4.0 ANTICIPATED ENVIRONMENT IMPACTS AND MITIGATION MEASURES

4.1 Preamble

Generally, the environmental impacts can be categorized as either primary or secondary. Primary impacts are those, which are attributed directly by the project and secondary impacts are those, which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the proposed actions. The details of criteria opted for impacts assessment are as per described hereunder:

Processes that may create risk to the environment are considered and are analyzed in terms of key potential environmental impacts. Actual and foreseeable events, including operational and typical events are discussed in this chapter.

The environmental impacts may include all those that are beneficial or adverse, short or long term (acute or chronic), temporary or permanent, direct or indirect and local or regional. The adverse impacts may include all those leading to harm to living resources, damage to human health, hindrance to other activities, impairment of quality for use, reduction of amenities, damage to cultural and heritage resources, and damage to physical structures. For each identified potential environmental impact, the associated environmental risk is assessed based on its likelihood and significance. For the proposed expansion, the impacts assessment is being performed in three steps:

- Step 1 : Identification of interactions between activities and environmental receptors
- Step 2 : Identification of potentially significant environmental impacts
- Step 3 : Evaluation of all significant environmental impacts

In Step 1, based on the project description and environmental baseline description, a detailed matrix of activities and environmental receptors is prepared. Then based on the legal framework and baseline environment data, it is determined whether an interaction exists between an activity and a receptor.

In Step 2, based on the interactions identified in Step 1, potentially significant impacts due to the proposed changes are identified. The impacts may be beneficial/adverse, direct/indirect, reversible/irreversible and short-term/long-term as per criteria given in **Table 4.1a**.

Table 4.1a: Impact Rating Assessment Matrix

Impact		Criteria
Nature of impact	Beneficial	Positive
	Adverse	Negative
Duration of impact	Short term	Impacts shall be confined to a stipulated time
	Long term	Impacts shall be continued till the end of plant life
Impacted Area	Localized	Impacts shall be confined within 10 km radius
	Regional	Impacts shall be continued beyond 10 km radius

In Step 3, all the potentially significant impacts are evaluated and a qualitative evaluation is made. An impact level is rated as "low", "medium" or "high". The impact rating is based on two parameters i.e. the "severity of impact" and the "likelihood of occurrence of impact".

- **Severity of Impact**: The severity of an impact is a function of a range of considerations including impact magnitude, impact duration, impact extent, compliance of prescribed legal framework and the characteristics of the receptors/ resources; and
- **Likelihood of Occurrence**: How likely is the impact (this is particularly important consideration in the evaluation of unplanned/ accidental events)?

The significance of each impact is determined by assessing the impact severity against the likelihood of the impact occurring as summarized in the impact significance assessment matrix provided in **Table 4.1b**.

Table 4.1b: Impact Rating Assessment Matrix

Impact Severity	Impact Likelihood			
	Unlikely (e.g. Not expected to occur during project lifetime)	Low Likelihood (e.g. may occur once or twice during project lifetime)	Medium Likelihood (e.g. may occur every few year)	High Likelihood (e.g. Routine, happens several times a year)
Slight	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
Low	Negligible Impact	Negligible Impact	Negligible to Minor Impact	Minor Impact
Medium	Negligible Impact	Minor Impact	Minor–Moderate Impact	Moderate Impact
High	Minor Impact	Moderate Impact	Major Impact	Major Impact

Notes:

Negligible Impact	:	*Defined as magnitude of change comparable to natural variation*
Minor Impact	:	*Defined as detectable but not significant*
Moderate Impact	:	*Defined as insignificant; amenable to mitigation; should be mitigated where practicable*
Major Impact	:	*Defined as significant; amenable to mitigation; must be mitigated*

KGSL's primary purpose and need for the proposed expansion is firstly to utilize the locally available infrastructure and raw material for manufacture of steel and secondly in

turn contribute in the social development of the study area/region directly or indirectly. The likely impacts of the proposed expansion would be due to:

- Construction phase which would be regarded as temporary or short term; and
- Operation phase, which would have long-term impacts.

The construction and operation phase of the proposed expansion comprises of various activities each of which has been considered to assess the impact on one or other environmental parameter as per given below:

KGSL's management is conscious of the continuous threat posed by pollution to society and is committed to use best environment management practices at planning & design stage during construction and operation phase. **KGSL** shall implement the requirements as mentioned in CREP in totality.

The *mitigation measures* have been designed within the framework of various Central/ State legislative and regulatory requirements on environmental and socio-economic aspects aiming at the following:

- To minimize disturbance to native flora and fauna;
- To prevent air, water, soil and noise pollution;
- To protect sites of historical, cultural and archaeological significance, if any; and
- To encourage the socio-economic development.

The impacts of the proposed expansion and corresponding mitigation measures designed/planned during construction and operation phase are described simultaneously.

4.2 Construction Phase

The construction activities will be carried out within:

- Existing plant site; and
- ROW of routes for water pipeline from Gandikota reservoir.

KGSL is committed to use best practices/standards in the steel industry for dust suppression and safety measures during the construction period. These practices/standards will act as a basis for implementation of the environmental management plan during the construction phase and will help in reduction of anticipated adverse impacts.

Construction activities normally spread over pre-construction, preparatory construction, machinery installation and commissioning, laying pipelines, testing and end with the induction of manpower and startup.

Pre-construction phase involves completion of all legal formalities with respect to No Objection Certificates from the various statutory bodies, surveys/ studies required, finalization of contract for procurement of machinery/ equipments, recruitment and hiring of requisite skilled, semi-skilled manpower and labour, provision of space and other facilities like water supply, disposal of wastewater and solid waste, etc. on temporary basis for the contracted labour to be employed and provision for storage of machinery and materials to be used for construction.

Preparatory construction phase mainly consists of transportation of machinery and materials to be used for construction, clearing and leveling of land, transportation of machinery/equipment to the site, construction of foundations, buildings and approach roads required for installation of the same etc

Machinery installation and commissioning phase involves activities like cutting, welding and construction of buildings and other facilities, laying of cables and pipelines, installation of machinery, testing etc.
Induction of manpower and start up is self-explanatory which also involves testing of plant for any type of leakages and designed capacity.

4.2.1 Components Creating Impacts on Natural Environment

- **Climate**

Climate is mainly governed by regional characteristics. Construction activities will not affect these regional characteristics, hence no impact is envisaged.

- **Land Use Pattern**

Proposed expansion is planned within the premises of existing plant; hence no additional land is required for proposed expansion.

However, 9.31 hect. land is envisaged to be procured for water pipe line (*refer Chapter 2 for details*) which is very small as compare to the total study area. Hence, the impact on the land use pattern of the study area is as per given below.

Impact Rating	Land Use pattern
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

- Land utilization and clearing for construction site will be kept at the absolute minimum practicable;
- Construction site would be designed to minimize the removal of soil and vegetation; and
- Topsoil will be cleared and stored for later reinstatement purposes by piling it along a boundary of the site and pipeline.

❑ **Ecology**

As mentioned in *Chapter 3*, study area consists of 2.66% area as forest land and the nearest reserved forest is at a distance of more than 10 km from plant site. Flora & fauna present in the study area are of common types.

As the construction phase will be mainly confined to the proposed project site only and estimated land to be required for ROW of water pipeline is 9.31 hect. Study area has the reasonably good road and railway network for transportation of construction material, hence, impact on the ecology due to construction of the proposed expansion is rated as per given below:

Impact Rating	Ecology
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

- Land clearing for construction site will be kept at the absolute minimum practicable;
- Construction site would be designed to minimize the removal of soil and vegetation;
- Check dams and adequate diversions shall be provided to divert storm water;
- Mitigation measures as defined in air, water and soil quality in subsequent paragraphs will further dilute the impacts on ecology;
- Horizontal Directional Drilling (HDD) will be used at the crossing of water bodies, roads and railway tracks for laying the pipeline, if any; and
- About 33.0% of total land project area is earmarked for greenbelt development/plantation.

❑ **Topography and Drainage Patten**

The general topography of the study area is determined by hills on the northern side with an elevation of 300-360 m above mean sea level. The remaining area is more or less plain with the altitudinal variation from 225-250 m mean sea level. The project site experiences a general slope from west to east with average altitude of 225.5 m above sea level.

Impact on topography and drainage pattern will be confined to project site only. With provision of adequate diversions and storm water drainage system, the impact on drainage pattern will be insignificant and irreversible. Hence, overall impact on topography and drainage pattern is rated as per given below.

Impact Rating	Topography & Drainage Pattern
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

- Land clearing for construction site will be kept at the absolute minimum practicable;
- Horizontal Directional Drilling (HDD) will be used at the crossing of water bodies, roads and railway tracks for laying the pipeline, if any; and
- Adequate diversions for storm water will be provided within the project premises.

❑ **Water Resources**

During the construction phase of proposed expansion, estimated total water requirement is 50-100 m^3/day, depending upon the type of construction activities. This requirement of water will be drawn through Pennar river and Gandikota reservoir as per granted permission.

The ground water in the study area occurs under semi confined to confined state in the granite & sedimentary strata while in an unconfined state in the alluvium strata. The depth of weathering is limited to 10 to 12 m but fractures occur intermittently to different depths down to 300 m. Depth of ground water level vary from 15 to 40 m during pre-monsoon and 6-12 m during post monsoon season in granitic terrain but in the sedimentary terrain it ranges from 12-25 m during pre-monsoon and 4-8 m during post monsoon season.

Hence, interference of the construction activities to the ground water will not be significant. It is recommended to carry out foundation work during pre monsoon season. Hence, overall impact is rated as per given below.

Impact Rating	Water Resources
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Low
Significance of impact	Negligible

Mitigation Measures

- Adequate water supply arrangement will be made at the construction site;
- Continuous attempt will be made to optimize/reduce the use of water;
- Continuous attempt will be made to avoid wastage and leakage of water;
- Regular record of water consumption on daily basis will be maintained;
- It is recommended to carry out the foundation work during pre monsoon season;
- Toilets and bathrooms on temporary basis will be provided at site; and
- Regular records of water flow of Pennar river and water level of Gandikota reservoir will be maintained.

❑ **Air Quality**

The sources of air emission during construction phase will include site clearing, removal and stockpiling of excavated soil, storage and handling of the construction materials, civil & mechanical works, movement of vehicles to be used for transportation of men and materials to the site and operation of construction equipment/machinery and camp site.

Emissions from them are expected to result in degradation of air quality, primarily in the working environment affecting employees involved in the construction activities. However, Suspended Particulate Matter (SPM) in the ambient air will be coarse and would settle within a short distance close to the construction site so measures will need to be taken to protect workers. Hence, dust and other emissions are unlikely to spread sufficiently to affect the surroundings of the construction site.

Traffic to the different sites during construction will be more intensive and much heavier than at present in normal operating conditions. In turn, it will subject existing roads to more stress. The present road conditions are reasonably good for proposed movement of traffic.

Gaseous emission like SO_2, NOx, CO, HC are also anticipated as a result of burning of fuel to accomplish construction phase due to operation of machinery /equipment.

As construction activities will be mainly confined to project site only except for water pipeline and for short duration, hence the impact on the ambient air quality during construction and development phase is rated as per given below.

Impact Rating	Ambient Air Quality
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Construction materials will be fully covered during transportation to the project site by road;
- Land clearing for construction site will be kept at the absolute minimum practicable;
- Construction site would be designed to minimize the removal of soil and vegetation;
- Topsoil removed will be preserved for later reinstatement purposes by piling it along a boundary of the site;
- Dust suppression systems (water spray) will be used as per requirement at the construction site; and
- Earth moving equipment, typically a bulldozer with a grader blade and ripper will be used for excavation work.

❑ **Noise Level**

The general noise level due to construction activities such as working of heavy earth moving equipment and machinery installation may sometimes go upto 90 dB(A) at the work sites during day time. The workers in general are likely to be exposed to an equivalent noise level of 80-90 dB(A) in 8 hour shift for which all statutory precautions as per the law will be implemented. Use of proper Personal Protective Equipment (PPE) will further mitigate adverse impact of noise on the workers, if any. The impacts can be further minimized and made insignificant by using standard practice of construction. The present noise level, monitored in the study area is well within the prescribed standard by CPCB/APPCB

Hence the impact on the noise level during construction and development phase is rated as per given below.

Impact Rating	Noise Level
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Provision of rubber padding/noise isolators;
- Preventive maintenance of the machine/equipments will be carried out;
- Provision of silencers to modulate the noise generated by machines; and
- Provision of protective devices like ear muff/plugs to the workers.

❑ **Water Quality**

The wastewater generated during construction phase will be mainly from domestic activities. The strength of total skilled, semiskilled and labour required for construction shall be 1000 (peak) and 500 (average). Wastewater generated from domestic purposes will be minimal as most of the workers will be from local area,.

The ground water in the study area occurs under semi confined to confined state in the granite & sedimentary strata while in an unconfined state in the alluvium strata. The depth of weathering is limited to 10 to 12 m but fractures occur intermittently to different depths down to 300 m. Depth of ground water level vary from 15 to 40 m during pre-monsoon and 6-12 m during post monsoon season in granitic terrain but in the sedimentary terrain it ranges from 12-25 m during pre-monsoon and 4-8 m during post monsoon season.

Dewatering may not be envisaged, as the minimum ground water table in the study area varies from 4 to 8 m.

During monsoon period, the wastewater may be generated from soil erosion. Soil erosion at project site would be increased as a result of excavation of topsoil. This may result in suspended solids and turbidity in run off water during the monsoon period. However, this impact will be temporary in nature.

Hence, overall impact is summarized as hereunder:

Impact Rating	Water Quality
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Major site clearing and excavation work will not be planned during monsoon season;
- Separate drains will be provided for draining storm water to the possible extent;
- All the debris resulting from the site will be isolated from the waste water and disposed off separately;
- A sediment trap will be provided to prevent the discharge of excessive suspended solids;
- An oil trap will be provided in the drainage line to prevent contamination by accidental spillage;
- To prevent contamination from accidental spillage of oil, the storage areas will be bunded and will be inspected and cleaned at regular intervals;
- It is recommended to carry out the foundation work during pre monsoon season ;
- Adequate treatment plan will be prepared before discharging of water, if foundation work is to be carried out during post monsoon season;
- Wash down area for cleaning of vehicles wheels will be provided and wheel wash waste will be drained properly and routed through oil trap;
- The contractor shall minimize the use of biocides, corrosion inhibitors during hydro statistically testing pipelines/flow lines and dyes. Low toxic chemicals shall be used wherever feasible;
- Precaution shall be taken to ensure that no spoil banks are formed as a result of pipeline laying. This shall ensure minimum alteration of sedimentary patterns of the flowing water bodies;
- Reinstate the existing surface flow conditions wherever diversion of flow of streams, ditches, culverts etc are required in the course of pipeline laying;
- The ground flow lines shall be laid below the ground level to a sufficient depth where the line crosses dunes, roads, access tracks or watercourses to ensure the protection of integrity of line;
- Waste water to be generated from the domestic activities at site shall be sent to existing soak pit after passing through the septic tanks.

❑ **Soil Quality**

During construction phase, solid waste such as excavated soil, debris, metal waste and oil & grease from construction machinery/equipment will be generated. This waste may contaminate soil at construction sites temporarily and would be restricted to a small area. Excavated topsoil will be used for backfilling and on completion of construction, all waste will be cleared as soon as possible.

During the construction phase, hydraulic oil, fuels and lubricating oils would be used. There is potential for accidental spills while re-fuelling or servicing vehicles and through breakage due to wear and tear. Procedures for maintenance of equipment would ensure that this risk is minimized and cleanup response is rapid if any spill occurs.

During construction phase, waste oil shall be generated as and when lubricating oil is changed. Waste oil shall be collected through the drain ports and stored in leak proof steel drums and sent to the "Spent Oil Storage Site". The waste oil drums shall be properly identified with label of what is contained in Telgu, Hindi and English. Waste lubricant generated shall be given to outside party for treatment, which shall be again used in the plant.

The solid waste generated by workers as municipal waste will be minimal as most of them belong to local area. The solid waste so generated shall be collected and disposed off as municipal waste to the site allocated by local administrative authorities.

Other solid waste like debris, metal pieces, cotton waste etc so generated will be collected and segregated and will be disposed off as per standard practice.

The overall impact is summarized as hereunder:

Impact Rating	Soil Quality
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Land clearing for construction site will be kept at the absolute minimum practicable;
- Construction site would be designed to minimize the removal of soil and vegetation;
- Topsoil will be cleared and stored for later reinstatement purposes by piling it along a boundary of the site;
- Every care will be taken to prevent soil erosion. Compaction and stabilization will be resorted during backfilling to ensure that no top soil is washed away;
- Ensure restoration of land surface and landform consistent with the condition and contours prior to commencement of construction;
- Reinstating the access ways to pre-development condition, particularly where the ROW crosses major water courses, roads or railway tracks;

- Litter, fuel, oil drums, used grease cartridges would be collected and removed properly;
- Dust bins will be placed at requisite locations; and
- Lubricating waste oil will be collected separately in drums and will be handed over to the authorized outside agency by APPCB as per CPCB guidelines.

4.2.2 Components Creating Impacts to Socio-Economic Environment

The components of the construction phase that could result in effects on the socio-economic environment include the following:

❑ **Property Management**

Proposed expansion is envisaged within the premises of existing plant hence no additional land is proposed to be acquired. However approximately 9 -10 hect land is envisaged for water pipeline from Government pumping station at village Kibile Bommepalle. This pumping station is responsible for distribution of water from Gandhikota reservoir.

Route for the pipeline is yet to be finalized. Private land will be procured as per mutually agreed terms within the state government policy framework while government land will be procured as per state govt. rules. Total land to be acquired is insignificant in comparison to the study area. Oustee will get adequate compensation which will create new business opportunities. Hence, overall impact is rated as:

Impact Rating	Property Management
Nature of impact	Beneficial
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

KGSL is committed to provide the compensation to the oustees as per the *Andhra Pradesh RESETTLEMENT AND REHABILIATION POLICY,2005 as amended thereof, if any* notified by Government of A.P.

❑ **Employment**

In addition to **KGSL** staff, the strength of total skilled, semiskilled and labour required for construction shall be 1000 (peak) and 500 (average). The labour strength engaged in the construction will depend upon construction activities, since many items of construction are labour intensive. Most of the unskilled and semi-skilled labour will be by and large available from the nearby villages and towns. Thus, impact on the physical and aesthetic resources will be minimal.

Further local skilled, semi skilled and unskilled labourers will get indirect employment during the construction phase. This might also result in a steep rise in agricultural wages in the surrounding villages, especially at the time of harvesting for short duration.

In addition to direct employment, several opportunities for locals will be available in terms of supply of construction materials & machinery, vehicles and other essential commodities.

Hence, overall impact is rated as:

Impact Rating	Employment
Nature of impact	Beneficial
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Low
Significance of impact	Negligible

Mitigation Measures

- Preference will be given to locals for temporary direct and indirect employment;
- Local suppliers for machineries and construction materials will be given preference; and
- Local transporters will be preferred for transportation of machinery/ materials.

❑ **Disturbance to Community Resources and Safety**

The disturbance to the community resources and safety will be mainly due to transportation of machinery and materials through public roads due to increase in the local traffic. There is a requirement for warning signs to minimize damage to the third-party vehicles. In addition, risk to public need to be managed by making mandatory for placing warning sign on vehicles and keeping vigilance during transportation by proper training and adequate manpower on board. Hence overall impact is rated as:

Impact Rating	Disturbance to Community Resources and Safety
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Low
Significance of impact	Negligible

Mitigation Measures

- Proper planning and communication with traffic police;
- Advance notice to local administration about the activities;
- Proper cordon off the site with sign boards;
- Diversion of traffic, if required;
- Placing the warning sign board on the vehicles during transportation of machinery and materials; and
- Proper training to the drivers about public safety.

4. 3 Operation Phase

Operation phase of the proposed expansion mainly comprises of the following activities:

- Transportation of additional raw materials to the plant site;
- Storage and handling of additional raw materials;
- Processing of additional raw materials;
- Cooling and heat recovery;
- Packing & Despatch of products;
- Operation of Waste Heat Recovery Boilers etc.; and
- Operation of Demineralised (DM) plant and softener.

Details of wastes anticipated during operation phase are as follows:

- Air emissions from operations as defined above, will be Dust, NO_x, SO_2 CO and unburnt hydrocarbons. The pollutants of concern are Dust i.e. Particulate Matter and Sulphur Dioxide (SO_2);
- Dry process is proposed to be adopted for manufacturing of steel. However, waste water generation shall be mainly anticipated from
    - Blow down from Waste Heat Recovery boilers;
    - Back washes from DM plant and softener; and
    - Domestic usages from plant and township.

- Solid waste shall be mainly generated from process, ESPs & bagfilters, water treatment plant, wastewater treatment plant, waste lubricating oil from machinery/equipments and municipal waste from domestic usages; and
- Accidental spillage of oil, if any.

4.3.1 Components Creating Impacts on Natural Environment

❑ **Climate**

Climate is mainly governed by regional characteristics. Operation of proposed expanded plant will not affect these regional characteristics, hence no impact is envisaged.

❑ **Land Use Pattern and Cropping Pattern**

The overall indirect impact on the land use is considered as positive due to adoption of latest methods of sowing and irrigation as there is likelihood of increase in purchasing power of local habitats, which could be attributed to the improvement in income due to direct and indirect employment opportunities. There is likely to be no change in the cropping pattern in the close vicinity of the plant from the prevalent cropping pattern.

Hence, overall impact is rated as:

Impact Rating	Land Use pattern and Cropping Pattern
Nature of impact	Beneficial
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

- A qualified agriculture expert will be deputed for providing assistance to the villagers ; and
- Awareness camps shall be organized in coordination with state govt. for providing information about "How to Increase the Crop Yield".

❑ **Ecology**

The overall impact on the terrestrial ecology can be considered positive as green belt will be developed and maintained by **KGSL**. 33% of the total plant area has been kept for green belt development/plantation.

It is evident from the above discussion that the study area does not have any ecological sensitivity except Dabbadhapalle Reserve Forest which is more than 10 km from the project site. . Hence, overall impact is rated as:

Impact Rating	Ecology
Nature of impact	Beneficial
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- The species proposed to be planted will be selected based on the criteria prescribed by CPCB as "Guidelines for Developing Greenbelts";
- Local species shall be preferred and shall be planted @1500 per hect;
- A qualified horticulturalist will be deputed for proposed greenbelt development/ plantation; and
- Proper fencing shall be carried out around the area where plantation is being carried out.

❑ **Impact on Ambient Air Quality**

A. Emission of Green House Gases

It is proposed to produce 59 MW power by waste heat recovery from Coke oven plant and Blast furnace which in turn shall save the burning of fossil fuel for generation of equivalent amount of power. Hence, net reduction in CO_2 emission.

The proposed expansion is designed with state of art technology and will follow the best applicable standard for emission of CO_2 per tonne of coal burned. Continuous efforts will be made for reduction of CO_2 emission, if adequate viable commercial technology shall be available.

B. Conventional Emission

The main sources of the pollution from the operation of proposed project are:

- Combustion of Iron ore, coal and other additives;
- Handling of raw materials; and
- Handling of solid waste to be generated.

Anticipated pollutants are particulate matter, sulphur dioxide (SO_2), oxides of Nitrogen (NOx) and carbon monoxide (CO). Oxides of Nitrogen will be controlled by optimizing core flame temperature while Carbon monoxide will be controlled by ensuring complete combustion.

The details of air pollution generation and its management during operation are given in **Table 4.2** and described hereunder:

Table 4.2: Details of Air Pollution Generation and Management

Sn	Particulars	Sources	Parameter	Control/Treatment
1	Stack emission	Stacks as mentioned in Table 2.15 & 2.16	SPM, SO_2, NOX & CO	1. ESP, bagfilters etc with designed outlet dust concentration of 50 to 150 mg/Nm^3; 2. Stack height as per $14Q^{0.3}$, where Q is the SO_2 generation in Kg/hr; 3. A well-designed burner system to limit the core flame temperature to keep the NOx concentration; and 4. Keeping a positive oxygen balance.
		DG sets		1. Stack height as prescribed by CPCB/APPCB
2	Fugitive Emission	Crushers and storage silo	SPM	1. Bag filters with designed outlet dust concentration of 50 mg/Nm^3
		Transfer points during collection and transportation of coal and ash		1. Bag filters with designed outlet dust concentration of 50 mg/Nm^3 2. Pneumatic conveying system for fly ash transportation 3. Water sprinklers and spray system
		Storage of raw materials and waste materials		1. Water sprinklers and spray system
3	Thermal Emission	Boilers and pipelines used for steam	Heat	1. Adequate thickness of insulating material with proper fastening shall be provided

Hence based on the above discussion and considering ambient air quality of the study area, dust and SO_2 have been considered as critical pollutants for dispersion modelling.

- ***Dispersion Modelling***

Prediction of Incremental Ground Level Concentrations (GLCs) of particulate matter and SO_2 is carried out by using Industrial Source Complex Short Term Model Version-3 (ISCST 3) software developed by US Environmental Protection Agency (USEPA). This model uses a steady state, sector-averaged Gaussian plume equation for application in complex terrain (i.e. terrain stack or release height) and stability classes developed by Pasquill and Gifford. The following assumptions are made while using the model:

- No dry and wet depletion of pollutants; and
- Receptors are on flat terrain with no flagpole.

The details of main stacks attached to proposed expansion and emissions to be released from them are as per given in **Table 4.3**.

Table 4.3: Source/ Release Characteristics from Proposed Expansion

Section	Stack	Details of Stack			Details of Stack Gas			PM		SO_2	
		Number	Height (m)	Dia (m)	Temp (0K)	Velocity (m/s)	Volumetric flow rate (m^3/hr)	mg/Nm^3	g/s	mg/Nm^3	g/s
Sinter Plant (1)	M/C Stack	1	50	3	423	11	300000	100	5.87	-	-
	Cooler Stack	1	40	3	423	9.2	234000	100	4.58	-	-
Sinter Plant (2)	M/C Stack	1	60	4	423	11	480000	100	9.39	-	-
	Cooler Stack	1	40	4	423	8.2	374000	100	7.32	-	-
Coke Oven	WHRB 01	1	40	2	473	13.7	155000	50	1.36	120	3.26
	WHRB 02	1	40	2	473	13.7	155000	50	1.36	120	3.26
	WHRB 03	1	40	2	473	13.7	155000	50	1.36	120	3.26
BF	WHRB	1	62	2.05	423	16	179856	150	5.28	200	7.04
SMS (02)	SMS Main Stack	1	70	1.4	338	12	70000	150	2.57	-	-
BF(02)	Slag Granulation Stack	1	35	1.7	344	2.14	17500	150	0.63	-	-
Lime/Dolo calcination plant (300 TPD)	Lime / Dolo plant stack	1	50	1	423	18	52000	150	1.53	-	-
Lime/Dolo calcination plant (100 TPD)	Lime / Dolo plant stack	1	40	0.6	423	18	18000	150	0.53	-	-

Note: Stack details and process parameter as given in Table 4.5 are tentative and exact details will be worked out during detailed engineering.

- **SPM**

Maximum 24 hourly average incremental GLCs of SPM during operation of proposed expansion are predicted for the grid size of 250mx250m and 101 grids. The first maximum 50 values of 24 hourly incremental GLCs of SPM are given in **Table 4.4**.

Table 4.4: 24 Hourly Average Incremental GLCs of SPM (µg/m^3)

Sn	Conc.	Receptor (X, Y)	Sn	Conc.	Receptor (X, Y)
1	14.70	750,1000	26	9.83	1750,1500
2	14.27	1000,1250	27	9.73	1750,1250
3	13.76	500, 750	28	9.72	0, 1000
4	13.25	1250,1500	29	9.62	2000, 2250
5	13.21	1000,1000	30	9.60	1500,1000
6	12.67	750, 750	31	9.59	2000, 2000
7	12.62	1250, 1250	32	9.55	1250,1000
8	12.32	1000, 1500	33	9.44	1250, 750
9	12.23	750, 1250	34	9.32	1250, 2000
10	11.99	1500,1750	35	9.31	1500,1250
11	11.80	1250,1750	36	9.27	1000, 750
12	11.60	1500,1500	37	9.21	2000,1500
13	11.08	500,1000	38	9.21	1500, 2250
14	10.97	1500, 2000	39	9.18	2000,1250
15	10.75	1750, 2000	40	9.18	500,1000
16	10.56	1750,1750	41	9.15	2000, 2500
17	10.47	1500,1250	42	9.15	0, 1000
18	10.44	1250,1000	43	9.12	-1250, 500
19	10.41	500,1000	44	9.10	750, 1250
20	10.40	-750, 250	45	9.09	750, 750
21	10.13	750, 500	46	9.08	-750, 500
22	10.08	-1000, 500	47	9.07	2000, 1750
23	10.05	1750, 2250	48	9.05	1000, 1750
24	9.97	1000, 500	49	9.02	500, 500
25	9.86	1000, 750	50	8.99	1750,1000

Note: All receptors are grid card type and distances are in meter

Contours for maximum 24 hourly average incremental GLCs of SPM are drawn at an interval of 2.0 µg/m^3 and corresponding isopleth is shown in **Figure 4.1**.

It is evident from the above discussion that maximum 24 hourly average incremental GLC value for SPM due to operation of proposed expansion is predicted as 14.7 µg/m^3 at a distance

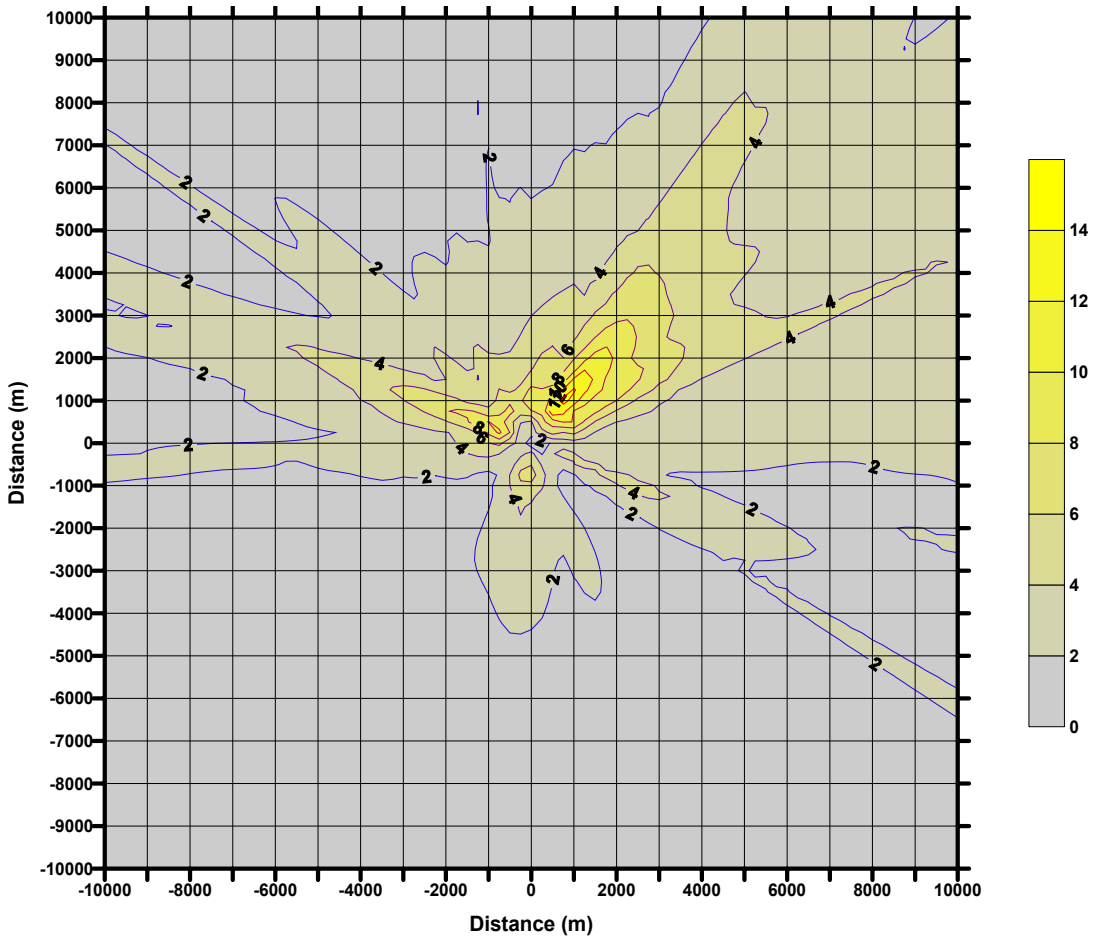


Figure 4.1: Contributed 24 Hourly GLCs of SPM (µg/m^3)

of 1250 m in NE direction. Contours of the GLCs depict that the travel of emissions from the operation of proposed expansion would be mainly in N-E quadrant.

- **Sulphur Dioxide (SO_2)**

Maximum 24 hourly average incremental GLCs of SO_2 during operation of proposed expansion are predicted for the grid size of 250mx250m and 101 grids. The first maximum 50 values of 24 hourly incremental GLCs of SO_2 are given in **Table 4.5**.

Table 4.5: 24 Hourly Average Incremental GLCs of SO_2 (µg/m^3)

Sn	Conc.	Receptor (X, Y)	Sn	Conc.	Receptor (X, Y)
1	5.34	1250, 1000	26	3.76	1250, 1000
2	5.13	1500, 1250	27	3.76	1000, 1250
3	4.81	1250, 1250	28	3.75	1500, 1500
4	4.77	1000, 750	29	3.73	1000, 500
5	4.72	1500, 1500	30	3.73	1500, 750
6	4.71	1500, 1000	31	3.67	1500, 1250
7	4.63	1750, 1500	32	3.67	2250, 1250
8	4.62	1250, 750	33	3.63	1000, 750
9	4.38	1750, 1750	34	3.63	1500, 1750
10	4.36	1000, 1000	35	3.62	2000, 2250
11	4.31	1750, 1250	36	3.61	2250, 2000
12	4.09	2000, 1750	37	3.58	2250, 2250
13	3.98	2000, 2000	38	3.56	1500, 750
14	3.96	1500, 1750	39	3.52	1750,1250
15	3.94	1250, 1500	40	3.52	1500, 2000
16	3.92	1750, 1000	41	3.51	1500, 1000
17	3.90	1250, 1250	42	3.50	1750,1750
18	3.87	2000, 1000	43	3.50	1750,1000
19	3.83	1750, 2000	44	3.49	2250,1000
20	3.81	1000,1000	45	3.49	1500,1750
21	3.81	2000,1500	46	3.49	1250,1750
22	3.79	1250,1500	47	3.45	1750,1500
23	3.77	2000,1250	48	3.45	1750, 2250
24	3.77	1000,1250	49	3.44	1000,1500
25	3.76	1750, 750	50	3.43	2250,1500

Note: All receptors are grid card type and distances are in meter

Contours for maximum 24 hourly average incremental GLCs of SO_2 are drawn at an interval of 1.0 µg/m^3 and corresponding isopleth is shown in **Figure 4.2**.

It is evident from the above discussion that maximum 24 hourly average incremental GLC value for SO_2 due to operation of proposed project is predicted as 5.34 µg/m^3 at a distance of 1600 m in ENE direction. Contours of the GLCs depict that the travel of emissions from the operation of proposed plant would be mainly in N-E quadrant.

Hence, findings of the above discussion are summarized in the table as given hereunder:

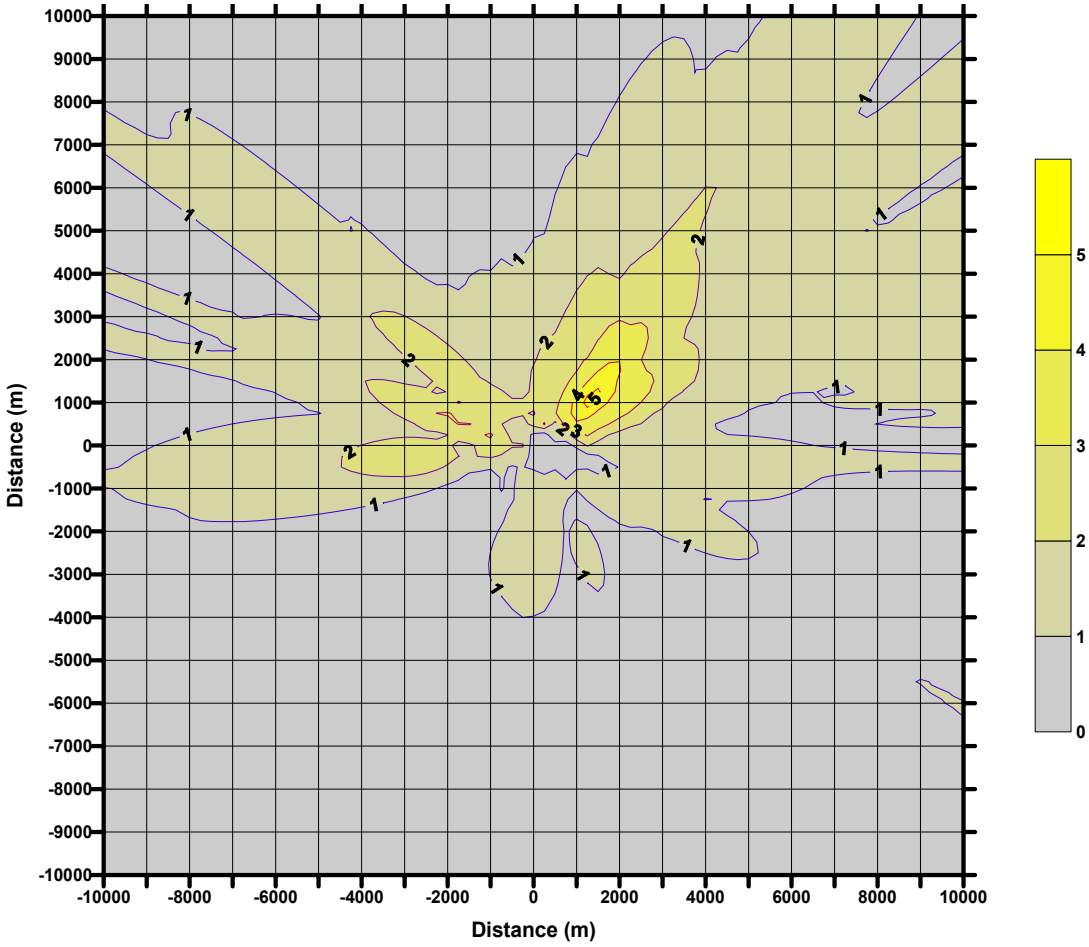


Figure 4.2: Contributed 24 Hourly GLCs of SO_2 (µg/m^3)

Sn	Pollutants	Maximum Concentration (µg/m^3)			
		Predicted incremental Value due to Operation of proposed expansion (Average(maximum))	Existing ambient Air Quality in the study area (Average(98 percentile))	Resultant ambient Air Quality in the study area (Average(98 percentile)	CPCB norms
1	SPM	2.06(14.7)	116.2 (155.9)	118.26 (170.6)	200
2	SO_2	0.94(5.34)	11.24 (14.25)	12.18 (19.59)	80

Hence, overall impacts are rated as:

Impact Rating	Ambient Air Quality
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

a) Green House Gases

- Annual targets will be set up for raw material consumption, power and water consumption;
- Using latest available technology for monitoring of process parameters;
- Energy audit & water audit will be carried out on regular basis for keeping check on power and water consumption and exploring the possibilities for further reduction; and
- By implementing effective house keeping.

b) Stack Emissions Management

The following measures are envisaged to be adopted which will in line with the existing operation:

- Suitably designed ESPs / Bag filters will be placed downstream of the stacks which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration of 50 to 150 mg/Nm^3 as per the details given in **Table 2.15**;
- In the event of failure of any pollution control equipment, automatic tripping in the control system, will be provided;
- For ESP operations, interlocking will be provided with supply to electrode, which means that any disturbance in the power supply to electrode will switch the whole unit off;
- SO_2 emission will be controlled by providing adequate stack height as per formula; $H=14Q^{0.3}$ where H is in meter and Q is the SO_2 emission rate in Kg/hr. Attempt shall be made to use low sulphur coal to the possible extent;
- Generation of NO_x gases depends to a great extent on the combustion temperature. A well-designed burner system, therefore, will limit the core flame temperature to ensure a reasonably low value of NO_x;

- Impact of CO emission is negligible in view of the firing technique of keeping a positive oxygen balance. However, regular monitoring and continuous auto regulation of fuel and air by automatic combustion control system are proposed to be installed;
- All vehicles and their exhausts would be well maintained and regularly tested for emission concentration;
- Adequate thickness of insulating material with proper fastening is provided to control the thermal pollution;
- Regular preventive maintenance of pollution control equipment; and
- Stack emissions will be regularly monitored by **KGSL**/ APPCB/ external agencies on periodic basis as per statutory requirements.

c) Fugitive Emission Management

The following measures are being envisaged for the proposed expansion:

- Jet Pulse bag filters at all dry material conveying and transfer points;
- Dust suppression system by water sprinkler at dump hopper of raw materials;
- Regular dust suppression with water sprinkler on the roads;
- Level sensor to have a gap of only half-meter in between stacking boom and top of pile;
- Plant roads & approach roads will be made of bitumen/ concrete;
- Areas between various sections and truck parking areas will be made of concrete/ bitumen/brickwork;
- Open areas within the plant premises and along with boundaries of the plant premises will be covered under green belt/plantation; and
- Raw Materials will be fully covered during transportation to/ from the plant site by road/ rail.

❑ **Traffic Density**

Road traffic to and from the proposed expansion during operation phase would not be so intensive and heavier than at present as envisaged main mode of transportation of the materials will be via railways. As per **Table 2.3** (***Chapter 2***), transportation of raw materials via road will be reduced while that of product will be increased by approximate 50 trucks/trailers per day. Hence, Traffic density will be increased marginally as result of proposed expansion. In turn, it will contribute to noise as well as ambient air quality in terms of dust and other gaseous pollutants. The regular maintenance of vehicles will limit the pollutants within prescribed standards. The present road conditions are reasonably good for proposed movement of traffic.

Hence, overall impact is rated as:

Impact Rating	Traffic Density
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Slight
Significance of impact	Negligible

Mitigation Measures

- All vehicles and their exhausts would be well maintained and regularly tested for emission concentration;
- Truck/trailers shall be parked made in designated parking area only;
- Minimize use of roads at any particular time by planning vehicles movements;
- Advise traffic police about the activities; and
- Road crossings to be used will be well marked.

❑ **Noise Levels**

General noise levels generated from equipments of the proposed plant will be as per given in **Table 4.6.**

Table 4.6: Noise levels Generated (dB(A))

Name of Source	Noise Level at 1 m distance
Pumps	85-100
Forced draft fans	85-100
Induced draft fans	77-97
Compressors	82-105
Boiler feed pump	95
Air Compressor	95
Diesel Generator	75

For an approximate estimation of dispersion of noise in the ambient from the source point, a standard mathematical model for sound wave propagation is used. For the modelling purposes, flat terrain is considered and environmental attenuation factors are not considered.

Based on the model, calculations are made and the estimated noise levels from the proposed activities at different distances are as follows:

Noise Level (dB(A))	Distance from source (m)
75	14
70	25
65	40
55	140

The above results show that the elevated noise levels will be limited to a short distance from source. However, maximum present maximum noise level at the plant boundary during day time (L_{day}) and night time (L_{night}) are 51.7 dB(A) and 43.2 dB(A) respectively. The noise level so generated from the plant operations will be mingled with the ambient noise level within short distance from the plant site.

The above noise levels worked out are without mitigation measures. With the Mitigation measures, the noise levels will be further restricted within very short distance from the sources. The operators/personnel working near the noise sources in the plant will be provided with earmuffs and earplugs.

Hence, overall impact is rated as:

Impact Rating	Noise Level
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- All rotating items will be well lubricated and provided with enclosures as far as possible to reduce noise transmission. Extensive vibration monitoring system will be provided to check and reduce vibrations. Vibration isolators will be provided to reduce vibration and noise wherever possible;
- In general, noise generating items such as fans, blowers, compressors, pumps, motors etc. will be so specified as to limit their speeds to generate minimum noise levels. Static and dynamic balancing of equipment will be insisted upon and will be verified during inspection and installation;
- Provision of silencers will be made wherever possible;
- The insulation provided for prevention of loss of heat and personnel safety will also act as noise reducers;
- Layouts of equipment's foundations and structures will be designed considering the requirement of noise abatement;

- Central control room(s) provided for operation and supervision of plant and equipment will be air-conditioned, insulated and free from plant noise. Necessary enclosures will also be provided on the working platforms/areas to provide local protection in high noise level areas;
- Proper housekeeping to avoid excessive noise generation;
- In case where the operation of the equipment warrants the presence of operators in close proximity to equipment, the operators will be provided with necessary safety and protection equipment such as ear plugs, ear muffs etc.;
- By provision of green belt /plantation in and around the plant premises; and
- By these measures, it is anticipated that noise levels at the boundary of the plant premises will be maintained below 75 dB (A). Earth mounds and plantations in the zone within the plant premises would further attenuate noise.

❑ **Water Resources**

The total water requirement of the existing plant is 1446 m^3/day while on commissioning of proposed expansion the same will be 21, 446 m^3/day . The water consumption per tones of steel is 7.2 m^3 considering working days as 340 per year.

Water requirement for the existing plant is met via infiltration bore wells (18 nos.) on the bed of Pennar river at a distance of 5 km from plant. While for the proposed expansion, addition water requirements will be met from the Gandikota reservoir which is about 22 km from plant site. The permission of withdrawal of water has already been obtained.

The withdrawal of water resources during the operation phase will not have significant impact on the water resources of the area. Hence, overall impact is rated as:

Impact Rating	Water Resources
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Continuous attempt will be made to optimize/reduce the use of water;
- Continuous attempt will be made to avoid wastage and leakage of water;
- 100% waste water will be recycled back after treatment;
- Regular record of water consumption on daily basis will be maintained;
- Toilets and bathrooms will be provided at site;

- Regular record of water flow of Pennar river and water level of Gandikota reservoir will be maintained; and
- Water conservation plan as per given in **Annexure-4.1** will be implemented.

❑ **Water Quality**

The details of wastewater generated during the operation of the proposed project are as per given hereunder:

Table 4.7: Details of Waste Water Management (m^3/day)

Particulars	Existing	Expansion	Treatment & Disposal
Plant process water			
Plant operation	15.0	80.0	Will be used for slag quenching /cooling
Water treatment Plant (DM or Softener)	0.0	140.0	After primary treatment as per details given below, treated water will be sent to coke oven plant for coke quenching
Cooling tower/Blow down	25.0	140.0	Will be used for slag quenching /cooling
Total	**40.0**	**360.0**	
Domestic water			
Domestic (from plant)	80.0	200.0	Will be treated in STP and treated waste water will be used for dust suppression (dust pollution control) & for green belt development.
Domestic (from Township)	0.0	300.0	
	80.0	**500.0**	
Total	**980.0**		
Quantity of water recycled			
(in %)	95 %		
(in cum/day)	930		

It is evident from the above table that no waste water will be discharged outside the plant premises. Hence, overall impact is rated as:

Impact Rating	Water Quality
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

In addition to above, following measures will be adopted:

- Attempt will be made to utilize the treated waste water for cooling during the plant operation; and

- Regular monitoring of treated wastewater quality will be carried out on regular basis for the relevant parameter prescribed by APPCB/MOEF based on its ultimate use.

❑ **Soil Quality & Solid Waste**

The details of main solid waste generation and management are summarized in **Table 4.8** during operation of expanded plant.

Table 4.8: Solid Waste Generation & Management

Nature of Waste	Composition	Quantity TPD		
		Pre Expansion	Post Expansion	Mode of Disposal/Recycling
Granulated Blast Furnace Slag	Oxides of Calcium, Magnesium, Silicon, Aluminum, Iron etc.	345	1150	Is/shall be sold to Cement Plants
Cast House Scrap	Pig Iron scrap	1	3	Is/shall be Sent to BOF
BOF Scrap	Steel scrap	12	40	Is/ shall be used in Steel Making
Sinter Plant Dust (ESP, Multi-cyclone)		0	193	Shall be recycled to Sinter Plant
Flue dust from the BF	Oxides of Iron, Si, Al, Mn, Ca, Mg	13	43	Shall be recycled to Sinter Plant
Coke fines from the Stock House	Coke fines	25	83	Shall be recycled to Sinter Plant
Scale from rolling mills & Continuous casting	Oxides of Iron	6	20	Shall be recycled to Sinter Plant
Steel Scrap	Scrap	20	67	Is/ shall be recycled to BOF
Lime Plant Dust	Lime	0	67	Shall be recycled to Sinter Plant
Steel Making Slag	Oxides of Iron, Ca, Si, Al	115	383	Partially it will be used as flux in Blast Furnace & rest will be used for selected land filling.
Converter Gas Cleaning Sludge	Oxides of Iron, Ca, Mg, Si, Al, Mn	18	60	Shall be recycled to Sinter Plant
BF Gas Cleaning Sludge	Oxides of Iron, Ca, Mg, Si, Al, Mn	5	17	Shall be recycled to Sinter Plant
Used Lead Acid Batteries	-	10	15	Shall be sold to selected parties.
Spent/Used Oil	-	3.7 m^3	10 m^3	To be sold to selected parties
Process dust	-	4	10	will be used in Sinter Plant
Sludge from Sewage treatment	-	-	3.5	will be used as manure
Sludge from primary treatment plant	-	-	2.0	will be used for land filling after ensuring its status for hazardous waste.
Sludge from coke plant desulphurization units	Gypsum	-	10	will be used for selective land filling.

It is proposed to deposit Steel Making slag about 250T/day in the low lying areas in the plant. An area of 4000 m^2 will be ear marked for primary dumping of slag & salvaging of scrap.

Various other types of wastes such as hazardous & non-hazardous wastes, municipal or domestic wastes and bio-medical wastes are anticipated during the operation of proposed expanded plant including township.

The wastes generated like used oils & waste oils, grease, lead acid batteries, other lead bearing wastes (such as gaskets etc.), oil & clarifier sludge, used resin, used photo-chemicals, asbestos packing, e-waste, metal scrap, C&I wastes, electrical scrap, empty cylinders (refillable), paper, rubber products, canteen (bio-degradable) wastes, building material wastes, silica gel, glass wool, fused lamps & tubes, fire resistant fluids etc. fall either under hazardous wastes category or non-hazardous wastes category as per classification given in Government of India's notification on Hazardous Wastes (Management and Handling) Rules 1989 (as amended on 06.01.2000 & 20.05.2003).

The handling and disposal of hazardous wastes will be done as per the Hazardous Wastes (Management & Handling) Rules 1989 (as amended in 2003) guidelines issued by Government of India for the treatment, storage and disposal of hazardous wastes.

The Hazardous Wastes (Recyclable) will be sold / auctioned to registered recyclers / refiners. The other hazardous wastes such as the activated carbon resins, used drums (hazardous) chromium (Cr-III electrolytes, used photo-chemicals, asbestos packing, used torch batteries, ribbon, toners / cartridges, mixed wastes (waste oil, water & cotton) filters, earth contaminated with synthetic oil (FQF) glass used & sodium silicate, lamps & tubes etc. fall under the category of Hazardous Wastes (Non-recyclable). These wastes will be small in quantity and stored in properly identified locations and disposed off as per guidelines prescribed by CPCB/APPCB.

Domestic or municipal waste will be generated in households at township and in canteen & offices at plant. This waste will be segregated into bio-degradable and non-biodegradable wastes at sources itself in different coloured containers and thereafter will be disposed separately. Bio-degradable waste will be spread uniformly in identified low lying areas and thereafter it will be covered with soil for use later as manure after composting. The segregated non -bio-degradable waste will be disposed off separately in other identified low lying areas.

Hospital (or Bio-medical) wastes will be generated from hospitals and include urine bags, plaster of Paris waste, empty plastic bottles of water & glucose, blood & chemical mixed cotton, blood & urines tubes etc.. These wastes will be segregated and placed in buckets of different colours as per the notification for Bio-Medical Waste (Management & Handling) Rules. The segregated bio-medical wastes will be treated in autoclaves before disposal into bio-medical waste disposal pits. The treated bio-medical waste shall be spread uniformly and covered with 10 cm thick soil in bio-medical waste disposal.

Hence, overall impact is rated as:

Impact Rating	Soil Quality & Solid Waste
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Low
Significance of impact	Minor

Mitigation Measures

- Attempt will be made to utilize the waste to maximum possible extent;
- Proper records of the solid waste to be generated and their usages for different purposes will be maintained;
- During transportation to other industrial units for use and to landfill site, waste will be properly wrapped with tarpaulin after water spraying;
- Area used for storage of solid waste, if required at plant site will be fenced properly. Continuous water spray will be made for dust suppression and pucca road shall be constructed up to storage yard;
- Dumping of solid waste will be made in systematic manner and will be leveled and compacted from time to time with layer of earth. At the end, the site will be reclaimed by appropriate species of trees;
- Suitable drainage system will be/has been developed for surface run off water during monsoon and at places settling/catch pits will be provided to arrest any solid particles before it will be flowing over to natural drainage system of the area;
- Dumping site will be properly fenced and surrounded by green belt;
- Regular ambient air quality for monitoring for dust and water monitoring will be carried out around the dumping site;
- Regular monitoring of sludge generated from neutralization pit will be carried out for relevant parameters;
- Lubricating waste oil will be collected separately in drums and shall be sold to authorized external agency for further treatment; and
- At storage area of domestic waste, pesticides will be used.

❑ **Occupational Health & Safety**

During operation phase, dust causes the main health hazard. Other health hazards are due to gas cutting, welding, noise and high temperature and micro ambient conditions especially near the furnace doors and platforms which may lead to adverse effects (Heat cramps, heat exhaustion and heat stress reaction) leading to local and systemic disorders. Injuries in industries are usually of minor nature like bruises, cuts, and

abrasions because of manual handling. However, serious accidents due to common reasons like fall from height and entrapment of limbs in machinery are also possible. Hence, overall impact is rated as:

Impact Rating	Occupational Health & Safety
Nature of impact	Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Medium
Significance of impact	Minor

Mitigation Measures

- Adequate arrangements are made for preventing the generation of dust by modifying the chutes at transfer points for reducing the falling height of material, preventing spillage of material by maintaining the handling equipment, isolating the high dust generating areas by enclosing them in appropriate housing and appropriately dedusting through high efficiency bag filters;
- Due care is taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated by raw material/solid waste handling system by water spraying at appropriate points;
- Almost all material handling systems are automatic i.e. unmanned. The workers engaged in material handling system will be provided with personal protective equipment like dust masks, respirators, helmets, face shields, etc.;
- Any worker found to develop symptoms of dust related diseases will changed over to other jobs in cleaner areas;
- Thermal insulation will be provided wherever necessary to minimize heat radiation from the equipment, piping etc. to ensure protection of workers. Insulation will be done by adequate cleats, wire nets, jackets etc. to avoid loosening (Insulation thickness is so selected that the covering jacket surface temperature does not exceed the surrounding ambient temperature by more than 15^{o}C. The effect of thermal pollution of air will be negligible considering the atmosphere as the ultimate heat sink and no other industry being located in the vicinity).

- **General Health Measures**

a) Sanitary facilities will be well equipped with supplies (e.g., protective creams) and employees will be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens;

b) Ventilation systems will be provided to control work area temperatures and humidity;

c) Personnel required to work in areas of high temperature and/or high humidity will be allowed to take frequent breaks away from these areas; and
d) Pre-employment and periodic medical examinations will be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to health hazards.

- **General Safety Measures**

a) Conveyors and similar machinery will be provided with a means for stopping them at any point;
b) Shield guards or guard railings will be installed at all belts, pulleys, gears and other moving parts;
c) Elevated platforms and walkways, and stairways and ramps will be equipped with handrails, toeboards and non-slip surfaces;
d) Electrical equipment will be grounded, well insulated and conform with applicable codes;
e) Employees will be provided with hard hats, safety boots, eye and ear protection, and snug fitting gloves as appropriate;
f) Masks and dust-proof clothing will be provided to personnel working in areas with high dust levels; and
g) Procedures will be strictly enforced for the storage, handling, and transport of explosives, flammable and hazardous materials.

- **Housekeeping**

a) Regular cleaning of roads and floor area within the plant premises;
b) Training on regular basis to all workers and staff about the importance of cleanliness;
c) Careful garbage transportation to dumping site and disinfections of transport vehicles body;
d) Decorative plantation to improve aesthetics of the plant; and
e) Construction of suitably designed drains all along the roads and boundary of the plant premises.

❑ **Risk Due to Accidents**

Risk assessment study (refer Chapter 7 for details) has been carried out for Maximum Credible Accidents Scenarios and accordingly Disaster Management plan (refer Chapter 8 for details) is prepared.

It is evident from the study that the calculated impact zone for worst scenarios may cross the plant premises but probability of accident is very less. Estimated risk is As Low As Reasonably Practicable and in acceptable range. Hence impacts may be rated as:

Impact Rating	Risk from Accidents
Nature of impact	Adverse
Duration of impact	Short term
Impacted Area	Localized
Likelihood of occurrence	Unlikely
Severity of impact	High
Significance of impact	Minor

Mitigation Measures

- Risk may be reduced by implementing risk reduction measures as defined in chapter-7 & 8.

4.3.2 Components Creating Impacts to Socio-Economic Environment

❑ **Employment and Economic Growth**

Establishment or expansion of any industrial activities, results in industrial growth, which in turn would generate direct and indirect opportunities of employment and business in the region. As per estimate, total additional manpower required for proposed expansion will be 940. In addition to above, significant number of casual labour will be required. Number of indirect employment will also be generated on local and regional basis.

There will be an increase (directly and indirectly) in the payment of royalty, excise duty and sales tax to Government due to the proposed expansion. Proposed township will also contribute in terms of employment and business opportunities for locals. Hence, overall impact is rated as:

Impact Rating	Employment & Economic Growth
Nature of impact	Beneficial
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Medium
Significance of impact	Moderate

Mitigation Measures

- Preference will be given to locals for direct and indirect employment;
- Local suppliers for machinery and materials will be given preference; and
- Local transporters will be preferred for transportation of man/machinery/materials.

❑ **Socio-Economic**

KGSL is committed to contribute to improve the socio-economic conditions of the area and contributing to the welfare of the local habitants to the maximum possible extent. **KGSL** will keep continuing to participate in implementation of Government schemes for the welfare of the society of the study area up to extent possible in addition to the direct and indirect employment generation and payment of taxes and royalty. Hence, overall impact is rated as:

Impact Rating	Socio-economic
Nature of impact	Beneficial
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	High
Severity of impact	Medium
Significance of impact	Moderate

Mitigation Measures

- **KGSL** will participated to the maximum possible extent with the local administration in the implementation of the govt social welfare schemes;
- **KGSL** will contribute to the maximum possible extent for the improvement of social infrastructure of the surrounding area;
- **KGSL** will review various welfare schemes going on in the area from time to time and take appropriate decisions of modifications/additions of welfare schemes as per requirement of local habitants; and
- **KGSL** will extend medical and education facilities developed for its employees to the locals to the maximum possible extent.

4.4 Impacts Evaluation

The evaluation of the impacts of the proposed expanded plant on the environment, both in terms of quality & quantity have been made. For quantification of impacts, matrix system as modified to some extent has been used as per given below:

For quantifying impacts on the environment, the guidelines and standards prescribed by Ministry of Environment & Forests, Central Pollution Control Board and Andhra Pradesh Pollution Control Board are being considered.

1000 numbers are distributed as per the weightage to each parameter considered based on its importance as per given below:

Parameters	Importance Value
Air Quality	150
Water quality	100
Water resources	100
Noise and vibration	50
Solid waste	150
Land Use Pattern	50
Forest & Vegetation	50
Wild life	50
Socio – economic	150
Employment	150

The severity has been divided in impact scores from 0-5 for calculating the severity of impacts on the environmental parameters due to various project activities as given below.

Severity criteria	Impact score
No impact	0
Significant impact-slight and short term	1
Significant impact-slight and long term	2
Moderate impact- short term	3
Moderate impact- long term	4
Major Impact - Permanent	5

The impact score can be -ve or +ve depending on whether the impact is adverse or beneficial.

Based on the above importance values and impact scores, the impact value (impact score x importance value) for each environmental parameters is calculated. The impact value for individual parameter is added to arrive at the total impacts value. The criterion used to make conclusive statement is based on the total impacts value without control measures is defined as given below.

Total impact value	Conclusions
Upto(-)1000	No appreciable impact on environment
(-) 1000 to (-) 2000	Appreciable but reversible impact. Mitigation measures important.
(-)2000 to (-) 3000	Significant impact which is mostly irreversible. Mitigation measures crucial.
(-) 3000 to (-) 4000	Major impact which is mostly Irreversible. Selection of process and raw material to be crucial.
Above (-) 4000	Permanent irreversible impact, alternative sites to be considered.

The environmental impact matrix based on the above principles has been attempted for the proposed project and is given in **Table 4.9**.

Table 4.9: Impact Evaluations - Construction & Operation Phase

Environmental parameters	Importance value	Construction Phase	Operation Phase		Impact Value		
			Without EMP	With EMP	Construction	Operation without EMP	Operation with EMP
Air Quality	150	(-)1	(-)4	(-)2	-150	-600	-200
Water quality	100	(-)1	(-)4	(-)2	-100	-400	-200
Water resources	100	(-)1	(-)4	(-)2	-100	-400	-200
Noise and vibration	50	(-)1	(-)4	(-)2	-50	-200	-100
Soil Quality & Solid waste	150	(-)1	(-)4	(-)2	-150	-600	-300
Land Use Pattern	50	(-)2	(-)2	0	-100	-100	0
Forest & Vegetation	50	(-)2	(-)2	0	-100	-100	0
Wild life	50	(-)2	(-)2	0	-100	-100	0
Socio – economic	150	(+)1	(+)2	(+)4	150	300	600
Employment	150	(+)1	(+)2	(+)4	150	300	600
Total					**-550**	**-1900**	**200**

The total impact value for the proposed expanded plant works out to be:

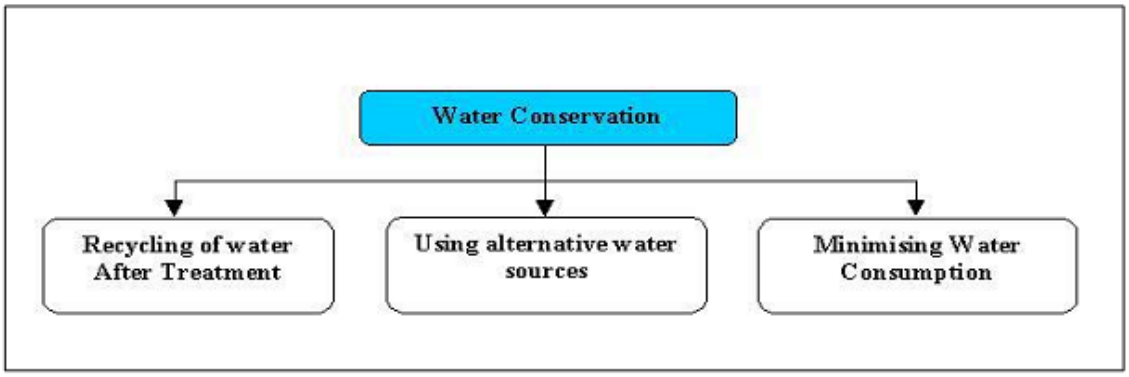
- During construction stage : (-) 550
- During operation stage without EMP : (-) 1900
- During operation stage with EMP : (+) 200

The results indicate no appreciable environment impact except on water resources on setting up of proposed expansion. To summarize, most of the project activities are not likely adversely affect the surrounding environmental quality.

Annexure 4.1

1.0 Water Conservation and Development

The water conservation plan consists of a combination of three major steps depicted below:



Water conservation shall be practiced to the extent possible by use of reclaimed water for non potable application like gardening, watering lawns and to make up evaporation losses for cooling towers, if any.

1.1 Recycling of Wastewater

As described in Chapter 2, sewage and waste water will be treated in a “state of the art” sewage treatment plant. This treated water will be used in process and a variety of non-potable uses such as horticulture, dust suppressing and cooling. Separate pipelines will be laid for using this water.

1.2 Minimizing Water Consumption

A combination of water saving appliances and water management measures will be planned in all the toilets in the township and plant. The message of water conservation will be spread to all users by way of awareness campaigns and circulars. Specific measures that will be implemented include the following:

- **Management Measures**
  - Reduce toilet cistern volume in single flush models;
  - Promote awareness on water conservation and reducing water wastage;
  - Quick fixing of leaking taps, pipes and toilet cisterns; and
  - Sweep with a broom and pan where possible, rather than hose down external areas.

- Minimize water use in gardens by the following measures:
  - Drip irrigation system shall be used for the lawns and other green areas. Drip irrigation can save between 15-40% of the water use, compared with other watering techniques. Plants with similar water requirements shall be grouped on common zones to match precipitation heads and emitters;
  - Use of low-volume, low-angle sprinklers for lawn areas;
  - Select controllers with adjustable watering schedules and moisture sensors to account for seasonal variations, and calibrate them during commissioning;
  - Selecting a drought resistant grass, and using lawn chemicals and fertilizer sparingly also reduces watering needs; and
  - Place 3 to 5 inch of mulch on planting beds to minimize evaporation.

- **Water Saving Investments**

- Reduce water delivery in taps, through the installation of low flow devices or aerators on taps;
- A manually pressed button flush valve which stops on release of button;
- Sensors on urinals, which ensure flushes, occur only when required in public areas of the complex; and
- Water Efficient Plumbing Fixtures

Water efficient plumbing fixtures may be used in proposed township and plant to save both water and energy. Typical toilets use 19 to 26 litres (5 to 7 gallon) of water per flush. Ultra flow toilets can do the same job using as 3 litres of (0.8 gallon). **Table 1.0** gives the details of the plumbing fixtures that can be used in proposed township and plant for achieving water efficiency.

Table 1.0: Details of Water Efficient Plumbing Fixtures

Application	Water Saving Devices	Function	Water Saving	Estimated per person water saving in liter/day
Toilet	Low flush toilets (13.2 liters/flush)	Reduces flush volume	7.6 liter/flush	8.0
Urinals	Ultra flush toilets (6.1 liters/flush)	Reduces flush volume	15.1 liter/flush	16.0-23.1
Faucet	Aerator with flow control	Reduce splashing and create appearance of greater flow	6.8-9.5 l/min	0.5
Appliances	Water efficient dish washer	Reduce water requirement	18.9 l/load	1.0

Source: Watergy, Alliance to save energy and US AID

1.3 Enhancement of Water Environment

Water development shall be practiced by installation of scientifically designed artificial water recharging structures. The objective of the exercise will be to enhance groundwater condition of the region.

Rain Water Harvesting and Reduce Surface Runoff

Rainwater harvesting can serves as a solution to the water problem in the water crises area by capturing the runoff. Rainwater harvesting helps in utilizing the primary source of water and prevent the runoff from going into sewer or storm drains, thereby serving dual purpose i.e. Making water available for future use and reducing the load on treatment plants as well as other service lines. Recharging water into the aquifers help in improving the quality of existing groundwater through dilution. Rainwater harvesting comprises of two components:

- Storing Rainwater in ground water reservoirs for beneficial use in future; and
- Rain water harvesting for artificial recharge of ground water.

KGSL is planning to opt for using the rainwater for groundwater recharging only. Amount of water that can be effectively harvested is called the harvesting potential of the site. Based on the run off coefficient, rainfall and type of catchments area, water harvesting potential of proposed expanded township can be calculated. **Table 2.0** provides runoff coefficients for various catchment surfaces.

Water harvesting potential = Rainfall (mm) x Area of catchment x Runoff coefficient

Table 2.0: Runoff Coefficient for Various Catchment Surfaces

Type of Catchment	Coefficient
Roof Catchments -Concrete	0.8-0.9
Ground Surface Coverings -Concrete	0.6-0.8

Source: Pacey, Arnold and Cullis, Adrian 1989, Rainwater Harvesting: The collection of rainfall and runoff in rural areas, Intermediate Technology Publications, London

Selection of type of structures for rainwater harvesting shall be made after studying the hydro-geological conditions of the site. Appropriate method will be selected from following methods after careful study of the area:

- Area Treatment ;
- Spreading Methods;
- Open Well and Shafts;

- Drilled wells and Bore Holes;
- Bank Infiltration; and
- Sand storage Dams.

KGSL will carry out rainwater harvesting by open well and shafts (soak pit type construction). In this water recharging method water is not pumped into the aquifer but allowed to percolate through a filter bed, which comprises sand and gravel. To stop the suspended solids from entering the recharge tube well, a filter mechanism is provided at the top.

Efficiency of rainwater harvesting and recharging ground water can be increased by following methods -

- Use vegetated swales and depressions to reduce runoff;
- Reduce and filter surface runoff; and
- Catch drainage all along the periphery of plot to prevent surface runoff.