (as Na), mg/l | 19 | 16 | 12 | 10 | 21 | 15 |
| 10 | Potassium(as K), mg/l | 2 | 4.1 | 3 | 3.5 | 3 | 2.0 |
| 11 | Copper (as Cu), mg/l, Max. | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 12 | Manganese (as Mn), mg/l, Max. | 0.03 | 0.063 | <0.01 | 0.307 | 0.02 | 0.027 |
| 13 | Sulphate (as $SO_4$), mg/l, Max. | 37 | 18.3 | 44 | 19.6 | 45 | 10.7 |
| 14 | Nitrate (as $NO_3$), mg/l | 0.26 | 4.4 | 1.24 | 3.3 | 0.11 | <1 |
| 15 | Cyanide(as CN), mg/l, | - | <0.01 | - | <0.01 | - | <0.01 |
| 16 | Mercury (as Hg), mg/l, Max. | - | <0.0005 | - | <0.0005 | - | <0.0005 |
| 17 | Nickel (as Ni), mg/l, Max. | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 18 | Lead (as Pb), mg/l, Max. | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 19 | Zinc (as Zn), mg/l, Max. | <0.01 | <0.05 | <0.01 | 0.051 | <0.01 | 0.211 |
| 20 | Chromium (as Cr), mg/l, Max. | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 21 | Total Coliform organisms, MPN/100ml | 120 | - | 280 | - | 128 | - |
| 22 | Sodium Absorption Ratio | - | 0.56 | - | 0.37 | - | 0.55 |
| 23 | Free Ammonia (as N) mg/l | - | <0.01 | - | <0.01 | - | |
| 24 | Electrical Conductivity, µmhos/cm | 223 | 301 | 210 | 201 | 296 | 263 |
| 25 | Boron, mg/l | - | 0.122 | - | <0.05 | - | 0.203 |
| 26 | TDS, mg/l | 123 | 299 | 116 | 245 | 163 | 276 |
| 27 | Turbidity, NTU | 51 | 13.7 | 98 | 202 | 8.5 | 2.71 |

The above data when compared with CPCB"s Surface water quality Criteria indicates that the water quality in Damodar River and Ijri Nadi were mostly of Class A and few parameters were in Class B before the construction of the plant. The data collected in 2020 in the post-violation period also shows most parameters for Damodar River and Ijri Nadi to be in Class A and B. However, BOD values at the Intake point of Damodar river has been observed to be high (>3 mg/L). The general pattern of the surface water quality in Damodar River and Ijri Nadi is observed to be fairly consistent before and after the violation period and no adverse impact on the surface water quality is anticipated due to the project activities.

### Wastewater Management Measures

Wastewater generated from various cooling circuits - routed through cooling towers & pressure filters.

Cooling tower blow down - used for dust suppression, slag quenching etc.

Effluent from Caster, Mills, etc. - contain suspended solids, oil & grease - Physico-chemical treatment schemes like oil separation, settling, clarification, filtration etc. employed.

Power plant effluent, backwash of DM water plant are neutralised in Neutralisation pit & treated water is recycled.

Sanitary wastewater including canteen effluent is treated in a Sewage Treatment Plant and reused for Green Belt, Water Sprinkling etc.

Existing 650 $m^3$/h Common ETP - used to treat the wastewater from all the units.

Wastewater generated in Coke ovens is used for quenching purposes.

No Effluent Discharge outside plant – ZLD.

### 13.5.4 Noise Environment

The increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, generator sets, loudspeakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological wellbeing of the people. Excessive noise interferes with people"s daily activities at, at home and during leisure time.

Construction Phase

The location the existing plant and construction at the present location would have impacted the ambient noise levels of the immediate surrounding habitation areas. Before the plant was constructed the back-ground noise levels near the plant area were in the range of 40-55 dB as per the earlier EIA. During the construction because of movement of vehicles, running of DG sets and all other construction activities did increase the noise levels that would have interferes with people"s daily activities.

In order to compensate the damage due to increase noise levels in the ambient environment during construction phase, fines/penalty proposed by CPCB vide Report on "Scale of Compensation to be recovered for Violation of Noise Pollution (Regulation & Control), Rules 2000", for violation of noise pollution norms regarding the use of diesel generator sets & sound-emitting construction equipments are considered. Considering the construction period of 7 years (2008-09 to 2014-15) and compensation rate of Noise @ Rs.75,000/- per month, Damage cost to Noise Environment during the Construction Phase is estimated to be Rs. 75,000 x 7 years x 12 months i.e. Rs. 63,00,000/-.

Operation Phase

During the operation phase, appropriate EMP has been undertaken and the values of Noise levels are within the Industry norms.

However, compensation cost against the Noise Environment during the operation phase is considered under, Rs. 20 Lakhs per year for Regular Environmental Monitoring Cost under 3% of EMP considered in Damage Cost under Table 13.3. Cost of PPE"s has already been considered under the OHS damage cost.

Total damage cost for Noise Environment is estimated as Rs. 0.63 crores.

Mitigation Measures

Noise attenuating sheets were provided during the construction period.
The main source of noise from industry during operation is due to operation of utility equipments, DG set, Air compressors, Cooling towers and movement of vehicle.
Necessary acoustic measure is provided to contain the noise generated from equipment"s.
The vehicles are maintained regularly in good condition to prevent noise generated due to any defect.
All staff are provided with necessary PPE kits.
Regular noise level monitoring is carried out in order to assess the noise levels in the study area.

### 13.5.5 Biological Environment

#### Construction Phase

The damage to Biological environment has already been considered under the damage cost of the Land Environment above.

#### Operation Phase

To estimate the damage cost, number of the trees required to be planted as per the statutory requirement is calculated and the deficit has been considered as the damage cost, already considered under the Land Environment section.

Further, there is no Biosphere Reserve, Ramsar Site, National Park, Wildlife Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in the Study Area. Schedule I animals found in study area are Indian Pangolin & Indian Rock Python. Site-specific Wildlife Conservation Plan has been prepared and Rs. 706.95 Lakhs will be spend for the implementation of the Wildlife Conservation Plan within the period of 10 years (2020-21 to 2029-30).

However, in order to estimate the compensation on account of Biological environment, additional 3% of the budget of the Site-specific Wildlife Conservation plan has been considered under the damage cost for the entire violation duration.

Therefore, damage cost estimated is 3% of Rs. 706.95 Lakhs x 12 years, ie. Rs. 254.50 Lakhs or 2.55 Crores.

### 13.5.6 Socio Economic

In the study are when compared with socio economic conditions before installation of the plant and now. In general socio-economic conditions are improved in the study area. There is a reduction in rural population & agricultural labors, improvement in literacy and main workers. Source of income has been diversified and per capita income has raised. There is no improvement in irrigation facilities in the study area. However, these changes cannot be attributed directly to the construction of the plant. However, due to construction of the plant in the present area, in some parts of the area which was in agriculture use has been diverted.

#### Construction Phase

For assessing the impact of establishment of steel plant during the construction phase, the loss of income from agriculture within the project area has been assessed.

Agricultural situation of the study area indicates that agriculture in this area is moderate. The farmers practice mono cropping due to absence of adequate irrigation facilities. Only a single crop of paddy is cultivated in the study area. The productivity of agricultural crops in the study area is 1.2 t /ha.

In the project area as indicted earlier, as per the revenue records the agrulture use in

the study area was 59.56ha (147.18 acres). The Agricultural income of Rs.12,500/- per acre has been considered (MSP of Bokaro District) for calculating the loss in agriculture income.

Considering the loss of income from agriculture from 2008-09 to 2020 by considering the Rs. 12,500/ acres.

Damage Cost (loss of income from Agriculture): 147.18 acres x Rs.12,500/acre x 12 years = Rs. 2.208 Crores.

Operation Phase

During operation of the plant, ESL has undertaken various steps for upliftment of the Socio economic condition of the region through its CSR activities. However, additionally 3% of the benefit accrued against the profit/EMP during violation period is considered under Community Resource Augmentation Plan (CRAP) for further upliftment of the community resources in the area.

Thus, the total Estimated Damage Cost (Socio-economic) for which Damage Remediation is estimated as ~Rs. 2.21 Crores.

### 13.5.7 Occupational Health and Safety

Construction Phase

All the Occupational Health and Safety compliance had been complied while undertaking the construction of the project. However, in addition to that, to estimate the compensation cost towards Occupational Health and Safety (OHS) during the construction period, Cost of Compliance with Health and Safety Management System among contractor in Construction Industry has been considered. Source (Source: https://www.researchgate.net/publication/270583124_COST_OF_COMPLIANCE_WITH_HEALTH_AND_SAFETY_MANAGEMENT_SYSTEM_AMONG_CONTRACTOR_IN_CONSTRUCTION_INDUSTRY )

Project Cost for the already installed facility is Rs.13,395 Crores. As per the above referred research paper, expenditure towards the compliance against the OHS is maximum upto 0.473% of the project cost. Therefore, cost of OHS Compliance for the project is estimated to be Rs.63.36 Crores.

Therefore, for estimating damage cost towards the OHS compliance, 3% of expenditure of OHS undertaken is being considered as damage cost. Therefore, Damage Cost is estimated to be Rs. 1.90 Crores.

Operation Phase

All the Occupational Health and Safety measures are being undertaken for the safe working at the existing project. However, in addition to that, to estimate the compensation cost towards Occupational Health and Safety (OHS) during the construction period, additional 3% of cost of OHS expenditure during operation period has been considered. OHS Budget for the FY 2020-21 is Rs. 3.18 Crores. Therefore,

Damage Compensation Cost against the Occupational Health and Safety (OHS) during the operation phase (considering 3% of cost of OHS expenditure during operation period) is 3% x Rs. 3.18 Crores/ year x 10 years i.e Rs. 0.95 Crores.

Thus, the total Estimated Damage Cost is estimated as Rs. 1.90 Crores + Rs. 0.95 Crores = Rs. 2.85 Crores.

### 13.5.8 Solid Waste

Construction Phase

a. Construction and Demolition Waste

During the construction period, good housekeeping practice was followed by the ESL. Hoverer, to access the damage cost towards the Solid waste generation during the construction phase, penalty against the generation of C&D waste for Dhanbad area has been considered.
(Source:
http://jkspcb.nic.in/WriteReadData/userfiles/file/cand%20D%20guidelines/guidelines%20for%20cd%20waste.pdf)

Considering a total of ~1925 days of C&D waste generation during violation period and Rs. 1000/- per day of penalty against the generation of C&D waste during the construction period for Dhanbad area. Estimated Damage Cost is Rs. 1000/- per day x 1925 days i.e. Rs. 19,25,000/-.

Additionally, the associated impacts of solid waste generation on air and water environment during construction phase has been considered as the damage cost equivalent to 3% of the total EMP cost.

b. Municipal Solid Waste

Total number of manpower deployed during construction phase is given in Table 13.29 below. The solid waste generated rate is considered 0.17 kg per capita per day.

As per the CPCB report on „Guidelines for Assessment of Environment Compensation to be levied for Violation of Plastic Waste Management Rules 2016", the compensation cost stipulated is Rs. 5000 /tonne of waste generation.

However, for considering damage assessment cost for the present proposal, double the amount of compensation i.e. Rs.10,000/tonne of waste, has been considered for damage due to the municipal solid waste generation during the violation period.

Total MSW generated during the construction phase is shown in Table 13.29 below.

Table 13.29: MSW Generation during Construction phase

| Sl. No. | Year | No. of days of Construction (days) | No. of labours employed | Total Man-days | MSW Generation rate (kg/capita/day) | Total MSW Generated (kgs) |
|---|---|---|---|---|---|---|
| 1. | FY 08-09 | 365 | 568 | 207320 | 0.17 | 35244.4 |
| 2. | FY 09-10 | 365 | 696 | 254040 | 0.17 | 43186.8 |
| 3. | FY 10-11 | 365 | 3893 | 1420945 | 0.17 | 241560.7 |
| 4. | FY 11-12 | 366 | 4917 | 1799622 | 0.17 | 305935.7 |
| 5. | FY 12-13 | 365 | 4804 | 1753460 | 0.17 | 298088.2 |
| 6. | FY 13-14 | 365 | 5804 | 2118460 | 0.17 | 360138.2 |
| 7. | FY 14-15 | 365 | 5904 | 2154960 | 0.17 | 366343.2 |
| | | | 26586 | 9708807 | | 1650497.2 |

Considering Rs. 10,000 per/tonne cost for damage compensation rate of MSW. The total compensation price is estimated to be Rs. 10,000/tonne x 1650.50 tonne i.e Rs. 16504971.9/- or Rs. 1.65 Crores.

Operation Phase

During the operation of the plant all the solid waste generated is being utilized and the hazardous waste are sent to TSDF / Authorised Recyclers. Expenditure for management of the industrial solid waste and hazardous waste is already being undertaken by ESL. Therefore, no additional cost towards the solid waste during the operation is being considered.

## 13.5 Summary of overall environmental/ecological damage cost

The Summary of overall environmental/ecological damage cost assessed during both construction phase and operation phase is presented in Table 13.30, Table 13.31 and Table 13.32, respectively.

Table 13.30: Construction phase -Total Environmental / Ecological Damage Cost

| S.N. | Attributes | Description | Damage Cost (Crore) |
|---|---|---|---|
| 1 | Land Environment | •Use of Forest Land – NPV including penalty raised by State Forest Dept. – covers all damages associated with forest land. (Rs.66,11,68,680/-) | 0.00 |
| | | •Use of Non-Forest Land (Soil Damage Cost) | 0.28 |
| 2 | Air Environment | •Damage Cost due to Construction of Plant (for emissions of pollutants $PM_{10}$, $PM_{2.5}$, $SO_2$ & NOx) | 5.60 |
| 3 | Water Environment | •GW Resource - Damage due to Obstruction to natural GW recharge | 0.99 |
| | | •GW Consumption (Consumed during Construction phase only) | 10.51 |
| | | •SW Runoff (Increase in stress on existing SW drainage) | 8.13 |
| | | •SW Consumption (No SW consumed during Construction phase) | 0.00 |
| 4 | Noise Environment | •Compensation considered with reference to Scale of Compensation to be recovered for Violation of Noise Pollution (Regulation & Control), Rules, 2000– CPCB June, 2020. | 0.63 |
| 5 | Biological Environment | •Damage to the Biological environment has already been considered under the Land Environment section. | 0.00 |

| S.N. | Attributes | Description | Damage Cost (Crore) |
|---|---|---|---|
| 6 | Socio-Economic | •Loss of Income from Agriculture estimated by considering MSP of Bokaro District. | 2.21 |
| 7 | OHS | •3% of the cost of OHS is considered as Damage cost during the construction period. Cost of OHS estimated from Cost of Compliance with Health and Safety Management System among contractor in Construction Industry. | 1.90 |
| 8 | Solid Waste | •Compensation considered against the generation of C&D waste during the construction period. Additionally, the associated impacts of solid waste generation on air and water environment during construction phase has been considered as the damage cost equivalent to 3% of the total EMP cost. | 0.19 |
| | | •MSW generation during construction phase | 1.65 |
| | | Total | 32.09 |

Table 13.31: Operation phase -Total Environmental / Ecological Damage Cost

| S.N. | Attributes | Description | Damage Cost (Crore) |
|---|---|---|---|
| 1 | Land Environment | •ESL has developed green-belt over 74 ha.<br>•However, the total amount for development of 33% area(123.69 ha) has been considered against the compensation cost. | 15.46 |
| 2 | Air Environment | •Damage Cost due to Operation of Plant (for emissions of pollutants PM10, PM2.5, SO2 & NOx) | 110.20 |
| | | •Agriculture Production loss due to Air Emission (In impacted area) | 9.10 |
| 3 | Water Environment | •GW Resource - Damage due to Obstruction to natural GW recharge | 0.36 |
| | | •GW Consumption (Consumed during Construction phase only) | 0.00 |
| | | •SW Runoff- Increase in stress on existing SW drainage (already considered in Construction phase calculation) | 0.00 |
| | | SW Consumption (No excess SW consumed beyond permitted quantity) | 0.00 |
| 4 | Noise Environment | •Compensation cost is considered under EMP as Regular Environmental Monitoring Cost (Rs. 20 Lakhs per year). 3% of EMP considered in Damage Cost separately. | 0.00 |
| 5 | Biological Environment | •3% of the budget of the Site-specific Wildlife Conservation plan has been considered under the damage cost. Damage against the deficit in Green-Belt already considered under the Land Environment section. | 2.55 |
| 6 | Socio-Economic | •3% of the benefit accrued against the profit/EMP during violation period will be utilised under Community Resource Augmentation Plan (CRAP). | 0.00 |
| 7 | OHS | •Damage Compensation Cost during the operation phase is considered as 3% of cost of OHS during operation period. | 0.95 |
| 8 | Solid Waste | •100% of the Solid waste generated is utilised. | 0.00 |
| | | •All the Hazardous waste generation is sent to TSDF / Authorised Recyclers. | |
| | | Total | 138.62 |

Table 13.32: Summary of Total Environmental / Ecological Damage Cost

| A. COST OF ENVIRONMENTAL / ECOLOGICAL DAMAGE | | | | |
|---|---|---|---|---|
| | | Construction | Operation | Total |
| 1 | Land Environment | 0.28 | 15.46 | 15.74 |
| 2 | Air Environment | 5.60 | 119.30 | 124.90 |
| 3 | Water Environment | 19.63 | 0.36 | 19.99 |
| 4 | Noise Environment | 0.63 | 0.00 | 0.63 |
| 5 | Biological Environment | 0.00 | 2.55 | 2.55 |
| 6 | Socio-Economic Environment | 2.21 | 0.00 | 2.21 |
| 7 | OHS | 1.90 | 0.95 | 2.85 |
| 8 | Solid Waste | 1.84 | 0.00 | 1.84 |
| | Total (A) | 32.09 | 138.62 | 170.71 |
| B. SHARE OF PROFIT / ENV. MNGT. MEASURES | | | | |
| | 3% of the accrued profit/ EMP during Violation Period | 4.61 | | |
| TOTAL COST OF ENVIRONMENTAL DAMAGE = A+B | | | | |
| Rs 175.32 Crores | | | | |

As indicated above, the total cost of Environmental damage (including 3% of the profits/ EMP due to the violation) is estimated to be Rs. 175.32 Crores.

## 13.6 PROPOSED REMEDIATION PLAN AND NATURAL AND COMMUNITY RESOURCE AUGMENTATION PLAN (NCRAP)

The environmental / ecological damage as assessed above, the Remediation Plan, Natural Resource Augmentation Plan and Community Resource Augmentation Plan along with budgetary provisions for remediation of damage caused due to violation production is given here under. Summary of Budgetary Provisions for Damage Remediation Plan, Natural Resource Augmentation Plan and Community Resource Augmentation Plan is given in subsequent tables.

The Budgetary allocation towards and Action Plan (implementation schedule) for Damage Remediation Measures, Year-wise Budgetary Plan towards Natural Resource Augmentation Measures and Year-wise Budgetary Plan towards Community Resource Augmentation Measures is given in Tables 13.36, 13.37, and 13.38 respectively. The summary of total budgetary provision is given in Table 13.39 and 13.40 respectively.

Table 13.36: Action Plan (implementation schedule) for Damage Remediation Measures

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| Air & Noise Environment | | | | | | | |
| 1 | Two nos. of 28 KL mist cannon for public road | In order to arrest dust in the public road due to transportation of raw material. 28 KL mist cannon shall be procured and it will be used in the road from Bandhdih to four lane. | No. of Units | 0 | 1 | 1 | 2 |
| | | | (Rs. In Crore) | 0 | 1.25 | 1.25 | 2.5 |
| 2 | Construction of village PCC Roads in place of earthern roads for better connectivity in the villages. (per KM) | (1)NOC from Panchayat (2)Renovation of existing Roads (3)Area Covered: Siyaljori, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh | No. of Units (KM) | 17 | 22 | 29 | 68 |
| | | | (Rs. In Crore) | 9.35 | 12.16 | 15.83 | 37.34 |
| 3 | Development of Biodiversity Park (2 Acre) | | No. of Units | 0 | 1 | continuing | 1 |
| | | | (Rs. In Crore) | 0 | 0.6 | 0.69 | 1.29 |
| | | | Sub-Total | 9.35 | 14.01 | 17.77 | 41.13 |
| Water Environment | | | | | | | |
| 4 | Roof top rain water harvesting in the govt. buildings/Schools | Govt. buildings such as school shall be identified in the nearby villages and roof top rain water harvesting stuructures will be developed. | No. of Units | 6 | 7 | 7 | 20 |
| | | | (Rs. In Crore) | 0.1 | 0.1 | 0.1 | 0.3 |
| 5 | Construction of new Pond & Ghat with Changing rooms for improving water table through better catchment area. | (1)Coverage: All Core Villages (2) NOC and Land from Panchayat | No. of Units | 2 | 4 | 4 | 10 |
| | | | (Rs. In Crore) | 1 | 2 | 2 | 5 |
| 6 | Renovation of Pond & construction of ghat with Changing rooms for improving water table through better catchment area. | (1)Coverage: All Core Villages (2) NOC from Panchayat | No. of Units | 7 | 7 | 8 | 22 |
| | | | (Rs. In Crore) | 1 | 1 | 1 | 3 |
| | | | Sub-Total | 2.1 | 3.1 | 3.1 | 8.3 |
| Land Environment | | | | | | | |

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| 7 | Waste Treatment Plant (10 tons) for villages | 2nos. of waste treatment plant in 2 villages shall be developed for treatment of municipal waste arising in the villages. | No. of Units | 0 | 1 | 1 | 2 |
| | | | (Rs. In Crore) | 0 | 2.5 | 2.5 | 5 |
| 8 | Tractor Trolly for waste lifting for villages | In all core villages the tractor trolly will be provided | No. of Units | 2 | 2 | 3 | 7 |
| | | | (Rs. In Crore) | 0.04 | 0.04 | 0.06 | 0.14 |
| 9 | Procurement of 2 nos. of Mechanical Sweeper machine for cleaning of road dust during transportation in the public road | In order to arrest dust in the public road due to transportation of raw material. 3 nos. of mechanical sweepers shall be procured and it will be used in the road from Bandhdih to four lane. | No. of Units | 0 | 1 | 2 | 3 |
| | | | (Rs. In Crore) | 0 | 0.95 | 1.9 | 2.85 |
| | | | Sub-Total | 0.04 | 3.49 | 4.46 | 7.99 |
| Biological Environment | | | | | | | |
| 10 | Grafted Fruit Plant Distribution in villages | No. of household and common places such as panchayat, school etc in our 7 core villages shall be identified and grafted fruit plant will be distributed to them. | No. of Units | 3333 | 3333 | 3334 | 10000 |
| | | | (Rs. In Crore) | 0.25 | 0.25 | 0.25 | 0.75 |
| | | | Sub-Total | 0.25 | 0.25 | 0.25 | 0.75 |
| | | | Total | 11.74 | 20.85 | 25.58 | 58.17 |

Table 13.37: Year-wise Budgetary Plan towards Natural Resource Augmentation Plan

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| 1 | Construction of Check dams for storage of water | (1) Identified locations: Siyaljori and Hutupathar (2)NOC from Panchayat, PHED (Public Health Engineering Dept.)/Minor irrigation dept. (3)The water shall be used for lift irrigation and drinking purpose | No. of Units | 1 | 1 | 0 | 2 |
| | | | (Rs. In Crore) | 0.6 | 0.6 | 0 | 1.2 |
| 2 | 5 MW Solar Power Plant | 5 MW of roof top solar power plant shall be installed. | No. of Units | 1 | Continue | Complete | 1 |
| | | | (Rs. In Crore) | 2.5 | 10 | 10 | 22.5 |
| 3 | Construction of Hand pump platforms & soak pits for better drainage of water, it will also support to augment the water level of the area. | (1)Coverage: 8 Core Village (2) Installation with support of PHED (3) NOC from Panchayats | No. of Units | 80 | 80 | 100 | 260 |
| | | | (Rs. In Crore) | 0.2 | 0.2 | 0.25 | 0.65 |
| 4 | Construction of new Pond & Ghat with Changing rooms for improving water table through better catchment area. | (1)Coverage: 8 Core Villages (2) NOC and Land from Panchayat | No. of Units | 2 | 3 | 3 | 8 |
| | | | (Rs. In Crore) | 1.5 | 2.25 | 2.25 | 6 |
| 5 | Renovation and cleaning of wells | (1)NOC from Panchayat (2) committee will be formed for the maintainance and they will for cleaning around well | No. of Units | 31 | 31 | 32 | 94 |
| | | | (Rs. In Crore) | 0.1 | 0.1 | 0.1 | 0.3 |
| | | | Total | 4.9 | 13.15 | 12.6 | 30.65 |

Table 13.38: Year-wise Budgetary Plan towards Community Resource Augmentation Plan

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| 1 | Lift Irrigation System from check dam for agriculture purpose | (1) To provide irrigation facility in the area through Lift Irrigation facility. (2) Check dam will be developed in Siyaljori and Huthupather village on Izri River (3) NOC from Govt./Dist. Administration (4) Village Committee will be formed for proper check and balance mechanism. | No. of Units | 1 | 1 | 0 | 2 |
| | | | (Rs. In Crore) | 0.3 | 0.3 | 0 | 0.6 |
| 2 | Establishment of 100 bed Super specialist hospital with modern equipment. | (1) Establishment of Super speciality Hospital (2) Location - Chandankiyari Block (3) Existing Government hospital will be upgraded and converted into the said facility (3) Support and NOC from District Administration/Health Department will be taken. (4) Infrastructure development, instrument and other basic amenities will be provided by Company (5) Operational part will be taken care by Govt. | No. of Units | 1 | Continue | Complete | 1 |
| | | | (Rs. In Crore) | 3 | 8 | 9 | 20 |
| 3 | Renovation of existing PHC centres for improving health infrastructure in the villages. | (1) Renovation and upgradation of existing Govt. Health Sub Centres (2) Location - Sabra, Mohal, Dhandabar, Chandaha,Batbinor (3) Basic facilities like medical instruments, lab items, necessary amenities will be developed by Company (4) Operational part will be taken care by Health Department. | No. of Units | 1 | 2 | 2 | 5 |
| | | | (Rs. In Crore) | 0.5 | 0.75 | 0.75 | 2 |
| 4 | Establishment of Animal Health Care centres | (1) Location - Chas and Chandankiyari Block (2) Existing govt infra structure will be upgraded (3) Operational part will be taken care by dept. | No. of Units | 1 | 1 | 0 | 2 |
| | | | (Rs. In Crore) | 0.15 | 0.15 | 0 | 0.3 |
| 5 | Establishment of skill based vocational training centre for livelihood generation | (1) To support the existing ITI centre of govt. in Chas/Chandankiyari block (2) Support by Company for infrastructure development, making provision of tools , machineries for different trades etc. (3) operational part will be taken care by Govt. | No. of Units | 1 | Continue | Complete | 1 |
| | | | (Rs. In Crore) | 1.5 | 0 | 0 | 1.5 |
| 6 | Renovation of Existing | (1) Existing Aganwari will be converted into Nandghar | No. of Units | 50 | 25 | 0 | 75 |

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| | Aanganwadi centres to improve the government ICDS infrastructure ( Nand Ghar Project) | by renovation of infrastructure (2) Coverage - Bokaro District (3) Total 75 units will be developed | (Rs. In Crore) | 1.68 | 1.7 | 0 | 3.38 |
| 7 | Establishment of Community Centre for social activities in the villages | (1) Total Nos - 8, (2) Location - Siyaljori, chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh (3) Land for construction will be provided by Govt, (4) The centres will be constructed by Company based upon BOQ of Govt. (5) Operational part will be taken care by the respective panchayat. | No. of Units | 2 | 3 | 3 | 8 |
| | | | (Rs. In Crore) | 0.24 | 0.36 | 0.36 | 0.96 |
| 8 | Drainage system to be developed under ESL swachta programme in the villages. | (1) Total coverage - 8 villages namely Siyaljori, chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh (2) Length -8 KM approx. (3) Work will be done by Company | No. of Units | 2 | 3 | 3 | 8 |
| | | | (Rs. In Crore) | 0.6 | 0.9 | 0.9 | 2.4 |
| 9 | Developing archery stadium with sports complex and play ground | (1) Location - 16 Khata (2) Upgradation of the Centre will be done through Infrastructure development, trainers facility, residential facility, archery Kit, gym facility and other resource development. (3) Operational and Monitoring will be done by Company | No. of Units | 1 | Complete | 0 | 1 |
| | | | (Rs. In Crore) | 1 | 1 | 0 | 2 |
| 10 | Smart Classes in Govt./Pvt. Schools | (1) To no of Schools - 20 (2) Villages to be coved - 8 (Siyaljori, chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh), (3) Training and Skill development of Teacher (4) To develop smart classes (5) NOC from Education Department (6) Monitoring will be done by respective schools. | No. of Units | 5 | 10 | 5 | 20 |
| | | | (Rs. In Crore) | 0.175 | 0.35 | 0.175 | 0.7 |
| 11 | Infrastructure development of Govt. / Pvt. Schools (Building, Toilets, Kitchen, Boundary etc.) | (1) To no of Schools - 20 (2) Coverage - 8 Village ( Chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh), (3) Entire infrastructure development through Company (upgradation of building, toilet, kitchen, boundary wall etc). (5) NOC from Education Department (6) Operational part will | No. of Units | 5 | 10 | 5 | 20 |
| | | | (Rs. In Crore) | 0.91 | 1.51 | 0.92 | 3.34 |

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| | | be taken care by Govt. | | | | | |
| 12 | Establishment of Mid Day Meal Kitchen | (1) Centralized mid-day meal kitchen will be established for Govt. schools of Chas & Chandankiyari Block (2) Coverage - all Govt. Schools of Chas & Chandankiyari Block (3) Operation - Through NGO under ICDS prog. | No. of Units | 0 | 1 | 0 | 1 |
| | | | (Rs. In Crore) | 0 | 5 | 0 | 5 |
| 13 | Establishment of Rural Market | (1) To provide facility of Rural Haat/Market (2) Location - Chas and Chandankiyari Block (3) Construction of Infrastructure, provision for sanitation, drinking water facility, sitting arrangement etc (4) Operation part will be taken care by local govt authority , cleaning, monitoring etc | No. of Units | 0 | 1 | 1 | 2 |
| | | | (Rs. In Crore) | 0 | 0.5 | 0.5 | 1 |
| 14 | Providing Bus facilities to the children of near by villages | (1) To access better education facility in Bokaro English Medium School , Bus facility will be provided to the children of nearby villages(2) Coverage - 4-5 villages (3) Monitoring - Company | No. of Units | 4 | 0 | 0 | 4 |
| | | | (Rs. In Crore) | 1 | 0 | 0 | 1 |
| 15 | Installation of Solar Street Light for better connectivity | (1) Solar based street light facility will be provided for better access during night (2) Coverage - 8 villages (Siyaljori, chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh), (3) NOC from Government/Panchayat (4) Monitoring by Village Committee | No. of Units | 185 | 185 | 0 | 370 |
| | | | (Rs. In Crore) | 0.46 | 0.46 | 0 | 0.92 |
| 16 | Solar high mast Light at common locations | (1) To create provision of street light for better access during night (2) Coverage - 8 villages (alkusha, bandhdih, bijulia, buribinor, bijulia, Bhagabandh, Dhandabar, siyaljori), (3) NOC from Government/Panchayat (4) Monitoring by Village Committee | No. of Units | 8 | 0 | 0 | 8 |
| | | | (Rs. In Crore) | 0.4 | 0 | 0 | 0.4 |

| Sl.No | Activities | Particulars | Physical Target/ Cost | 21-22 | 22-23 | 23-24 | Total |
|---|---|---|---|---|---|---|---|
| 17 | Establishment of Solar operated Water ATM for safe drinking purposes | (1) Total Nos of Water ATM - 62, (2) Coverage 8 villages namely Siyaljori, chandaha, Buribinor, Alkusha, dhandabar, Bhandih, Huthupather, Bhagabandh (3) Monitoring - Village Committee | No. of Units | 20 | 20 | 22 | 62 |
| | | | (Rs. In Crore) | 4.4 | 4.4 | 4.84 | 13.64 |
| 18 | Availability of tap Drinking water from check dam | (1) To provide drinking water facility in villages through water tank, pipe line and tap connection for each households . (2) Coverage - 4 villages (3) NOC by PHED dept (4) Monitoring by Village committee | No. of Units | 1 | 1 | 2 | 4 |
| | | | (Rs. In Crore) | 2 | 2 | 4 | 8 |
| 19 | Purchasing of Ambulance | (1) Location - Chas & Chandankiyari PHC, (2) Nos - 2 ambulance, (3) To provide two new ambulance with proper branding (4) Operational part will be taken care by Health Dept. | No. of Units | 0 | 1 | 1 | 2 |
| | | | (Rs. In Crore) | 0 | 0.2 | 0.2 | 0.4 |
| 20 | Model College | One model college will be established for Chas/ Chandankiyari area. Land will be provided by the Govt. | No. of Units | 0 | 1 | 0 | 1 |
| | | | (Rs. In Crore) | 0 | 15 | 0 | 15 |
| 21 | Construction of Marriage Hall | Location-Siyaljori, Budhibinor, Bhagabandh, Hutupathar, Alkusa, bandhdih, Dhandabar | No. of Units | 2 | 3 | 2 | 7 |
| | | | (Rs. In Crore) | 1 | 1.5 | 1 | 3.5 |
| 22 | School for Disabled Children | Location - Chas Block | No. of Units | 0 | 0 | 1 | 1 |
| | | | (Rs. In Crore) | 0 | 0 | 0.46 | 0.46 |
| | | | Total | 19.315 | 44.08 | 23.105 | 86.5 |

Table 13.39: Summary of Total Budgetary Provision

| Description | Estimated Budget (in Cr. Rs) |
|---|---|
| Damage/remediation with respect to ecological aspects | 58.17 |
| Natural Resources Augmentation Plan for three years | 30.65 |
| Community Resources Augmentation Plan for three years | 86.50 |
| Total Budgetary Provision | 175.32 |

The summarised year action plan for implementation of the funds allocated for Damage remediation along with NCRAP is as given table below:

Table 13.37: Summary of Damage Remediation Plan, Natural Resource Augmentation Plan and Community Resource Augmentation Plan

| Sl. No. | Activity Proposed | Year-1 (Rs. Cr.) | Year-2 (Rs. Cr.) | Year-3 (Rs. Cr.) | Total (Rs. Cr.) |
|---|---|---|---|---|---|
| 1. | Damage Remediation Plan | 11.74 | 20.85 | 25.58 | 58.17 |
| 2. | Natural Resources Augmentation Plan | 4.9 | 13.15 | 12.6 | 30.65 |
| 3. | Community Resources Augmentation Plan | 19.315 | 44.08 | 23.105 | 86.50 |
| | Total Fund | 35.96 | 78.08 | 61.29 | 175.32 |

ESL shall submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with JSPCB prior to the grant of EC. The quantum shall be as recommended by the EAC and finalized by MoEFCC. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the EAC and approval of MoEFCC.

The SPCB has undertaken credible action against ESL Steel Ltd. under the provisions of Environment (Protection) Act, 1986, the copy of the same is attached as Annexure 13.2.