5.0 ENVIRONMENT MANAGEMENT PLAN

5.1 Introduction

The Environment Management Plan (EMP) is necessary to ensure sustainable development in the area of the proposed plant complex. Hence, it needs to be an all encompassive plan for which the proposed industry, Government and Regulating agencies like Pollution Control Board working in the region and more importantly the affected population of the study area need to extend their cooperation and contribution. The identification and quantification of impacts based on scientific and mathematical modelling has been presented. The Management Action Plan aims at controlling pollution at the source to the extent possible, with the available technology, followed by treatment measures before they are discharged.

Sound Environment Management Plan by the plant authorities is required to mitigate the impacts of the proposed with its surrounding environment. Specifically, the EMP lays stress on key environmental aspects and issues of the project during operation phase by:

- Identifying potential environmental impacts;
- Recommending mitigation measures for the negative impacts;
- Identifying opportunities for enhancement measures;
- Providing an organizational framework for operating Environment Management System and other functions of the project by assigning roles and responsibilities for environmental monitoring and management;
- Formulating Environmental Action Plans (EAPs) which specify mitigation, periodic and annual monitoring activities during project implementation and operation.

The potential environmental impacts from the proposed project are identified and the magnitude of these impacts also predicted. The potential environmental impacts to be regulated from the proposed plant are summarized below:

- Air pollution due to the emission of particulate matter and sulphur dioxide and fugitive emissions;
- Noise pollution due to various noise generating equipment;
- Wastewater generation from TPP as well as from domestic activities; and
- Solid waste (STP sludge + Flyash) disposal.

In order to minimize these adverse impacts and to ensure that the environment in and around the project site as well as the neighbouring population is well protected, an effective Environment Management Plan is developed for construction phase as well as operational phase.

5.2 Environment Management during Construction Phase

The construction activities of the proposed plant will have some adverse impact on the environment. The activities during the construction phase of proposed plant include site preparation, transportation of construction materials and equipment and construction of the infrastructure facilities. During this phase, it is

imminent that workers/labourers would be staying on site till the completion of the construction work. However, this is not considered as a long-term impact. The project proponents, in order to minimize these impacts, would undertake adequate preventive and remedial measures as outlined below:

5.2.1 Air Pollution Management

No major leveling and cutting operations are required, due to the availability of plain land. Hence, no major excavation of the area except for the purpose of foundation is envisaged. However, during dry weather conditions, dust is likely to be generated from excavation and transportation activities. Hence, it is necessary to control the dust generated by excavation and transportation activities. Dust control will be carried out by water sprinkling. Ambient air levels of SO_2 and NOx are likely to increase due to the operation. However, most of the construction equipments are mobile. Hence, there will not be concentration of emissions at any single point. The emissions from diesel vehicles in use will be checked on monthly basis and brought to the required levels of emission standards. It will also be ensured that both gasoline and diesel powered construction vehicles are properly maintained to minimize smoke in the exhaust emissions.

5.2.2 Noise Environment

Noise generation during construction phase is due to the operation of heavy equipment and vehicular traffic in the area. However, these impacts are short term, intermittent and temporary in nature. The effect of noise on the nearest inhabitants during the construction activity will be negligible as the noise will be diffused by the natural obstructions and with distance. However, it is advisable that on-site workers working with high noise generating equipment will have protection devices like earmuffs. Noise prone activities have to be restricted to the extent possible to day time only particularly to be avoided during 10 pm to 6 am in order to have minimum impact on community.

5.2.3 Water Environment

The water environment is likely to affect to certain extent due to the construction activities because of the generation of effluents from sanitary facilities for the construction workers, washing of vehicles and spillage of fuels. The water resources are likely to be affected quantitatively because of water utilization by the workers for domestic purposes. However, these are of temporary in nature and the impact will be minimum, limited to constructional phase only.

The vehicle maintenance area will be located in such a manner to prevent contamination of surface and ground water sources by accidental spillage of oil. Unauthorized dumping of waste oil will be prohibited.

5.2.4 Sanitation

The construction site will be provided with sufficient and suitable toilet facilities for workers to meet the proper standards of hygiene. Septic tanks followed by soak pits may be utilized to treat the domestic wastewater generated during constructional activity.

5.2.5 Land Environment

As soon as construction is over, the surplus earth will be utilized to fill up low-lying areas, the rubbish will be cleared and all unbuilt surfaces reinstated. The site does not involve any cutting of trees. Development of greenbelt will be taken up along with construction works.

5.2.6 Socio-Economics and Demography

Normally, the construction activity will benefit the local populace in a number of ways such as supply of construction labourers-skilled, semi-skilled and un-skilled, secondary sector employment and provision of goods and services for daily needs including transport.

5.2.7 Storage of Hazardous Material

The hazardous materials anticipated to be stored at the site during construction include petrol and diesel, gas for welding/cutting purpose, paints and solvents. These materials will be stored as per the international safety norms in ventilated enclosures. Site will to be identified for the storage of diesel away from the construction site.

5.3 Environment Management during Operation Phase

5.3.1 Air Quality Management

Coal based thermal power plants emit fly ash as the major pollutant besides varying degrees of other pollutants namely: coal dust, sulphur dioxide and oxides of nitrogen etc. Therefore it is recommended to monitor the concentration of PM, SO2 and NOX in the ambient air at regular intervals at predetermined locations. The control measures to combat air pollution due to proposed power plant have been formulated under two categories, i.e. for individual units as well as for the whole power plant in general. These are delineated hereunder:

- ***Coal Handling System***

Dust emission is mostly of fugitive type and necessities installation of close conveyor system along with suitable dust trapping/control facility at various transfer points. At coal yard, to prevent dust emission due to wind, frequent spraying of water is recommended. This also helps in preventing spot fires.

- ***Coal Crusher and Bunkers***

For the fine dust control, bag filters have been successfully tried in such operations. Better efficiency dry collection system will prove to be long term cost effective because of possibility of coal recovery in the process.

- ***Flue Gas***

For high efficiency collection of fly ash in flue gas from the boiler, a high efficiency ESP is proposed to be installed in this plant and that would be designed to limit the emission of the particulate matter for permissible level. Sprinkling of water will be

applied at the dust generating areas. As far as gaseous pollutants namely NOX and SO2 are concerned, control measures will be taken by provision of 77 m stack as per regulations in the EPA, 1986.

Fugitive and stack emissions from the power plant will contribute to increase in concentrations of PM, SO_2 and NOx pollutants. The mitigative measures recommended in the plant are:

- Installation of ESP of efficiency more than 99.9% to limit the PM concentrations below 50 mg/Nm^3 with an extra standby field;
- Provision of bi-flue stack of 77-m height for wider dispersion of gaseous emissions;
- Furnaces and boilers will be operated with minimum excess air so that fuel consumption is reduced and NOX emissions are minimized. Low NOx burners will be installed for further reduction in NOX emission.
- The stack will have sufficient capacity to take care of emergency release conditions, for additional load of flue gas under boiler start up and shutdown periods.
- All the internal roads will be asphalted to reduce dust emission due to vehicular movement.
- The combustion units will be maintained properly for obtaining optimum efficiency and to ensure that the emission rates remain within estimated levels.
- The fugitive emissions of coal dust from storage facilities, from crushers and at coal transfer points will be reduced by adopting appropriate measures like cyclones/bag filters/ water sprinklers/ fog system.
- Developing of Greenbelt (100-m wide towards village areas and river course, 50 to 100-m wide towards other area) around the plant to arrest the fugitive emissions;
- Design of control equipment to meet the standards stipulated by CREP;
- Online flue gas monitors as well as flue gas flow rates and temperature measurement will be provided for all stacks; and

5.3.2 Noise Level Management

Manufacturers and suppliers of noise generating devices/machines like steam turbine generator, compressors and other rotating equipment will be asked to provide acoustic enclosures for noise control by adopting appropriate design and state of art technology for fabricating/assembling machines.
Proper noise barriers/ shields etc., will be provided around the equipment wherever required. Noise from equipment will be adequately attenuated by providing soundproof enclosure and insulation to minimize the noise level.

5.3.2.1 Recommendations for Noise Management

To reduce the impact of noise, shock absorbing techniques may be adopted

- Equipment will conform to noise levels prescribed by regulatory authorities (<85 dB (A));
- All opening like covers, partitions may be acoustically sealed

- The operator's cabin (control rooms) will be properly insulated with special doors and observation windows
- The operators working in the high-noise areas would be strictly instructed to use earmuffs/ ear plugs
- Noise levels will be reduced by the use of absorbing material on floors, walls and ceilings
- There will be thick vegetation in the plant premises to attenuate continuous noise.

5.3.3 Water Pollution Management

Wastewater will be generated from cooling towers, boilers in the power plant. Besides, domestic wastewater from canteen and employees wash area, township will also be generated.

- ***Demineralization (DM) Plant Effluent***

During treatment, acidic and alkaline effluent will be generated periodically. The effluents need be collected in a neutralizing pit where the acidic and alkaline effluents will be neutralized with each other. This will be pumped and mixed with other effluents in the polishing pond after filtration.

- ***Boiler Blow-down***

The boiler blow down does not require treatment to achieve the limits but relies on operating at sufficient blow down levels to prevent the build-up of contaminants. Also, by operating with proper chemistry in the condensate and feed water systems, copper and iron are not present in significant quantities in the blow downstream. The boiler blow down is also directed to the guard pond.

- ***Effluent from Oil Handling Areas***

The effluent carrying oil spillage etc. will be taken to oil/water separation. The decanted oil (containing small amount of water) will be taken to an oil separation tank for further separation. The decanted oil may be stored in a tank for reuse. The supernatant water need be sent to the polishing pond.

- ***Effluent from Ash Pond***

The drain and overflow water from the ash pond would flow from settling pond to stilling pond and from stilling pond to the clarifier where the suspended solids will be reduced by addition of alum/electrolyte. The clarified water will be pumped to the ash handling system.

- ***Domestic Waste from the Plant***

Domestic wastewater will be treated in Sewage Treatment Plant. The treated sewage from the plant will meet stream standards and would be used for plantation and secondary uses.

● ***Air Pre-heater Wash Water Effluent***

Frequently, the air pre-heaters of the boilers need to be washed. The washed water would be led to the respective settling basins located near the boilers. From the settling basins, dust-laden water would be pumped at suitable intervals, to the guard pond.

● ***Rain (Storm) Water Drainage***

The plant and storm water drainage will take into account the topography of the plant area, intensity of hourly rainfall and the existing area drainage pattern.

Out of the total rainfall in the plant area, a part of it will percolate into the ground, but the remaining major portion will constitute the storm water. The storm water drainage system consists of a network of open drains. Drainage from the roofs of buildings will be taken down by down comers. These down comers will discharge water into open peripheral drains. The runoff from plant areas, open areas, buildings and installations will be carried through the network of open drains running all along the road system and finally joining the main drain. The drain will be connected to water reservoir.

Interceptor drains will be constructed to collect water form surrounding areas to convey to the main drain. Open drains will be provided on one side or both sides of the road as required. For open drains, at least brick masonry lining on the sides and bottom will be provided.

Rain harvesting structures will be constructed on top of all available structures so that the rain water can be recycled for plant requirements. The rain (storm) water removed from the building roofs and yard area grade level surfaces would be directed through the open ditches and culverts to the storm drainage piping. All ditches would be concrete lined and located along the roads. All drainage ditches would be located to provide the shortest practical drainage path while providing efficient drainage for the yard. Grade level would be contoured such that storm water runoff is directed on the ground by sheet flow, to well defined drainage paths leading to the ditches.

● ***Monitoring of Waste from the Plant***

All the treated effluent will be monitored regularly for the flow rate and identified parameters of quality, so that performance efficiency of treatment systems are evaluated and necessary changes recommended from time to time.

The recommended measures to minimise the impacts and conservation of fresh water are:

- Recycling of wastewater generated in cooling tower into process and ash disposal, coal handling and service water requirements;

- The plant raw water requirement will be optimised. The COC in cooling system will be maximised (such as COC=5);

- The effluent carrying oil spillage in the plant area will be sent to oil-water separator for removal of oil;
- Coal stock piles and ash ponds will be provided with garland drains and water will be treated for suspended / floating solids;
- Adequate treatment of wastewater prior to recycling/reuse to maximum extent;
- Provision of sewage treatment plant to treat domestic sewage generated from plant and township;
- Utilization of treated domestic wastewater in toilet flushing, greenbelt development and dust suppression;
- Lining of effluent pond suitably to prevent any seepage into ground to avoid any groundwater contamination;
- Provision of separate storm water system to collect and store run-off water during rainy season and utilization of the same in the process to reduce the fresh water requirement;
- Treated effluents from all streams will be stored in CMB/Effluent Pond /Guard Pond having 5 to 6 days detention time and the aquaculture may be practiced with bioassay tests on regular basis; and
- Suitable rainwater harvesting structures to be constructed.

♦ ***Wastewater Treatment***

The treatment given to the influent in the STP will be both chemical and biological treatment. The effluent will be treated adopting the following steps:

- Collection of domestic wastewater;
- Conveyance of sewage to STP;
- Screening at STP;
- Grit removal;
- Aeration for biological treatment;
- Secondary settling (biological sedimentation);
- Coagulation;
- Clariflocculation;
- Filtration; and
- Drying of chemical and biological sludge.

- ***Bar Screen Channel***

Two manually cleaned screens will be provided. One screen is operated at a time and the other will be standby.

- ***Grit Channel***

Two manually cleaned grit channels will be provided for removal of grit from the effluent. One channel will be operated at a time.

- ***Aeration***

Sewage after screening and de-gritting waste will be fed into the aeration tank. In addition to this, return sludge from the clarifier will be admitted to the inlet of the aeration tank. Here the effluent will be aerated to oxidize the organic matter. Microorganisms present in the return sludge oxidize the organic matter and use it as food and form their own cell mass. Thus, microorganism cell mass concentration continues to rise. The cell mass when removed in subsequent stage of settling, reduces the oxygen demand considerably.

The aerators provided on the platform maintain the contents in aerobic conditions by maintaining adequate oxygen transfer rates. They also provide adequate mixing of the contents and thereby contents do not settle on the floor of the tank. The flow from the outlet launder goes to the secondary clarifier.

- ***Secondary Sedimentation***

When liquid-containing solids in suspension is placed in a relatively quiescent state, those solids having a higher specific gravity than the liquid will tend to settle, and those with a lower specific gravity will tend to rise. These principles are used in the design of sedimentation tanks for treatment of wastewater. The objective of treatment by sedimentation is to remove, readily settable solids and floating material and thus to reduce the suspended solids content.

The mixed liquor from aeration tank will be carried to the center of the tank in a pipe encased in concrete beneath the tank floor. At the center of the tank, the wastewater enters a circular well, designed to distribute the flow equally in all directions. The sludge removal mechanism revolves slowly and has arms equipped with scrapers. The hopper collects the sludge, which is sent to the sludge drying beds. The sludge produced is known as biological sludge. The layout of the effluent treatment plant is given in **Figure-5.1.**

- ***Clariflocculator***

The working is similar to that of secondary clarifier described above, except that additional flocculator compartment is provided for formation of flocs with the help of coagulant viz. alum.

- ***Pressure Filter***

The effluent from the clariflocculator will be subjected to tertiary treatment, in order to further reduce the suspended solids in the effluent. One filtration unit will be provided to remove colloidal flocs and turbidity carried over from clariflocculator. The filtration unit consists of filter feed pumps, dual media pressure filter, frontal piping and air blower for air scouring.

- ***Drying of Chemical and Biological Sludge***

Sludge drying beds will be provided to de-water the sludge containing about 95-99% water. The dewatered sludge, in the form of dried cake, will be disposed off. Sludge is spread on the media containing gravel and sand. Simple physical straining of solid takes place. Water is partially evaporated at ambient temperature. At the bottom of the media, a collection system comprising of open jointed pipes will be provided to collect the filtrate. The entire system is enclosed by brick masonry. Filtrate is carried to influent sump.

- ***Utilization of STP***

The sewage water reclamation plant will cater to the load envisaged from the proposed plant. The layout and section of the sewage treatment plant is given in **Figure-5.2**.

- ***Wastewater Treatment - Effluent Treatment Plant at CPP***

The effluents from the respective neutralization pits in the CPP (DM plant, blow down from steam generator) will be routed to an Effluent Treatment Plant (ETP). The ETP consists of neutralizer, clarriflocculator, pressure filters and softener. The sludge from the clarriflocculator is routed to sludge drying beds. The effluent will be subjected to tertiary treatment for 100% re-utilization.

➢ ***Effluent Disposal***

The treated wastewater quality will confirm to the GSR-422 (E) standards for on land irrigation. The treated water will be re-cycled back to the water reservoir for use in the CPP make-up and dust suppression. Due to the above treatment process and 100% re-utilization of the treated wastewater there will not be any adverse impact on the water quality as no effluent will be discharged outside the plant premises. The wastewater from various units of the plant will be appropriately treated and disposed and the details are provided in **Table- 5.1.**

TABLE-5.1
WASTE WATER AND TREATMENT

Type of Wastewater	Treatment Proposed
Cooling tower blow down	Used in CHP, AHP
Boiler blow down	Sent to raw water reservoir after treatment for oil and grease
DM water treatment plant regeneration water	Neutralization pit and sent to guard pond
Service water	Sent to CMB
Effluents from fuel storage areas, floor washings, runoff from Oil handling area	Passed through Oil water separator and sent to guard pond
Sewage from township and plant	Treated in STP

Effluent zero discharge concept will be adopted for the proposed plant. The liquid effluents will be collected and treated/recycled:

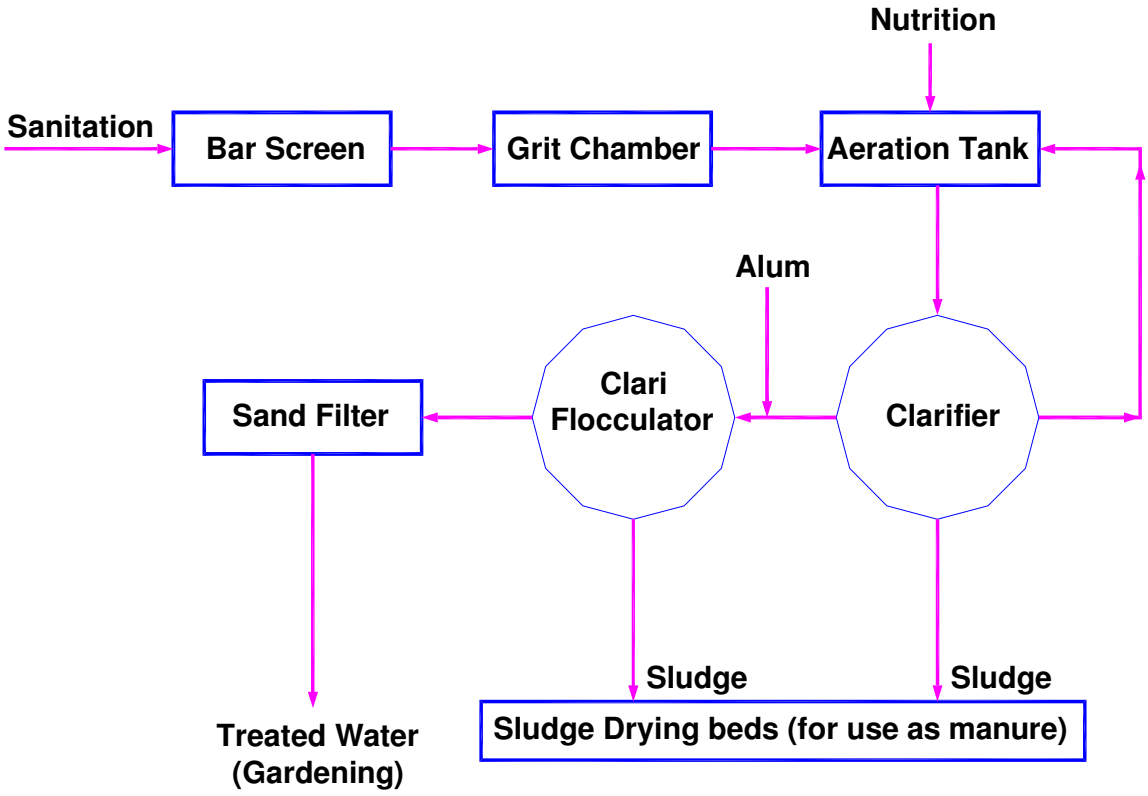

FIGURE-5.1
SCHEMATIC DIAGRAM OF SEWAGE TREATMENT PLANT

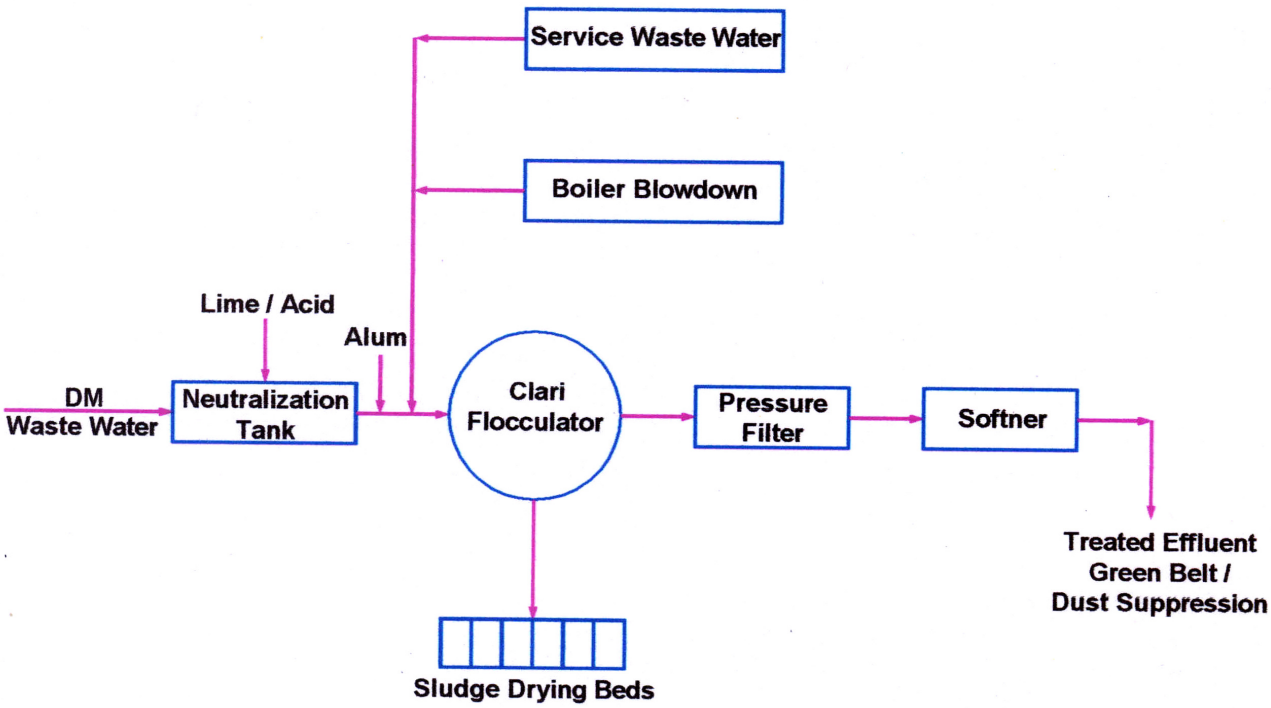

FIGURE-5.2
SCHEMATIC DIAGRAM OF EFFLUENT TREATMENT PLANT

The sludge from the clarifiers will be dewatered in the sludge thickener and solids will be disposed of the plant. Clear water will be led to clarified water reservoir for reuse. The waste water from the DM plant and pressure filter will be collected in neutralising pit and neutralised before pumping it to the guard pond. The plant & building drains will also be collected in the guard pond. The boiler blow down will be led to clarifier for reuse. The oily waste water from the plant will be treated using oil water separator and the oil separated water will be led to the guard pond. Complete CW blow down will be led to guard pond.

All the effluent collected in the guard pond (of existing plant) will be mixed and settled. This water will be used for coal handling plant dust suppression and in ash handling plant. The remaining water will be used for gardening purposes.

➢ **Rain Water Harvesting**

- *Roof Top Rain Water Utilization Program for Industrial Area*

❖ Administrative Block

There will be an administrative building in the industrial area having flat roof top area. This building will be provided with four PVC drain pipes in the front and four PVC drain pipes in the back. Entire roof top rain water is collected through these drain pipes and brought to a cemented drain which is 0.5 m in width and 0.6 m deep and will be constructed in front and back of the building.

It is proposed that cemented drain may be used as recharge trench by deepening it up to depth of 1 m. The excavated part of the drain will remain unlined and naked and will be filled with filter media.

❖ Work shop

There will be a mechanical and electrical workshop in the plant area having sloping roof and roof top area. This building will be provided with galvanized semi-circular trough for collecting rain water which comes down through drain pipes. There will be PVC drain pipes in the front and in the back of the workshop shed. Entire roof top rain water will be collected through these drain pipes and brought to a cemented drain which will be 0.5 m in width and 0.6 m deep and will be constructed in front and back of shed and goes to nearby open area.

It is proposed that cemented drain may be used as recharge trench by deepening it up to total depth of 1 m. The excavated part of the drain will remain unlined and naked and will be filled with filter media.

❖ Surface Runoff Utilization from Paved Roads

Industrial area will have few main asphaltic roads which are meant for approaching different buildings as mentioned above. These roads will be 8 and 6 m wide having slopes on either sides.

It is proposed that entire runoff from the roads be utilized for ground water recharge by constructing a recharge trench along the road on either sides. Proper

slopes may be provided so that entire rain water joins the trench. The trench will be 0.40 m wide for 8 m wide roads and 0.30 m wide for 6 m wide roads with one metre depth and the same section of filter media as suggested earlier. The trenches will be unlined with top layer of pebbles so that underlying coarse sand does not get disturbed and also the trenches are visible while walking.

The rain water harvesting measures are also proposed to be carried out in colony area through three recharge pits and three recharge trenches, ground water storage will be augmented during a normal rainfall year.

With all the rain water harvesting measures proposed to be carried out in the plant area through recharge trenches and percolation ponds, ground water storage will be augmented during a normal rainfall year. This is in addition to the increment in the ground water storage due to normal rainfall by natural recharge.

- **Groundwater Recharge with Rain Water Harvesting**

There is generation of surface run-off from the plant facility during monsoon season. The run-off will be of two types, i.e., run-off from the pervious area of the facility site and run-off from the built-up area of the facility.

- **Run-off from the Built-up Areas**

The run-off from the paved surfaces of the proposed facility will be routed through a carefully designed storm water drainage network and collected in storm water collection sump and excess rainwater will be discharged to bore wells constructed on these internal drains.

- **Run-off from the Pervious Area**

The run-off from the pervious area will be routed directly to the rainwater harvesting structures constructed at suitable locations as per the contours. For augmenting the ground water resources in the plant premises, number of rainwater harvesting pits will be constructed and the internal drains where excess rain water is flowing in drain will be diverted to these pits. These structures will facilitate percolation of water into the ground thus augmenting the groundwater sources. The roof top water will be routed to the storm drains. This will result in increase in groundwater tables and to some extent in the improvement of ground water quality. The size and the locations of rainwater harvesting pits will be decided during detailed engineering of the project. Run off from the proposed project site is calculated using rational formula:

Average run-off from the proposed project facility is calculated using rational formula:

Q = C x I x A
Q = Run-off in m^3/annum
A = Catchment Area (sq.m)
C = Coefficient of Run-off
I = Intensity of Rainfall in m/annum =0.752 m/annum

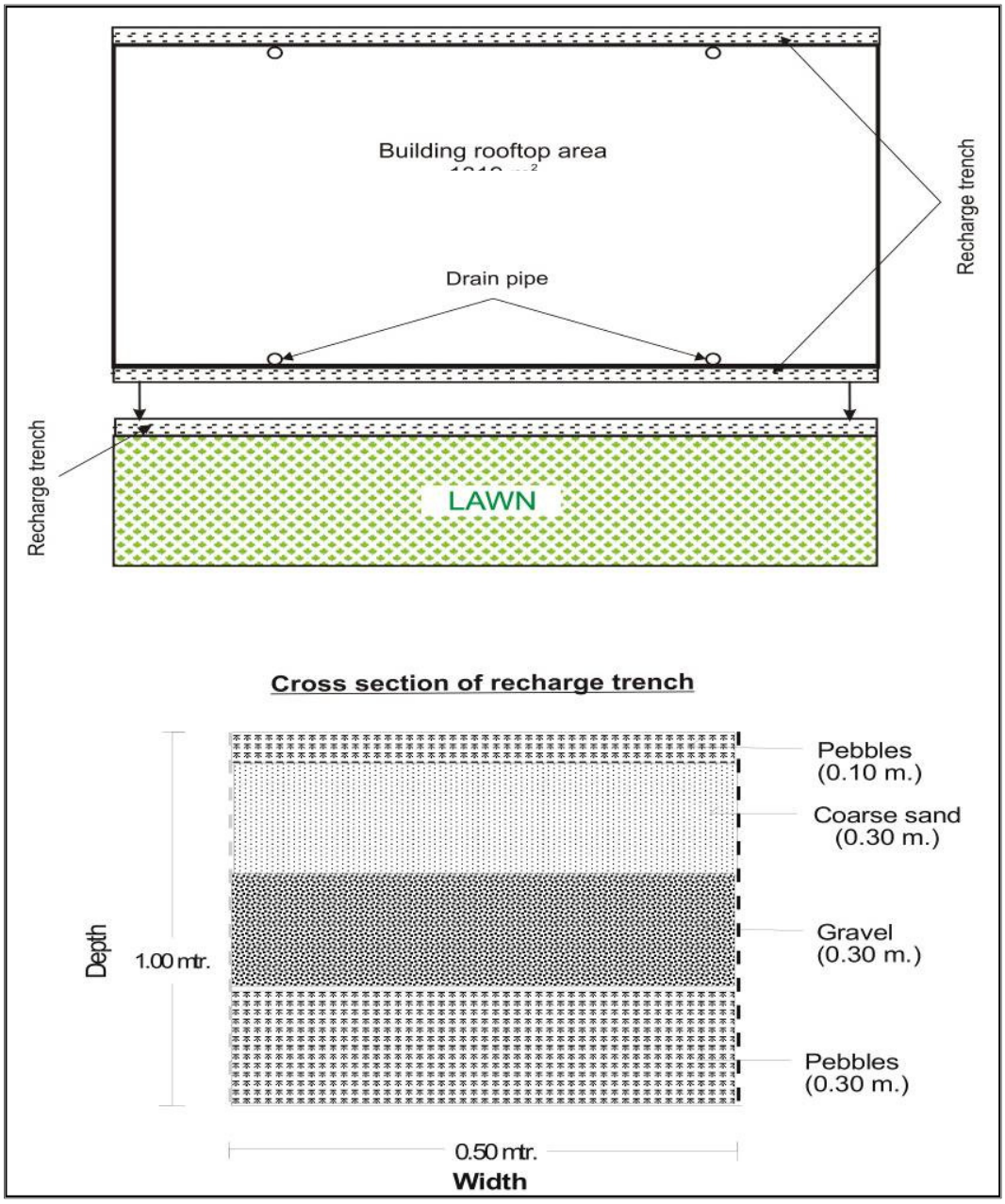

FIGURE-5.3
RAIN WATER HARVESTING STRUCTURE

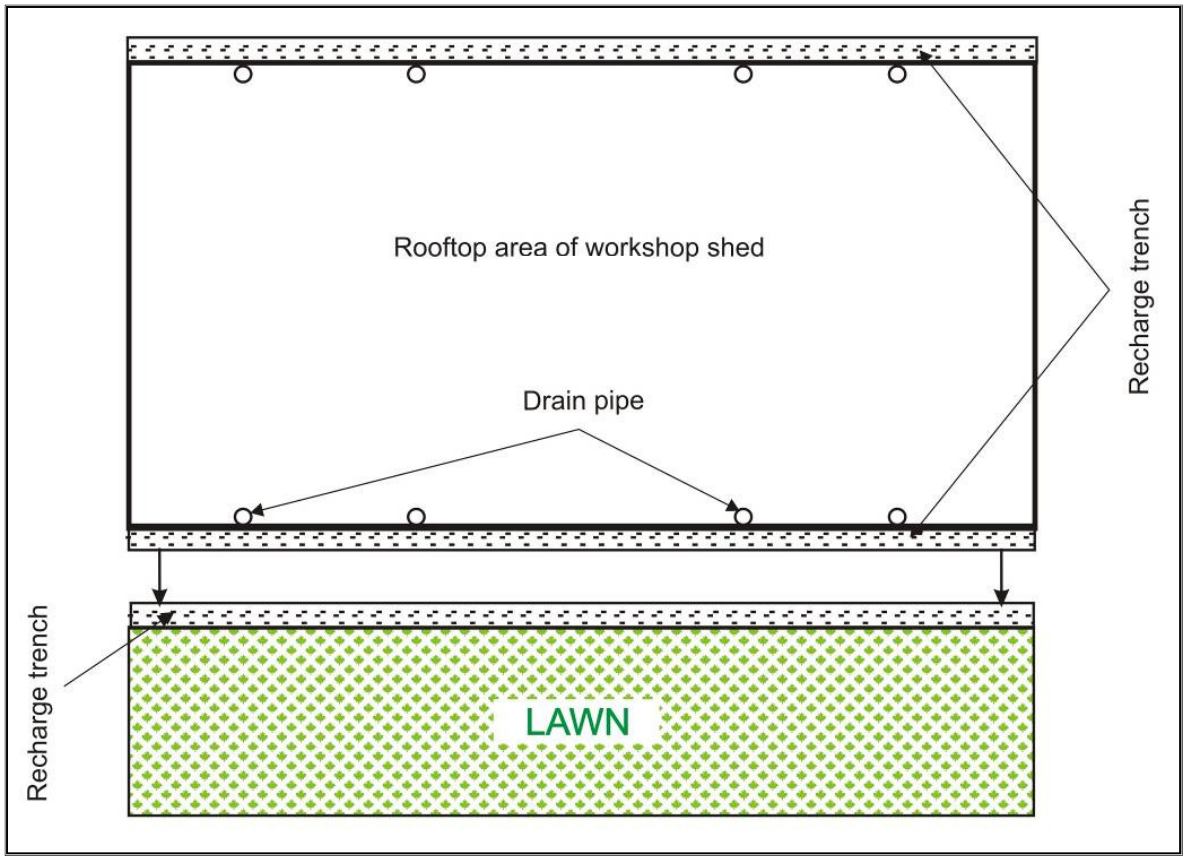

FIGURE-5.4
RECHARGE SYSTEM FOR WORKSHOP

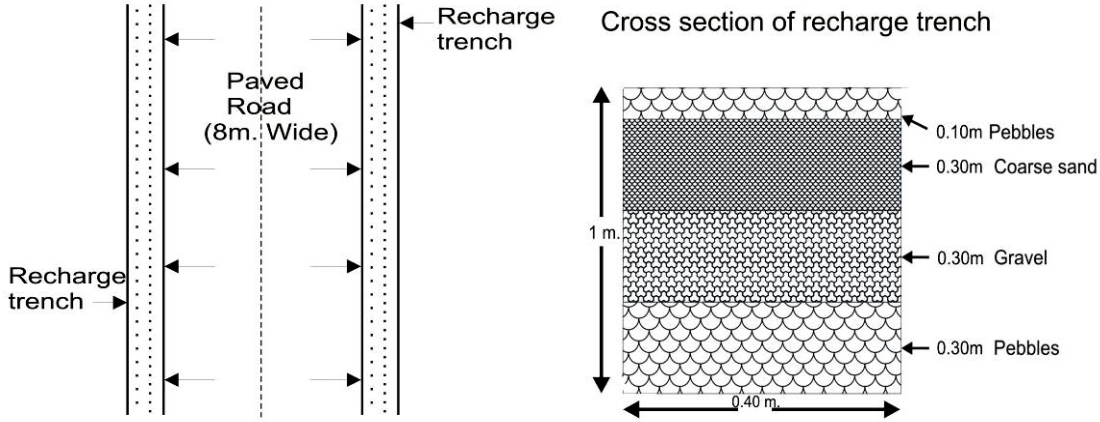

FIGURE-5.5
RECHARGE SYSTEM FOR PAVED ROAD THROUGH RECHARGE TRENCH

5.3.4 Solid Waste Management

The ash generated in CPP will be 100% utilized for cement manufacturing.

Waste Minimisation

The proposed waste minimisation, recycle, reuse& recovery techniques will be implemented in various processes during the operational phase of the project. The list of waste minimisation techniques in various processes of captive power plant is given in **Table-5.2.**

TABLE-5.2
WASTE MINIMISATION APPROACH IN VARIOUS PROCESSES OF CAPTIVE POWER PLANT

Sr. No	Process Area	Activity	Environmental Benefits
1	Coal handling & processing	Reduce handling losses during unloading/ loading and conveyance by ensuring appropriate moisture content and dust collection/suppression systems	1. Conservation of natural resources 2. Low PM in work environment
		Efficient operation of dust collectors during coal crushing and feeding to paste plant	
		Periodic calibration of weigh scales and their cross verification at various points	
2	Steam generation	Ensure complete coal combustion with minimum un-burnt carbon and excess air in boiler exhaust	1. Efficient use of natural resources 2. Efficient application or 3R principles
		Maximize waste heat recovery through recuperators and economizers	
		Maintain boiler condition so as to maximize the heat transfer through predictive/preventive maintenance	
		Avoid steam leakages during transfer to ST	
		Ensure calibration of steam flow meters and conduct periodic cross verification with coal consumption and power generation	
3	Power generation	Ensure periodic maintenance of ST and its maximum loading	Efficient use of natural resources
		Monitor and maintain specific steam/power consumption ratio as per suppliers specifications	
4	Ash Management	Strive to generate minimum ash by achieving highest boiler and turbine efficiencies	Minimum high volume waste generation
		Maximize ash use in cement industries, applications, including mine backfilling so that its storage, handling/re-handling is reduced	1. Minimum land use for waste storage 2. Reclamation of abandoned mines
5	Auxiliary power Consumption	Carryout periodic energy audit to identify opportunities for reduction in electricity consumption and ascertain that auxiliary power consumption is below or as per theoretical values	Conservation of non-renewable natural resource
6	Water Conservation	Recycling of all the boiler blow-down and part of the cooling tower blow down for reuse in the process	1. Reduced water demand 2. Efficient use of

Sr. No	Process Area	Activity	Environmental Benefits
		Increases the COC in Cooling towers and to recycle the water.	waste water streams
		Conduct water audit after plant stabilization to identify the areas for further conservation	

5.3.5 Greenbelt Development

➢ **Objectives of Greenbelt**

Implementation of afforestation program is of paramount importance for any industrial development. In addition to augmenting present vegetation, it will also check soil erosion, make the ecosystem more complex and functionally more stable, make the climate more conductive and restore water balance. It can also be employed to bring areas with special problems under vegetal cover and prevent further land deterioration. The total plant area covering cement plant and proposed power plant is about 141.57-ha out of which total 33% ie 46.7-ha will be converted into greenbelt development area. Plantation scheme is given in **Table-5.3**.

TABLE-5.3
PLANTATION SCHEME

Year	Area (ha)	No. of trees / ha	Total saplings
I	9.34	2500	23350
II	9.34	2500	23350
III	9.34	2500	24300
IV	9.34	2500	23350
V	9.34	2500	24300
Total	**46.7**	**2500**	**116750**

About 33% of plant area will be allotted for green belt development. Nearly 116750 samplings will be developed in an area of 46.7 ha (2500 trees/ha). Environment management plan is shown in **Figure-5.6**.

The detailed program for green belt is given below:

➢ **Criteria for Selection of Species**

Species to be selected will fulfill the following specific requirements of the areas:

- Availability of seed material;
- Tolerance to specific conditions or alternatively wide adaptability to eco-physiological conditions;
- Rapid growth;
- Capacity to endure water stress and climatic extremes after initial establishment;
- Differences in height, growth habits and bole shapes;
- Pleasing appearance;
- Capacity to selectively concentrate some materials from the surroundings;
- Providing shades;
- Large bio-mass and leaves number to provide fodder and fuel;
- Ability of fixing atmospheric Nitrogen; and
- Improving waste lands.

➢ **Raising Seedlings in Nursery**

Seedlings will be raised in nurseries. Adequate number of surplus seedlings will be available considering 10% mortality in seedlings. Healthy seedlings will be ready for transfer to permanent location before rainy season.

➢ **Preparation of pits and preparing them for transfer of seedlings**

- Standard pit size will be 1 m x 1 m x 1 m;
- The distance between pits will vary depending on their location;
- The pits will be filled using good soil from nearby agricultural fields (3 parts) and Farm yard manure (1 part);
- Rhizobium commercial preparation (1 kg/1000 kg);
- BHC powder, if the soil inhabits white ants (Amount variable); and
- The pits will be watered prior to plantation of seedlings.

➢ **Recommended Species for Plantation**

Based on climate and soil characteristics of the study area, some species are recommended for plantation. The climate of the region is extreme where there is heavy rainfall as well as extreme heat and soil temperature is very high in summer. Hence in order to have a ground cover, some fast growing species which do not require watering have been recommended for mass plantation. The species are as presented below:

- *Albizia lebeck* (Kala siris)
- *Leucena latisiliqua* (Sabubal)

The above mentioned species not only resist water stress but also covers the ground quickly and also have wider soil adaptability.

For protecting the environment from dust, temperature, chemicals, emissions the following species have been recommended.

Plant species for plant area and its Boundary

- *Azadirachta indica* (Neem)
- *Butea monosperma* (Palas)
- *Bauhinia purpuriai* (Papeli)
- *Syzygium cummini* (Jamun)
- *Ponqamia pinnata* (Honge)
- *Mangifera indica* (Aam)
- *Ficusbenghalensis* (Ala)
- *Bambusa multiplex* (Bas)
- *Tamarindus indica* (Imli)
- *Acaciachundra* (Mungli)
- *Acacia lebbeck* (siris)
- *Acacia Leucophloe (Sarkar Tumma)*

Plant species for vacant spaces:

- *Syzygium cumminii* (Jamun)
- *Eucalyptus hybrid* (Nilgiri)
- *Azadirachta indica* (Neem)
- *Pongamia glabra* (Ganuga)
- *Terminalia arjun* (Arjun)
- *Ficus reliosa* (Pipal)
- *Casia fistula* (Amaltas)
- *Bambuea multiplex* (bas)
- *Tamarindus indica* (Imli)
- *Polyalthia longifolirai* (Asoka)
- *Butea monosperma* (Palas)

5.3.6 Socio-Economic Development

The development activities needs to be taken up, based on the requirement of the people in the area. The basic requirement of the community needs to be strengthened by extending health care, educational facilities developed in the township to the community, providing drinking water to the villages affected, building/strengthening of existing roads in the area.

The preference will be given to the local population for direct and in-direct employment. The proposed project may create opportunities for indirect employment in the field of vehicle hiring, labours, trading of construction material, carpenters etc. This will help in improving the socio economic status of the region.

The company will participate in social development activities in all the villages surrounding the proposed plant area. Social welfare activities will be taken up on a large scale. These activities will have the following focus areas:

- Health Care
- Social well being
- Education
- Sustainable Livelihood
- Infrastructure Building
- Afforestation;
- Rural water supply; and
- Assistance in utilizing government programs.

➢ **Health Care**

The following activities have been identified will be implemented through CSR action plan:

- Mobile Health Clinic
- Medical camps for communities and cattle
- Preventive medical care
- More focus on women and child health care
- Awareness on sanitation and hygiene
- Segregation and disposal of domestic wastes

- **Education**

- Infrastructure support to Schools and Educational Institutes
- Scholarships and skill development opportunities
- Computer training
- Personality development training
- Promotion of sports & cultural activities
- Celebration of important national festivals
- Support for organizing natural resource conservation activities

- **Employment and Livelihood**

- Direct / Indirect employment
- Opportunities to work with business associate of the company
- Training program for entrepreneurship development
- Support for women Self Help Group (SHG)
- Guidance and support and for Horticulture, Dairy and Poultry
- Organize training program for better agro productivity its marketing

- **Financial literacy**

- Tie up with banks to promote saving and financial planning

- **Infrastructure**

- Construction of road and building of common interest
- Development of drinking water facilities

- **Natural resource conservation**

- Encourage roof rain water harvesting for safe drinking water
- Construction of check dams
- Implementation of various measure for ground water recharge
- Training program on judicious use of water
- Plantation with the support of local traditional wisdom

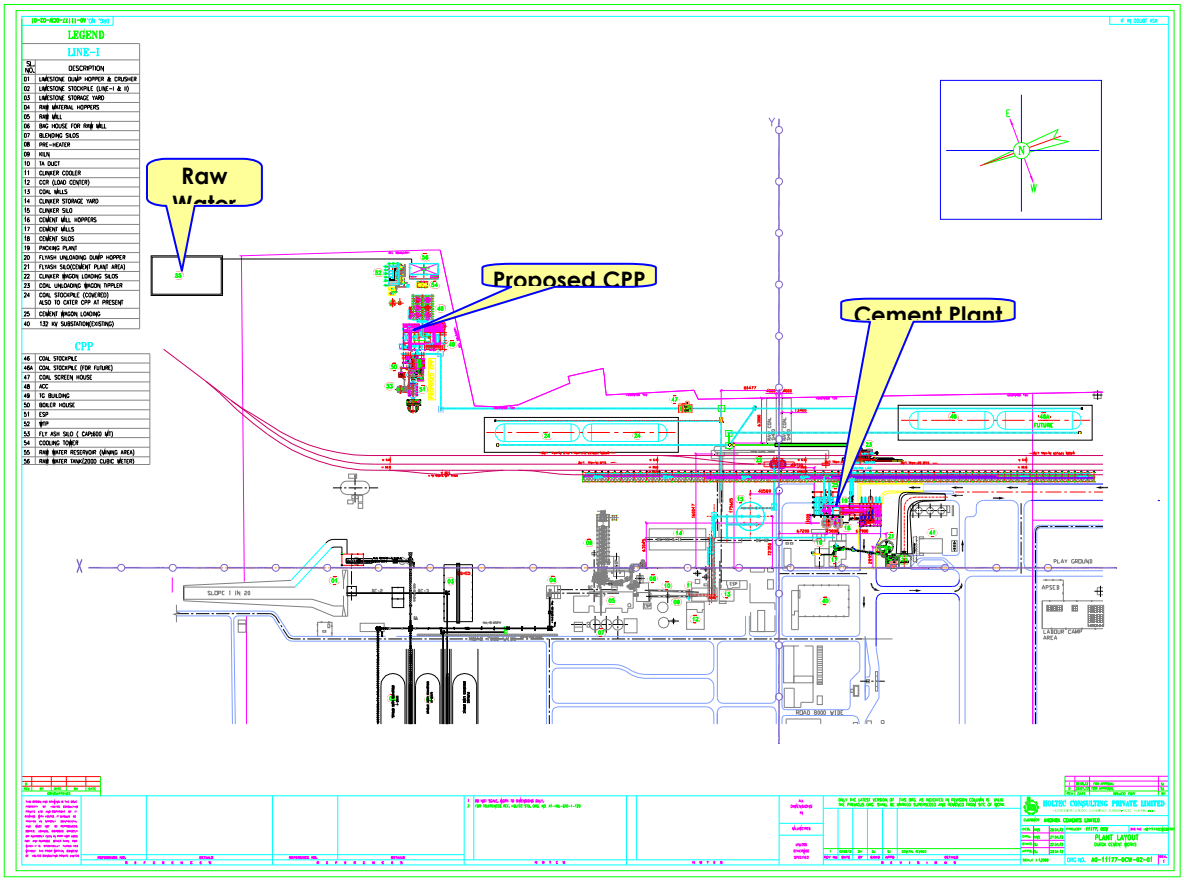

FIGURE-5.6
GREEN BELT DEVELOPMENT PLAN

5.4 Compliance with Corporate Responsibility for Environmental Protection Guidelines

The compliance status of the proposed power plant with CREP guidelines is given below in **Table-5.4**.

TABLE-5.4
COMPLIANCE WITH CREP GUIDELINES

Sr. No.	CREP Guideline	Compliance Status
1	Implementation of Environmental Standards (emission & effluent) in non- compliant ➢ Submission of action plan ➢ Placement of order for Pollution of control equipment	Will be complied with SPCB/CPCB standards
2	For existing thermal power plants, a feasibility study will be carried out by Central Electricity Authority (CEA) to examine possibility to reduce the particulate matter emissions to 100 mg/Nm^3. The studies shall also suggest the road map to meet 100 mg/Nm^3. The studies shall also suggest the road map to meet 100 mg/Nm^3 wherever found feasible.	It is a new proposal. The PM emission calculations will be based on 50 mg /NM3. As per the predicted observations done by the modelling the emissions will be within the limit of NAAQS 2009.
3	New / expansion power projects to be accorded environmental clearance on or after1.4.1.2003 shall meet the limit of 100 mg/Nm^3 for particulate matter.	Not applicable
4	Development of SO2 & NOx emission standards for coal based plants. ➢ New/ expansion power projects shall meet the limit of SO2 & NOx. ➢ Existing power plants shall meet the limit of SO2 & NOX.	CPCB standards will be considered and implemented.
5	Install/activate opacity meters/ continuous monitoring system in all the units with proper calibration system.	CEMs will be planned during operating phase
6	Development of guidelines/ standards for mercury and other toxic heavy metals emissions.	Implemented during operation phase
7	Review of stack height requirement and guidelines for power plants based on micro meteorological data.	Stack of 77m height is proposed for the 30 MW power plant
8	Implementation of use of beneficiated coal as per GOI Notification: Power plants will sign fuel supply agreement (FSA) to meet the requirement as per the matrix prepared by CEA for compliance of the notification as short term measure.	Various options will be explored

Sr. No.	CREP Guideline	Compliance Status
	Options/mechanism for setting up of coal washeries as a long term measure ➢ Coal India will up its own washery ➢ Sate Electricity Board to set up its own washery ➢ Coal India to ask private entrepreneurs to set up washeries for CIL and taking washing charges ➢ SEBs to select a private entrepreneur to set up a washery near pit- head installation of coal beneficiation plant	
9	Power plants will indicate their requirement of abandoned coal mines for ash disposal & Coal India/ MOC shall provide the list of abandoned mines to CEA.	Not applicable
10	Power plants will provide dry ash to the users outside the premises or uninterrupted access to the users within six months.	100% flyash utilisation in cement plant in the same complex.
11	Power Plants should provide dry flyash free of cost to the users.	100% flyash utilisation in adjacent cement plant
12	State P.W.Ds/ construction & development agencies shall also adhere to the specifications/Schedules of CPWD for ash based products utilization MoEF will take up the matter with State Governments.	100% utilization in Cement plant in the same complex.
13	(i) New plants to be accorded environmental clearance shall adopt dry flyash extraction or dry disposal system or Medium (35-40%) ash concentration slurry disposal system or Lean phase with hundred percent ash water re-circulation system depending upon site specific environmental situation. (ii) Existing plants shall adopt any of the systems mentioned in 13 (i).	Taken into consideration.
14	Flyash Mission shall prepare guidelines/manuals for flyash utilization.	Will be implemented during the operational phase
15	New plants shall promote adoption of clean coal and clean power generation technologies	The technology adopted is sub-critical

5.5 Summary of Anticipated Environmental Impacts and Mitigation Measures

The summary of anticipated adverse environmental impacts and the mitigation measures during operational phase are given in the **Table-5.5.**

TABLE-5.5
SUMMARY OF ANTICIPATED IMPACTS DURING OPERATION PHASE

Discipline	Potential Negative Impacts	Probable Source	Mitigative Measures	Remarks
Constructional Impact				
Water Quality	Increase in suspended solids due to soil run-off during heavy precipitation	Loose soil at construction site	During monsoon season run off from construction site will be routed to a temporary sedimentation tank for settlement of suspended solids.	_
Air Quality	Increase in dust and NOx concentration	Levelling activity and heavy vehicular movement	Sprinkling of water in the construction area and unpaved roads will be done. Proper maintenance of vehicles will be done.	The impact will be low, as the main approach road will be tarred.
Noise	Increase in noise level	Construction equipment	Equipment will be kept in good condition to keep the noise level within 90 dB(A). Workers, who are working in the high noisy areas, will be provided with protective equipment. Construction activity will be restricted to day time only.	Workers will be provided necessary protective equipment *e.g.* ear plugs, earmuffs.
Terrestrial Ecology	Clearing of vegetation including cutting of forest areas	Land acquisition and soil enabling activities	Compensatory afforestation will be done. Landscaping and extensive green belt development and plantation in the open area will be carried out. Transplantation of the existing matured trees will be undertaken and transplanted in the area earmarked for greenbelt development.	Extensive plantation in the surrounding areas including plant site will be done. The greenbelt will be developed in plant area, ash pond area, township.
Operational Impact				
Water Quality	Deterioration of surface water quality	Discharge from various plant units and other auxiliary units	Adequate treatment facilities will be provided so that the treated effluents conform to the regulatory standards. All the treated wastewater will be routed to raw water reservoir for reuse. No water will be discharged to surface water body except in rainy season, when runoff water having F<2 will be released to outside the	The reuse of treated wastewater will help in conserving the fresh water resources.

Discipline	Potential Negative Impacts	Probable Source	Mitigative Measures	Remarks
			plant area. The guard pond will be properly lined to prevent any seepages into ground and avoid ground water contamination.	
Air Quality	Increase in PM, SO_2 and NOx levels in ambient air.	Stack emissions and fugitive emissions from coal stockyards and CHP.	ESPs having >99.99 % efficiency will be provided to control Particulates Matter emission to less than 50 mg/Nm^3. Stacks of 77 m height will be provided for the proper dispersion of gaseous pollutants. Low NOx burners will be installed to control NOx emissions. Motorable roads in the plant area will be paved to reduce dust emission. Afforestation programs will be undertaken around the plant area. Dust suppression measures will be implemented in the coal handling plant and stock yards.	The resultant air quality will conform to the stipulated standards.
Solid Waste	Fly ash and bottom ash	From the ESPs	100% ash utilisation in cement plant	Dust generation in ash pond will be controlled by water sprinkling. There will not be any water discharge from the pond and impact on water quality is not envisaged. All endeavors will be made towards 100% fly ash utilization.
Noise Levels	Increase in noise levels in the plant area.	Equipment in main plant and auxiliaries.	Equipment will be designed to conform to noise levels prescribed by regulatory agencies. Provision of green belt and plantation would further help in attenuating noise.	Employees working in high noise areas would be provided earplugs/ earmuffs as protective device.
Demography and Socio-Economics	Strain on existing amenities like housing, water	Influx of people of proposed	Locals will be given preference in employment and especially displaced	Overall socio-economic status of the area is

Discipline	Potential Negative Impacts	Probable Source	Mitigative Measures	Remarks
	sources and sanitation, medical and infrastructure facilities.	power plant employees as well as contractor's employees/ labourers.	persons on priority. No significant impact is envisaged as sufficient additional facilities are proposed by the project proponents.	expected to improve considerably.
Storm Water Control	Impact on water resources	Rain water	Treat storm water discharges from site. Separate storm drains will be provided.	Separate storm water drains will ensure discharge of uncontaminated run-off water during rainy season. The collected run-off water from the drains will be used for rainwater harvesting within the plant premises.
Fire & Safety	Accidents and disasters related to fire & safety	Chemical and fuel storages	Disaster Management Plan (DMP) has been prepared	On-site and Off-site Emergency plan will be implemented during any disaster.

5.6 Environment Management System

Environment policy at industry level is yet to be defined formally. Standards are stipulated by various regulatory agencies to limit the emission of pollutants in air and water. Similarly, a mandatory practice is recommended for preparing an Environment statement each year in order to encourage the industries to allow efficient use of resources in their production processes and reduce the quantities of waste per unit of product. This in itself is not sufficient since this does not provide an assurance that its environment performance not only meets, will continue to meet, legislative and policy requirements.

Hence, Environment Management Systems (EMS) is suggested at the industry level for ensuring that the activities, products and services of the region conform to the carrying capacity (supportive and assimilative capacity) of the environment. Since this is more in line with the quality systems, it is proposed to develop one as outlined in the following sub sections. The EMS - its set-up, role and responsibilities is given below.

5.6.1 Formation of an Environment Management System

The environment management system for the power plant will enable it to maximize its beneficial effects and minimize its adverse effects with emphasis on prevention. It will:

- Identify and evaluate the environment effects arising from the plant's activities;
- Identify and evaluate the environment effects arising from incidents, accidents and potential emergency situations;

- Identify the relevant legislative and regulatory requirements;
- Enable priorities to be identified and pertinent environment objectives and targets to be set;
- Facilitate planning, control, monitoring, auditing and review of activities to ensure that the policy is complied with; and
- Allow periodic evaluation to suit changing circumstances so that it remains relevant.

5.6.2 Implementation of an Environment Management System

The top management of the power plant is committed to development of its activities in an environmentally sound manner and supports all efforts in achieving this objective. In pursuance of this, formal environment management system shall be established during the operating phase of the plant which shall carry out periodic environment review, covering the following four areas:

* Legislative and regulatory requirements;
* Evaluation and registration of significant parameters and their environment impacts;
* Review of environment management practices and procedures being proposed; and
* Assessment of feedback from investigation of previous environment incidents and noncompliance with legislation, regulations or existing policies and procedures.

The environment review shall address the following:

* The nature and extent of problems and deficiencies;
* The priorities to be accorded to rectify them; and
* An improvement program designed to ensure that the personnel and material resources required are identified and made available.

- ***Environment Management Records***

The power plant shall establish and maintain a system of records to demonstrate compliance with the environment management systems and the extent of achievement of the environment objectives and targets. In addition to the other records (legislative, audit and review reports), management records shall address the following:

* Details of failure in compliance and corrective action;
* Details of complaints and follow up action;
* Appropriate contractor and supplier information;
* Inspection and maintenance reports;
* Monitoring data; and
* Environment training records.

- ***Environment Management Reviews***

The senior management shall periodically review the Environment Management System (EMS) to ensure its suitability and effectiveness. The need for possible

changes in the environment policy and objectives for continuous improvement shall be ascertained and revisions made accordingly.

5.6.3 Implementation Schedule of Mitigation Measures

The mitigation measures suggested in Chapter-4 shall be implemented so as to reduce the impact on environment due to the operations of the proposed project. In order to facilitate easy implementation of mitigation measures, the phased priority of implementation is given in **Table-5.6**.

TABLE-5.6
IMPLEMENTATION SCHEDULE

Sr. No.	Recommendations	Time Requirement	Schedule
1	Air pollution control measures	Before commissioning of respective units	Immediate
2	Water pollution control measures	Before commissioning of the plant	Immediate
3	Noise control measures	Along with the commissioning of the Plant	Immediate
4	Ecological preservation and up gradation	Stage wise implementation	Immediate & Progressive

Source: Vimta Labs Limited, Hyderabad

5.7 Budgetary Allocation for Environment Protection

As environment protection will be monitored and implemented by a centralized environment management cell. The capital cost of the proposed project will be Rs. 135.38 Crores. The details of investment for procuring the equipment for efficient control and monitoring of pollution along with annual recurring cost are given in **Table-5.7.**

TABLE-5.7
COST OF ENVIRONMENTAL PROTECTION MEASURES

Sr. No	Particulars	Proposed Cost	
		Capital (Rs. Crores)	**Recurring Cost per Annum (Rs. Lakhs)**
1	Pollution monitoring and air quality equipment's	14.7	4.2
2	Water quality monitoring & management	1.0	0.8
3	Greenbelt / Plantation for entire period	0.5	2.2
4	Occupational Health	0.2	0.0
	Total	**16.3**	**7.2**