REPORT
ON
THE LAND REQUIREMENT
OF
THERMAL POWER STATIONS

GOVERNMENT OF INDIA
(MINISTRY OF POWER)
CENTRAL ELECTRICITY AUTHORITY
NEW DELHI

DECEMBER, 2007

RAKESH NATH

CHAIRPERSON
Central Electricity Authority
& Ex Officio Secretary,
Govt. of India

FOREWORD

The country has been continuing to face power shortages in spite of appreciable growth in generation. The demand for electrical energy is increasing at a faster rate and shall continue to grow in tune with the projected growth of economy. Out of total present installed capacity of 138251 MW, the coal based thermal capacity is 73492 MW (53%). During 11th Plan, a coal based thermal capacity of 52905 MW is proposed to be added. Further, a number of Ultra Mega Power Projects (UMPPs) are planned to be set up at pit head and coastal locations requiring a very large area of land for main plant, ash disposal and other facilities. Land is precious and in view of large capacity addition proposed by coal based thermal power projects need has been felt to optimize the land requirement for the thermal plants.

A Committee consisting of experts from CEA, NTPC, BHEL, Desein and Tata Consultancy Engineers was constituted by CEA to examine the land requirement of thermal power plants of various capacities at different locations and give its recommendations. The Committee has studied the power plant layout practices being followed in India and abroad and deliberated on the land requirement for various facilities for the pit head and coastal power plants. The Committee has brought out a report giving recommendations for land requirement for different configurations of the thermal power plants.

The report gives the details of the land requirement for various systems/ facilities for pit head stations, load centre stations and coastal stations of capacities 1000 MW, 2000 MW, 3000 MW & 4000 MW comprising unit size of 500 MW, 660 MW & 800 MW. Though the Committee has recommended the maximum land requirement for ash dyke keeping in view the latest stipulations of MOE&F, there is an urgent need to further increase the ash utilization and reduce ash dyke area so as to conserve land. The power project developers should explore the ways for having a further possible reduction in land requirement especially for ash dyke and colony to reduce the overall requirement for the power plant.

The Report of the Committee was discussed in the Authority and it was decided to forward the report to all concerned. I hope the recommendations given in the report will serve as useful guidelines for State Governments, power utilities and other power project developers for optimizing the land requirements for coal based thermal power plants.

December, 2007
New Delhi

(RAKESH NATH)

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1.0 BACKGROUND

1.1 While deliberating the land requirement for coal based thermal power stations, especially for the proposed Ultra Mega Power Projects (UMPPs) in the Ministry of Power, it was observed that comparatively larger area was being made use for setting up coal based thermal power stations in our country whereas the land requirement in other countries was reported to be much less. Since the availability of suitable land and its acquisition is getting more difficult day by day, it was felt essential to optimize the plant layouts and thereby to reduce the overall land requirement for thermal power plants.

1.2 Accordingly, the Central Electricity Authority (CEA) constituted a committee comprising of members from CEA, NTPC, BHEL, Desein & Tata Consulting Engineers (TCE) on 4th April, 2007 to work out the land requirement for coal based thermal power stations of different capacities both for pit head stations based on indigenous coal and coastal stations based on imported coal. (Annexure-I) The Committee comprised of the following members:

1. Shri S. Seshadri, Chief Engineer, CEA	-	Chairman
2. Shri N.K. Gupta, G.M. (Mech.). BHEL	-	Member
3. Shri S.K. Anand, Sr. D.G.M.,BHEL	-	Member
4. Shri R. Baijal, D.G.M. (Engg.), NTPC	-	Member
5. Shri K.P. Viswanatham, D.G.M., NTPC	-	Member
6. Shri B. Hemasundar, Vice President, Desein Private Ltd.	-	Member
7. Shri V. Sreenivasan, C.E. (Mech.), TCE	-	Member
8. Shri N.K. Nair, Director, CEA	-	Convenor
9. Shri Subash Chander, Dy. Director, CEA	-	Member

1.3 The terms of reference of the Committee are:

a) To work out the minimum land requirements for coal based thermal power plants having capacities of 1000 MW, 2000 MW, 3000 MW & 4000 MW.
b) To develop layouts for the above thermal power plants (pit-head and coastal-site).
c) To study layouts being followed in developed countries.
d) To give recommendations on the requirements of land taking into consideration (a), (b) & (c).

1.4 Accordingly, the Committee took up the review of the layout of thermal power plants with the following capacities and unit sizes:-

2x500 MW units for 1000 MW power project.
3x660 MW units 2000 MW power project.
5x660 MW units or 4x800 MW units for 3000 MW power project.
5x800 MW or 6x660 MW for 4000 MW power project.

1.5 The layouts developed by NTPC, BHEL, Desein & TCE for power projects with the above configurations which are either under construction or being planned were referred by the Committee to work out the land requirement for the 1000 MW, 2000 MW, 3000 MW and 4000 MW capacity thermal power plants. The Committee met on 20th April, 3rd May, 16th May and 22nd June, 2007. During these meetings, NTPC, BHEL, Desein & TCE furnished the following general layouts to the Committee which were deliberated.

1. Kakatiya Thermal power station – Unit-1 (1x500 MW) of M/s. APGENCO
2. Vijayawada Thermal Power Station – Unit-7 (1x500 MW) of M/s. APGENCO
3. Aravali Super Thermal Power Project , Stage-1 (3x500 MW), Jhajjar of M/s. Aravali Power Company Private Limited.
4. Sipat Super Thermal Power Project (3x660 MW + 2x500 MW) of M/s. NTPC.
5. Barh Super Thermal Power Project (3x660 MW + 2x660 MW) of M/s. NTPC.
6. Tanjung Bin Super Thermal Power Project (3x700MW), Indonesia
7. Nagarjuna Thermal Power Project (2x507.5 MW) of Nagarjuna Power Corporation Ltd.
8. North Karanpura Super Thermal Power Project (3x660 MW) of M/s NTPC
9. 5x800 MW Ultra Mega Power Project (UMPP) of Mundra, Gujarat of M/s. Tata Power Company.

1.6 The Committee deliberated and discussed various issues of land requirement for each of the plant equipments and systems. The recommendation of the committee was deliberated in the Ministry of power and in Central Electricity Authority. The report has been finalised taking into account the comments furnishied by them.

2.0 LAND REQUIREMENT FOR MAIN PLANT AND AUXILIARY SYSTEMS OF INDIGENOUS COAL BASED THERMAL POWER STATIONS

2.1 Boiler, T.G. and Transformer Yard

i) The Power plant shall make optimum use of land and facilities to minimize total life cycle costs but not at the cost of flexibility of maintenance and future expansion. Major external functional system shall be so oriented that any maintenance work as well as subsequent construction work can be carried out without any interference and/or hindrance to the running plants/units.

ii) The power block shall be functionally subdivided into the turbine-generator area, steam generator area including Mill bay, auxiliary bay area and the electrical equipment area. The optimum arrangement of equipment shall be determined by considering functional requirements, economy of piping and electrical cables, economy of equipment supports, installation and maintenance access requirements, ventilation requirements, and equipment generated noise and vibration level. Space shall be provided to allow plant personnel easy and safe access to all equipment which may require preventive maintenance. Space shall be provided to allow unobstructed access for maintenance tools and implements required for maintenance on permanently installed equipment requiring regular maintenance. Ample space shall be provided to allow removal of any equipment that cannot be maintained in site or may require replacement. Sufficient space for movement of mobile equipment shall also be provided.

iii) Lately, environmental aspects have started playing significant role in selecting the site for thermal power station. MOE&F has already prescribed siting criteria for thermal power stations. The emission norms for particulate matter for coal based thermal power stations have been stipulated. No emission regulation for SO_x have been prescribed and SO_x control is sought to be achieved by providing tall stacks for wider dispersion as per stack height guidelines prescribed by the CPCB. The Ground Level Concentration (GLC) limits of SO_2, NO_2, CO, Lead & SPM have however been stipulated. The sizing criteria, emission norm and other stipulations by Environmental Regulating Authorities will need to be kept in view while identifying the area requirements.

iv) Main plant area extends from the chimney on one side to transformer yard on the other end. The land requirement for the Main plant (Boiler, Turbine-Generator along with their auxiliaries) depends upon the following factors:

a) Boiler size, which depends on the coal characteristics

b) Electrostatic precipitator (ESP) size, which depends on the ash content in coal and emission levels allowed for the station.

c) The number and arrangement of coal mills depends upon the calorific value of the coal

d) The arrangement and size of maintenance bay which depends on the number of units.

e) The distance to be kept between the units

f) Exhaust ducting layout for multiple units

v) The size of the boiler and the ESP are comparatively large when firing Indian coals with high ash content and low calorific value. The typical values of Gross calorific value of Indigenous coal as available for the power sector is in the range of 3000 – 4000 kCal/kg with ash content of 35-45%. These gross calorific values are very much less when compared to that of imported coal with a gross calorific value of 6000 kCal/Kg. Also the ash content in the imported coal is of the order of 10%. From this it can be easily inferred that almost double the quantity of indigenous coal needs to be fired in the boiler for getting the same output. Moreover, the ash quantity generated in the boiler with Indian coal is about 8 times when comparing with imported coal. The handling of coal and ash of such large quantities invariably requires more space which is discussed elsewhere in the report. The ESP size depends on the permissible emission levels of particulate matter. If the emission level is to be brought down to 50 mg/Nm3, the number of fields required will also go up and hence the ESP size. Other factors affecting the main plant area are the arrangement of the mills. If these are arranged in the CD bay, the area required will be more and if these are arranged on the sides of the boiler the area requirement will be less and we can have a compact layout.

The land requirement for the main plant is found to vary from 29.7 acres for 2x500 MW plant to 108.8 acres for 6x660 MW plant as indicated in table below.

Description	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
Main Plant including Transformer yard	300 W x 400 D =29.7	550 W x 400 D = 54.4	825 W x 400 D = 81.5	1100 W x 400 D = 108.8	700 W x 440 D = 76.1	850 W x 440 D = 92.4
Pitch (Centre to Centre of boiler)	120	125	125	125	130	130

[Area in acres ; dimensions in metres]

vi) From the above table it may be seen that the main plant area requirement is a function of the capacity of the plant, unit size and also the quality of coal used in the station. In the first four cases it is presumed that coal with 40% ash will be used and hence the main plant area varies proportionately with the plant capacity. However, in the later two cases it is presumed that the ash content in the washed coal to be used for these power stations is only 34% and hence the main plant area requirement is comparatively less.

vii) The centre to centre distance of the boiler is a function of the unit size. As seen from the table, for the 500MW unit size the pitch is 120m whereas it is 125m for the 660MW unit size. However, the pitch is kept as 130m for the 800MW unit size.

2.2 Coal Handling System

2.2.1 Coal handling Plant is the lifeline of a coal fired power plant. The coal handling facility must be flexible, reliable and capable of handling larger quantity of coal in less time. In planning and determining the design parameters for a coal handling facility, the maximum fuel burn rate of power plant is the ruling criterion. But other parameters i.e. plant and coal source locations, physical extent of the system, environmental considerations and the type and properties of coal are to be considered as well. The coal unloading system is designed depending on the location of the coal source and mode of transportation. There are two types of coal unloading systems in use.

i) **Merry-Go-Round (MGR)** : This system is most economic and also reliable. This system requires wagons with bottom discharge hoppers fitted with pneumatically operated automatic door actuating mechanism. Coal from wagons is unloaded in underground track hoppers. The complete system is dovetailed in such a manner that there is no holdup in the operation of the MGR system. From track hopper, Coal is supplied to crusher house with the help of reclaim conveyors installed below the track hopper. The capacity of reclaim conveyors is such that the track hopper is evacuated before the arrival of next coal rake. This system is adopted in pit head power stations.

ii) **Wagon Tippler Type System**: In this type of system coal is unloaded from wagons with help of wagon tippler into the wagon tippler hopper. From wagon tippler hopper, coal is fed to the crusher house with the help of Apron Feeder or Vibro feeder. This system is adopted in power stations located away from the coal mines.

2.2.2 Crusher House consists of roller screens and coal crushers. Roller Screens are used to bypass under-size coal to belt conveyors carrying crushed coal. The ROM coal of size -300 mm is supplied to crushers that crush it to -20mm size. The crushed coal is supplied either to coal bunkers or to coal stock piles for emergency use. Crushed coal is sent to stockpiles when coal is not required in the bunkers. The stacking is done with the help of bucket wheel type Stacker-Reclaimer moving on the rails. This can stack coal on either side of reversible yard conveyors. When coal is required in bunkers and crushers are not in operation, coal is reclaimed either by Stacker-Reclaimer or by emergency reclaim hoppers. In case of emergency reclaim hoppers, the coal is fed by dozers. The vibro feeders are installed below the emergency reclaim hoppers to supply coal to reclaim conveyors.

2.2.3 Marshalling yard/ Railway siding

The marshalling yard is essential to place the coal rakes received for the station. Many times two or more rakes are despatched by Railways at very short time intervals resulting in bunching of coal rakes at the power station. Hence it is necessary to give sufficient area for laying the required number of railway lines in the marshalling yard for parking and unloading the coal rakes to be received for the station. It was decided that the marshalling yard required for thermal stations shall be 20 acres in addition to the land requirement for the coal handling plant.

2.2.4 The land requirement for the coal handling system depends upon the following factors:

a) Location of the power plant - A pit head station requires more area to enable smooth movement of the coal rakes during unloading and for return of the empty coal rakes. The loop formation for the rake with bottom discharge wagons to enable the above requirement needs more area. The marshalling yard requirements are comparatively less in this case. In the case of a load centre station, the marshalling yard requirements are more as a number of coal rakes are to be received each day. The number of rail tracks to be provided also depends on the number of wagon tipplers which in turn depends on the station capacity.

b) Type of coal unloading system – It is either through track hopper or through wagon tipplers. The normal arrangement of the wagon tipplers in thermal stations located at the load centre needs a lot of space. The arrangement of track hopper necessitates bottom discharge wagons which Railways are finding difficult to arrange.

c) The storage requirement - The power stations keep a dead storage of one month coal requirement for load centre stations and for 15 days in case of pit head stations and this requires lot of area considering the ash content in Indian coal. The number and size of the coal stackpiles depend on the station capacity.

d) The redundancies to be kept for the system - Redundancies are generally kept for the conveyor system, wagon tippler/track hopper system, stacker reclaimer, crushers etc. for the reliable operation of the system. These redundancies are considered necessary for the operation of the coal handling plant efficiently at higher availability factor.

2.2.5 The land requirement for coal handling system is summarized in the table given below:

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Coal handling system area (acres)						
a)Pithead stations with MGR	220	240	240	250	250	250
b)Load centre stations with wagon tippler	200	200	--	--	--	--

2.2.6 From the table given above it may be noted that the area for the coal handling plant is not a function of the capacity of the plant, but on the facilities to be provided and the coal storage requirements. For a 2x500 MW pit head station the coal handling plant area is taken as 220 acres whereas for 4000 MW station (either 6x660 or 5x800 MW) the coal handling plant area requirement is 250 acres. The Committee is of the view that stations of 2000 MW or more capacity will have facility of MGR system whereas for the station less than 2000 MW may have either wagon tipplers or MGR system for unloading the coal. However, while working out the area requirement, the Committee presumed that all the stations under consideration shall have MGR System.

2.3 Raw Water Reservoir

The capacity of the raw water reservoir depends upon the source of water for the station and also on the type of cooling system adopted. For a coastal plant where sea water is used for condenser cooling the reservoir capacity will be much less. Raw water requirement also depends on the quality of raw water available. Generally for sea water direct cooling is preferred. However, the temperature of the cooling water discharged to the sea has to be kept within 7 degree temperature rise to avoid harm to aquatic life. The cooling of the discharge water is achieved by allowing it to first flow to a pond or by allowing to flow through long discharge channels which adds to the total area requirement. For power plants using river water, once through cooling system is not permitted by MOEF and so natural draft or induced draft cooling towers are to be provided which occupy larger spaces.

If the source of water is not available during certain periods of the year, then the storage reservoir has to be kept or alternate source needs to be tied up. The area required for the reservoir also depends on the depth of the reservoir which varies between 4 to 8 metres normally based on the water table in that area. The committee observed that in some cases where intake channel/ canal is required to be shut down for maintenance, the reservoir capacity is kept for even upto 30 days of water consumption. It is seen that the area required for water reservoir is considerable and hence needs to be optimized. The committee feels that a raw water reservoir capacity for 10 days requirement and with 8 m depth is reasonable for working out the land requirement. The area of the water reservoir is a function of the capacity of the plant and can be assumed to be proportional to the same. For a 2x500 MW station, an area of 40 acres has been kept whereas for the 5x800 MW station the water reservoir area is taken as 160 acres as indicated below.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Water Reservoir area	40	80	140	160	130	160

[Area in acres]

2.4 Water System

The water system includes the pre- treatment and clarification plant, water treatment plant, circulating water system with cooling towers and effluent treatment system. The land requirement for the water system depends largely on the type of cooling towers selected for the plant and the quality of raw water. The natural draught type of cooling towers(NDCT) require large area whereas the induced draught type of cooling towers(IDCT) need relatively less space. For example, the water system for a 2x500 MW TPS require 45 acres of land with natural draught cooling towers whereas 28 acres only with induced draught cooling towers. If an open condenser cooling system is adopted the land requirement will further reduce. The area requirement for the water system including cooling towers is a function of the capacity of the plant and hence the same is presumed to be proportionate to plant capacity. It is recommended that the stations shall make use of natural draft cooling towers to reduce auxiliary consumption also. Accordingly the land requirement is worked out as below. Water System Area with Induced Draft Cooling Towers is also worked out and indicated in the Table below:

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Water system area with NDCTs	45	90	135	150	135	150
Water system area with IDCTs	28	54	90	108	90	112

[Area in acres]

2.5 Switchyard

The land requirement for the switchyard depends on the type of arrangement of bays- i.e., either a 1½ breaker system or a 2 main bus + 1 transfer bus system is adopted for the switchyard layout for 400 kV and above. Both these arrangements have their own advantages & disadvantages and, therefore, generally the power stations adopt either of the two systems. In the 1½ breaker system, three breakers are installed for two bays of the switchyard whereas for the 2 main bus + 1 transfer bus system arrangement one breaker will be there for each bay. It is seen that both arrangement for the switchyard layouts have been adopted for various power stations. BHEL intimated that the 2 main bus + 1 transfer bus system adopted by them for the Mejia TPS Extn. (2x500 MW) indicate a space of 375mx150 m for the switchyard. The Committee is of the view that the depth of the switchyard shall be kept as 175 m whereas the width shall be same as that of the main plant subject to a minimum of 375 m for the 2 main bus +1 transfer bus system. The Committee felt that the 1½ breaker system is a better arrangement for major power stations because of better reliability even though it needs more space. In this case the width of the switchyard is kept the same as that of the main plant whereas depth is 350 metres. Generally the size of the switchyard depends upon the number of line bays necessary to evacuate the power from the generating station. However, the committee feels that it is necessary to restrict the width of the switchyard to that of the main plant. The committee, therefore, recommends to have a switchyard of size of main plant width x 350 m for 400 kV transmission whereas the size of main plant width x 500metres for 765 kV switchyard would be required for 1 ½ breaker scheme.

The land requirement for switchyard with both the system for different capacities of plants are summarized below. Land requirement for a HVDC switchyard is not included in this report and such requirement, if any, would be extra.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Switchyard (400kV) **i) 1½ Breaker scheme**	300x350 26	550x350 47.6	825x350 71.4	1100x350 95.1	700x350 60.5	850x350 73.5
ii) 2 Bus + Tr. Bus scheme	16.5 (375x175)	24 (550x175)	36 (825x175)	48 (1100x175)	30.5 (700x175)	37 (850x175)
Switchyard (765 kV) **i) 1 ½ Breaker scheme**	300x500 = 37.5	550x500 = 68.75	825x500 103.13	1100x500 137.5	700x500 = 87.5	850x500 = 106.25

[Area in acres ; dimensions in metres]

2.6 Ash Handling System

The ash handling plant consists of bottom ash & fly ash collection and disposal systems. The fly ash evacuation is done using dry and wet systems whereas the bottom ash and air preheater ash is generally evacuated in wet mode. The ash content in Indian coals being supplied to thermal power stations is of the order of 40% except in cases where washed coal is used. Even the washed coal contains about 34% of ash. Accordingly, the amount of ash generated in a power station is of the order of 2 million tonnes per annum for 1000 MW plant capacity. MOE&F in their notification dated 19th July, 1999 had specified that the fly ash utilization has to be 100% from 10th year of commissioning of the plant. Fly ash constitute about 80% of the total ash generated in a power plant. The dry fly ash handling system consists of vacuum collection system, pressure conveying system, intermediate silo, main silo, compressor house etc. The wet fly ash handling system consists of vacuum collection system and subsequent wetting unit that converts ash into slurry and discharging it into the common ash slurry pit. Laying of dry ash pipelines/ash slurry pipe lines, compressor rooms, ash slurry pump house, silos etc. need space due to the large quantity of ash to be handled.

The area required for Ash Handling System for various capacities of the plant is given below:

Description	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
Area requirement for Ash Handling System	6	11	16	22	14	21

[Area in acres ; dimensions in metres]

The area required for ash handling system depends on the capacity of the plant and also on the ash content in the coal. From the table given above it is seen that the area requirement for ash handling system proportionately increases with the capacity of the plant and also with the ash content in the coal. Thus for a 2x500 MW station the area required is 6 acres whereas for the 6x660 MW station the same is 22 acres. However, while using coal with lesser ash content the land requirement gets reduced and is calculated as 14 and 21 acres for the 4x800 MW and 5x800 MW stations respectively using coal with 34% ash.

2.7 F.G.D. System

Flue Gas Desulphurisation (FGD) system is necessary to capture the sulphur in the flue gas when the boiler is fired with high sulphur coal. High percentage of sulphur is observed in imported coal. Indigenous coal has very low sulphur and hence FGD system is not warranted.

However, MOE&F while according environment clearance stipulate that space is to be kept in the layout for installing FGD system, if required, in future. There are two types of FGD system - Limestone based system and Sea Water based F.G.D. system. Space is required for FGD system equipments and for the storage of limestone, a byproduct. The space requirement for F.G.D. limestone storage was deliberated and it was felt by the committee that separate storage space for this need not be kept while working out the land requirement. However, the land requirement for installing the F.G.D. system will be considered. In the case of coastal power stations where sea water based F.G.D. system will be installed, the space requirement shall be considered accordingly. It was decided that space varying from 7 acres for 2x500 MW units to 27 acres for 6x660 MW units is required for limestone based FGD system. However, the space required for the sea water based FGD system as reported by the representative of M/s TCE is 4 acres for a 3x 700 MW station using imported coal.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW	3x700 MW Coastal station
Area required for F.G.D. system	7	14	20	27	17	21	4

[Area in acres ; dimensions in metres]

2.8 Miscellaneous Station Facilities

In addition to the main unit/station facilities described above, there are a number of miscellaneous station facilities such as

a) Administrative Building
b) Service Building
c) Compressor house
d) Fire station
e) Fire water pump house
f) Laboratories
g) Hydrogen generation plant
h) DG set room
i) Auxiliary boiler building
j) Fire water tanks
k) Workshop
l) Canteen
m) Security office building

The space requirement of these miscellaneous facilities, even though comparatively less when compared with the area required for major station facilities also needs consideration in deciding the overall space requirement for the station. The area corresponding to these miscellaneous facilities is given below.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Miscellaneous station facilities	10	10	11	11	11	10

[Area in acres]

2.9 Laydown, Steel Storage yard and Preassembly Yard

Laydown area is necessary for keeping/storing equipments to be erected or to be repaired. Steel storage yard and preassembly yard are required for storing and assembling of plant and equipments. The Committee felt that the space for the Laydown and preassembly yard shall be kept uniformly at 50 acres irrespective of the capacity of the power station since the construction with more number of thermal units will be done in phases. Moreover, the coal handling area can also be used for preassembly activities during the initial stages till the station is commissioned. The space being kept initially for the laydown & pre-assembly will be later converted into green belt. It was also decided that the space for the steel storage yard will be kept as 10 acres uniformly irrespective of the station capacity.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x80 0 MW
Space for Lay-down & Pre-assembly	50	50	50	50	50	50
Steel Storage yard	10	10	10	10	10	10

[Area in acres]

2.10 Permanent Store and Construction Store

Permanent store is provided for storing of materials, spares, consumables etc. required during the operation and maintenance of the station. The committee is of the view that a space of 20 acres for permanent store will be kept uniformly for all the stations. Similarly the land requirement for the construction store shall be kept as 10 acres uniformly for all the stations.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Space for Permanent Store	20	20	20	20	20	20
Space for Construction Store	10	10	10	10	10	10

[Area in acres]

2.11 Roads

The roads in a power station can be divided into the following types:-

i) All main plant roads shall be 10 metre wide.
ii) All secondary plant roads shall be 5 metre wide provided with 1.5 metre wide hard shoulders on either side and shall be for access to plant auxiliary areas and buildings.
iii) Peripheral roads along the boundary wall shall have adequate nos. of watch towers as per requirement.

The roads shall provide access to all the units of the generating station from the site boundary line and throughout the site to buildings and activity areas. It was decided that the land requirement for the roads along the boundary of the power station shall only be considered since the roads inside the plant area are already considered while arriving at the land requirement for the main plant and other auxiliary plant areas. Accordingly an area of 20 acres will be kept for the stations less than 2000 MW capacity and 25 acres for stations with capacity 2000 MW or more for constructing the Peripheral roads along the boundary wall.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Land for Roads	20	25	25	25	25	25

2.12 Land Scaping & Green Belt

The landscaping and ground cover system is meant to enhance the appearance of selected areas, enhance soil and slope stabilization of the land of the generating station, and assist in reducing the noise level and fugitive dust generated by the plant. Land scaping is generally adopted for power station premises from the main gate to the service /administrative building. As per the stipulations of MOE&F, green belt is to be provided all around the power station boundary by planting trees and the total green area including landscaping area will be 1/3rd of the plant area. This will include Laydown area which will be later on converted into Green area.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 M	4x800 MW	5x800 MW
Green Belt Including land scaping area and Laydown area	150	210	270	310	260	290

[Area in acres]

3.0 Maximum Land Requirement for Ash Dyke

3.1 The land requirement for ash disposal depends on the capacity of the power station, ash content in the coal and also on the ash utilization in the area where the plant is located. The ash content in the coal being supplied to thermal power stations in the country is of the order of 40% except in cases where washed coal is used. Even the washed coal contains about 34% of ash. Accordingly, the amount of ash generated in a power station is of the order of 2 million tonnes per annum for 1000 MW plant capacity. Correspondingly the area required for ash disposal is also very large. MOE&F had specified that the fly ash utilization has to be 100% from 10th year of commissioning of the plant. Fly ash constitute about 80% of the total ash generated in a power plant. Fly ash utilization not only depends on the location of the power station but also on the agencies who are involved in this business. Since the power stations have no control over the agencies in the field of fly ash utilization, the task of 100% fly ash utilization is difficult in most of the cases. Therefore, the power station authorities have no alternative except to keep sufficient space for the ash disposal without which the power plant might have to be shut down after a few years of operation. The land requirement for the ash dyke is worked out based on the following criteria:

a) PLF - 90%

b) Ash content in coal - 40% for units upto 660 MW/ 34% for 800 MW units based on Indian coal and 10% ash in imported coal

c) Height of ash dyke -18 metre (In stages) for pit head/load centre projects and 15metre for coastal projects

d) Ash dyke shall be sufficient for 25 years of plant operation

e) Bottom ash will be fully discharged into the dyke for 25 years of plant operation.

f) Fly ash will be discharged starting with 10% utilization in the first year and 100 % utilization during the 10th year.

g) Density of ash in dyke - 1 T/m3

h) Unit Heat Rate - 2250 kCal/kWh. for 660/800 MW units

i) Calorific value of coal - 3600 kCal/kg for Indian coal and 6000 kCal /kg for imported coal

3.2 Based on the above criteria, the maximum area for the ash disposal for different station capacities are worked out and indicated in the table below. This maximum area takes into account the area for overflow lagoon, ash dyke and dyke embankment. 50 m wide green belt is also to be provided all around the ash dyke. The maximum area has been worked out assuming that the site is in zone-3 and without clarifier for the ash water recovery. It is seen that the maximum area requirement per MW goes on reducing as the capacity of the station increases.

Plant Size (MW)	2x500	3x660	5x660	6x660	4x800	5x800
i) Ash Storage Area	360	667	1148	1375	800	982
ii) Embankment	39	57	67	70	53	60
iii)Area for Overflow Lagoons	25	30	30	50	40	50
iv) Green belt	76	101	125	135	107	118
Total Area	**500**	**855**	**1370**	**1630**	**1000**	**1200**

[Area in acres]

However, there is a considerable scope for reducing the land requirement for ash dyke by maximum utilization of Fly Ash as well as bottom ash.

3.3 Fly Ash Utilization

3.3.1 The installed capacity of coal/lignite based TPS in the country is 73492 MW as on 30.11.2007 and the figure is likely to increase with commissioning of the thermal capacity of about 53000 MW during 11th Plan. It is estimated that from a total coal/lignite based thermal capacity of 124932 MW likely by the end of 11th Plan, the fly ash generated (considering 40% ash content in coal and at 80% PLF) would be of the order of 196.12 million tones per annum. Since the economics prefer installation of coal/lignite based Thermal Power Stations near the source of coal/lignite i.e. at pit heads, ash generated is to be utilized in various ways by locating cement manufacturing industries and other industries manufacturing ash based products in the vicinity of the power stations. The integrated development of these industries along with the power project shall ensure 100% ash utilization.

3.3.2 Presently the ash based products are at developmental stage and need to be made more environmental friendly. Some of the areas of ash uses include:

a) Brick/ Block/ Tiles manufacturing
b) Cement manufacturing
c) Roads and embankment construction
d) Structural fill for reclaiming low lying areas
e) Mines fill
f) Agriculture, Forestry and Waste land development

g) Part replacement of cement in mortar and concrete
h) Hydraulic structure (Roller compacted concrete)
i) Ash dyke raising
j) Building components – Mortar, Concrete, Concrete Hollow Blocks, Aerated Concrete Blocks etc.
k) Other medium & high value added products (Ceramic tiles, wood, paints) pavement blocks, light weight aggregate, extraction of alumina, cenospheres etc.

4.0 Land Requirement for Facilities Outside the Power Plant

The facilities such as , raw water pump house including desilting basin, marshalling yard and corridors for MGR system, ash slurry pipelines & water pipelines which are outside the main power plant are also to be considered while arriving at the total land requirement for the station. The area required for pipeline corridors shall remain same irrespective of the same is laid underground or over-ground depending upon the terrain of the site.

4.1 Raw Water Intake System

Land is required for the raw water pump house, de-silting basins to be constructed at the raw water source. It was decided that an area of 10 acres shall be kept for this purpose for stations upto 3000 MW and 15 acres for stations capacity more than 3000 MW.

4.2 Corridor for Ash Slurry Pipe Lines

The area for the ash slurry pipe lines from the station to the ash dyke is taken as 25 acres for 10 km long and 10 m wide corridor.

4.3 Corridor for MGR System

It is necessary that the corridor for the MGR system in the case of pit head stations is also considered and included in the land requirement. The Committee is of the view that single track is sufficient for stations upto 1000 MW pit head stations for moving the coal rakes to the power station. However, double line is required for stations more than 1000 MW capacity. A width of 30 metre is required for laying the single railway track including service road and the land requirement for such stations is worked out as 150 acres. The width for laying double railway line shall be of 35 metre and accordingly the land requirement is 175 acres. The calculations are based on a travel distance of 20 km.

4.4 Raw Water Intake Pipeline Corridor

In most cases the raw water source is far off from the station. However, it was decided that a length of 10 km. for the raw water pipe line with a corridor of 14 metres wide shall be considered for working out the land requirement

4.5 Total Land required for facilities outside the plant other than ash dyke

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
1.Raw water pump house including de-silting basin	10	10	15	15	15	15
2.Area for various corridors						
i.)Ash slurry pipeline corridor	25	25	25	25	25	25
ii) Corridor for MGR System	150	175	175	175	175	175
iii) Corridor for Raw Water pipe lines	35	35	35	35	35	35
Sub- Total (2)	210	235	235	235	235	235
Total	**220**	**245**	**250**	**250**	**250**	**250**

[Area in acres]

5.0 Township

Township needs to be constructed for the power station employees near the station and hence the land requirement for this purpose is to be considered. The township requirement depends on the manpower employed which in turn depends on the capacity of the station. Based on experience of NTPC , the committee decided that the land requirement for constructing the township for station upto 2000 MW capacity shall be kept as 100 acres and for stations beyond 2000 MW capacity 150 acres. It is necessary to further optimize the land required for the township by adopting multi-storey type residential accommodation for the employees and also by minimizing the land required for other facilities such as school, hospital, recreation club etc.

Description	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
Township	100	100	150	150	150	150

6.0 SUMMARY OF TOTAL LAND REQUIREMENT FOR INDIGENOUS COAL BASED STATIONS

6.1 Table -1 indicates the land requirement for each of the facilities for 2x500 MW, 3x660 MW, 5x660 MW, 6x660 MW, 4x800 MW & 5x800 MW thermal power stations based on indigenous coal. From this Table it may be seen that the facilities which occupy larger area in a thermal power station are main power plant equipments, coal handling system, water system including cooling towers & water reservoir, switchyard and green belt.

6.2 The land requirement for various equipment/ system facilities is summarized as under:

Sl. No	Land required for	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
	2	3	4	5	6	7	8
A.	**Main Power Plant**						
	i) Power Plant	450	640	820	940	790	880
	ii)Green belt for power plant	150	210	270	310	260	290
	Total for Main plant (A)	**600**	**850**	**1090**	**1250**	**1070**	**1170**
B.	**Ash dyke including green belt**	**500**	**855**	**1370**	**1630**	**1000**	**1200**
C.	**Other Facilities outside the plant area**	**220**	**245**	**250**	**250**	**250**	**250**
D.	**Township**	**100**	**100**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1420**	**2050**	**2860**	**3280**	**2450**	**2770**

The following criteria /norms have been adopted while considering land requirement for various plant & equipment/facilities:

1. Landscaping area is included in Green belt.

2. 1/3rd of the plant area has been provided as green area. This includes the area for Laydown which will be later converted to Green belt.

3. The area required for Construction Office/parking (size 200x300 m) is not included in the above.

4. The space/corridors required for diversion of the drains and transmission lines, if any, passing through the plant area /ash dyke, etc. shall be extra.

5. The space required for dry ash silos not included in the above table.

6. 40% ash in coal for pit head and 34% ash in coal for load centre stations has been considered.

7.0 LAND REQUIREMENT FOR IMPORTED COAL BASED COASTAL THERMAL POWER STATION:

7.1 The Committee while considering land requirement for imported coal (10%ash) based power project, examined the general layout drawing for the coastal Tanjung Bin Super thermal power project (3x700 MW) , Indonesia. The following observations are made by the Committee on this layout.

a) The main plant area including the transformer yard is only 27.8 acres. This reduction in area is due to reduction in the boiler and ESP sizes since this power station is using coal with 10% ash content. The centre to centre distance of the boilers is 100 m. In International layouts, the size of the boiler and that of ESP will be comparatively smaller due to high calorific value and low ash content in the coal available in most of the countries. Hence, the International layout will require less space for the main plant. The number of mills required for the same unit size and the no. of fields required for the ESP will also be less in such cases even though the emission levels are more stringent than those in our country. Accordingly, the pitch of the boilers (centre to centre distance) will be less compared to that in Indian power station layouts.

b) The area for the coal handling system is 163 acres where the coal storage is kept for 45 days. The coal is obtained through the sea port. If we consider storage requirement only for 30 days the coal handling area will get reduced to 108.7 acres.

c) The water system is occupying an area of 7.3 acres only since the cooling is based on sea water and no cooling towers are provided. Essentially the area of 7.3 acres is for the water treatment systems and the CW pump house.

d) No water reservoir has been kept for the station since the total water requirement is met from the sea water.

e) An area of 45 acres has been kept for the laydown requirements.

f) The area required for constructing roads is 20 acres. It is comparable with the area required for roads of similar capacity Indian power stations.

g) Green belt has not been provided for the station. However this area will be 98.78 acres (30% of the plant area).

h) The area required for ash dyke, ash pipe line corridor, embankment, and ash water recovery system is 138.68 acres.

From the above discussions and from the Table -2 enclosed it is seen that the total land required for the power plant works out to be 329.26 acres only. However, if we consider the green belt including landscaping as 30%, then the total area requirement for the plant will be 428.04 acres and the land requirement per Megawatt for plant including green belt is observed to be 0.20 acre only.

8.0 COMPARISON OF PLANT AREA FOR STATIONS USING INDIGENOUS COAL VS IMPORTED COAL:

8.1 3x660 MW indigenous coal based station Vs 3x660 MW imported coal based station.

The layout for the coastal station (3x660MW) using imported coal is enclosed with the report. This layout is observed to be very compact due to the absence of the facilities such as water reservoir, cooling towers and due to requirement of less land for main plant, ESPs, CHP, FGD and AHP because of better quality coal. The total power plant area with 30 days coal storage works out to be 280 acres only. From the layout developed for the 3x660 MW station using indigenous coal, the land requirement is calculated as 620 acres. A comparison of the land requirement in both cases is given in Table-6. From this comparison the following emerge:

a) The main plant area is only 27.8 acres for 3x660 MW plant with imported coal as against 54.4 acres for the station using indigenous coal.

b) Coastal power station makes use of sea water based technology for the flue gas desulphurization system which requires 4 acres of land compared to 14 acres for the limestone based technology to be used for the indigenous coal based station.

c) The area for the coal handling system is 108 acres for 30 days storage for coastal station without MGR whereas the same for pit head station with Indian coal with MGR and 15 days storage is 240 acres.

d) The area required for water system is 7.3 acres only since the cooling is based on sea water and no cooling towers are provided. For the 2000 MW indigenous coal based station the area for the water system is 91.5 acres.

e) No water reservoir has been kept for the station since the total water requirement is met from the sea whereas for the station using indigenous coal the area for the water reservoir is 80 acres for 10 days storage.

f) A green belt equal to $1/3^{rd}$ of the plant area is provided for both the stations.

g) The area required for constructing ash dyke is taken as 240 acres for coastal station whereas the land requirement for the station using indigenous coal is 855 acres. These areas include the area for green belt around the ash dyke.

The table below indicates the total land requirement in both the cases with all the facilities:

Description	3x660 MW (Pit head /Load centre using Indigenous coal)	3x660 MW (Coastal- without MGR &Cooling Tower) using Imported coal
Total Land Required	**2050**	**840**
Land/MW	**1.00**	**0.42**

9.0 The General Layout Drawings

The general layout drawings for the following power stations are enclosed with the report:

a) 3 x 660 MW pit head thermal power station.

b) 6 x 660 MW pit head thermal power station.

c) 3 x 660 MW coastal thermal power stations without cooling tower and MGR system.

d) 5 x 800 MW coastal thermal power station with cooling tower and MGR system.

e) 5x800 MW coastal thermal power station without cooling tower and MGR system

10.0 RECOMMENDATIONS

From the foregoing discussions the Committee recommends the following land requirement. However, the individual power developer should explore the ways for having a further possible reduction in the land requirement especially for the ash dyke and the colony to reduce the overall land requirement for the power plant.

10.1 Pit head stations using Indian Coal

Sl. No	Land required for:	2x500 MW	3x660 MW	5x660 MW	6x660 MW	4x800 MW	5x800 MW
1	2	3	4	5	6	7	8
A.	**Main Plant**						
	i) Power Plant	450	640	820	940	790	880
	ii)Green Belt for power plant	150	210	270	310	260	290
	Total (A)	**600**	**850**	**1090**	**1250**	**1050**	**1170**
	Land / MW	**0.60**	**0.43**	**0.33**	**0.32**	**0.33**	**0.29**
B.	**Total Ash dyke area including Green belt**	**500**	**855**	**1370**	**1630**	**1000**	**1200**
C.	**Land for other facilities outside plant area**						
	i) Land for corridors	210	235	235	235	235	235
	ii) Land for raw water pump house and desilting basin	10	10	15	15	15	15
	Total (C)	**220**	**245**	**250**	**250**	**250**	**250**
D.	**Township**	**100**	**100**	**150**	**150**	**150**	**150**
	Grand total	**1420**	**2050**	**2860**	**3280**	**2450**	**2770**
	Land/ MW	**1.42**	**1.04**	**0.87**	**0.83**	**0.77**	**0.69**

Note: Coal with 40% ash upto 660 MW units and 34% ash for 800 MW units

10.2 3x660MW Coastal Power Station based on Imported Coal

Sl. No	Land required for	3x660 MW (Coastal - without MGR & Cooling Tower)	3x660 MW (Coastal - with MGR &Cooling Tower)	3x660 MW (Coastal - with MGR & without Cooling Tower)	3x660 MW (Coastal - without MGR & with Cooling Tower)
A.	**Main power plant**				
	i) Power plant	300	430	340	390
	ii) Green Belt for power plant	100	140	110	130
	Total (A)	**400**	**570**	**450**	**520**
	Land/MW	**0.20**	**0.29**	**0.23**	**0.26**
B.	**Ash Dyke incl. Green belt**	**240**	**240**	**240**	**240**
C.	**Land for other facilities**				
	i) Land for corridors	90	130	130	90
	ii) Land for raw water pump house and desilting basin	10	10	10	10
	Total (C)	**100**	**140**	**140**	**100**
D.	**Township**	**100**	**100**	**100**	**100**
	GRAND TOTAL	**840**	**1050**	**930**	**960**
	Land/ MW	**0.42**	**0.53**	**0.47**	**0.48**

10.3 5x800 MW Coastal Power Station using Imported Coal

Sl. No	Land required for	5x800 MW (Coastal- without MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &without Cooling Tower)	5x800 MW (Coastal- without MGR & with cooling tower)
A.	**Main power plant**				
	i) Power plant	430	630	480	580
	ii) Green Belt for power plant	140	210	160	190
	Total (A)	**570**	**840**	**640**	**770**
	Land/ MW	**0.14**	**0.21**	**0.16**	**0.19**
B.	**Ash Dyke incl. Green belt**	**390**	**390**	**390**	**390**
C.	**Land for other facilities outside plant area**				
i)	Land for corridors	100	140	140	100
ii)	Land for raw water pump house and desilting basin	10	10	10	10
	Total (C)	**110**	**150**	**150**	**110**
D.	**Township**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1220**	**1530**	**1330**	**1420**
	Land/ MW	**0.30**	**0.38**	**0.33**	**0.36**

10.4 6x660MW Coastal Power Station using Imported Coal

Sl. No	Land required for	6x660 MW (Coastal- with MGR &Cooling Tower)	6x660 MW (Coastal- without MGR &Cooling Tower)	6x660 MW (Coastal- with MGR &without Cooling Tower)	6x660 MW (Coastal- without MGR &withCooling Tower)
A.	**Main power plant**				
	i) Power plant	660	475	520	630
	ii) Green Belt for power plant	220	155	170	210
	Total (A)	**880**	**630**	**690**	**840**
	Land/ MW	**0.22**	**0.16**	**0.17**	**0.21**
B.	**Ash Dyke incl. Green belt**	**400**	**400**	**400**	**400**
C.	**Land for other facilities**				
i)	Land for corridors	140	100	140	100
ii)	Land for raw water pump house and desilting basin	10	10	10	10
	Total (C)	**150**	**110**	**150**	**110**
D.	**Township**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1580**	**1290**	**1390**	**1500**
	Land/ MW	**0.40**	**0.33**	**0.35**	**0.38**

Notes:

1) Landscaping area is included in Green belt.

2) Area earmarked for Laydown will be later converted to green belt.

3) The area requirement for construction office/parking (size 200x300 m) is not included in the above.

4) The space required for diversion of the drains, transmission lines passing through main plant area or ash dyke area, if any, shall be extra.

5) The space required for dry ash silos not included in the above.

6) The Land requirement has been worked out for Pit head stations using coal with 40% ash for units upto 660 MW and with 34% ash for 800 MW units.

7) For Coastal stations using imported coal and ash content has been assumed as10 %.

8) Water Storage for 10 days requirement has been considered for working out the land requirement for water reservoir of 8m depth.

9) 20 km long MGR and 30/35m wide corridor has been considered.

10) 10 km long and 12m/ 14m wide corridor for water pipelines has been considered.

11) Land for 765 kV switchyard with 1½ breaker scheme has been considered in the total land requirement.

TABLE-1

LAND REQUIREMENT FOR DIFFERENT CAPACITIES OF THERMAL POWER STATIONS (With indigenous coal)

[Area in acres; Dimensions in metres]

S. No	Description	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
1	2	3	4	5	6	7	8
A.	Main Power Plant						
1.	Boiler TG including Transformer yard	300 W x 400 D = 29.7	550 W x 400 D = 54.4	825 W x 400 D = 81.5	1100 W x 400 D = 108.8	700 W x 440 D = 76.1	850 W x 440 D = 92.4
2.	Pitch (Centre to Centre of boiler)	120	125	125	125	130	130
3.	Coal Handling System a)Pit head station (MGR) b)Load Centre Station	220 200	240 200	240 --	250 --	250 --	250 --
4.	Water Reservoir (10 days and 8m depth)	40	80	140	160	130	160
5	Water System						
a.	Raw water pump house	60x20 = 0.3	60x20=0.3	80x20=0.4	80x20=0.4	80x20=0.4	80x20=0.4
b.	Fore bay	40x60=0.6	40x60=0.6	40x60=0.6	40x60=0.6	40x60=0.6	40x60=0.6
c.	Chlorination Plant	40x20=0.2	40x20=0.2	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4
d.	Acid Store & Chemical House	40x40=0.4	40x40=0 .4	40x40=0 .4	40x40=0 .4	40x40=0 .4	40x40=0 .4
e.	Cooling Tower & Auxiliary CWPH	45	90	135	150	135	150
	Sub Total	46.5	91.5	136.8	151.8	136.8	151.8
6.	Ash Handling System	6	11	16	22	14	21
7.	Fuel oil facilities	3	3	6	6	6	6
8.	F.G.D. system	7	14	20	27	17	21
9.	Switchyard (a) 1½ Breaker scheme-400 kV	300x350 = 26	550x350 = 47.6	825x350 = 71.4	1150x350 = 95.1	700x350 = 60.5	850x350 = 73.5
	(b) 1½ Breaker scheme-765 kV	300x500 = 37.5	550x500 = 68.75	825x500 = 103.13	1100x500 = 137.5	700x500 = 87.5	850x500 = 106.25

Table- 1 (contd.)

S. No	Description	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
1	2	3	4	5	6	7	8
10	Miscellaneous facilities						
a	Administrative Building	100x150=3.75	100x150=3.75	100x150=3.75	100x150=3.75	100x150=3.75	100x150=3.75
b	Service Building	90x60=1.3	90x60=1.3	90x60=1.3	90x60=1.3	90x60=1.3	90x60=1.3
c	Workshop	90x40=0.9	90x40=0.9	90x40=0.9	90x40=0.9	90x40=0.9	90x40=0.9
d	Compressor House	90x40=0.9	90x40=0.9	2(90x40)=1.8	2(90x40)=1.8	2(90x40)=1.8	2(90x40)=1.8
e	Fire Station	40x25=0.3	40x25=0.3	80x25=0.5	80x25=0.5	80x25=0.5	80x25=0.5
f	Canteen	50x40=0.5	50x40=0.5	50x40=0.5	50x40=0.5	50x40=0.5	50x40=0.5
g	Security office complex	30x30=0.2	30x30=0.2	30x30=0.2	30x30=0.2	30x30=0.2	30x30=0.2
h	Lab	35x20=0.2	35x20=0.2	35x20=0.2	35x20=0.2	35x20=0.2	35x20=0.2
i	Hydrogen Plant	75x75=1.4	75x75=1.4	75x75=1.4	75x75=1.4	75x75=1.4	75x75=1.4
j	DG Sets	15x10=0.04	15x10=0.04	15x10=0.04	15x10=0.04	15x10=0.04	15x10=0.04
k	Auxiliary Boiler	30x20=0.2	30x20=0.2	30x20=0.2	30x20=0.2	30x20=0.2	30x20=0.2
l	Fire Pump house	40x10=0.1	40x10=0.1	40x10=0.1	40x10=0.1	40x10=0.1	40x10=0.1
m	Fire Water Tank	40x20=0.2	40x20=0.2	40x20=0.2	40x20=0.2	40x20=0.2	40x20=0.2
	Sub Total	10	10	11	11	11	11
11	Laydown & Pre-assembly yard	50	50	50	50	50	50
12	Steel Storage yard	10	10	10	10	10	10
13	Permanent Store	20	20	20	20	20	20
14	Construction Store	10	10	10	10	10	10
15	Roads	20	25	25	25	25	25
	Total(Main Plant with 765 kV switchyard without green belt)	**450**	**640**	**820**	**940**	**790**	**880**
16	Green Belt for power plant	150	210	270	310	260	290
	Total(A) (Main Plant with 765 kV switchyard including green belt	**600**	**850**	**1090**	**1250**	**1050**	**1170**

Table- 1 (contd.)

S. No	Description	2x500 MW (40% ash)	3x660 MW (40% ash)	5x660 MW (40% ash)	6x660 MW (40% ash)	4x800 MW (34% ash)	5x800 MW (34% ash)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
B.	**Ash Dyke**						
	Ash storage area	360	667	1148	1375	800	982
	Embankment	39	57	67	70	53	60
	Area for overflow lagoons	25	30	30	50	40	50
	Green belt	76	101	125	135	107	118
	Total (B)	**500**	**855**	**1370**	**1630**	**1000**	**1200**
C.	**Other Facilities outside plant area**						
1.	Raw water pump house including de-silting basin	10	10	15	15	15	15
2.	Area for corridors						
	i)Ash slurry disposal pipeline corridor	25	25	25	25	25	25
	ii)Corridor for MGR System	150 (20kmx30m)	175 (20kmx35m)	175 (20kmx35m)	175 (20kmx35m)	175 (20kmx35m)	175 (20kmx35m)
	iii)Corridor for Raw water pipe lines	35 (10kmx14m)	35 (10kmx14m)	35 (10kmx14m)	35 (10kmx14m)	35 (10kmx14m)	35 (10kmx14m)
	Sub-total (2)	205	233	235	235	235	235
	Total (C)	**220**	**245**	**250**	**250**	**250**	**250**
D.	**Township**	**100**	**100**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1420**	**2050**	**2860**	**3280**	**2450**	**2770**

The following has been considered while working out land requirement for various equipment and systems:

1. Indigenous Coal with 40% ash for units upto 660 MW and with 34% ash (washed coal) for 800 MW. 10% ash in imported coal for coastal stations.
2. Water Storage for 10 days requirement with water reservoir of 8m depth.
3. MGR rail distance of 20 km for pit head stations and 10 km for coastal stations, with 30m /35m width corridor for single track/ double tracks.
4. 10 km long and 12m/ 14m wide corridor for water pipelines.
5. 765 kV switchyard with 1½ breaker scheme except for 2x 500 MW plant.
6. Area for green belt is taken as 1/3rd of the main plant area. This includes area for laydown which will be later converted to green belt.
7. The space required for diversion of the drains and transmission lines passing through plant area/ash dyke area, if any, shall be extra.

TABLE- 2

LAND REQUIREMENT FOR TANJUNG BIN 3x700 MW - COASTAL POWER STATION IN INDONESIA

Sl. No	Description	3x700 MW (Imported Coal)
1	2	3
A.	Main Power Plant	
1.	Main Plant including Transformer yard	300Wx375 D = 27.8
2.	Pitch (Centre to Centre of boiler)	100 m
3.	Coal handling system Pit-head station Load Centre Station	163 **
4.	Water Reservoir	--
5 a	Water System	3.4 #
b	Raw water pump house	--
c	Fore bay	40x60= 0.6 *
d	Chlorination	2(40x20) = 0.4 *
e	Acid Store/ Chemical House	40x40 = 0.4 *
f	Cooling Tower/ Auxiliary CWPH	100x100 = 2.5 *
	Sub Total	7.3
6.	Ash Handling System	550x80 = 11 *
7.	Fuel oil facilities	60x45 = 0.7 *
8.	F.G.D. system	85x175 =4 $
9.	Switchyard 1½ Breaker system-400 kV	550x350 =48*

Table- 2 (contd.)

10. a	Administrative Building / Workshop	(Incl. in main plant area)
b	Service Building	90x60 = 1.3 *
c	Compressor House	2(90x40) = 1.8 *
d	Fire Station	80x25 = 0.5 *
e	Canteen	50x40 = 0.5 *
f	Security office	30x30 = 0.2 *
g	Lab	35x20 = 0.2 *
h	Hydrogen plant	75x75 =1.4 *
i	DG Sets	15x10 = 0.04 *
j	Auxiliary Boiler	30x20 = 0.2 *
k	Fire/Pump house	25x15 = 0.1
l	Fire Water Tanks	30x15 = 0.12
	Sub Total	8
11.	Lay down & pre-assembly yard	45
13.	Steel storage yard	10 *
14.	Permanent Store	20 *
15.	Construction Store	10 *
16.	Roads	20 *
	Sub-total	**329.26**
	Green Belt (30%)	98.78 *
	Total (A)	**428.04**
B.	Outside plant area but within 10 km from plant	
1.	Ash Dyke including Ash slurry disposal pipeline	138.68
2.	Raw water Intake system including de-silting basin	--
3.	Corridor for MGR System including marshalling yard	--
4.	Township	100 *
	Total (B)	**238.68**
	GRAND TOTAL	**666.72**

[Area in acres ; Dimensions in metres]

* - Assumed area same as for other projects.
** - storage for 45 days
\# - No cooling tower – Once through system
$ - A part of FGD area also included in the main plant area. Sea water based FGD system used.

TABLE-3

LAND REQUIREMENT FOR 3x660 MW COASTAL THERMAL POWER STATIONS USING IMPORTED COAL

[Area in acres ; Dimensions in metres]

Sl. No	Description	3x660 MW (Coastal- without MGR &Cooling Tower)	3x660 MW (Coastal- with MGR &Cooling Tower)	3x660 MW (Coastal- with MGR & withoutCooling Tower)	3x660 MW (Coastal- without MGR &withCooling Tower)
1	2	3	4	5	6
A.	**Main Power Plant**				
1.	**Main Plant including Transformer yard**	300Wx 375 D = 27.8	300Wx 375 D = 27.8	300Wx 375 D = 27.8	300Wx 375 D = 27.8
2.	**Pitch (Centre to Centre of boiler)**	100 m	100 m	100 m	100 m
3.	**Coal handling system**	108	150	150	108
4.	**Water Reservoir**	--	--	--	--
5	**Water system**	3.4	3.4	3.4	3.4
a.	**Raw water pump house**	40x60= 0.6	40x60= 0.6	40x60= 0.6	40x60= 0.6
b.	**Fore bay**	40x20 = 0.2	40x20 = 0.2	40x20 = 0.2	40x20 = 0.2
c.	**Chlorination**	40x40 = 0.4	40x40 = 0.4	40x40 = 0.4	40x40 = 0.4
d.	**Acid Store/ Chemical House**	100x100 = 2.5	100x100 = 2.5	100x100 = 2.5	100x100 = 2.5
e.	**Auxiliary CWPH**	40x20 = 0.2	40x20 = 0.2	40x20 = 0.2	40x20 = 0.2
f.	**Cooling Tower**	--	90	--	90
	Sub Total	7.3	97.3	7.3	97.3
6.	**Ash Handling System**	550x80 = 11	550x80 = 11	550x80 = 11	550x80 = 11
7.	**Fuel oil facilities**	60x45 = 0.7	60x45 = 0.7	60x45 = 0.7	60x45 = 0.7
8.	**F.G.D. system**	85x175 =4	85x175 =4	85x175 =4	85x175 =4
9.	**a) Switchyard -400 kV (1½ Breaker scheme)**	550x350=47.6	550x350=47.6	550x350=47.6	550x350=47.6
	b) Switchyard -765 kV (1½ Breaker scheme)	550x500 = 68.75	550x500 = 68.75	550x500 = 68.75	550x500 = 68.75

Table- 3 (contd.)

Sl. No	Description	3x660 MW (Coastal- without MGR &Cooling Tower)	3x660 MW (Coastal- with MGR &Cooling Tower)	3x660 MW (Coastal- with MGR & withoutCooling Tower)	3x660 MW (Coastal- without MGR &withCooling Tower)
1	2	3	4	5	6
10.	**Miscellaneous facilities**				
a	**Administrative Building**	100x90=2.3	100x90=2.3	100x90=2.3	100x90=2.3
b	**Service Building**	90x60 = 1.3	90x60 = 1.3	90x60 = 1.3	90x60 = 1.3
c	**Workshop**	50x40 = 0.5	50x40 = 0.5	50x40 = 0.5	50x40 = 0.5
d	**Compressor House**	90x40 = 0.9	90x40 = 0.9	90x40 = 0.9	90x40 = 0.9
e	**Fire Station**	80x25 = 0.5	80x25 = 0.5	80x25 = 0.5	80x25 = 0.5
f	**Canteen**	50x40 = 0.5	50x40 = 0.5	50x40 = 0.5	50x40 = 0.5
g	**Security office complex**	30x30 = 0.2	30x30 = 0.2	30x30 = 0.2	30x30 = 0.2
h	**Lab**	35x20 = 0.2	35x20 = 0.2	35x20 = 0.2	35x20 = 0.2
i	**Hydrogen plant**	75x75 =1.4	75x75 =1.4	75x75 =1.4	75x75 =1.4
j	**DG Sets**	15x10 = 0.04	15x10 = 0.04	15x10 = 0.04	15x10 = 0.04
k	**Auxiliary Boiler**	30x20 = 0.2	30x20 = 0.2	30x20 = 0.2	30x20 = 0.2
l	**Fire/Pump house**	25x15 = 0.1	25x15 = 0.1	25x15 = 0.1	25x15 = 0.1
m	**Fire Water Tanks**	30x15 = 0.12	30x15 = 0.12	30x15 = 0.12	30x15 = 0.12
	Sub Total	8	8	8	8
11.	**Laydown & pre-assembly yard**	45	45	45	45
12.	**Steel storage yard**	10	10	10	10
13.	**Permanent Store**	20	20	20	20
14.	**Construction Store**	10	10	10	10
15.	**Roads**	20	20	20	20
	Total(Main Plant with 765 kV switchyard without green belt-Rounded off)	**300**	**430**	**340**	**390**
16.	**Green Belt**	100	140	110	130
	Total (A) (Main Plant with 765 kV switchyard including green belt)	**400**	**570**	**450**	**520**

Table- 3 (contd.)

Sl. No	Description	3x660 MW (Coastal- without MGR &Cooling Tower)	3x660 MW (Coastal- with MGR &Cooling Tower)	3x660 MW (Coastal- with MGR & withoutCooling Tower)	3x660 MW (Coastal- without MGR &withCooling Tower)
1	2	4	4	5	6
B.	**Ash Dyke** i) Ash storage area ii) Embankment iii)Area for overflow lagoons iv) Green belt **Sub-total (B) Rounded off**	 129 28 30 50 **240**	 129 28 30 50 **240**	 129 28 30 50 **240**	 129 28 30 50 **240**
C.	**Other Facilities outside plant area**				
1.	Raw water pump house including de-silting basin	10	10	10	10
2.	Area for corridors				
	i)Ash slurry disposal pipeline corridor	25	25	25	25
	ii)Corridor for MGR System	35	75	75	35
	iii)Corridor for Raw water pipe lines	30 (10kmx12m)	30 (10kmx12m)	30 (10kmx12m)	30 (10kmx12m)
	Sub-total(2)	90	130	130	90
	Total (C)	**100**	**140**	**140**	**100**
D.	**Township**	**100**	**100**	**100**	**100**
	GRAND TOTAL	**840**	**1050**	**930**	**960**

The following has been considered while working out land requirement for various equipment and systems:

1. Indigenous Coal with 40% ash for units upto 660 MW and with 34% ash (washed coal) for 800 MW. 10% ash in imported coal for coastal stations.

2. Water Storage for 10 days requirement with water reservoir of 8m depth.

3. MGR rail distance of 20 km for pit head stations and 10 km for coastal stations, with 30m /35m width corridor for single track/ double tracks.

4. 10 km long and 12m/ 14m wide corridor for water pipelines.

5. 765 kV switchyard with 1½ breaker scheme.

6. Area for green belt is taken as 1/3rd of the main plant area. This includes area for laydown which will be later converted to green belt.

7. The space required for diversion of the drains and transmission lines passing through plant area/ash dyke area, if any, shall be extra.

TABLE-4

LAND REQUIREMENT FOR 5x800 MW COASTAL THERMAL POWER STATION USING IMPORTED COAL

[Area in acres ; Dimensions in metres]

Sl. No	Description	5x800 MW (Coastal- without MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &without Cooling Tower)	5x800 MW (Coastal- without MGR &with Cooling Tower)
1	2	3	4	5	6
A.	Main Power Plant				
1.	Main Plant including Transformer yard	700 W x 400 D = 70	700 W x 400 D = 70	700 W x 400 D = 70	700 W x 400 D = 70
2.	Pitch (Centre to Centre of boiler)	120 m	120 m	120 m	120 m
3..	Coal handling system	150	200	200	150
4.	Water Reservoir	--	--	--	--
5. a.	Water system	2.0	2.0	2.0	2.0
b.	Raw water pump house	80x20=0.4	80x20=0.4	80x20=0.4	80x20=0.4
c.	Fore bay	40x60=0.6	40x60=0.6	40x60=0.6	40x60=0.6
d.	Chlorination	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4
e.	Acid Store & Chemical House	40x40=0 .4	40x40=0 .4	40x40=0 .4	40x40=0 .4
f.	Auxiliary CWPH	80x20=0.4	80x20=0.4	80x20=0.4	80x20=0.4
g.	Cooling Tower	--	150	--	150
	Sub Total	**4.2**	**154.2**	**4.2**	**154.2**
6.	Ash Handling System	400 x 100 = 10	400 x 100 = 10	400 x 100 = 10	400 x 100 = 10
7.	Fuel oil facilities	400x60 =6	400x60 =6	400x60 =6	400x60 =6
8.	F.G.D. system	175 x175 = 7.5	175 x175 = 7.5	175 x175 = 7.5	175 x175 = 7.5
9.	(a) Switchyard 1½ Breaker scheme-400 kV	700x350 =61.25	700x350 =61.25	700x350 =61.25	700x350=61.25
	(b) Switchyard 1½ Breaker scheme-765kV	850x500 = 106.25	850x500 = 106.25	850x500 = 106.25	850x500 = 106.25

Table- 4 (contd.)

Sl. No	Description	5x800 MW (Coastal- without MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &without Cooling Tower)	5x800 MW (Coastal- without MGR &with Cooling Tower)
1	2	3	4	5	6
10.	Miscellaneous Facilities				
a	Administrative Building	100x150=3.75	100x150=3.75	100x150=3.75	100x150=3.75
b	Service Building	90x60=1.3	90x60=1.3	90x60=1.3	90x60=1.3
c	Workshop	90x40=0 .9	90x40=0 .9	90x40=0 .9	90x40=0 .9
d	Compressor House	2x(90x40)=1.8	2x(90x40)=1.8	2x(90x40)=1.8	2x(90x40)=1.8
e	Fire Station	80x25=0 .5	80x25=0 .5	80x25=0 .5	80x25=0 .5
f	Canteen	50x40=0 .5	50x40=0 .5	50x40=0 .5	50x40=0 .5
g	Security office complex	30x30=0 .2	30x30=0 .2	30x30=0 .2	30x30=0 .2
h	Lab	35x20=0 .2	35x20=0 .2	35x20=0 .2	35x20=0 .2
i	Hydrogen plant	75x75= 1.4	75x75= 1.4	75x75= 1.4	75x75= 1.4
j	DG Sets	15x10=0 .04	15x10=0 .04	15x10=0 .04	15x10=0 .04
k	Auxiliary Boiler	30x20=0 .2	30x20=0 .2	30x20=0 .2	30x20=0 .2
l	Fire/Pump house	40x10=0 .1	40x10=0 .1	40x10=0 .1	40x10=0 .1
m	Fire Water Tanks	40x20=0 .2	40x20=0 .2	40x20=0 .2	40x20=0 .2
	Sub Total	11	11	11	11
11.	Laydown & pre-assembly yard	50	50	50	50
12.	Steel storage yard	10	10	10	10
13.	Permanent Store	20	20	20	20
14.	Construction Store	10	10	10	10
15.	Roads	25	25	25	25
	Sub-total (Main Plant with 765 kV switchyard without green belt – Rounded off)	**430**	**630**	**480**	**580**
16.	Green Belt for Power Plant	140	210	160	190
	Total(A) (Main Plant with 765 kV switchyard including green belt)	**570**	**840**	**640**	**770**

Table- 4 (contd.)

Sl. No	Description	5x800 MW (Coastal- without MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &Cooling Tower)	5x800 MW (Coastal- with MGR &without Cooling Tower)	5x800 MW (Coastal- without MGR &with Cooling Tower)
1	2	3	4	5	6
B.	**Ash Dyke**				
	i) Ash storage area	237	237	237	237
	ii) Embankment	35	35	35	35
	iii)Area for overflow lagoons	50	50	50	50
	iv)Green belt	63	63	63	63
	Sub-total(B) (Rounded off)	**390**	**390**	**390**	**390**
C.	**Other Facilities outside plant area**				
1.	Raw water pumphouse including de-silting basin	10	10	10	10
2.	Area for corridors				
	i)Ash slurry disposal pipeline corridor	25	25	25	25
	ii)Corridor for MGR System	35	75	75	35
	iii)Corridor for Raw water pipe lines	40	40	40	40
	Sub-Total (2)	100	140	140	100
	Total (c)	**110**	**150**	**150**	**110**
D.	**Township**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1220**	**1530**	**1330**	**1420**

The following has been considered while working out land requirement for various equipment and systems:

1. Indigenous Coal with 40% ash for units upto 660 MW and with 34% ash (washed coal) for 800 MW. 10% ash in imported coal for coastal stations.
2. Water Storage for 10 days requirement with water reservoir of 8m depth.
3. MGR rail distance of 20 km for pit head stations and 10 km for coastal stations, with 30m /35m width corridor for single track/ double tracks.
4. 10 km long and 12m/ 14m wide corridor for water pipelines.
5. 765 kV switchyard with 1½ breaker scheme.
6. Area for green belt is taken as 1/3rd of the main plant area. This includes area for laydown which will be later converted to green belt.
7. The space required for diversion of the drains and transmission lines passing through plant area/ash dyke area, if any, shall be extra.

TABLE-5

LAND REQUIREMENT FOR 6x660 MW COASTAL THERMAL POWER STATION USING IMPORTED COAL

[Area in acres ; Dimensions in metres]

Sl. No	Description	6x660 MW (Coastal- with MGR &Cooling Tower)	6x660 MW (Coastal- without MGR &Cooling Tower)	6x660 MW (Coastal- with MGR & withoutCooling Tower)	6x660 MW (Coastal- without MGR &withCooling Tower)
1	2	3	3	3	3
A.	Main Power Plant				
1.	Main Plant including Transformer yard	900 W x 375 D = 84.38	900 W x 375 D = 84.38	900 W x 375 D = 84.38	900 W x 375 D = 84.38
2.	Pitch (Centre to Centre of boiler)	100 m	100 m	100 m	100 m
3.	Coal handling system	180	140	180	140
4.	Water Reservoir	-	-	-	-
5 a.	Water system	2.0	2.0	2.0	2.0
b.	Raw water pump house	80x20=0.4	80x20=0.4	80x20=0.4	80x20=0.4
c.	Fore bay	40x60=0.6	40x60=0.6	40x60=0.6	40x60=0.6
d.	Chlorination	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4	2(40x20)=0.4
e.	Acid Store & Chemical House	40x40=0 .4	40x40=0 .4	40x40=0 .4	40x40=0 .4
f.	Auxiliary CWPH	80x20=0.4	80x20=0.4	80x20=0.4	80x20=0.4
g.	Cooling Tower	150	--	--	150
	Sub Total	**154.2**	**4.2**	**4.2**	**154.2**
6.	Ash Handling System	800x80 = 16	800x80 = 16	800x80 = 16	800x80 = 16
7.	Fuel oil facilities	400x60 =6	400x60 =6	400x60 =6	400x60 =6
8.	F.G.D. system	10	10	10	10
9.	(a) Switchyard -400 kV (1½ Breaker scheme)	900x350 =78.75	900x350 =78.75	900x350 =78.75	900x350 =78.75
	(b) Switchyard -765 kV (1½ Breaker scheme)	1100x500 = 137.5	1100x500 = 137.5	1100x500 = 137.5	1100x500 = 137.5

Table- 5 (contd.)

Sl. No	Description	6x660 MW (Coastal- with MGR &Cooling Tower)	6x660 MW (Coastal- without MGR &Cooling Tower)	6x660 MW (Coastal- with MGR & withoutCooling Tower)	6x660 MW (Coastal- without MGR &withCooling Tower)
1	2	3	4	5	6
10.	Miscellaneous Facilities				
a	Administrative Building	100x150=3.75	100x150=3.75	100x150=3.75	100x150=3.75
b	Service Building	90x60=1.3	90x60=1.3	90x60=1.3	90x60=1.3
c	Workshop	90x40=0 .9	90x40=0 .9	90x40=0 .9	90x40=0 .9
d	Compressor House	2(90x40)= 1.8	2(90x40)= 1.8	2(90x40)= 1.8	2(90x40)= 1.8
e	Fire Station	80x25=0 .5	80x25=0 .5	80x25=0 .5	80x25=0 .5
f	Canteen	50x40=0 .5	50x40=0 .5	50x40=0 .5	50x40=0 .5
g	Security office complex	30x300 .2	30x300 .2	30x300 .2	30x300 .2
h	Lab	35x20=0 .2	35x20=0 .2	35x20=0 .2	35x20=0 .2
i	Hydrogen plant	75x75= 1.4	75x75= 1.4	75x75= 1.4	75x75= 1.4
j	DG Sets	15x10=0 .04	15x10=0 .04	15x10=0 .04	15x10=0 .04
k	Auxiliary Boiler	30x20=0 .2	30x20=0 .2	30x20=0 .2	30x20=0 .2
l	Fire/Pump house	40x10=0 .1	40x10=0 .1	40x10=0 .1	40x10=0 .1
m	Fire Water Tanks	40x20=0 .2	40x20=0 .2	40x20=0 .2	40x20=0 .2
	Sub Total	11	11	11	11
11.	Laydown & pre-assembly yard	50	50	50	50
12.	Steel storage yard	10	10	10	10
13.	Permanent Store	20	20	20	20
14.	Construction Store	10	10	10	10
15.	Roads	25	25	25	25
	Sub-Total (Main Plant with 765 kV switchyard without green belt – Rounded off)	**660**	**475**	**520**	**630**
16.	Green Belt for Power Plant	220	155	170	210
	Total (A) (Main Plant with 765 kV switchyard including green belt)	880	630	690	840

Table- 5 (contd.)

Sl. No	Description	6x660 MW (Coastal- with MGR &Cooling Tower)	6x660 MW (Coastal- without MGR &Cooling Tower)	6x660 MW (Coastal- with MGR & withoutCooling Tower)	6x660 MW (Coastal- without MGR &withCooling Tower)
1	2	3	4	5	6
B.	**Ash Dyke** i) Ash storage area ii) Embankment iii)Area for overflow lagoons iv) Green belt **Sub-total (B) (Rounded off)**	 262 36 50 64 **400**	 262 36 50 64 **400**	 262 36 50 64 **400**	 262 36 50 64 **400**
C.	**Other Facilities outside plant area**				
1.	Raw water pump house including de-silting basin	10	10	10	10
2.	Area for corridors				
	i)Ash slurry disposal pipeline corridor	25	25	25	25
	ii)Corridor for MGR System	75	35	75	35
	iii)Corridor for Raw water pipe lines	40	40	40	40
	Sub-total(2)	140	100	140	100
	Total (C)	**150**	**110**	**150**	**110**
D.	**Township**	**150**	**150**	**150**	**150**
	GRAND TOTAL	**1580**	**1290**	**1390**	**1500**

The following has been considered while working out land requirement for various equipment and systems:

1. Indigenous Coal with 40% ash for units upto 660 MW and with 34% ash (washed coal) for 800 MW. 10% ash in imported coal for coastal stations.

2. Water Storage for 10 days requirement with water reservoir of 8m depth.

3. MGR rail distance of 20 km for pit head stations and 10 km for coastal stations, with 30m /35m width corridor for single track/ double tracks.

4. 10 km long and 12m/ 14m wide corridor for water pipelines.

5. 765 kV switchyard with 1½ breaker scheme.

6. Area for green belt is taken as 1/3rd of the main plant area. This includes area for laydown which will be later converted to green belt.

7. The space required for diversion of the drains and transmission lines passing through plant area/ash dyke area, if any, shall be extra.

TABLE-6

COMPARISON OF THE LAND REQUIREMENT FOR 3x 660 MW PIT HEAD VS COASTAL THERMAL POWER STATION

[Area in acres ; Dimensions in metres]

Sl. No	Description	3x660 MW (Pit head using Indigenous coal)	3x660 MW (Coastal- without MGR &Cooling Tower) using Imported coal	Difference in area[3-4]
1	2	3	4	5
A.	Main Power Plant			
1.	Main Plant including Transformer yard	550 W x 400 D = 54.4	300Wx 375 D = 27.8	26.6
2.	Pitch (Centre to Centre of boiler)	125 m	100 m	
3.	Coal handling system	240	108	132
4.	Water Reservoir	80	--	80
5.a.	Water system	--	3.4	
b.	Raw water pump house	60x20=0.3	--	
c.	Fore bay	40x60=0.6	40x60= 0.6	
d.	Chlorination	40x20=0.2	2(40x20) = 0.4	
e.	Acid Store & Chemical House	40x40=0 .4	40x40 = 0.4	
f.	Auxiliary CWPH	--	100x100 = 2.5	
g.	Cooling Tower	90	--	
	Sub Total	91.5	7.3	84.2
6.	Ash Handling System	550x80 = 11	550x80 = 11	--
7.	Fuel oil facilities	200x60 =3	60x45 = 0.7	2.3
8.	F.G.D. system	550x100 = 14	85x175 =4	10

Table- 6 (contd.)

Sl. No	Description	3x660 MW (Pit head /Load centre using Indigenous coal)	3x660 MW (Coastal- without MGR &Cooling Tower) using Imported coal	Difference in area[3-4]
1	2	3	4	5
9	(a) Switchyard 1½ Breaker scheme-400 kV	550x350 =47.6	550x350 =47.6	--
	(b) Switchyard 1½ Breaker scheme-765 kV	550x500 = 68.75	550x500 = 68.75	--
10.	Miscellaneous Facilities			
a	Administrative Building	100x150= 3.75	70x85 = 1.5	
b	Service Building	90x60=1.3	90x60 = 1.3	
c	Workshop	90x40=0 .9	40x40=0.4	
d	Compressor House	90x40=0 .9	2(90x40) = 1.8	
e	Fire Station	40x25=0 .3	80x25 = 0.5	
f	Canteen	50x40=0 .5	50x40 = 0.5	
g	Security office complex	30x30=0 .2	30x30 = 0.2	
h	Lab	35x20=0 .2	35x20 = 0.2	
i	Hydrogen plant	75x75= 1.4	75x75 =1.4	
j	DG Sets	15x10=0 .04	15x10 = 0.04	
k	Auxiliary Boiler	30x20=0 .2	30x20 = 0.2	
l	Fire/Pump house	40x10=0 .1	25x15 = 0.1	
m	Fire Water Tanks	40x20=0 .2	30x15 = 0.12	
	Sub Total	10	8	2
11.	Laydown & pre-assembly yard	50	45	5
12.	Steel storage yard	10	10	-
13.	Permanent Store	20	20	-
14.	Construction Store	10	10	-
15.	Roads	25	20	5
	Total (with 765 kV switchyard and Rounded off)	**640**	**300**	**340**
16.	Green Belt	210	100	110
	Total	**850**	**400**	**450**

Table- 6 (contd.)

Sl. No	Description	3x660 MW (Pit head /Load centre using Indigenous coal)	3x660 MW (Coastal- without MGR &Cooling Tower) using Imported coal	Difference in area[3-4]
1	2	3	4	5
B.	**Ash Dyke** . Ash storage area	712	129	
	. Embankment	57	28	
	. Area for overflow lagoons	30	30	
	. Green belt (30 %)	101	50	
	Sub-total (B)	**855**	**240**	**615**
C.	**Other Facilities outside plant area**			
1.	Raw water pump house including de-silting basin	10	**10**	--
2.	Area for corridors			
i	Ash slurry disposal pipeline corridor	25	**25**	**--**
ii	Corridor for MGR System	175	**35**	**140**
iii	Corridor for Raw water pipe lines	35	**30**	**--**
	Sub- total (2)	235	**90**	
	Total (c)	**245**	**100**	**145**
D.	**Township**	**100**	**100**	**--**
	GRAND TOTAL	**2050**	**840**	**1210**

The following has been considered while working out land requirement for various equipment and systems:

1. Indigenous Coal with 40% ash for units upto 660 MW and with 34% ash (washed coal) for 800 MW. 10% ash in imported coal for coastal stations.

2. Water Storage for 10 days requirement with water reservoir of 8m depth.

3. MGR rail distance of 20 km for pit head stations and 10 km for coastal stations, with 30m /35m width corridor for single track/ double tracks.

4. 10 km long and 12m/ 14m wide corridor for water pipelines.

5. 765 kV switchyard with 1½ breaker scheme.

6. Area for green belt is taken as 1/3rd of the main plant area. This includes area for laydown which will be later converted to green belt.

7. The space required for diversion of the drains and transmission lines passing through plant area/ash dyke area, if any, shall be extra.

Govt of India
Central Electricity Authority
Office of Secretary, CEA
Sewa Bhawan, R.K. Puram
New Delhi - 110066

No. CEA/5-41(05)/Secy-2007/73 Dated: 4th April, 2007

Office Order

Subject: Constitution of a Committee to work out the optimal land requirements for thermal power stations – reg.

A Committee comprising of the following members is hereby constituted to work out the optimal land requirements for coal based thermal power stations:

1. Shri S. Seshadri, CE (TPI), CEA - Chairman
2. Representative of NTPC - Member
3. Representative of BHEL - Member
4. Representative of M/s. Desein - Member
5. Representative of M/s. TCE Ltd. - Member
6. Representative of M/s. L&T Sargeant & Lundy Ltd - Member
7. Shri N.K. Nair, Director (TE&TD), CEA - Member (Convenor)
8. Shri Subhash Chander, Dy. Director (TE&TD), CEA - Member

The Committee may also co-opt any other member.

The terms of Reference of the Committee are:

a) To work out the minimum land requirements for coal based thermal power plants having capacities of 1000 MW, 2000 MW, 3000 MW & 4000 MW.
b) To develop layouts for the above thermal power plants (pit-head and coastal site)
c) To study layouts being followed in developed countries.
d) To give recommendations on the requirements of land taking into consideration (a), (b) & (c).

The Committee may visit existing thermal power stations, if required.

The Committee shall submit its recommendations within three weeks from the date of issue of this Office Order.

4-4-07

(B.K. Misra)
Secretary, CEA

To:

1. Shri S. Seshadri, CE (TPI), CEA

2. Chairperson & Managing Director, NTPC, Scope Complex, Lodhi Road, New Delhi -110 003. Fax No. 24363050
-- with the request to nominate a representative urgently.

3. Chairperson & Managing Director,BHEL, BHEL House, Siri Fort, Asian Games Village, New Delhi-110 049. Fax No. 26492043
-- with the request to nominate a representative urgently.

4. Managing Director, M/s. Desein Pvt. Ltd., Desein House, Greater Kailash-II, New Delhi-110048 Fax No. 29218392 & 29219566
-- with the request to nominate a representative urgently.

5. M/s. TCE Ltd. 73/1, St. Mark's Road, Bangalore.
-- with the request to nominate a representative urgently.

6. L&T Sergeant & Lundy Ltd., A-2329, Gate No. 6, Green Field Colony, Faridabad -1210036. Tel. No. 95-129-25122641.
-- with the request to nominate a representative urgently.

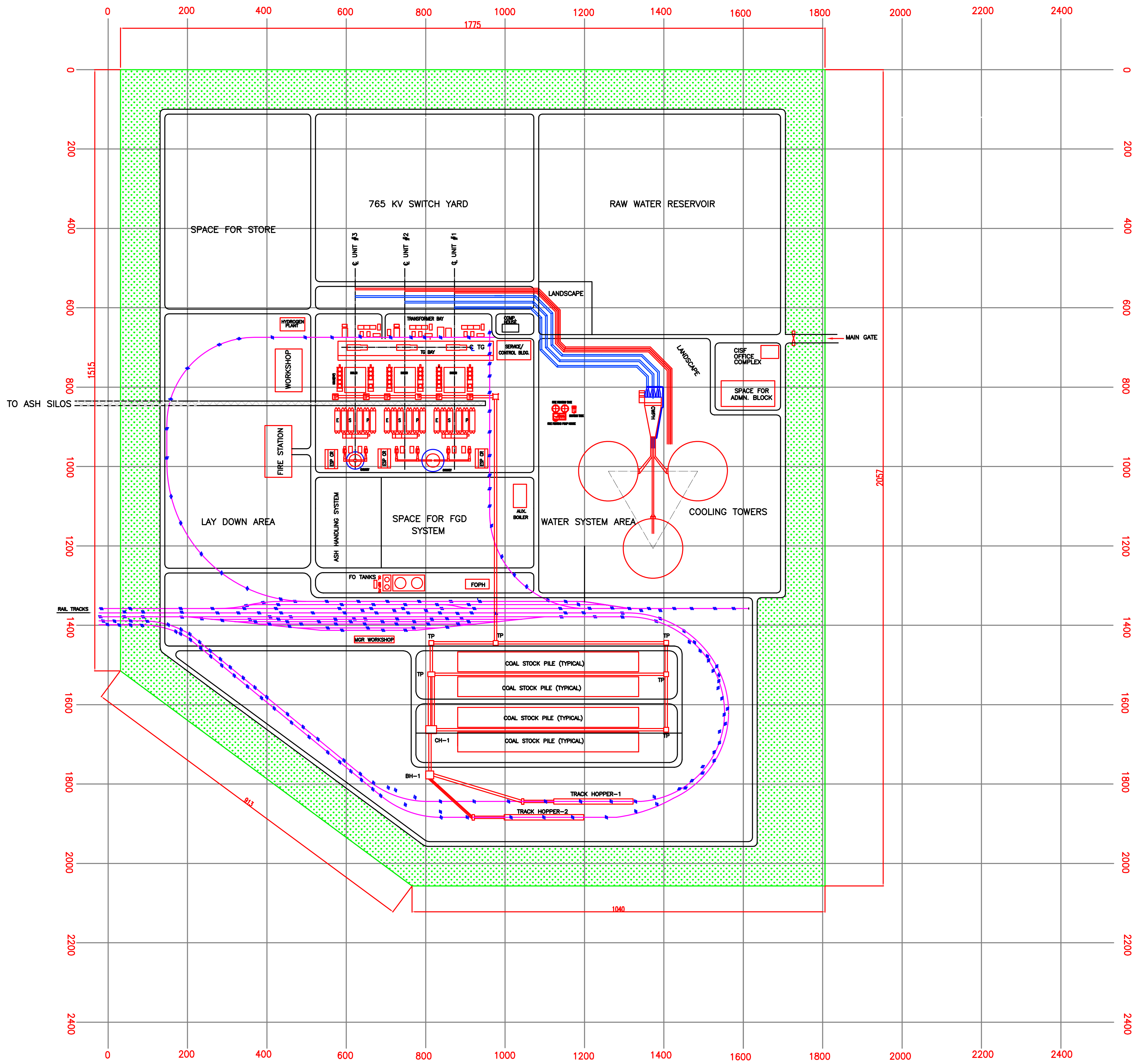
7. Shri N.K. Nair, Director (TE&TD), CEA.

8. Shri Subhash Chander, Dy. Director (TE&TD), CEA.

Copy for kind information to:

1. Chairperson, CEA, 2nd floor, Sewa Bhawan, R.K. Puram, New Delhi-110066.

2. Member (Thermal), CEA, 9th floor, South Wing, Sewa Bhawan, R.K. Puram, New Delhi-110 066.



NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. OVERALL AREA OF THE LAND IS 850 ACRES

LEGEND:–

1. ROADS (DOUBLE LINE) ROADS (SINGLE LINE)
2. BOUNDARY WALL
3. FENCING
4. RAILWAY LINE
5. FACILITIES/ BUILDINGS
6. WATCH TOWER
7. FORMATION LEVEL
8. LAND ACQUISITION LINE
9. SLOPE PROTECTION WORKS
10. CONTOUR

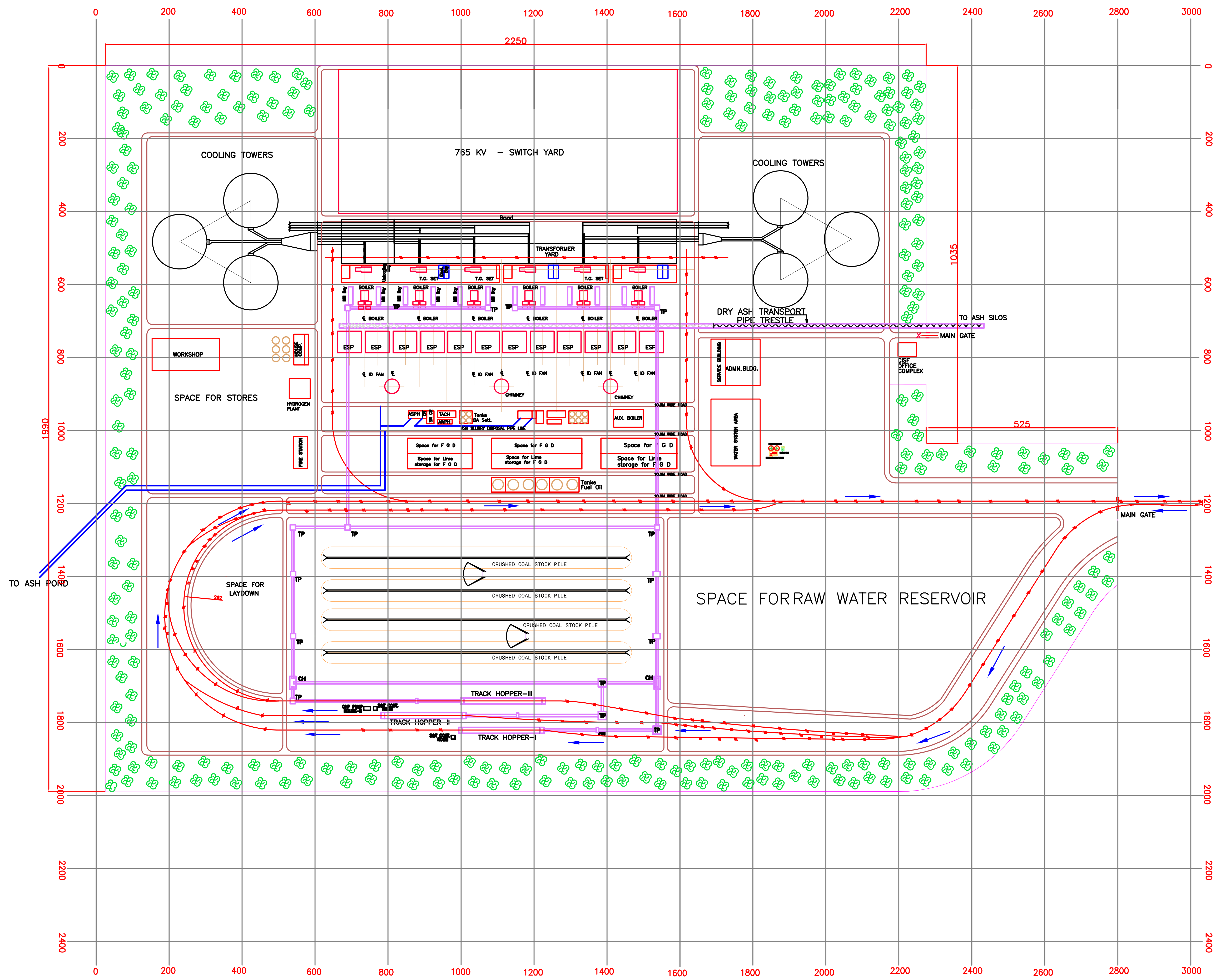
EXHIBIT – 1

PIT HEAD THERMAL POWER PROJECT (3X660MW)
PIT HEAD STATION (INDIGENOUS COAL)

CENTRAL ELECTRICITY AUTHORITY

TITLE: TYPICAL GENERAL LAYOUT (3X660MW)

DRG. No. CEA - TE & TD - GT & AS - STANDARD - 01



NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. OVERALL AREA OF THE LAND IS 1250 ACRES

LEGEND:–

1. ROADS (DOUBLE LINE)
   ROADS (SINGLE LINE)
2. BOUNDARY WALL
3. FENCING
4. RAILWAY LINE
5. FACILITIES/ BUILDINGS
6. WATCH TOWER
7. FORMATION LEVEL
8. LAND ACQUISITION LINE
9. SLOPE PROTECTION WORKS
10. CONTOUR

EXHIBIT – 2

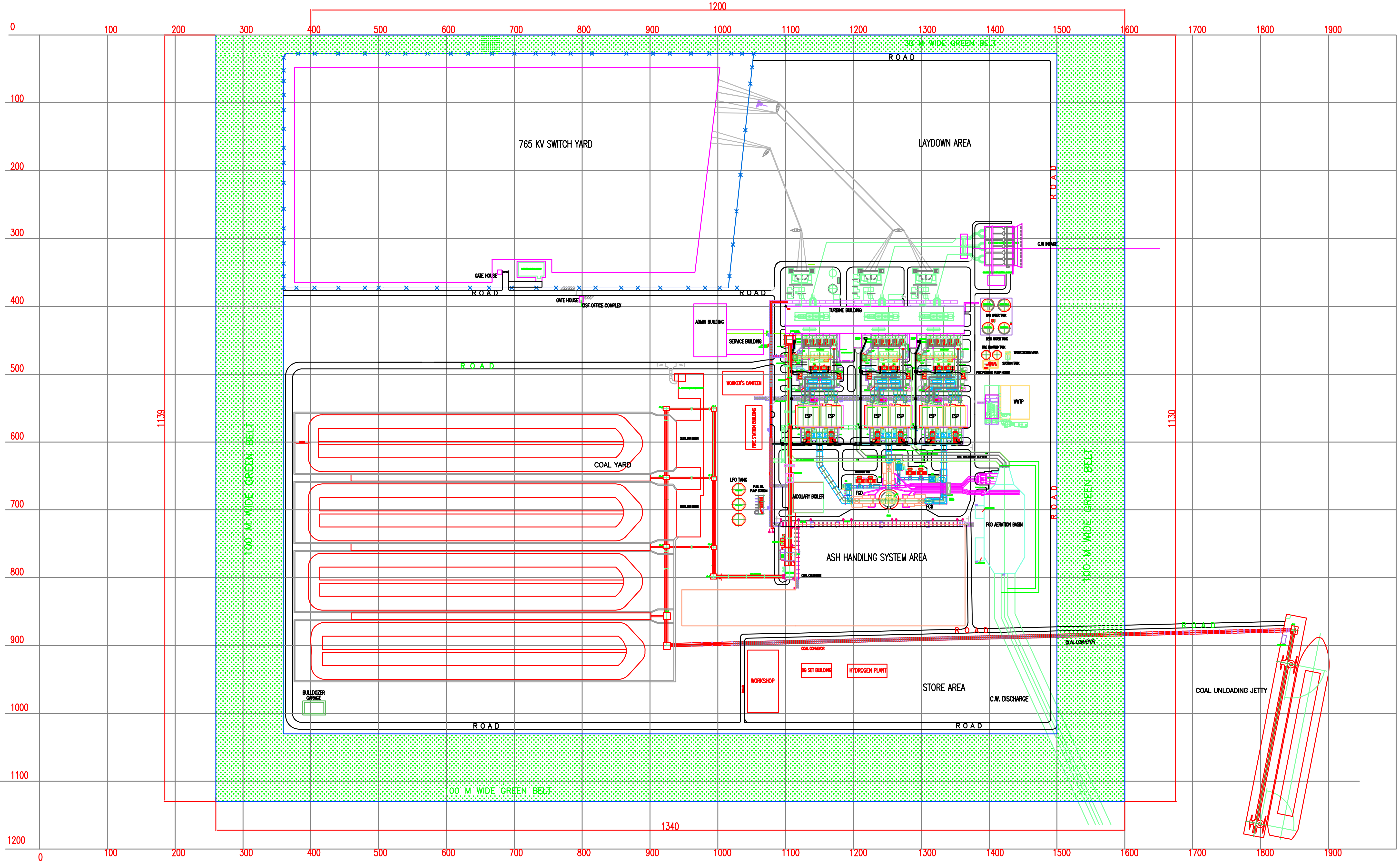
PIT HEAD ULTRA MEGA THERMAL POWER PROJECT
(6 X 660 MW)

CENTRAL ELECTRICITY AUTHORITY

Designed	S.C.GOOMER
Drawn	VINOD
Checked	S.C.GOOMER
Recmed.	N.K.NAIR
Appd.	S.SESHADRI
Scale	1:4500
DATE	APR. 2007

TITLE: TYPICAL GENERAL LAYOUT
(6 X 660 MW)

DRG. No. CEA-TE & TD -GT & AS -STANDARD-03



LEGEND:–

1. ROADS (DOUBLE LINE) . . . .
   ROADS (SINGLE LINE) . . . .
2. BOUNDARY WALL. . . . .
3. FENCING . . . .
4. RAILWAY LINE. . . . .
5. FACILITIES/ BUILDINGS . . . .
6. WATCH TOWER . . . .
7. FORMATION LEVEL . . . .
8. LAND ACQUISITION LINE . . . .
9. SLOPE PROTECTION WORKS . . . .
10. CONTOUR . . . .

NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. OVERALL AREA OF THE LAND IS 400 ACRES

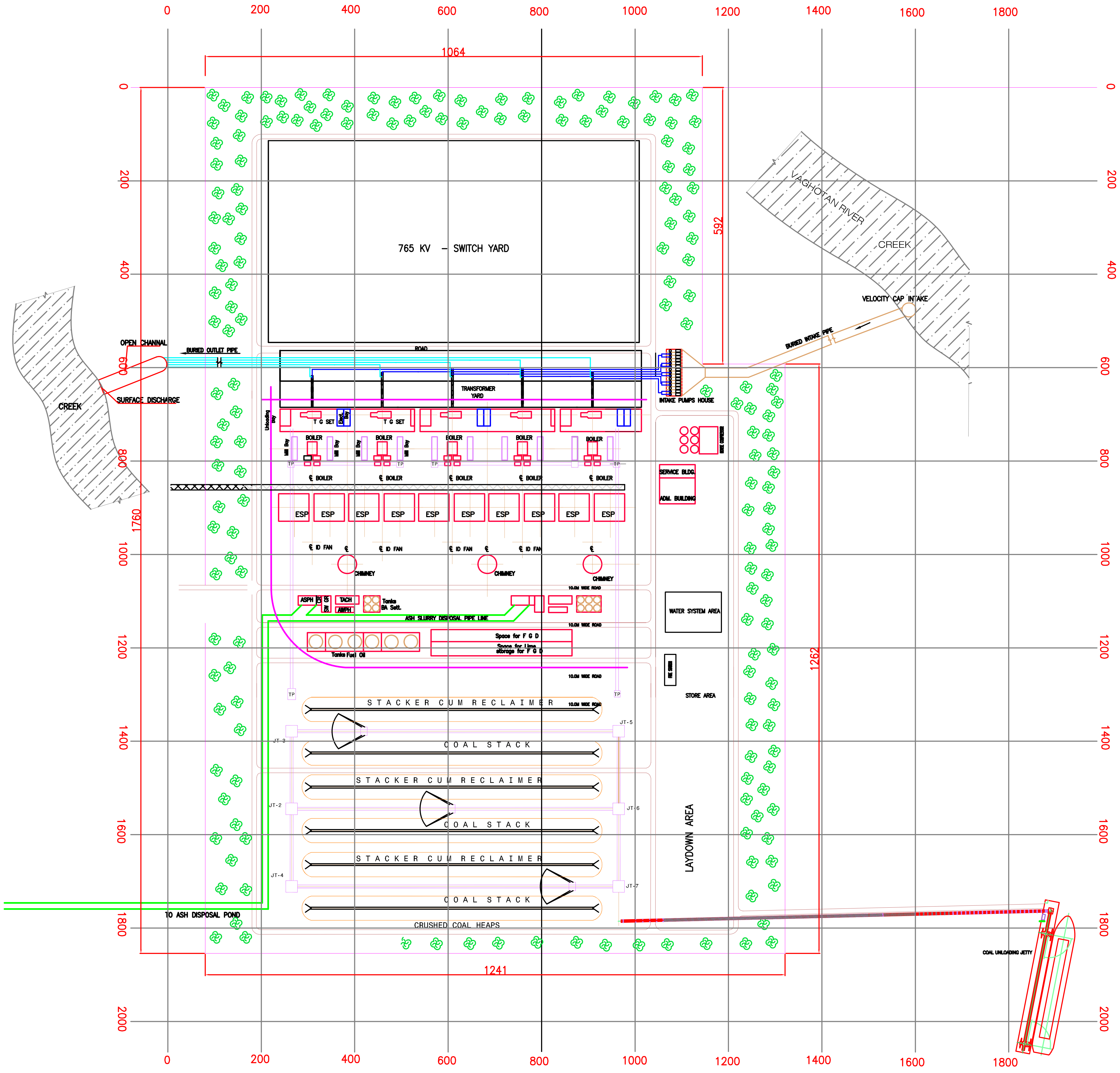
EXHIBIT – 3

COASTAL THERMAL POWER PROJECT (3X660MW)

CENTRAL ELECTRICITY AUTHORITY

TITLE: **TYPICAL GENERAL LAYOUT (3X660MW)**

DRG. No. CEA - TE & TD - GT & AS - STANDARD - 02



NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. OVERALL AREA OF THE LAND IS 570 ACRES

LEGEND:–

1. ROADS (DOUBLE LINE) ....
   ROADS (SINGLE LINE) ....
2. BOUNDARY WALL.................
3. FENCING ....
4. RAILWAY LINE...............
5. FACILITIES/ BUILDINGS ....
6. WATCH TOWER ....
7. FORMATION LEVEL ....
8. LAND ACQUISITION LINE ....
9. SLOPE PROTECTION WORKS ....
10. CONTOUR ....

EXHIBIT – 4

COASTAL ULTRA MEGA THERMAL POWER PROJECT (5x800 MW)

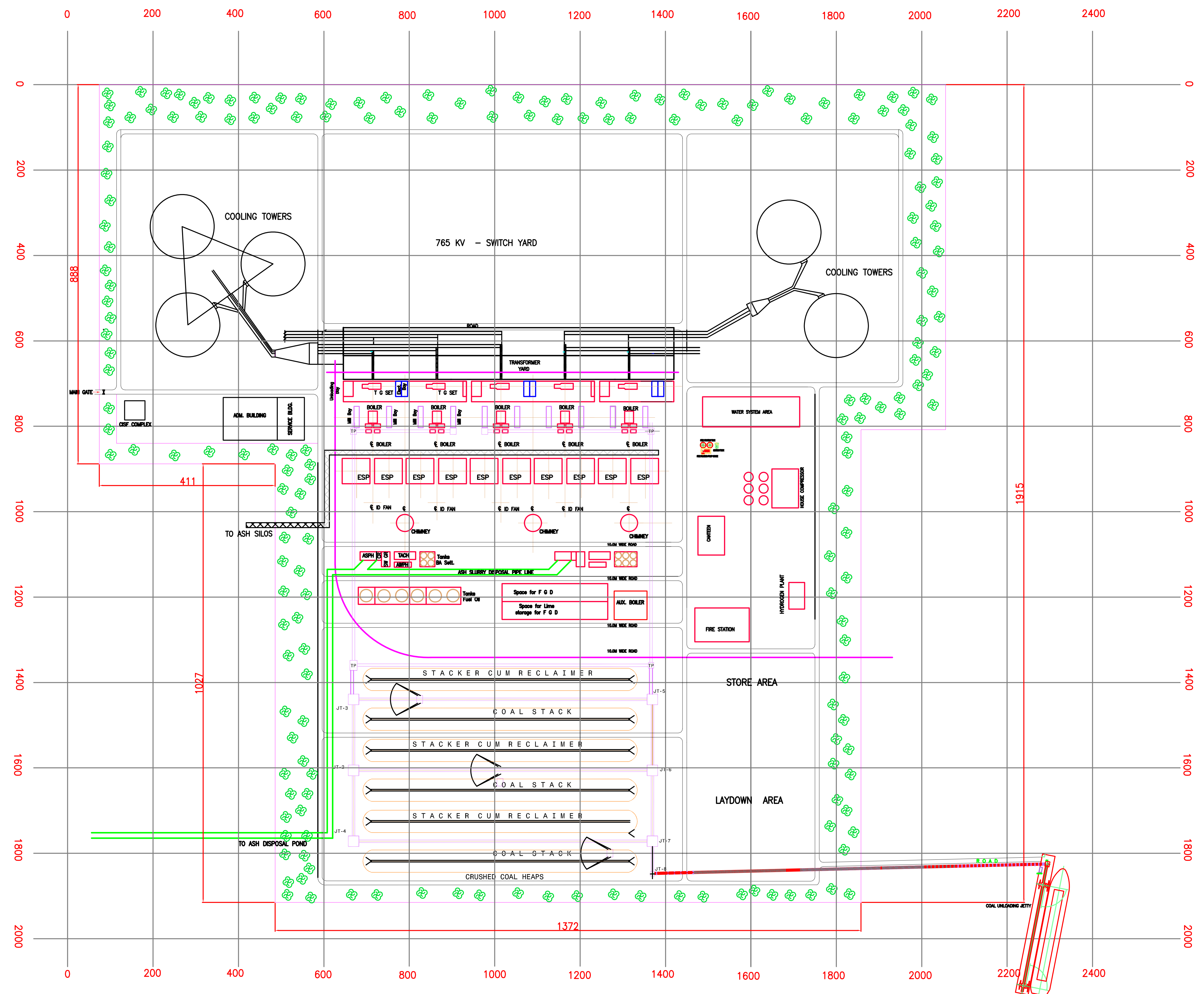
WITH ONCE -THROUGH SYSTEM

CENTRAL ELECTRICITY AUTHORITY

Designed	S.C.GOOMER
Drawn	VINOD
Checked	S.C.GOOMER
Recmed.	N.K.NAIR
Appd.	S.SESHADRI
Scale	1:4500
DATE	APR. 2007

TITLE: TYPICAL GENERAL LAYOUT (5X800MW)

DRG. No. CEA-TE & TD -GT & AS -STANDARD-04



NOTES:

1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
2. OVERALL AREA OF THE LAND IS 770 ACRES

LEGEND:–

1. ROADS (DOUBLE LINE)
   ROADS (SINGLE LINE)
2. BOUNDARY WALL
3. FENCING
4. RAILWAY LINE
5. FACILITIES/ BUILDINGS
6. WATCH TOWER
7. FORMATION LEVEL
8. LAND ACQUISITION LINE
9. SLOPE PROTECTION WORKS
10. CONTOUR

EXHIBIT – 5

COASTAL ULTRA MEGA THERMAL POWER PROJECT (5x800 MW)

WITH COOLING TOWER SYSTEM

CENTRAL ELECTRICITY AUTHORITY

Designed	S.C.GOOMER
Drawn	VINOD
Checked	S.C.GOOMER
Recmed.	N.K.NAIR
Appd.	S.SESHADRI
Scale	1:4500
DATE	APR. 2007

TITLE: TYPICAL GENERAL LAYOUT (5X800MW)

DRG. No. CEA-TE & TD -GT & AS -STANDARD-05