Cauvery Power Generation Chennai Pvt. Ltd

PRE-FEASIBILITY REPORT

ON

ENVIRONMENTAL ASPECTS

OF

PROPOSED

EXPANSION

BY

Installation of additional 2 x 180 MW

within/adjacent to the Existing 1 x 63 MW Plant Site

at

Billakuppam Village,

Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu.

August 2014

CONTENTS

1.0 EXECUTIVE SUMMARY 1

2.0 INTRODUCTION 3

3.0 ABOUT PROJECT PROPONENT 3

4.0 THE PROPOSED PROJECT 4

5.0 PROJECT LOCATION 4

6.0 LAND USE/LAND CLASSIFICATION 7

7.0 RAW MATERIALS CONSUMPTION 7

8.0 FUEL TRANSPORTATION 8

9.0 PROCESS DESCRIPTION 8

10.0 RAW WATER REQUIREMENT 15

11.0 ENERGY CONSUMPTION 17

12.0 WORK FORCE 17

13.0 WASTE & WASTE MANAGEMENT 17

13.1 Air Pollution 17
13.2 Waste Water Management 20
13.3 Solid Waste Management 20

14.0 SITE ANALYSIS, PLANNING & REHABILITATION AND RESETTLEMENT 21

15.0 PROJECT SCHEDULE & COST ESTIMATION 21

16.0 CONCLUSION 21

Fig 1.0 Project Location 5

Fig 2.0 Plant Layout 6

1.0 EXECUTIVE SUMMARY

The Proposed activity is Expansion of existing power plant by installing additional 2 x 180 MW coal based thermal power plant within/adjacent to the existing operating plant site, wherein 1 x 63 MW is already in operation.

Project Location

The location of the project is at Billakuppam Village, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu. The plant site is devoid of any forest land. There are no areas of ecological sensitivity or notified bio diversity area or wildlife sanctuary etc. within 10 kms radius of the plant site.

Project Proponent

Cauvery Power Generation Chennai Private Limited (CPGCPL) is a Special Purpose Vehicle by promoters' of Kaveri Gas Power Ltd. Now it has proposed to expand the existing power plant by installing additional 2 x 180 MW coal based power plant within/adjacent to the existing plant site, wherein 1 x 63 MW is already in operation.

Products & Capacity

Expansion of Thermal Power generation using coal by installing additional 2 x 180 MW power plant within/adjacent to the existing operation of 1 x 63 MW power plant site.

Raw Material Requirement

The raw material used will be Imported Coal.

The details of coal consumption are as follows

Existing 1 x 63MW	Proposed Additional 2 x 180 MW	Upon Expansion
905 T/D	5130 T/D	6035 T/D

Raw Water Requirement & Source

Main Condensate is based on Air Condensate Cooling. The water requirement are as follows:

Existing 1 x 63 MW	For Proposed 2 x 180 MW	Upon Expansion
51 KLD	221.5 KLD	272.5 KLD

It is proposed to fully augment & install a wholesome rain water harvesting system to meet the raw water requirement through a series of rain water reservoirs / borewells.

Solid Waste Generation & Method of Disposal

The details of total Ash generation are as follows.

Solid Waste	Existing 1 x 63MW	Proposed 2 x 180MW	Upon Expansion
Fly Ash	40 T/D	115 T/D	166 T/D
Bottom Ash	1 T/D	14 T/D	15 T/D

Fly ash at present being completely disposed and would also be completely disposed after expansion.

The Bottom ash will be stored in Ash dykes.

Man Power

The work force in existing operation is 50-Nos, whereas an additional 100 workers will be required for operation of expansion plant.

Project Cost

The project cost for expansion will be Rs.1800/- Crores.

2.0 INTRODUCTION

India's Electricity Act 2003 introduced structural changes to the power industry, permitting private investment for the first time since 1948. This allowed establishment of private power plants.

Private Power Plants are set-up either as Merchant Power Plant, Independent Power Producer (IPP), Captive Power Plant (CPP) or a Group Captive Power Plant.

Private Power Plants in recent times has helped bridge gap between Demand & Supply of electrical energy. More so, Private Power Plants have helped the State Government utilities in meeting the electrical power requirements to a large extent.

3.0 ABOUT PROJECT PROPONENT

Cauvery Power Generation Chennai Private Limited (CPGCPL) is a Special Purpose Vehicle promoted by promoters' of Kaveri Gas Power Ltd.

CPGCPL has set up a Coal based Captive Power Plant of 63 MW capacity at Gummidipoondi near Chennai in Tamil Nadu, India.

The plant started generating power from November 2012. The coal for the plant is imported from Indonesia and supplied by Coastal Energy Limited. Being a Captive Power Plant, not less than 51% of the entire power generated is being distributed to the participating Captive Consumers.

Now it has proposed to expand the existing power plant by installing additional 2 x 180 MW coal based power plant within/adjacent to the existing plant site, wherein 1 x 63 MW is already in operation.

4.0 THE PROPOSED PROJECT

The proposed expansion by installing additional 2 x 180 MW coal based thermal power plant within/adjacent to the existing plant premises, wherein 1 x 63 MW is already in operation. The Plant is based on Air Cooled Main Condensate Cooling, Finfan Auxiliary Cooling. The fuel used is imported coal.

5.0 PROJECT LOCATION

The proposed expansion is located within/adjacent to the existing plant premises at Billakuppam Village, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu.

The project location is as shown in **Fig.1.0** and the Plant Layout of the project is as shown in **Fig 2.0**.

Fig 1.0 Location Map

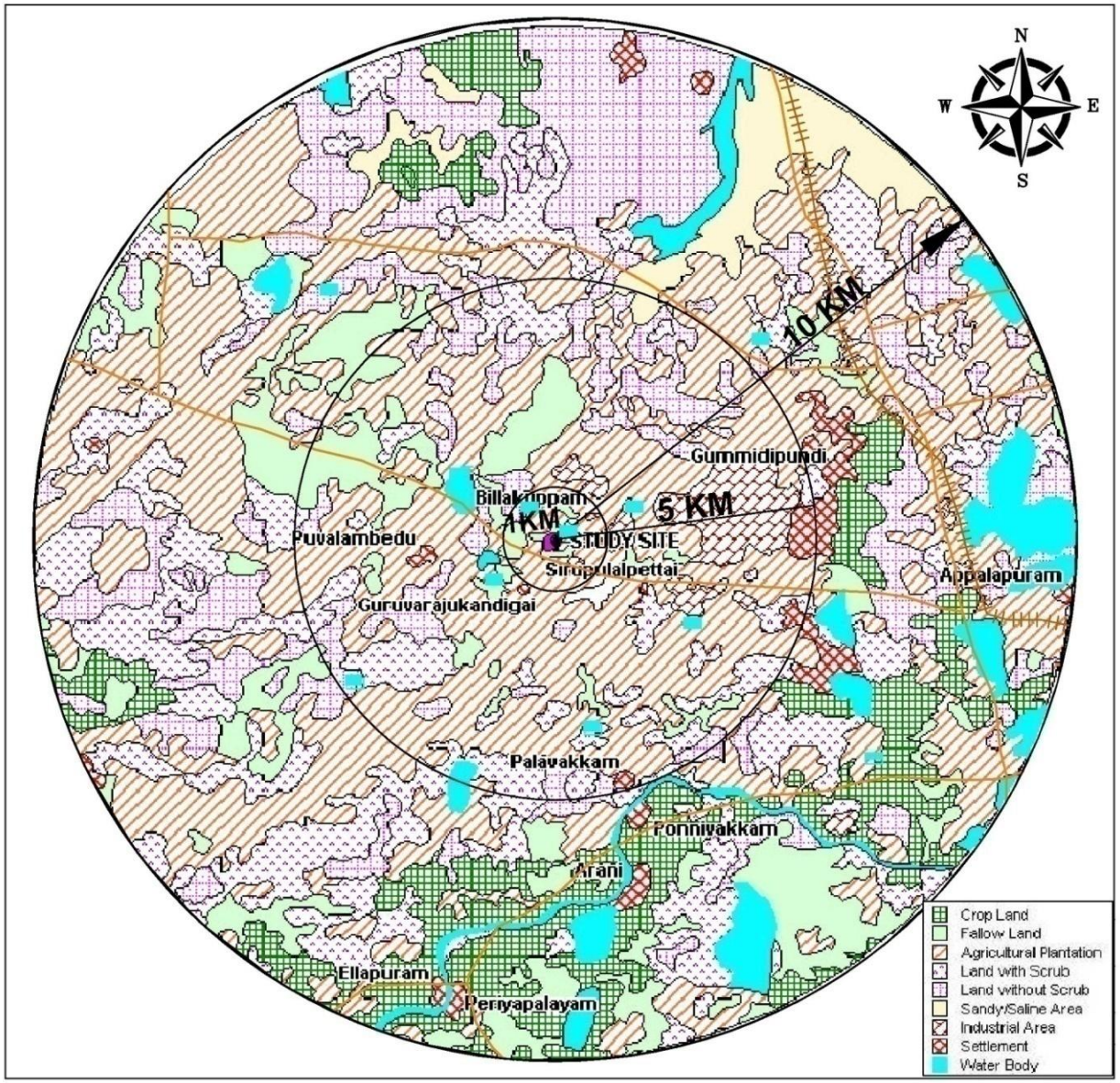
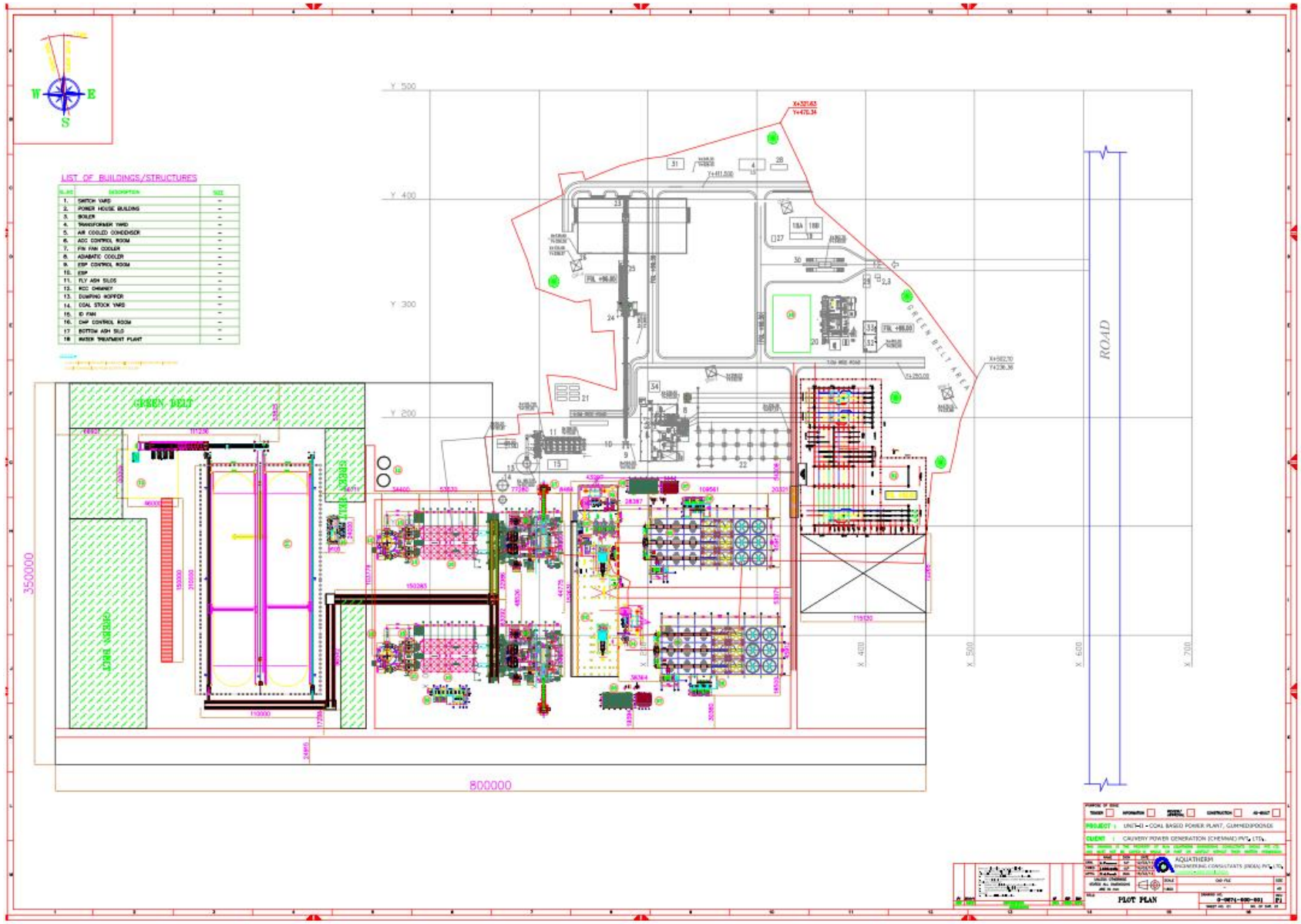


Fig 2.0 Plant Layout



6.0 LAND USE/LAND CLASSIFICATION

The existing plant is located in an unclassified land as per the Directorate of Town & Country Planning, and is a dry rainfed agricultural land as per the Revenue Records. The land proposed for expansion is also a unclassified dry rainfed land..

7.0 RAW MATERIALS CONSUMPTION

The main raw material will be imported coal from Indonesia. The imported coal from Indonesia is at present being used and the expansion plant will also use imported coal from Indonesia. The coal consumption in exiting plant as well as in proposed plant will be as follows.

Existing 1 x 63MW	**Proposed Additional 2 x 180 MW**	**Upon Expansion**
905 T/D	5130 T/D	6035 T/D

The Design Station Heat Rate will be 2453 Kcal/KWh, and an indicative coal characteristics will be as follows.

S. No.	**Particulars**	**Imported Coal**
1	Gross Calorific Value	4100 k cal/kg
2	Moisture	36 %
3	Ash	2.75%
4	Fixed Carbon	43.87%
5	Sulphur	0.5%
6	Hydrogen – 3.42%	3.42%
7	Oxygen – 13.55%	13.55%
8	Nitrogen – 0.91%	0.91%

8.0 FUEL TRANSPORTATION

The existing road, viz. NH-5, SH-52 will be used for coal transportation. Imported Coal will be shipped by sea and unloaded at Ennore Port and then will be transported by road by 40T capacity Trucks, which will be fully closed.

9.0 PROCESS DESCRIPTION

The proposed additional units will have a power generating capacity of **2 x 180 MW** (360000 units per hour). These power plants is of regenerative cycle & reheat design and mainly consists of steam generator and auxiliaries with coal as fuel, regenerative feed heat system with condensing steam turbine and auxiliaries and all other equipment associated.

The heat energy available in the fuels is used to produce steam at 150 ata; 545 Deg C in the water tube boiler. The heat energy present in the steam is used to drive the steam turbine. The turbine and the AC generator are coupled together. Hence, as the turbine rotates, the heat energy is converted into mechanical energy which in turn is converted into electrical energy in the AC generator. The electricity produced in the generator is at 15.75kV. It is further stepped upto 230kV in step up transformers. The power is evacuated to the TNEB grid at 230 kV level.

The main components of the above power plant are

a. Boiler
b. Turbine Generator
c. Air cooled condenser
d. Fuel and Ash Handling System
e. Water Treatment Plant
f. Cooling water system
g. Electricals
h. Power Evacuation Equipments

Boiler:

563 tph, 150 ata, Pulverised Coal Fired Boiler with single furnace with reheat superheater design, radiant dry bottom, two passes, supported by full steel structure,

water cooled, membrane wall, high-temperature steam cooled superheaters, natural water circulation and balanced draft for gas and air system

The steam generator for the proposed power plant will have PC boiler. The boiler shall be having coal pulverizer with tangential/front wall firing arrangement which crushes the 50mm coal to powder form and injected to furnace through primary air.

Two (2) 100% capacity horizontal multistage, barrel casing centrifugal type, boiler feed pumps, driven by electric motors, are envisaged. Each pump would supply feed water to the boiler through the high pressure heaters and feed control station. Inlet feed water temperature to economiser inlet shall be around 248 Deg.C.

Boiler feed water first enter into the economizer inlet header then go through horizontal economizer bundles, outlet header, connection pipe, drum water zone, and then go to downcomer.

Economizer shall be non-steam type with bare tube heating surface. Connection between flue gas duct and economizer shall be expansion joint type. The tubes shall be configured in line.

Regenerative Air heaters are provided for this project. They are arranged at back end of the boiler connected with gas duct, bifurcated into three (2) chambers for Cold air for combustion, flue gas, cold air for fuel injection

The dust in the flue gas shall be reduced to below 50 mg /Nm^3, by using an Electro Static Precipitator (ESP). The flue gas coming out of the ESP is vented to the atmosphere through a RCC chimney. Each boiler is connected with individual RCC chimney of 120m height

Steam Turbine:

The turbine uses the heat energy available in the steam to produce mechanical energy which is turn drives the alternator to produce electricity. The steam coming out of the turbine is condensed using air cooled condensers. The condensate thus produced is pumped back to the boiler.

Steam turbine shall be 180 MW rating, HP, IP & LP cylinder, horizontally split, multi-valve, multi-stage extraction cum condensing steam turbine with controlled extractions for regenerative feed heating and steam sealing. The turbine will be designed to suit the main steam parameters before emergency stop valve of turbine and exhausting against

condenser back pressure of 0.18 ata. The turbo-generator set is designed for a maximum throttle steam flow at turbine valve wide open (V.W.O) condition of 110% turbine rating condition, if achieved.

Main Steam from boiler will be admitted to HP stage of turbine and its outlet Cold reheat steam will be sent to Reheat chamber of boiler. The Reheat superheated steam will be admitted to IP stage of turbine.

Turbine receives the steam supply through stop valves and governing valves. Exhaust annulus will be sized for an acceptable exhaust steam velocity.

The turbine auxiliaries comprise of seals, governor, turning gear, turning gear oil pump set, turbine oil system along with centrifuge and vapor extractor with coolers, lube oil and seal oil systems with coolers.

All essential controls and safety interlocks shall be provided along with a fully automatic gland sealing system.

The turbine exhaust steam shall be condensed in radial type (transverse to turbine axis) air cooled condenser. Condensate from the condensate storage tank shall be pumped back to deaerator by means of condensate extraction pumps through ejectors & gland steam condenser.

Air cooled condenser :

The exhaust steam from turbine will be fed to the Air cooled condenser where the steam gets cooled and changes in state occurs. The steam gets condensed when it passes in to tubes where the atmospheric air blown using forced draught fan. The condensate gets collected in condensate storage tank and pumped back to deaerator in BTG cycle by Condensate extraction pump

The ACC is designed to achieve the back pressure of 0.18 ata with ambient temperature of 40degC. The no. of streets will be 2 or 3 containing multiple row & cells.

The Complete ACC structure will be steel/RCC in construction including the fan deck area.

Fuel & Ash Handling System:

Imported coal will be used for this project. It is envisaged that Indian coal would be received by dedicated road trucks .Imported coal will be received in port and from port coal will be transported though trucks. Coal will be discharged into the respective below

ground unloading hoppers from the trucks and is fed to crusher. The coal shall also be dozed from the stockyard using dozers or JCBs into the below ground hoppers.

Necessary dust suppression system to the coal unloading above ground hoppers shall be provided.

Capacity of the unloading, crushing system will be to meet peak coal receipt.

Coal unloaded into below ground hoppers, shall be evacuated by the belt conveyor and fed on to the distribution belt conveyor in the crusher house. In the crusher, coal will get crushed and size of the coal will be reduced suitable for the boiler.

The screened / crushed coal of 50mm size from the belt conveyor is being conveyed and storyed in coal shed. Then it is transferred upto the Transfer Tower nearer to the boiler. From transfer tower, the motor operated travelling tripper conveyor is provided to fill the coal into the respective coal bunkers .From the coal bunkers coal will be fed to the purlveriser.

Necessary dust extraction units will be provided on the plough feeders for extracting dust generated during unloading of coal. DE units shall also be provided for Coal Unloading Hopper area, Crusher House, Bunkers and Bunker floor.

The fly ash handling system shall be designed to collect ash in dry form in fly ash silos through pneumatic pressure conveying system.

The fly ash collected in ESP hoppers shall be gravity fed into individual ash vessels provided below each hoppers. Each ash vessel shall be provided with one (1) manual operated knife type gate valve, one (1) stainless steel expansion bellow, one (1) pneumatic operated ash intake valve (dome type) etc.

The conveying air shall be vented to atmosphere through bag filters mounted on top of silo.

The conveying air required for the system shall be drawn from conveying air compressors. The instrument air required for the operation of various valves shall be drawn from the plant instrument air service.

The air required for fluidizing ESP hoppers and fly ash silos for establishing free flow of ash into ash vessels, fly ash silos shall be provided. Two (2) Fluidizing Air Blowers (one working & one standby) with one air heater shall be provided.

One (1) no of fly ash silos in RCC construction, to store fly ash generated from Boiler shall be provided.

Fly ash silos shall be provided with two (2) outlets - one for disposal of ash in conditioned form into open trucks through ash conditioner and other for disposal of fly ash in dry form to closed container trucks through telescopic unloading spout.

The bottom ash generated in the boiler will be collected in a bottom ash hopper through pneumatic conveying or dry ash handling conveyor and transferred to bottom ash silo

One (1) bottomash silo in RCC construction, to store bottom ash generated from Boiler shall be provided.

The bottom ash silo shall be provided with two (2) out lets one for unloading bottom ash in conditioned form to open trucks through ash conditioner and other one with blind flange for future use.

Water Treatment Plant:

The raw water shall be treated in a DM plant to the quality required for the high pressure boiler. The effluent from the DM plant due to regeneration of resins will be treated in a neutralization pit before letting into the guard pond.

The proposed scheme of water treatment plant will be:

Incoming Raw Water Line ---- Raw Water Reservoir ---- Raw Water Pumps ---- Chlorine Dosing Skid ---- PSF / MGF ----- UF Fast Flush Storage Tank ---- UF Fast Flush Pump --- Basket Filter --- Ultra Filter Membrane --- UF Permeate Tank --- UF Backwash Pump --- MCF Feed Pumps --- Acid Dosing Skid ---- Sodium meta bisulphite Dosing ---- Anti scalant dosing ---- MCF --- High Pressure RO Module Feed Pump ---- RO Module --- Chemical Cleaning Skid ---- Degasser Tower --- Degasser Blowers --- Degassed Water Storage Tank ---- Potable water Pumps ---- DG Water Transfer Pump ---- Strong Acid Cation (SAC) Exchanger ---- Acid Measuring Tank ---- Strong Base Anion Exchanger ---- Caustic Dilution Tank ---- Mixed Bed Exchanger ---- Acid Measuring Tank & Caustic Dilution Tank for MB Exchanger ---- Mixed Bed Blower ---- pH Dosing Tank, Pump & MCF ---- DM Water Storage Tanks ---- DM Water Transfer Pumps

The blowdown water from the boiler will be mixed in the Guard pond with the water from neutralization pit. After cooling, the water will be pumped to Waste water treatment plant and less conductivity water is recovered and reused. The final reject water will be used for ash quenching / coal dust suppression / greenbelt.

Feed water pump ---- Chlorine Dosing Skid ---- PSF / MGF ---- UF Fast Flush Storage Tank ---- UF Fast Flush Pump --- Basket Filter --- Ultra Filter Membrane --- UF Permeate Tank --- UF Backwash Pump --- MCF Feed Pumps --- Acid Dosing Skid ---- Sodium meta bisulphite Dosing ---- Anti scalant dosing ---- MCF --- High Pressure RO Module Feed Pump ---- RO Module (2stages) --- Chemical Cleaning Skid ---- Raw water tank.

Cooling water system:

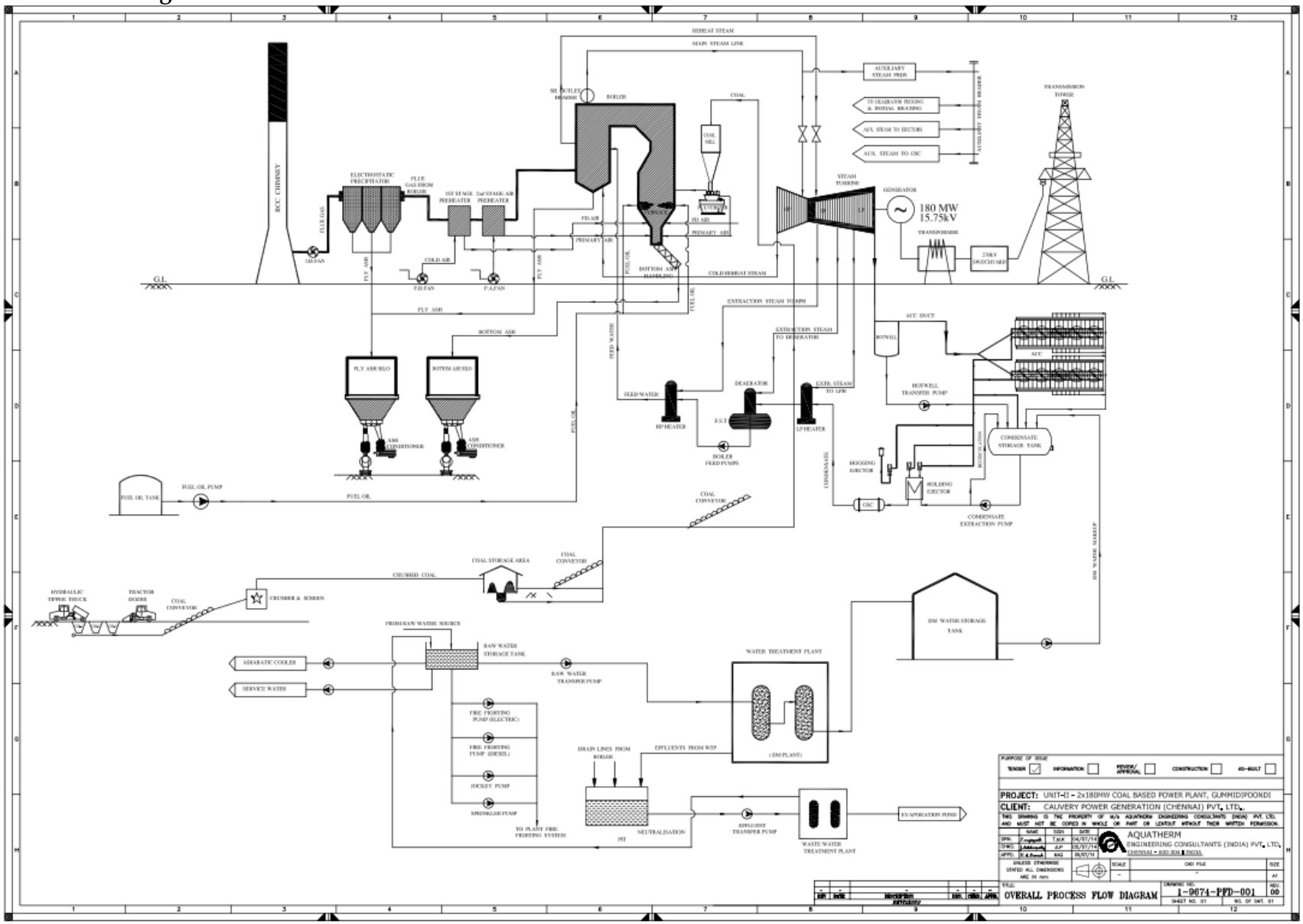
The Fin fan cooler is provided for cooling the process media in lube oil cooler, boiler feed pump, etc., the water gains the heat from the respective process equipment and gets cooled in fin fan cooler tubes exposed to atmospheric air by induced draught fan.

The generator gets cooled by water circulation in Adiabatic cooling arrangement to achieve the desired lower temperature for better efficiency.

Electrical System & Power Evacuation:

The electrical system consists of Power and Motor Control Centre, auxiliary transformers, generator transformer and switchyard equipments like CT, PT, breaker, isolator etc., which are essential for evacuating the power to the TNEB grid. Key line diagram and HT single line diagram attached.

Process Flow Diagram



10.0 RAW WATER REQUIREMENT

The present plant operates using Air Cooled Condenser for Main Condensate cooling, and the proposed units will also be based on Air Cooled Condenser as a means for Main Condensate Cooling.

Moreover, the existing plant operates using finfan cooler for Auxiliary Cooling, and the same mode of operation is proposed in the expansion units also.

THERE IS NO WATER USAGE for any of cooling activities in the unit.

The unit requires at present, and in expansion is only to make-up water lost due to blow down from the boiler. Apart from regenerating requirements of the D.M. Plant.

The details of Water Requirement are as follows

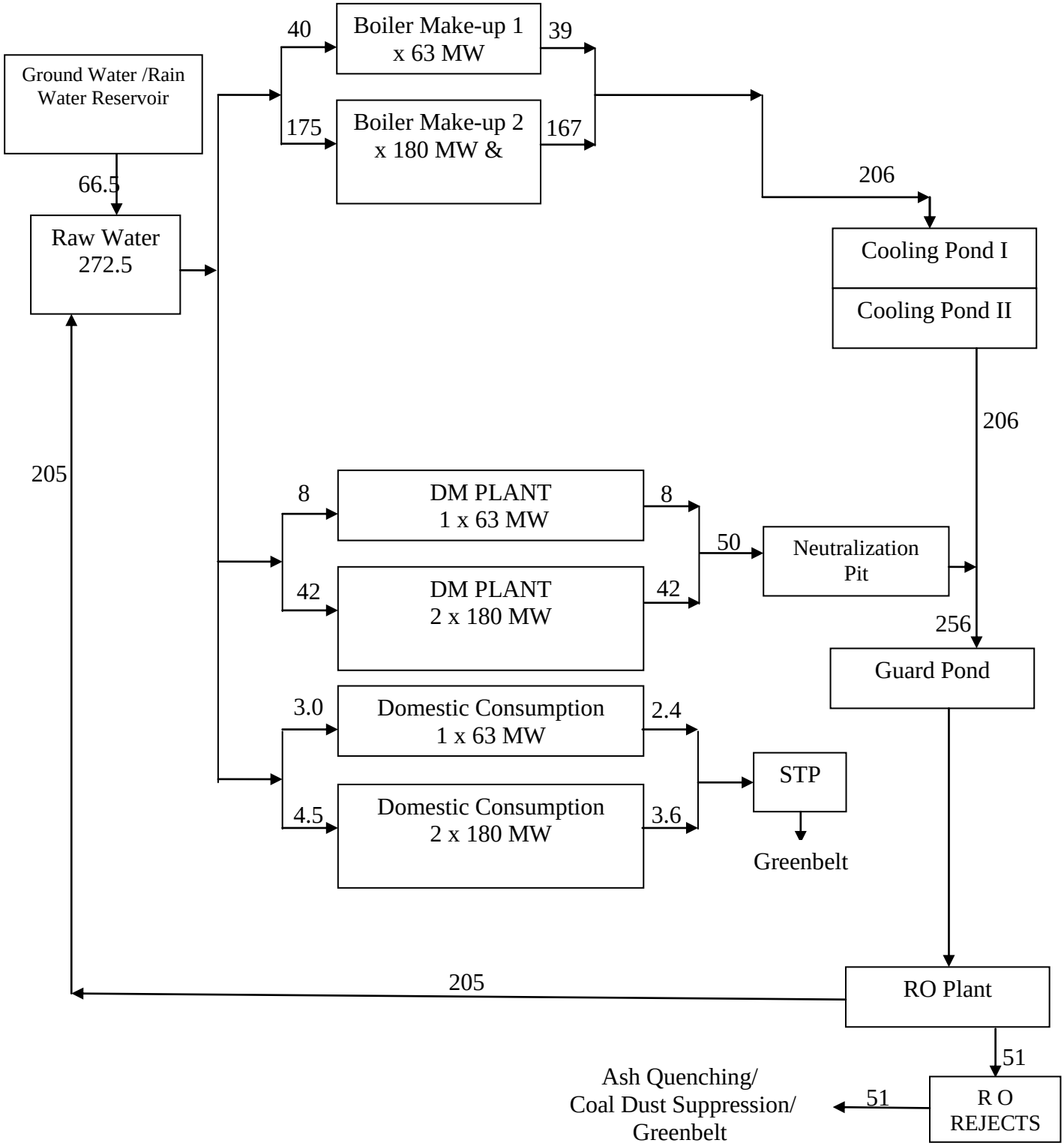
Existing **1 x 63 MW**	**For** **2 x 180 MW**	**Upon Expansion**
51 KLD	221.5 KLD	272.5 KLD

At present water requirement is met from borewells, for which ground water clearance is already obtained.

In expansion, it is proposed to use water from harvested rain water / borewells.

Water Balance Diagram is as follows:

WATER BALANCE
All Values are in KLD



11.0 ENERGY CONSUMPTION

It is a proposed augmentation of power generation facility and hence the auxiliary power requirement will be met internally.

12.0 WORK FORCE

The work force in existing operation is 50-Nos, whereas an additional 100 workers will be required for operation of expansion plant.

13.0 WASTE & WASTE MANAGEMENT

13.1 Air Pollution

The daily consumption of coal is around 2565 Tonnes

The rate of SO_2 emission due to usage of coal is calculated as given below

Sulphur content	=	0.5%
S	=	(2565 x 0.5/100) = 12.825 T/D
SO_2	=	12.825 x 2 T/D
	=	25.65 T/D = 1068.75 kg/hr
SO_2 emission	=	1068.75 kg/hr = 296.875 g/s

Stack height calculation:

$H = 14\ Q^{0.3}$

Where,

H = height of the Stack

Q = SO_2 Concentration in Kg/hr.

Hence

H = $14 \times (1068.75)^{0.3} = 14 \times 8.103 = 113.446$ m

The stack height proposed is 120 meters for each boiler.

Stack Emission Characteristics

Stack No	*1	2	3
Material of Construction	RCC	RCC	RCC
Stack attached to	1 x 63 MW	1 x 180 MW	1 x 180 MW
Stack height (m)	105	120	120
Stack diameter (mm) approx..	5000	5000	5000
Volume Flow Rate (m3/s)	110.80	280.0	280.0
Velocity of flue gas (m/s)	22.0	21.0	21.0
Temperature of flue gas (°C)	140	140	140
Flue gas specific volume (kg/Nm^3)	1.3	1.3	1.3
Fuel Consumption (Kg/s)	10.47	29.76	29.76
Sulphur content (% w/w)	0.5	0.5	0.5
Emission rate – NOx (g/s)	94.27	267.19	267.19
Emission rate – SO_2 (g/s)	104.75	296.88	296.88
Emission rate – SPM (g/s)	5.54	14.0	14.0

The following environmental protection or pollution control systems have already been considered for mitigation of impacts on Air Environment.

- Existing **105 m,** Proposed 2 Nos. of **120 m** tall stacks for flue gas emission.
- Space provision for retrofitting FGD (Flue Gas Desulfurization) systems.
- High efficiency ESPs to reduce SPM level in the exhaust gas to <50mg/Nm^3.
- Dust suppression and extraction system at Handling Plant area to Control Fugitive Emission.
- Green belt development and afforestation in the plant and ash disposal areas.
- A minimum water depth will be maintained in the ash pond to prevent fugitive dust emission.
- Use of bag filters at all transfer points.
- Use of limestone to limit SO_2 emission.

High efficiency Electrostatic Precipitator of 99.9% are provided for limiting SPM concentration in the flue gas to less than 50 mg/Nm^3. The tall stacks of Existing

105 m, Proposed 2 Nos. of **120 m** based on maximum SO_2 concentration in the flue gas is provided for natural dispersion at high elevation so that ground level concentration are within acceptable limits.

The emission of NO_X, is reduced by burning fuel at a lower temperature and shortening the throughput time of the fuel. NO_X is also controlled by operating at low excess air.

Fugitive Emissions

To control fugitive emissions from process units in the plant, the following measures are already in place.

- Tarring of roads inside the factory.
- Preventive maintenance of valves and other equipments.
- Green belt on all sides within the project boundary, and community plantation around the unit with help of local area development authorities have already been done.
- Ambient air quality and stack/fugitive emissions monitored regularly.
- In-plant training provided to the plant personnel on operation and maintenance of dust collectors, techniques of dust emission measurements, particle size analysis etc.
- Effective operation and maintenance of pollution control system is ensured to contain the emissions/keep them within the CPCB limits
- A good house keeping consisting of simple, obvious task of cleaning up spills, removing accumulations around processing equipment and in general keeping things neat and clean form a part of normal operation and maintenance procedure

Measures for arresting fugitive dust emissions along with the envisaged pollution control equipments are adequate and will help to have a healthy and cleaner

environment inside the plant thereby improve the productivity and the efficiency of the workers as well as that of plant machinery.

13.2 Waste Water Management

The quantity of waste water generation are given below

Waste Water Generation in KLD			
	Existing 1 x 63 MW	**For Proposed 2 x 180 MW**	**Upon Expansion**
Boiler Blow Down	39	167	206
D.M. Plant Regeneration Waste	8	42	50
Domestic Sewage	2.4	3.6	6.0

Boiler Blowdown & DM. Plant regeneration waste water is at present treated in 2-stage RO Plant.

Upon Expansion,

Daily make-up water requirement will be 66.5 KLD. About 256 KLD of water requirement is met from recycling & reusing. Boiler Blow down & DM Plant Regeneration Waste Water from proposed Augmentation/ Expansion will also be treated in 2-stage RO Plant. 205 KLD is used for boiler make-up /D.M Plant and 51 KLD used for Ash Quenching/ Coal Dust Suppression/ Greenbelt.

Domestic Sewage is treated in Sewage Treatment Plant & used for greenbelt. Hence, resulting in Zero Discharge.

13.3 Solid Waste Management

The details of total Ash generation are as follows.

Solid Waste	**Existing 1 x 63MW**	**Proposed 2 x 180MW**	**Upon Expansion**
Fly Ash	40 T/D	115 T/D	166 T/D
Bottom Ash	1 T/D	14 T/D	15 T/D

Fly ash at present being completely disposed and would also be completely disposed after expansion.

The Bottom ash will be stored in Ash dykes.

14.0 SITE ANALYSIS, PLANNING & REHABILITATION AND RESETTLEMENT

The proposed expansion by installing additional 2 x 180 MW is within/adjacent to the exiting the plant site wherein 1 x 63 MW is already under operation. Hence, no rehabilitation and resettlement issues.

15.0 PROJECT SCHEDULE & COST ESTIMATION

The construction of 2 x 180 MW power plant is proposed to start upon obtaining Environmental Clearance from SEIAA, Tamil Nadu/Consent from TNPCB, and scheduled to be commissioned in 18 months from obtaining Environmental Clearance.

The project cost for expansion will be Rs.1800/- Crores.

16.0 CONCLUSION

The proposed expansion will result in better utilization without any modification to the majority of existing environment.

Adequate measures already proposed to mitigate negative impacts, and thus aid positive impacts on environment due to the proposed expansion.