1.0 INTRODUCTION

M/s. JSW Energy Limited (JSWEL) is a part of JSW Group of Industries and proposes to set up a 1320 MW coal based power plant based on super critical technology at Kukurda, Nawapara, Dumarpalli, Chhuhipalli and Salheona villages of Raigarh Tehsil, Raigarh District, Chhattisgarh State.

1.1 Purpose of the Report

As per Environment Impact Assessment Notification dated 14th September, 2006, construction and operation of power plants requires Environmental Clearance (EC) to be obtained from MoEF (Ministry of Environment and Forests, New Delhi) as category A - 1(D) before the commencement of ground activity. In accordance with the TOR issued by the MOEF vide its letter No. J-13012/79/2009 dated Nov 4, 2009, Environmental Impact Assessment (EIA) report is prepared in order to assess the environmental impacts due to the proposed power plant.

1.2 Project Cost

The cost of the total project is about Rs. 7300 Crores, which includes Rs.391 Crores for environmental protection measures. The project will be fully commissioned in 52, months from zero date.

1.3 Description of the Site

The land identified for the proposed project about 321 ha. (792 acres) is mostly unirrigated single crop agricultural land and barren uncultivable waste land There are no streams or nallas in the project site. The land in the plant site is mostly plain land with a general elevation of about 208-m AMSL.

1.4 Environmental Setting of the Site

The environmental setting of the proposed plant site is given in **Table-1**. The location map of the project and study area map of 10-km radius around the proposed site are given in **Figure-1.**

2.0 Details of Power Plant

Layout of the power plant has been optimised considering the space requirements for all the equipment, systems, buildings, structures, coal storage area including railway and marshalling yard, ash silos, raw water storage tank, water treatment plant, cooling water pump house, etc., and the total area requirement is considerably lower than the norms prescribed by CEA. Necessary plant drainage system would be provided at the proposed power plant site. In laying out various facilities, following general aspects have been taken into consideration:

- Provision to install 2X660 MW with space for future addition of one more unit;
- Coal storage yard for 20 days requirement at site for 1320 MW;
- Ash silos for fly ash;
- Predominant wind directions as shown in the wind rose to minimise pollution, fire risk etc;
- Raw water supply and storage facilities; and

- Availability of adequate space for fabrication / construction equipment.

The layout facilitates movement of men and materials between the various facilities both during construction and operation. The project layout is presented in **Figure-2.**

TABLE-1
ENVIRONMENTAL SETTING OF THE SITE

<table>
<tr><th>Sr. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1</td><td>Plant Location</td><td>Kukurda, Nawapara, Dumarpali, Chhuhipali and Salheona</td></tr>
<tr><td>2</td><td>Plant site coordinates</td><td><u>Coordinates for Plant Site</u>:
<table><tr><th>Corner Point</th><th>Latitude</th><th>Longitude</th></tr><tr><td>A</td><td>21^0 50’51” N</td><td>83^0 30’ 24” E</td></tr><tr><td>B</td><td>21^0 51’16” N</td><td>83^0 32’ 24” E</td></tr><tr><td>C</td><td>21^0 50’29” N</td><td>83^0 32’ 22” E</td></tr><tr><td>D</td><td>21^0 50’09” N</td><td>83^0 31’ 24” E</td></tr><tr><td>E</td><td>21^0 50’09” N</td><td>83^0 31’ 24” E</td></tr></table></td></tr>
<tr><td>3</td><td>Ash pond coordinates</td><td><u>Coordinates for Ash Pond Site</u>:
<table><tr><th>Corner Point</th><th>Latitude</th><th>Longitude</th></tr><tr><td>W</td><td>21^0 51’04.42” N</td><td>83^0 32’ 25.24” E</td></tr><tr><td>X</td><td>21^0 51’06.72” N</td><td>83^0 32’ 45.62” E</td></tr><tr><td>Y</td><td>21^0 50’49.06” N</td><td>83^0 32’ 48.67” E</td></tr><tr><td>Z</td><td>21^0 50’49.76” N</td><td>83^0 32’ 24.55” E</td></tr></table></td></tr>
<tr><td>4</td><td>Colony coordinates</td><td><u>Coordinates for Township</u>:
<table><tr><th>Corner Point</th><th>Latitude</th><th>Longitude</th></tr><tr><td>1</td><td>21^0 50’42” N</td><td>83^0 30’ 42” E</td></tr><tr><td>2</td><td>21^0 50’42” N</td><td>83^0 30’ 58” E</td></tr><tr><td>3</td><td>21^0 50’34” N</td><td>83^0 30’ 58” E</td></tr><tr><td>4</td><td>21^0 50’34” N</td><td>83^0 30’ 42” E</td></tr></table></td></tr>
<tr><td>5</td><td colspan="2">Climatic Conditions (IMD, Raigarh)</td></tr>
<tr><td>a)</td><td>Temperature
Mean maximum
Mean minimum</td><td>
42.6^{0}C (May)
13.2 ^{o}C (January)</td></tr>
<tr><td>b)</td><td>Mean Annual Rainfall</td><td>1602.3 mm</td></tr>
<tr><td>c)</td><td>Relative Humidity</td><td>Maximum-41.0 minimum-20.0%</td></tr>
<tr><td>d)</td><td>Predominant wind directions</td><td>Post-monsoon: NE and SE
Winter: NE and NW
Annual: NE and SE</td></tr>
<tr><td>6

a)

b)

c)</td><td>Climatic conditions at Site

Temperature

Relative humidity

Predominant wind directions</td><td><u>From 1st October- 31 Dcember 2009</u>
Maximum 32.5^{o}C ; Minimum 7.4 ^{o}C

Max:85% and Min: 50%
NE, NW and SE</td></tr>
<tr><td>7</td><td>Plant site Elevation above MSL</td><td>208-m above MSL</td></tr>
<tr><td>8</td><td>Plant site Topography</td><td>Generally plain</td></tr>
<tr><td>9</td><td>Present land use at the site</td><td>Unirrigated.single crop agricultural and barren land</td></tr>
<tr><td>10</td><td>Nearest highway</td><td>NH-200 (5.6 km,SE)</td></tr>
<tr><td>11</td><td>Nearest railway station</td><td>Jamgaon (5.0 Km,NE)</td></tr>
<tr><td>12</td><td>Nearest Airport</td><td>Raipur (200-km, SW)</td></tr>
<tr><td>13</td><td>Nearest major water bodies</td><td>River Chote Kelo (2.5 km, S)
River Kelo (8.5 km, SW)
Back waters of Hirakud reservoir(9.5 Km SE)</td></tr>
</table>

Sr. No.	Particulars	Details
14	Water source for the project	Mahanadi river (48-km, SE)
15	Nearest town/City	Raigarh(14.2km W)
17	Hills/valleys	One-Two small hills exist within the 10-km radius
18	Archaeologically important places	None in 15-km radius as per Archaeological Survey of India records
19	Protected areas as per Wildlife Protection Act,1972 (Tiger reserve, Elephant reserve, Biospheres, National parks, Wildlife sanctuaries, community reserves and conservation reserves)	None in 15-km radius as per Wildlife Protection Act,1972 and records of Forest Department of Chhattisgarh
20	Reserved Forests	12 forest blocks
21	Seismicity	Seismic Zone-III as per IS 1893 (Part I): 2002
22	Defence Installations	None in 10-km radius area
23	Major industries in 10-km radius	MSP sponge iron plant, Jamgaon, Ind Synergy sponge iron plant, Mahapalli.

Note: All distances mentioned are aerial distances,

2.1 Project Size or Magnitude of Operation including Resources

The details of proposed power plant are presented in **Table-2.**

TABLE-2
DETAILS OF PROPOSED POWER PLANT

Sr. No.	Features	Description
1	Capacity	1320MW
2	Configuration	2X660
3	Type of boilers	Pulverized coal fired super critical boilers
4	Power evacuation	Power will be evacuated into PGCIL's grid and CSEB's grid through 400KV level at village Kotra
5	Fuel	Coal
6	Source of Coal	Through linkage from SECL / MCL mine nearby; part of the coal may be sourced from JSW share of coal from Utkal 'A' block near Angul, Orissa.
7	Coal Requirement	6.94 MTPA
8	Sulphur content	Design: 0.4% Worst : 0.5%
9	Ash Content in Coal	Design 41% Worst: 45%
10 A B	Ash generation Bottom Ash Fly Ash	3.123 MTPA 0.625 MTPA 2.498 MTPA
11	ESP efficiency	99.9%
12	Stack	One 275-m high, bi-flue
13	Water Requirement	2403 m^3/hr with Cycle of Concentration 5.


83° 25
83° 30'
21° 55'
21° 50'
21° 45'
N
Patrapali
Saraipali
Manvapalli
Siarpali
Jamgam
Loing
Mauhapalli
Chuhipali
Kukurda
10 KM
Bhutpali
Nawapara
Sakarbaga
Dumarpali
Banora
Katapalli
Khairpali
Topo Sheet No. 64 O/5, O/9
SCALE
1 0 1 2 Km

FIGURE-1

LOCATION MAP OF THE PROJECT

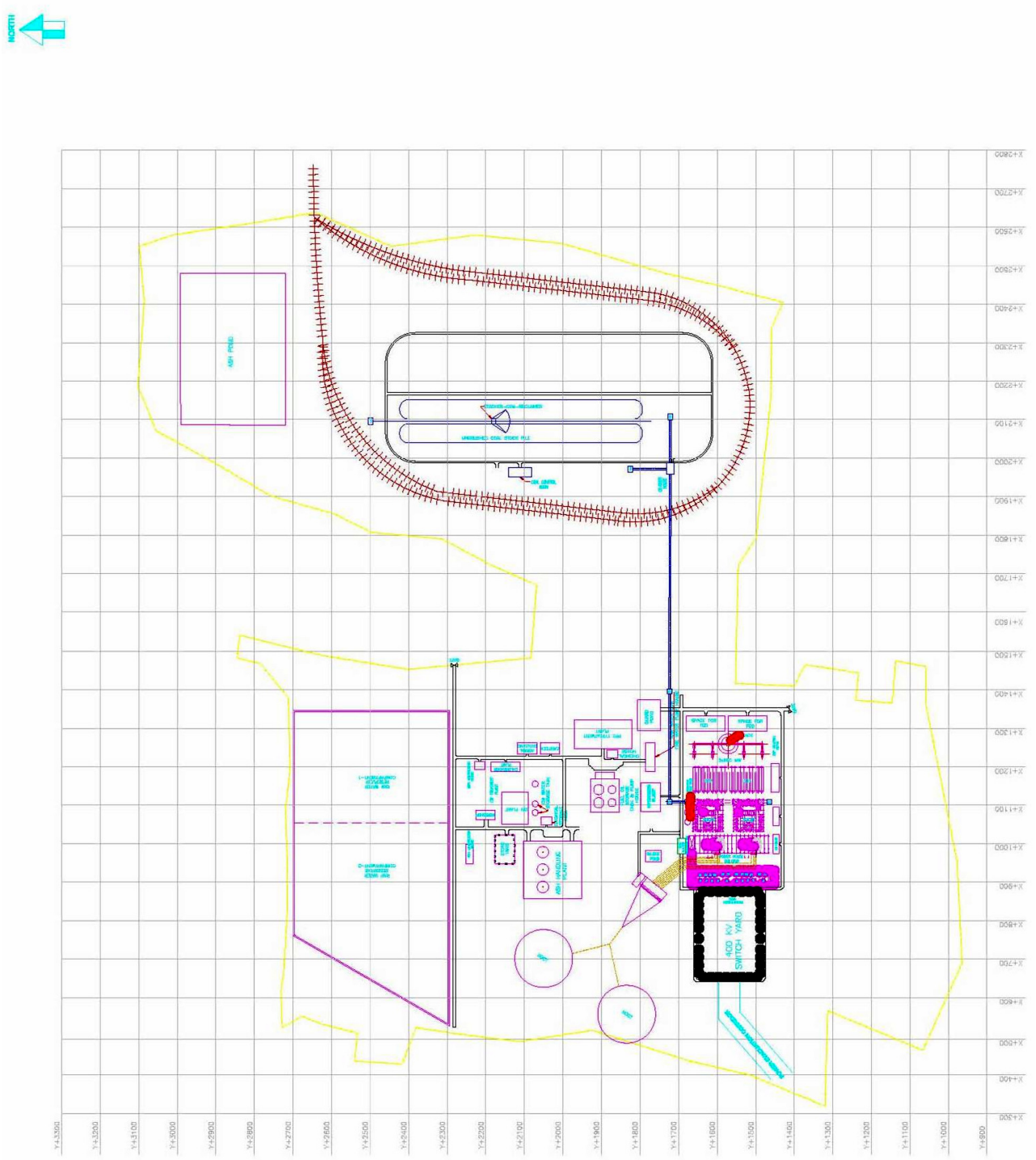

FIGURE-2

POWER PLANT LAYOUT

2.2 Technology

Steam Generator Units

State-of-the-art technology has been considered for design of the proposed station. To achieve efficiency without sacrificing availability, the choice of Steam parameters considered are in accordance with super-critical technology. The parameters of the main plant and equipment are presented in **Table-3.**

TABLE-3
MAIN PARAMETERS FOR THE STEAM GENERATOR

Sr. No.	Parameter	Unit	Value
1	Main Steam Flow at BMCR	Tons/ hour	2100 (at VWO condition)(min)
2	Main Steam Flow at TMCR	Tons/ hour	1970
3	Main Steam at SH Outlet		
	Pressure	Kg/cm^2	250
	Temperature	^oC	567
4	Main Steam at Turbine Inlet		
	Pressure	$Kg/cm^2(g)$	247
	Temperature	^oC	565
5	RH Outlet		
	Pressure	$Kg/cm^2(g)$	51
	Temperature	^oC	565±5 or higher
	Reheat steam temperature at IP turbine inlet	^oC	593

2.3 Land Requirement

The total land required for the proposed power plant is,321.0 ha which comprises of government waste land and single crop agricultural private lands.

2.4 Fuel Requirement, Source, Quality and Transportation

Coal is proposed to be sourced from Mand-Raigarh coal fields of South Eastern Coalfields Ltd. or North Ib Valley fields of Mahanadi Coalfields Ltd., both located within 60 kms from the project site. The coal grade from the prospective mines is expected to be of grade F or G with an 'as received' calorific value of approximately 3500 Kcal / Kg. Estimated annual consumption of coal would be approximately 6.94 Million tons / annum at 85% PLF. It has been envisaged that Railway siding / MGR system will be drawn from Jamgaon railway station to the project site to transport the coal from the mine.

- ***Fuel Oil***

Heavy Fuel Oil (HFO) and Light Diesel Oil (LDO) will be used as secondary fuel for start-up and coal flame stabilization during low load operation of the steam

generator while firing coal. In the proposed power plant, the required HFO will be 9828 Kilolitres per annum.

2.5 Water Requirement

The total water requirement of entire project will be 2403 m^3/hr and will be sourced from River Mahanadi at about 48-km from site. This water would be supplied through dedicated water pipeline system and has storage reservoir. For this purpose, Government of Chhattisgarh has already allocated requisite amount of water from Mahanadi.

2.6 Manpower

The total manpower of power plant during operational period is estimated to be about 600 persons. The proposed power plant will require skilled and semi-skilled personnel during operation, maintenance and administration. People from neighbouring villages, if found suitable, shall be employed during construction and operational phases.

2.7 Township

The township will be developed which includes residential quarters, project hostel, guest house, recreation facilities, health centre, shopping facilities, open air theatre, bank, post office.

2.8 Sources of Pollution

The various types of pollution from the proposed power plant are air pollution, water pollution, solid waste and noise pollution.

- ***Air Emissions***

The major pollutants emitted from the power plant stack will be SO_2, NOx and particulate matter. Proper control measures as described below will be installed to minimize the stack emissions within the stipulated/permissible limits prescribed by National Ambient Air Quality Standards.

- ***Suspended Particulate Matter***

Suspended Particulate Matter (SPM) is one of the important pollutants from the proposed power plant. High efficiency (>99.9%) electrostatic precipitators are proposed to be installed to limit the particulate matter emissions to below 50 mg/Nm^3.

- ***Sulphur dioxide***

The sulphur content in coal is about 0.5%. One bi-flue stack of 275-m height will be provided, as per CPCB/MoEF norms, to disperse the gaseous emissions.

- ***Oxides of Nitrogen***

To reduce the NOx emissions from the steam generator, all provisions in the steam generator design and fuel firing system will be made. Necessary

confirmation from the boiler manufacturers regarding concentration from stack will be less than 350 mg/Nm^3 generation of NOx would be taken as a measure to control production of this pollutant right at the source.

- ***Liquid Waste Generation***

Effluents will be generated from cooling tower blow down, wash water and wastewater from sanitary facilities. Sanitary effluent will be treated in sewage treatment plant. The cooling water blow down will be treated and reused in ash conduction and disposal system and dust suppression system. Blow down from cooling towers will be the main sources of the wastewater. Besides this, DM plant waste, domestic waste from canteen and toilets will be the other wastes generated. The cooling tower blow down will be reused in dust suppression, ash/coal handling, fly ash conditioning, ash disposal and service water. The treated wastewater from sewage & effluent treatment plant will be used in greenbelt development. 625 m^3 of waste water will be generated during operation of the power plant and reused in process, dust suppression, coal handling system and greenbelt development plan. Zero Discharge concepts will be followed.

Adequate storm drains will be constructed along the boundary of the plant area and within the plant area to drain off the storm water during monsoon period.

- ***Solid Waste Generation in Power Plant***

Ash is the main solid waste generated in the coal based thermal power plant. Major portion of the ash will be utilized by supplying to potential users. Efforts will be made to utilize 100% fly ash as per the Fly Ash Notification, 1999 and its subsequent amendments.

The ash which is not lifted by the potential users will be disposed off in the ash dyke using High Concentration Slurry Disposal (HCSD) method. Greenbelt will be provided enveloping the ash pond to arrest the fugitive dust emissions. Ash pond will also be provided with HDPE liner to prevent leaching of contaminants to groundwater.

- ***Noise Pollution***

The noise levels expected from various noise generating sources in the proposed plant vary from 65- 85 dB(A).

Acoustic enclosures will be provided wherever required to control the noise level below 85 dB(A). Anywhere not possible technically to meet the required noise levels, personal protection equipment will be provided to the workers. The wide greenbelt around the plant will work as green mufflers to attenuate the noise level dissemination outside the plant boundary.

3.0 BASELINE ENVIRONMENTAL STATUS

Baseline environmental studies have been carried during post monsoon and part of winter season of 2009. Studies have been carried out in 10-km radius from project as centre for Soil quality, Ambient air quality, Water quality, Noise level monitoring, flora and fauna studies and demography.

3.1 Meteorology

The Central Monitoring Station (CMS) equipped with continuous monitoring equipment was installed on top of a residential building at a height of 3.0 m above ground level to record wind speed, direction, relative humidity and temperature. The meteorological monitoring station was located in such a way that it is free from any obstructions and as per the guidelines specified under IS: 8829. Cloud cover was recorded by visual observation. Rainfall was monitored by rain gauge.

Maximum temperature of 32.5^{o}C and minimum temperature of 7.4^{0}C was recorded during the study period. Maximum temperature was observed during October and the minimum temperature was observed during December of the study period.

- ***Wind Speed/Direction***

Predominant winds are mostly from NE (25.1%) followed by NW (19.2%) and SE (10.9%) direction and wind speed ranging between 1-16 km/hr were recorded during the study period.

3.2 Air Quality

The prime objective of the baseline air monitoring is to evaluate the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the operation of the proposed power plant. Ambient Air Quality Monitoring (AAQM) stations were set up at **ten locations** in study area covering upwind, downwind and crosswind directions. Particulates and gaseous pollutants were monitored during study period and results were incorporated in the report. Monitoring procedures and methods were as per CPCB and MOEF guidelines.

The minimum and maximum concentrations for TSPM were recorded as 56.2 μg/m^3 and 138.2 μg/m^3 respectively. The maximum concentration was recorded at Jamgaon while the minimum at village Katapali.

The minimum and maximum concentrations for RPM were recorded as 14.3 μg/m^3 and 32.2 μg/m^3 respectively. The maximum concentration was recorded at village Jamgaon and the minimum concentration was recorded at 14.3 μg/m^3.

The minimum and maximum SO_2 concentrations were recorded as 4.1μg/m^3 and 9.5 μg/m^3 respectively. The maximum concentration was recorded at village Jamgaon while the minimum was recorded at locations of Banora, Sakarbaga and Khairpali.

The minimum concentration of 5.5μg/m^3 for NOx was recorded at villages of Sakarbaga and Khairapali and maximum of 12.0 μg/m^3 at Jamgaon (AAQ5).

The minimum and maximum CO concentrations were recorded as 166.1 μg/m^3 and 345.0 μg/m^3.

The Ozone concentrations were observed to be Below Detectable Limit (BDL) except in one location at jamgaon where it varied between 0.6 to 1.1 μg/m^3.

All the measured values were within the limits as per NAAQM norms.

3.2 Water Quality studies

Four surface water and ***Eight*** ground water sources covering 10-km radial distance were monitored for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of industrial and other activities on surface and ground water. The samples were collected and analyzed as per the procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA).

Surface Water Quality

- The analysis results indicate that the pH values were in the range of 7.56 to 8.20; the maximum value was observed at back waters of Hirakud reservoir; minimum value was observed at River kelo near village Chuhipali and all of which are well within the specified standard of 6.5 to 8.5.

- The TDS was observed in the range of 45 mg/l to 192 mg/l, the maximum TDS value was observed at River Kelo near village chuhipali and whereas minimum value was observed at Sapnai nala near village Banora.

- DO was observed to be in the range of 5.9 to 6.5 mg/l.

- The chlorides and sulphates were found to be in the range of 11.3 to 65.0 mg/l and 1.1 to 9.7 mg/l respectively. It is observed that chlorides and sulphates are well within the permissible limits.

It is evident from the above values that all the parameters are found to comply with the requirements of IS: 2296 specification of surface water. The surface water quality does not indicate any industrial contamination.

- ***Ground Water Quality***

Most of the villages in the project area have hand pumps and wells, as most of the residents of these villages make use of this water for drinking and other domestic uses.

- The analysis results indicate that the *pH* ranges between 6.8 to 7.6, which is well within the specified standard of 6.5 to 8.5.
- Total *hardness* was observed to be ranging from 90.0 to 184 mg/l. The maximum *hardness* (184 mg/l) was recorded at location Sakarbaga and the minimum (90 mg/l) was recorded at village Nawapara.
- *Chlorides* were found to be in the range of 9.9 mg/l to 33.6 mg/l, the maximum concentration of chlorides (33.6 mg/l) was observed at village Chuhipali and where as the minimum value of 9.9 mg/l was observed at village Jamgaon.
- *Sulphates* were found to be in the range of1.1 mg/l to 25.8mg/l. The maximum was observed at village Manvapali(25.8 mg/l) whereas the minimum was observed at village Khairpali (1.1 mg/l).

- The Total Dissolved Solids (TDS) concentrations were found to be ranging between 146 to 290 mg/l, with the maximum TDS observed at village Jamgaon (290 mg/l) and minimum observed at village Dumrapali (146 mg/l).

The ground water quality in the study area does not indicate any industrial contamination.

3.3 Soil Characteristics

Ten locations within 10-km radius of the proposed plant boundary were selected for soil sampling. The samples have been collected and analyzed as per the established scientific methods for physico-chemical parameters.

The soil analysis results are presented in the report. It has been observed that the pH of the soil ranged from 7.9-8.1 indicating that the soils are neutral in nature. The soil in the study area is predominantly of silty clay type. The Electrical Conductivity was observed to be in the range of 103-340 μS/cm.

The Nitrogen and Phosphorous values are in the range of 8.3-80.6 kg/ha and 6.2-152.8 kg/ha respectively. The nitrogen and phosphorous levels of the soils in the region indicate that soils are less to moderate in nitrogen and phosphorous levels. The Potassium values range between 80-249.5 kg/ha, which indicate that the soils have medium quantity of Potassium. The soil from the study area shows moderate fertility due to their NPK content.

3.4 Noise Level Survey

The objective of noise monitoring in the study area is to evaluate the baseline noise and assess the impact of the total noise expected to be generated by the proposed project. **Ten locations** were monitored for assessing the existing noise levels in and around the project location. The analysis results reveal that the monitored noise levels are well within the limits as per statutory norms prescribed by Ministry of Environment and Forests.

3.5 Flora and Fauna study

Ecological studies were conducted in the 10 km radius impact zone to assess the biological resources. 288 plant species were identified which are mainly composed of phanerophytes and therophytes, hemicryptophytes.13 forest blocks exist in study area and mainly comprise of *Shorea robusta, Terminalia tomentosa, Adina cordifolia, Ceiba pentandra, Cassia tora, Eupatorium odarattum, Parthinium hystreophorus, Blumea* for woody and herbal populations. 82 animal species were recorded/ observed during the study period. It can be concluded that 1 species belongs to Sch-I, 7 species belong to Sch-II and rest of species belong Sch-III, Sch-IV and Sch-V of Wildlife Protection Act, 1972. Detailed aquatic ecological studies were also conducted and results are incorporated in the report. As per the MOEF Notifications and State Forest Department notifications there no protected areas as per Wildlife Protection Act,1972 in 15-km radius from the Project site.

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Identification of Impacts

The environmental impacts are categorized as either primary or secondary impacts. Primary impacts are those, which are attributed directly to the project and secondary impacts are those, which are indirectly induced and typically include the associated investment and changed pattern of social and economic activities by the proposed action. The impacts have been assessed for the power plant assuming that the pollution due to the existing activities has already been covered under baseline environmental monitoring and details are incorporated in report.

4.2 Operation Phase

Air Environment

Industrial Source Complex [ISC3] 1993 dispersion model has been used for simulations from point sources to assess the dispersion of pollutants.

- Air pollution modeling, carried out for proposed power plant shows that resultant concentrations of SO_2 (40.4 µg/m^3), NOx (39.8 µg/m^3) and TSPM (146.5 µg/m^3) due to the proposed project for study period will remain well within the National Ambient Air Quality Standards.

- Limiting of pollutant discharge and minimizing its effect on air quality, within prescribed standards, will be achieved, by installing tall stacks, for better dispersion of particulates and gaseous pollutants.

- Consequently the proposal is unlikely to have any major impacts on local or regional air quality or to adversely affect human health or status of pollution-sensitive vegetation, either locally or on nearby terrain.

The predictions indicate that the SPM, SO_2, NOx concentrations are likely to be well within the prescribed limit for residential and rural zone as per National Ambient Air Quality standards prescribed by the Central Pollution Control Board, New Delhi.

Water Environment

- ***Liquid Waste Generation in Power Plant***

About 60-m^3/hr of wastewater will be used for ash handling system, 30 m^3/hr used for green belt and 2 -m^3/hr is in the form of sludge. Remaining 533-m^3/hr of wastewater will be collected in Effluent Collection and Equalization Tank (ECET), treated in RO plant and re-used for cooling tower make-up. Zero Discharge concepts will be followed.

Solid Waste Management and Land Use

A long-term ash management agenda has been drawn to ensure compliance with the Ash Management Rules and meet CREP (Corporate Responsibility for Environment Protection) requirements. All efforts will be made to promote ash

utilization in construction business. 100% fly ash utilization will be achieved within 4 yr from the date of commencement of the project operations.

Noise Environment

The main noise generating sources are blowers from boilers and turbines. The impact of noise emission from boilers will be minimized by acoustic enclosures and the noise levels will be limited to 85dB [A].

Greenbelt Development

About 33% of land will be developed as greenbelt with a minimum width of 50-m around the plant site. In the proposed greenbelt, a total 150,000 trees will be planted with a density of 2000 trees/ha.

Socio- Economics

The major economic impacts, which will accrue to the region, during the construction phase and operation of the Power Plant, will be an increased availability of direct and indirect employment. Local people will be benefited after commissioning of the proposed project in terms of petty to major contractual jobs and associated business establishments. Local youth will be given preference in employment during construction and operational phase on the experience and qualification. In addition, several avenues of employment generation will be created due to the proposed project.

5.0 ENVIRONMENTAL MONITORING PROGRAMME

Post project environmental monitoring is important in terms of evaluating the performance of pollution control equipment installed in the project. The sampling and analysis of the environmental attributes will be as per the guidelines of CPCB/CECB. Following attributes will be covered in the post project environmental monitoring in and around the project site:

For environmental protection measures, JSWEL has allocated about Rs. 391 Crore as capital investment and Rs. 28.7 Crore per annum as recurring expenditure during operation of Plant.

6.0 ENVIRONMENT MANAGEMENT PLAN

6.1 Environment Management Plan during Construction Phase

During construction phase, the construction activities like site levelling, grading, transportation of the construction material cause various impacts on the surroundings.

Air Quality Management

The activities like site development, grading and vehicular traffic contribute to increase in SPM and NOx concentration. The mitigation measures proposed to minimize the impacts are:

- Water sprinkling in construction area;
- Asphalting the main approach road;
- Proper maintenance of vehicles and construction equipment.

Water Quality Management

The wastewater from vehicle and construction equipment maintenance centre will contribute to oil and grease concentration. The wastewater from labour colony will contribute to higher BOD levels. The mitigation measures proposed to minimize the impacts are:

- Sedimentation tank to retain the solids from run-off water;
- Oil and grease trap at equipment maintenance centre;
- Septic tanks to treat sanitary waste at labour colony;

Noise Level Management

Operation of construction equipment and vehicular traffic contribute to the increased noise level. Proposed mitigation measures are:

- Good maintenance of vehicles and construction equipment;
- Restriction of construction activities to day time only for equipments generating substantial noise;
- Plantation of trees around the plant boundary to attenuate the noise; and
- Provision of earplugs and earmuffs to workers.

6.2 Environment Management Plan during Operation Phase

During operation phase, the impacts on the various environmental attributes should be mitigated using appropriate pollution control equipment. The Environment Management Plan prepared for the proposed project aims at minimizing the pollution at source.

- ***Air Pollution Management***

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

- Installation of ESP's of 99.99% efficiency to limit the SPM concentrations below 50 mg/Nm^3;
- Provision of 275-m high stack for wider dispersion of gaseous emissions;
- Providing low NOx burners to reduce the NOx emissions;
- Provision of Dust extraction system at transfer points of conveyor system;
- Enclosed conveyor belt to prevent dust generation;
- Provision of water sprinkling system at material handling and storage yard;
- Transportation of the ash by closed bulkers;
- Asphalting of the roads within the plant area; and
- Development of Greenbelt around the plant to arrest the fugitive emissions.

- ***Water Pollution Management***

The wastewater will be generated from cooling towers in the power plant. Additionally, domestic wastewater from canteen and employees wash area will also be generated. The recommended measures to minimise the impacts are:

- Provision of sewage treatment plant to treat domestic sewage from plant and township;
- Utilization of treated domestic wastewater for greenbelt development;
- Lining of guard pond suitably to prevent any seepage into ground to avoid any groundwater contamination;
- Provision of separate storm water system to collect and store run-off water during rainy season and utilization of the same in the process to reduce the water requirement;
- Suitable rainwater harvesting structures to be constructed.

- ***Noise Pollution Management***

In the process, various equipment like pumps, cooling tower, compressors etc generate the noise. The recommendations to mitigate higher noise levels are:

- Equipment to conform to noise levels prescribed by regulatory authorities;
- Provision of acoustic enclosures to noise generating equipment like pumps;
- Provision of thick greenbelt to attenuate the noise levels; and
- Provision of earplugs to the workers working in high noise level area.

- ***Solid Waste Management***

The main solid waste from the proposed Power Plant will be ash (Fly ash and Bottom ash). The total generation of ash from power plant is 3.123 MTPA. Out of this, the bottom ash will be 0.625-MTPA and the fly ash will be about 2.498 MTPA. It is proposed to utilize 100% of the fly ash generated as Fly ash management policy. All efforts will be made to utilize fly ash for various purposes. Unused fly ash and bottom ash will be disposed off by HCSD method into the lined ash dyke area. To control fugitive dust emission from the ash pond area water sprinkling would be done. After the ash dyke is abandoned, its area will be reclaimed through suitable plantation.

- ***Ash Disposal***

The ash disposal system proposed is for High Concentration Slurry Disposal (HCSD). Treated wastewater will be used in ash handling plant.

7.0 RISK ASSESSMENT AND DISASTER MANAGEMENT STUDIES

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the proposed power plant. On the other hand, risk analysis deals with the recognition and computation of risks, the equipment in the plant and personnel are prone to, due to accidents resulting from the hazards present in the plant.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies and these details discussed in details in EIA report.

8.0 PROJECT BENEFITS

The proposed project by JSWEL would enable to meet part of the growing power demand in the power deficient states of India. Further, the proposed power plant will result in improvement of infrastructure as well upliftment of social structure in the area. It is anticipated that the proposed power plant will provide benefits for the locals in two phases i.e. during construction phase as well as during operational stage.

8.1 Construction Phase

- ***Employment***

The construction phase of power plant is expected to span over 42 months. Approximately 4000 persons would be required for the construction work in peak period.

- ***Community Services***

JSWEL will employ local people to the extent possible in order to reduce the need for additional infrastructure. In addition, JSWEL will develop necessary infrastructure like accommodation, water supply, sewerage, medical facility, etc. for catering to the needs of the project personnel and their families. It is proposed to develop township for employees near the plant site. The local people will be indirectly benefited by these developments.

- ***Transportation***

JSWEL will be laying approach road to project area. Development of power plant in this area will boost infrastructural facilities materials transportation, mechanical workshops, etc

8.2 Operational Phase

8.2.1 Demography benefits

During the operational phase, about 600 people shall be employed (directly or indirectly). Considering that most of the skilled, semi-skilled/un-skilled personnel required for the proposed project would be recruited from within the study area to the extent possible. The proposed project would bring considerable benefit to the population in the study area which results in better scope for direct/indirect employment opportunities.

8.2.2 Education

Unskilled people and limited skilled people (depending on availability) shall be hired from local population. In addition, some secondary developments like opening of new schools, shops may take place in view of the increased family population due to the proposed employment. These factors will be beneficial to locals residing in the study area.

9.0 CONCLUSION

As far as the impact of the power station as the local environment is concerned, the various environmental management measures proposed to be adopted in this state-of-the-art power station would minimize it to an insignificant level. However, development of this project has many beneficial impact/effects in terms of bridging the electrical power demand and supply gap and providing employment opportunities that will be created during the course of its setting up and as well as during the operational phase of the project.