Executive Summary

Environmental Impact Assessment for The Proposed Pit Head Coal Based 540 MW Power Plant At Gorra, Dist: Raigarh (C.G.)

(EIA Report prepared as per TOR vide MoEF Letter No. J-13012/78/2007-IA.II (T) dated 12th July 2007)

1.0 Introduction

The power requirement (based on the data from Chhattisgarh State Electricity Board) was 1856 MW during year 2003, however the projected power demand during year 2012 would be 2895 MW. The demand for electricity in Chhattisgarh State has increased almost by 400 MW (30%) after the new state has formed.

In the above backdrop, M/s. Patni Power Projects Private Limited (PPPPL) has proposed to set up a coal base independent power plant (I.P.P.) with 4 units (2 X135 MW in Phase I and II each), a total capacity of 540 MW at Gorra, in Raigarh district of Chhattisgarh State, looking to the sufficient availability of raw material like coal & water nearby. The coal based thermal power requiring 2.96 million tones of coal per annum will be met from South Eastern Coalfields Limited (SECL) and Mahanadi Coalfields Limited (MCL). This would not only contribute towards the overall development of the state but would also reduce the power deficit of the country to some extent. Due to the ample coal reserves in Chhattisgarh, PPPPL has extended its activity by signing MOU on January 10, 2007 with the State Government for power generation. Energy generated in the proposed power plant will be sold to Power Trading Corporation (PTC) for evacuation to the deficit regions of the country. In the present study, two units of 135 MW each have been considered in Phase – I and two units of 135 MW each in Phase - II. In this report impacts have been identified for 540 MW power plant and accordingly environmental management plan has been delineated.

PPPPL has retained Anacon Laboratories Nagpur to undertake Environmental Impact Assessment studies of proposed 540 MW thermal power plant at Gorra (C.G.) for various environmental components and to prepare the effective Environmental Management Plan (EMP) for minimizing the adverse impacts of the project, based on the field data collected for various environmental components, viz., air, noise, water, land, biological and socio economic including the parameters of human interest.

1.2 Site Details

The site is located at latitude $21^0$50'22.6" North and longitude $83^0$16'40" East (Toposheet No. 64/O/5). It is mostly leveled with average ground elevation around 238 m above MSL. The land is mostly government owned (70%) and partly private with some social forestry. There is no protected or reserved forest within close vicinity from the periphery of the project site. The proposed site is well connected with road network.

1.3 Thermal Power Generation Process

In thermal power generation, chemical energy of coal is first converted into thermal energy (during combustion), which is then converted into mechanical energy (through a turbine) and finally into electrical energy (through a generator). The coal travels from the coal handling plant by conveyor belt to the coal bunkers, from where it is fed to the pulverising mills which grind it as fine as face powder. The finely powdered coal mixed with air is then blown into the boiler by a fan where it burns like a gas. The boiler walls are lined with boiler tubes containing high quality demineralised water (known as boiler feed water). The combustion heat released from the coal is absorbed by the boiler tubes and the heat converts the boiler feed water into steam at high pressure and temperature. The steam, discharged through nozzles on the turbine blades, makes the turbine rotate. Generator is coupled to the end of the turbine. When the turbine rotates the electricity is produced in generator, which is passed to the step-up transformer which increases its voltage so that it can be transmitted efficiently

over the power line of the grid. The power is evacuated via Switch Yard through a Transmission System. The measure process unit of the proposed thermal power plant are discussed in detail in Detail Project Report.

2.0 Baseline Environmental Status and Identification of Impacts

2.1 Air Environment

The prime objectives of Ambient Air Quality (AAQ) monitoring within 10 Km. radial distance of PPPPL site was to establish existing regional background levels and baseline Air Pollution status. Micrometrological studies were carried out by installing an automatic weather monitoring station to record micrometeorological data.

The overall observations for January 2007, February 2007 and March 2007, showed the predominant wind direction was from N and NE. The status of ambient air quality within the study area during the study period with respect to SPM, RPM, SO_2 and NO_X was found to be less than NAAQS prescribed by CPCB, New Delhi for rural and industrial area.

2.2 Noise Environment

The ambient noise levels were monitored in 'A' weighed decibel scale in the form of spot sound pressure levels as well as 1 hourly equivalent noise (Leq) levels. It is observed that maximum sound pressure levels of the study area varied in the range 40–47 dB (A) in the day time and 32–40 dB (A) in the night time. These observations indicate that the ambient noise levels within the impact zone comply with prescribed standards.

2.3 Water Environment

The water quality in the impact zone was assessed through physico-chemical analysis of 8 groundwater and 2 surface water samples collected during February 2007. The pH and TDS (surface water) were found in range of 7.4 – 7.6 and 200-212 mg/lit respectively. The other parameters such as

inorganic nutrients and heavy metals of surface water samples are below stipulated drinking water standards.

The total dissolved solids (ground water) are found to be in the range of 330-458 mg/lit which are below drinking water standards (500 mg/lit). The data indicate low mineral content in terms of chloride and sulphate.

Bacteriological examination of surface water samples indicates the presence of Faecal Coliform which may be due to the human activities observed during the study period.

Freshwater Requirement and Wastewater Sources

Water will be drawn (@ 2075 m^3/hr) from Mahanadi river to meet the requirement in process, cooling tower make up, DM plant, drinking and sanitary, ash handling systems and other plant services. The raw water reservoir will have overall storage capacity 264000 m^3 (nearly five days raw water requirement). The overall water balance for the proposed power plant is presented in **Fig. 2.1**.

Wastewater would be generated from cooling water system, plant services, boiler blow down, powerhouse drains, oil handling run off from coal pile area, DM plant regeneration waste, filter backwash, raw water clarifier sludge, ash pond run off, domestic waste, etc. The waste water generated in the process will be neutralized and will be stored in guard pond.

The treated effluents will meet the Minimum National Standards (MINAS) for thermal power station laid down by Central Board for the Prevention and Control of Water Pollution (CBPCWP) and Environment (Protection) Rules 1986. The storm and catchment water from the plant would be drained out by separate drainage system.

2.4 Land Environment

The proposed power plant will be set up in 275 hectares. The soil is predominantly sandy loam, which is followed by weathered material and bed rock. Soil samples have been collected at eleven locations within the study area. Physical characteristics of soil are delineated through specific parameters viz. particle size distribution, bulk density, porosity, water holding capacity and texture. The bulk density of the soil in the study area ranged between 1.32 to 1.43 g/cm^3 which indicates favorable physical condition for plant growth. The porosity and water holding capacity of the soils are in the range of 34.65% to 40% and 31.62 % to 38.66% respectively. Variations in the pH of the soil in the study area is found to be neutral (6.73 to 7.83), thus conducive for growth of plant. Organic Carbon and Nitrogen are found in the range of 0.82 – 2.07% and 266 – 624 kg/ha. This shows that soil is moderately good in organic and nutrient content.

Remote sensing Studies

The land use studies of area falling within 10 km radius around the power plant were carried out based upon the visual interpretation of recent (November 2006) Remote Sensing Satellite Imagery of the study area and the land use pattern is assessed as follows: (**Fig. 2.2 Land use Land cover map of the study area)**.

S. No.	Land use pattern	Area (ha.)	PGA *** (%)
1	Agricultural land and Plantation	25153	80.47
2	Wasteland	3743	11.98
3	Settlement	1612	5.16
4	Water bodies	747	2.39
	Total	**31255**	**100.0**

(* Percentage to total geographical area)**

Flora

The study area has sparse vegetation which is heterogeneous in nature. The common trees observed in this area are *Mangifera indica*, (mango) *Eugenia Jambulana* (Jamun), *Ziziphus jujuba* (ber), *Emblica officinales* (amla) *Eucalyptus hybrid* (safeda), Terminalia arjuna (Arjuna), Peterocarpus marsupium (Bija), Madhuca indica (Mahua) and Diospyros melanoxylon (Tendu) are common timber trees. Some of these species are observed as road side vegetation. Shrubs like *Lantana camara* (phulbooti), *Calotropis procera* (aak) *Zizyphus nummularia* are also present in study area.

Fauna

No national park or sanctuary is present in the study area. Common mammals, birds and reptiles are observed. Only domestic animals are noted during study period.

Solid Waste

The ash generation will be in the form of fly ash - 3282 MTPD and bottom ash - 820 MTPD (considering 45% ash in coal) i.e. 13,32,000 TPA. The fly ash will be used for brick making, light weight aggregates and cellular concrete products and sold to nearby cement industries. The unutilized fly ash and bottom ash shall be disposed off safely in ash pond in the plant premises. The STP sludge generated will be 5.4 Tones/ annum which will be used as manure for plantation.

2.5 Socio-Economic Environment

Study area encompasses 94 villages in Raigarh District. Demographic data in this region is as follows:

- The total population of the study area is 83149 with 17228 households.

- Sex ratio (no. of females: 1000 males) is 999 as against the sex ratio of 964 for the district.
- The scheduled castes & scheduled tribes percentage of the total population of the study area is 13.32% and 25.08% respectively.
- The literacy rate in the study area is 63%.
- The employment rate is 36 %.
- 88% of the main workers are engaged in agriculture and allied activities.

Survey Observations

Following salient observations were recorded:

- Primary education facilities are available in all the villages. In some of the villages it is extended up to high schools. For higher studies people go to the nearest town i.e. Raigarh.
- The local population avails the medical facilities from primary health centers and sub centers. During emergency people move to Raigarh.
- Most of the villages are connected by pucca roads. Transportation service is good but in some of the villages people have to walk 2-3 km to catch the bus.
- Drinking water facility in respect of quality and quantity is satisfactory.
- Communication facilities are very poor in the villages surveyed.
- Agriculture is the main occupation of the local population. Double crops like paddy, sunflower, ground nut, wheat and pulses are grown in this area.

Awareness and opinion about the project

- The respondents from most of the villages are aware about the project.
- They have good opinion about the project as it will improve the economy, infrastructural facilities, job opportunities and business opportunities of the villages.
- Mixed reactions were observed in the region. The financially sound cultivators are against the project but the poor cultivators are in favour of this project.
- The project affected population expects fair compensation and permanent jobs in the power plant.
- The educated youths opined that the management should give preference to them/local people for employment as per their educational qualifications.

Commitment of PPPPL towards Social Welfare Activities

The project will provide full opportunity for local people to get employment and help in the up liftment of socioeconomic status of the area. The commitments of management include up liftment of social, health, basic needs of drinking water supply and provision of education facilities. Management will develop green belt to improve aesthetic quality of the region. Sufficient provision has been made in the project about construction of roads, culverts, bridges, plantations, water works, PHCs, schools, recreation hall etc. and other infrastructural development in the study area.

3.0 Prediction of Impact

3.1 Air Environment

The air pollution impacts from a coal based thermal power plant depend upon various factors, viz. design, capacity, process technology, quality of fuel (coal) used for combustion, operation & maintenance of process units and air pollution control equipments installed within the individual process units.

Point Source

Amongst the continuous point source emissions, SPM, SO_2, and NOx will be of prime concern. Coal to be used in the proposed power plant is expected to contain 45%ash. About 20% of this will be retained in the furnace hopper as bottom ash and the remaining 80% ash will be carried along with the flue gas in the form of particulate matter as fly ash. To limit the concentration of the fly ash to below 50 mg/Nm^3, installation of electrostatic precipitator of 99.89% efficiency would be installed. In addition, 220 m high stack would be provided for adequate dispersion of pollutants. The NOx emissions from the boilers would be controlled by providing low NOx burners and air staging in furnace e.g. fire air. The furnace temperature of around 900^OC will meet CPCB limits of NOx generation. Properly designed boiler would keep the stack emission of NOx to 750 mg/Nm^3. Space provision shall be kept for retrofitting Flue Gas De-sulphurization (FGD) system, if

required in future. Properly designed furnace and burner systems would help in reducing CO and NOx.

The steam generators shall use F Grade (GCV – 3200 KCL/kg), low sulphur (0.4% sulphur) coal for steam generation. Hence the impact due to the sulphur content will be insignificant.

Fugitive Emissions

The fugitive emissions of coal dust will be due to coal handling activities at storage yard, wind erosion, spillages from conveyor system, etc. The fugitive emissions (mainly coal dust) will be less as it will be released relatively closer to ground level. Dust nuisance due to coal handling would be further minimized by providing suitable dust suppression/extraction system at crusher house, junction towers, coal unloading area and the coal stockyard.

Dust extraction system

- Dust extraction system with suction ducting, bag filters, blowers etc shall be provided at the crusher house, screen house and boiler bunker.
- Dust suppression system shall be provided at the storage sheds.
- Bunker sealing and bunker ventilation shall be provided for boiler bunkers.

Air Quality Prediction Model

The Industrial Source Complex (ISC) model is applied with the flat terrain option. The ground level impacts of individual pollutants i.e. SO_2, NOx and SPM from the proposed thermal power plant are predicted in terms of 24 hourly average concentrations. The ground level concentrations (GLCs) of the individual pollutants are computed through ISC model at 250 m distance interval within the study area of 10 km radius to superimpose over baseline data and also up to 25 km distance in all directions as per MoEF guidelines. The prediction results in this study, corresponding to winter season are shown in the form of concentration

isopleths which also indicate the spatial distribution of concentration levels. Maximum incremental increase in 24 hours NOx at ground level is predicted as 1 ug/m^3 at Dhangaon which is well within the prescribed air quality standard. The maximum 24 hourly SPM at ground level from proposed power plant is predicted 1.3 ug/m^3 at Dhangaon with pollution control equipments. All these maximum GLCs (winter season) are predicted at about 2-3 km downwind distance in south-west direction from the proposed site of thermal power plant.

The air quality impacts from the flue gas emissions due to proposed project would be complying with the prescribed air quality standards for residential area, after implementation of proposed air pollution control equipment.

3.2 Noise Environment

Equivalent sound pressure level averaged over 8 hours. Leq (8 hrs) is used to describe exposure to noise in work places. In special cases, where noise levels may exceed the acceptable limits, such as around the turbine, provision shall be made of acoustic shield, if necessary.

All equipment in the proposed power plant would be selected /designed /operated to have a noise level below 85 to 90 dBA in line with the OSHA requirements. In addition, it would be ensured that in the surrounding area, the noise levels do not exceed 75 dBA in day time and 70 dBA in night time to meet the Indian Standard regulations.

The Leq (day) and Leq (night) noise levels for the study areas were found to be well within the prescribed limits promulgated by CPCB. There will not be significant impact due to the proposed plant on the human settlements around it.

3 Water Environment

The impacts on water environment will be insignificant as the following pollution control equipments would be strictly monitored as post project monitoring activities.

- The waste water generated would be acidic or alkaline which would be neutralized in a neutralizing basin and finally discharged into Guard Pond.
- The blowdown from the unit will be used for bottom ash sluicing and dust suppression in coal handling system.
- The cooling tower blow down will be controlled to maintain solid loading within limits prescribed by CPCB for discharged effluent. The quality of the waste generated from the sources will meet MINAS Standards.
- The salient characteristics of the blow down water from the point of view of pollution are the pH and temperature since suspended solids will be negligible.
- Boiler blow-down water would be lead into the guard pond where cooling water system blow down would also be added resulting in lowering the temperature.
- The water generated from clarifier sludge and backwash from filtration plant would be sent to sludge pond and clean water would be taken to guard pond. The guard pond effluent can also be used for dust suppression and ash moistening.
- The blow down from the steam generator and cooling water system would be led to Central Monitoring Basin (guard pond) for using the same for coal and ash handling system needs.
- Sewage from the plant will be treated in sewage treatment plant and treated effluent will be used for plantation.
- Thus no wastewater will be discharged outside the factory premises

3.4 Land Environment

Construction Phase

The landuse pattern during construction phase, would be gradually stabilized by itself during operational phase. The construction camps and makeshift services would be either dismantled or realigned and will be made permanent. The area should be developed aesthetically so that there would not be any adverse impact during operation phase.

Operation Phase :

Solid waste

The Ash handling System comprises of wet /dry extraction system for bottom ash and fly ash. Dry ash would be disposed in dry form in cement industries for brick preparation. Provisions would be kept in the fly ash and bottom ash silo for disposal in wet form or in high concentration slurry mode. Total ash generation would be 4102 T/day considering 80% plant load factor (Fly ash 3282 T/day and Bottom Ash 820 T/day). Strict adherence to the above schedule will not have any adverse impact on the surrounding environment.

3.5 Socio-Economic Environment

The proposed thermal power plant would create mixed impacts on the socio-economic environment due to:

- Change in occupation pattern.
- Migration of population from nearby areas for jobs.
- Strain on existing infrastructure.
- Potential impact due to fly ash on human beings and agriculture.
- However the positive impacts would consequently lead to an upliftment of the Quality of Life of the people in the area.

4.0 Environmental Management Plan

While implementing the project, the proponent shall follow guidelines specified by CPCB under Corporate Responsibility for Environmental Protection (CREP) for thermal power plants. However following environmental management plan has been suggested during construction and operation phases.

Construction Phase

Following control measures are recommended to mitigate the probable adverse impacts during construction phase:

- Widening and strengthening of approach road to facilitate vehicular traffic even with heavy machinery cargo during construction phase as well as to evacuate fly ash (for utilization) during operation phase.
- Clear demarcation of sites for construction workers camp to prevent occupational hazards. Ensure water supply, sanitary facilities, housing, domestic, fuel etc.
- Necessary care as per the hazardous material storage guidelines and safety norms for petroleum.
- Vehicles at the project site shall be properly maintained to minimize exhaust emissions as well as noise generation.
- During dry weather conditions, the dust emissions arising out of the excavation, leveling, transportation and stockpiling activities would be controlled by water sprinkling.
- Noise prone activities would be restricted to the extent possible during daytime in order to have minimum noise impacts during night time.
- Tree plantation would be undertaken at the time of preparation of the project, so that they would grow to considerable height by the time of commissioning of the proposed project.
- After construction phase, surplus of excavated soil would be utilized to fill up low lying areas and all surfaces be reinstated.

Operation Phase

Coal Handling System

Proper mitigative measures shall be practiced by providing water sprinklers at transfer points as well as bag filters to prevent dust to be air born.

Flue Gas

For the collection of fly ash from flue gas (from the boiler), ESPs with 99.89% efficiency will be provided. The level of SPM below 50 mg/Nm^3 would be maintained. In view of low sulphur content in coal no control equipment for SO_2 is envisaged however, lime dosing will be practiced if required. Low NOx burners and regulation of the air and temperature would be adopted for NOx emissions. Proper maintenance of ESP should be done at regular intervals to prevent fugitive emissions.

4.1 Air Environment

The following air pollution control measures have been recommended for implementation of proposed power plant.

- Attempts to achieve/maintain the Plant Load Factor (PLF) of at least 80%.
- For minimizing the SPM levels in ambient air, use of beneficiated coal.
- Furnaces and boilers should be operated with minimum air to reduce fuel consumption and NOx emissions.
- The following options shall be considered to mitigate NOx emissions from fuel combustion:
  - Dry Low NOx (DLN) burners
  - Multiple combustion chamber technology
  - Steam injection technology
  - Selective Catalytic Reaction (SCR) Technology
- Ambient air quality for SPM, RPM, SO_2, NOx and CO, CO_2 will be regularly monitored in consultation with State Pollution Control Board.

- Online flue gas monitors including SPM, SO_2, NOx, CO, HCs etc. shall be provided for the stacks.
- Porthole and sampling facilities will be provided as per CPCB guidelines.
- Fuel quality monitoring on regular basis with special reference to ash and sulphur contents will be practiced.
- Greenbelt (100 m wide) will be developed at the planning stage of the power plant.
- Stacks of sufficient capacity to take care of emergency release of flue gases under boiler start up and shutdown periods.
- To control fugitive emissions of HCs and their impacts in the vicinity, following measures are recommended:
  - Provision of mechanical seals in pumps.
  - Prevention and maintenance of valves flanges/joints, mechanical seals, storage tanks roof vents etc. and other equipments.
  - Water spraying at coal yard, to control impacts of dust emission due to wind erosion and prevent spot fires in coal stock piles.
  - Suitable dust extraction system for dust control from crusher.
- Personal protective devices such as dust filters, earplugs, etc. will be provided to the workers.

4.2 Noise Environment

- Manufacturers and suppliers of major noise generating machines/equipments like compressors, turbines, generators would be asked to minimize the noise levels generated by the machines i.e. using noise absorbing material for enclosures or using appropriate design/technology for fabricating/assembling machines.
- The operator's cabins (control rooms) would be properly (acoustically) insulated with special doors and observation windows.
- The operators working in the high-noise areas, i.e. compressor houses, blowers, generators, feed pumps, steam generation plant, turbo-generator area would be strictly instructed to use ear-muffs/ear-plugs.
- Implementation of greenbelt (shrub plantation), landscaping with horticulture (noise barriers) etc. at power block areas would reduce noise impacts within the project premises.

4.3 Water Environment

Wastewater Management

During treatment, acidic and alkaline effluent will be generated periodically from De-mineralisation (DM) Plant and boiler blowdown which will be collected in a neutralizing pit where the acidic and alkaline effluents will be neutralized with each other. This will be pumped and mixed with other effluents in the polishing pond after filtration. The treated effluent would be recycled.

Coal Yard Drainage

Coal storage yard would be provided with separate drains (for monsoon), which will be led to a common sump of adequate capacity. The solids will settle in the sump and the clear water would be used for floor washing purpose.

Wastewater Management for Zero Discharge Effluent

The project proponent is planning to adopt zero discharge principle for the proposed 540 MW unit. This would be achieved by recycling the treated wastewater for dust suppression and plantation.

4.4 Land Environment

- Quantification and characterization of solid waste would be done regularly for proper management before it is sold to authorized vendors.
- Industry shall adopt rainwater-harvesting scheme in the proposed factory premises for recharge of ground water/ direct use for plantation.
- The discharge of liquid wastes in to water bodies and particulate matter into the atmosphere would be controlled to stipulated standards.

- Land clearing activities in the area would be minimized. Rich and diverse vegetation in the study area will be protected and maintained.
- Destruction of natural habitats of animals will be minimized. Nesting, mating and other behavioral patterns of wildlife will be protected.

Use of Fly Ash

Action plan for 100% ash utilization will be developed keeping in view the MoEF Notifications (1999, 2003) on use of ash.

Recycling of fly ash by prohibiting the manufacture of clay bricks, tiles or blocks with mixing 25% of ash with soil within a radius of 100 km of power plant, has been made mandatory. Fly ash is a pozzolanic (a siliceous or silico-aluminous material) that has no cementing value itself but which, in timely divided form and in presence of moisture, reacts chemically with lime (calcium hydroxide) to form concrete compounds. The pozzolanic property of fly ash reduces permeability, dry shrinkage and heat of hydration, reducing cracking, thus making it suitable for commercial uses such as :

- Mixing of ash with soil for manufacturing clay bricks/tiles/blocks.
- Fly ash will be used for manufacturing ash-based products viz., pozzolona cement, concrete blocks, panels or any other construction

material or construction of roads, railway embankments, dams, dykes or any other construction activity.

- Fly ash would be used in the replacement of limestone dust as filler in bituminous concrete.
- Filling up of abandoned mines will be also practiced to use the ash to the extent possible.
- At any time plant will not store more than three months ash generated in their storage and/or ash ponds.

Guidelines for Greenbelt Development

In order to attenuate the pollutants, a 50 m wide greenbelt of proposed project will be developed all along the periphery. Approximately 1500 trees per ha will be planted in consultation with the local Forest Department as per following guidelines:

- Trees growing up to 10 m or more would be planted around the proposed power plant.
- Planting of trees would be undertaken in rows around the installation to prevent horizontal dispersion of pollutants.
- Perennial and evergreen Trees would be planted along roadsides, to arrest auto exhaust and noise pollution.
- Open areas inside the plant boundary would be covered with grass lawns for effective trapping and absorption of air pollutants.
- Fast growing tress with thick perennial foliage would be grown to maintain regional ecological balance as well as soil and hydrological conditions of the region.

The species identified for greenbelt development shall be planted using pitting technique. The pit size should be either 45 cm X 45 cm X 45 cm or 60 cm X 60 cm X 60 cm depending on quality of soil.

4.5 Socio-economic Environment

Following measures are suggested for minimizing the adverse impacts on socio-economic environment.

- Communication with the local community would be done on regular basis by the project authorities to provide an opportunity for discussion.
- Project authorities will organize regular environmental awareness programmes.
- Social welfare activities to be undertaken by the project authorities, in collaboration with local administration.
- Project authority shall provide free medical facilities to villagers within the study area.
- Locally available workforce would be employed.
- Mobile medical dispensaries would be provided for medical check-up and also for providing essential medicines to villagers.
- To minimize the strain on infrastructure, existing facilities would be augmented.

NOTE :-

1. ALL FIGURES ARE IN M

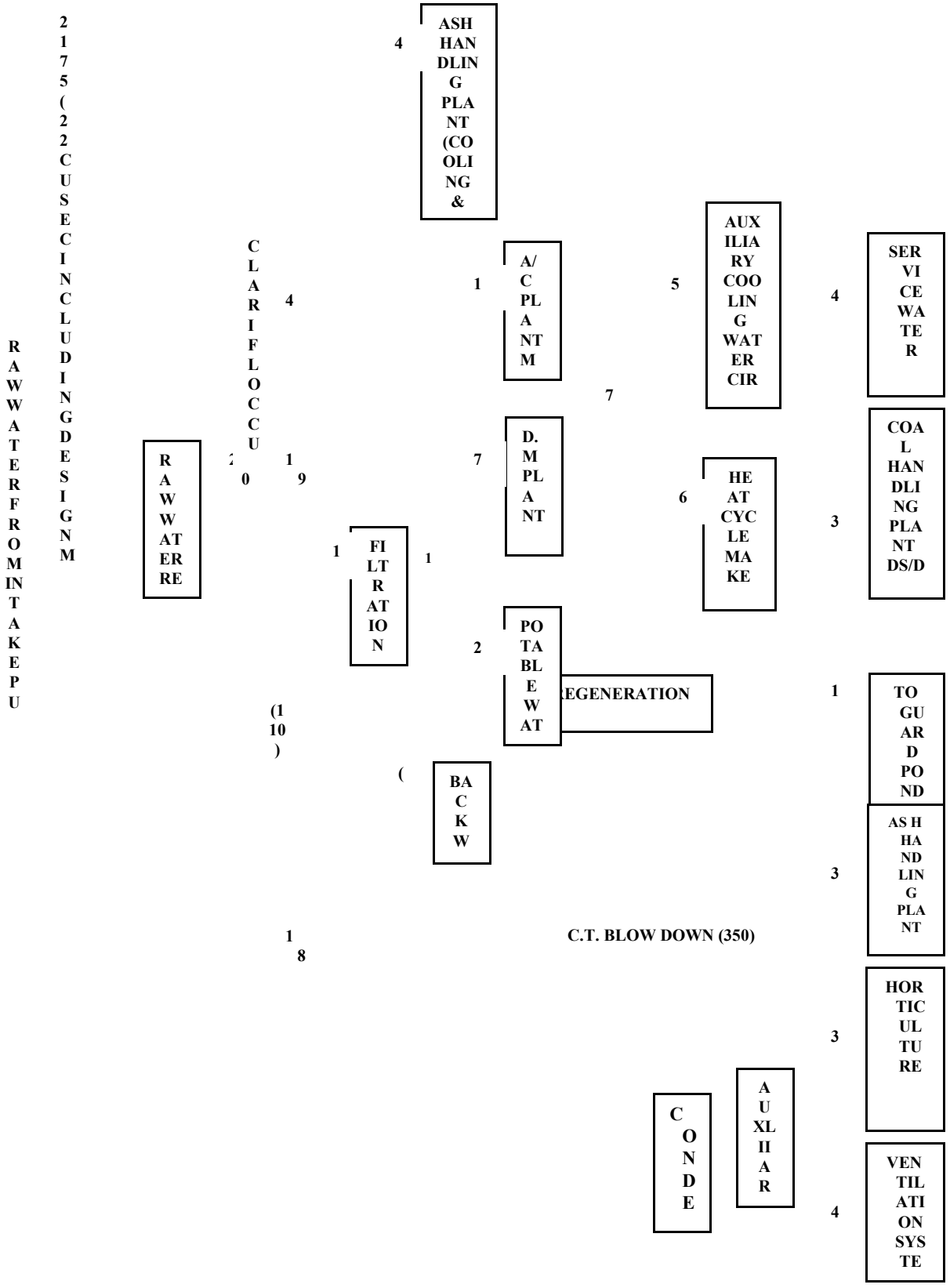
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Fig. 2.1 Flow Diagram of Water Balance

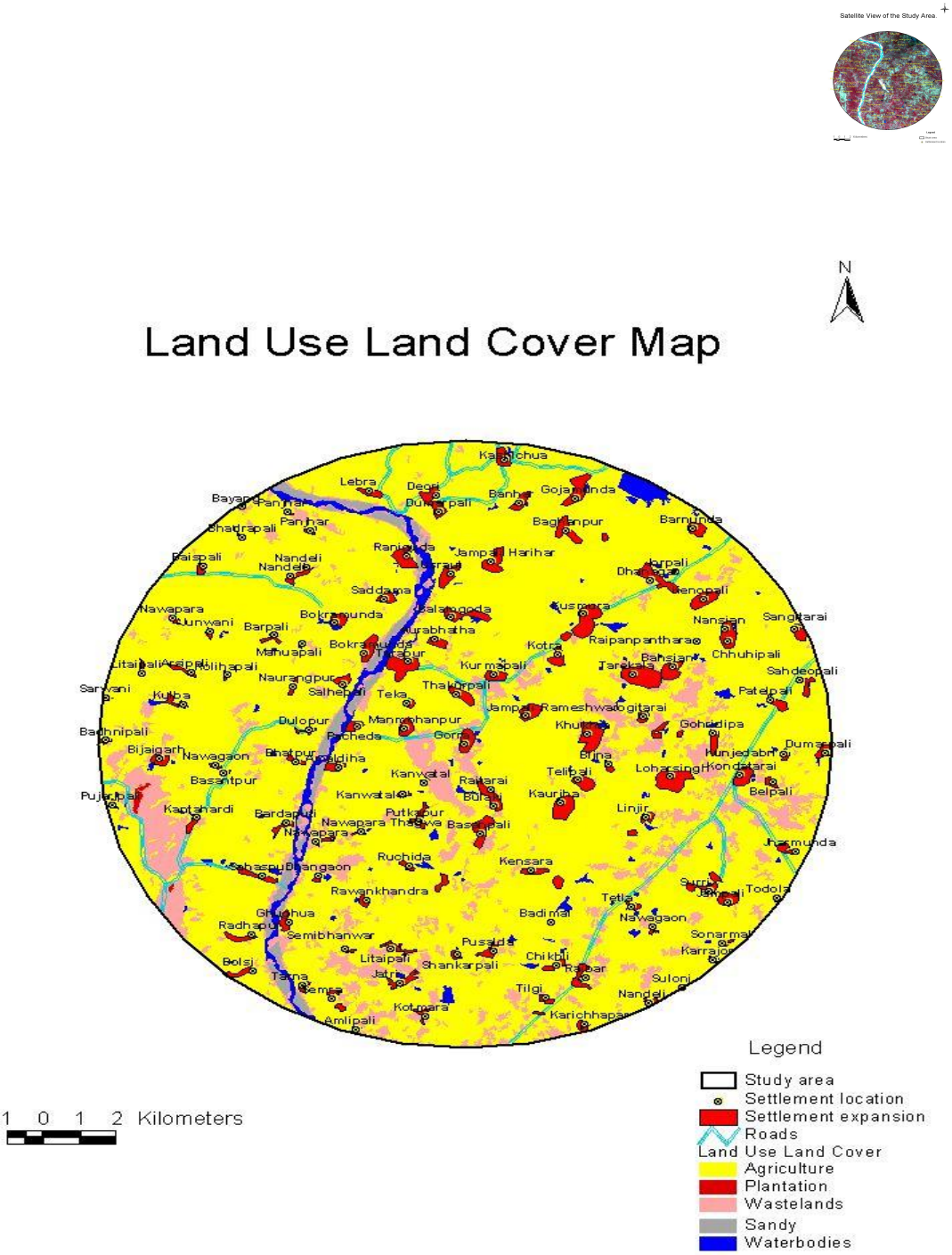

Fig. 2.2: Land use Land cover map of study area