3.0 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Preamble

In order to asses the baseline environmental data of the study area a primary data collection programme as per details given in Chapter-1, was undertaken in an area of 10 km radius surrounding the project site during the following periods:

1. April to July-08 for three months before getting TOR from MOEF; and
2. February-09 to March-09 for one month for complying the conditions stipulated in TOR issued by MOEF

Monitoring was carried out to assess the baseline scenario in the area for micrometeorological conditions, ambient air quality, water quality (surface and ground), ambient noise levels, soil quality and traffic movement.

Detailed satellite imageries interpretation was carried out and thematic maps of the study area were prepared by visual interpretation using tone texture variations from Satellite imagery. Digital image processing techniques were used to classify land use of the study area.

Detailed ecological study was carried out in the study area for identification of existing floral and faunal species and classifying faunal species as per schedule defined in the Wildlife (Protection) Act, 1972.

Background socio-economic information of the study area was taken from census of India, 2001. The primary information was also collected during the site visits.

The baseline environment of the study area is described in the following sections:

3.2 Environmental Setting

As shown in **Figure 3.1**, the details of environment settings of the study area covering an area of 10 km radius around the project site are given in **Table 3.1**:

Table 3.1: Environment Setting

Sn	Areas	Name/ Identity	Aerial distance (within 10 km from Proposed project location boundary)
1	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Rivers: • River Pennar Mountains: • Penna/Muchukota Hills	• 3 km • 8 km

Sn	Areas	Name/ Identity	Aerial distance (within 10 km from Proposed project location boundary)
2	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	• SH 30 • South Central Main Railway Line	• Adjacent to Plant Boundary • Adjacent to Plant Boundary
3	Areas containing important, high quality or scarce resources *(ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*	Cement grade Limestone mines, Road metal, Building Stones	• 8 km, N
4	Industries within 25 Km radius	• Penna Cement (Talaricherevu) • Ultra Tech Cement (Kaverisammudram • Limestone & Shale Mines • Cuddapah Slab & granite polishing units (In and around Tadipatri) • Ganga Bhavani Metal Crusher • Sindhu Industries (pulversing unit) • Vinayaka Industries (cement grinding) • Sai Sindhu sponge Iron Pvt Ltd	• North 9 km • North west 11 km • North 15 km • North West 6-8 km • West – 11 km • NW – 6 km • NW-7 km • NW-7km • NW-11km

3.3 Topography

The general topography of the study area is determined by hills on the northern side with an elevation of 300-360 m above mean sea level. The remaining area is more or less plain with the altitudinal variation from 225-250 m mean sea level. The project site experience a general slope from west to east with average altitude of 225.5 m above mean sea level as depicted in **Figure 3.2**.

3.4 Geology

The geology of the area is underlain by rocks of Archean age. The rock types are mostly pre-cambian granite genesis and highly malgmatised. Due to proximity to Cuddapah district, Cuddapah rocks also occur in the area. The geological sequence of the area is given as under;

Age	Formation
Quaternary (Sub Recent)	Alluvium
Recent	Talus
Pleistocene	Laterite
Upper Gondwanas	Satyavedu Conglomerate

Cuddapah	Cheyeir Quartzite's and shale's
Achaean	Granite Genesis

The Achaean group of rocks occupies major part of the study area. These rocks are considered to be belonging to Dharwarian system. The granites of the area predominantly consist of Feldspars, Quartz, Mica and Hornblende and epidiorite as accessory mineral. Shale's, limestone, quartzite and conglomerates of the Cuddapah super group along with Granite genesis which is covered by Alluvium underlies the study area along the river courses to the extent of 200 to 500 m with a thickness of 10 to 15 m. The granites of the sandy area are overlain by alluvium.

The area belong to Seismic zone I (least active) as per IS 1893 (PART -1).

3.5 Drainage and Hydrogeology

The general drainage pattern of the study area is from northwest to southeast as depicted in **Figure 3.3**. The study area falls in catchment area of Pennar river and forms 4th order basin.

River Pennar is the main surface water body in the study area and is a seasonal river. It flows from north west to south east direction. Drainage pattern of the study area is of dendritic type, having a gentle slope of 223 to 255 m elevation from the mean sea level. Number of natural seasonal streams from the north and south of the study area are emerging and finally discharged into Pennar river. All streams are of 1st to 3rd order category. The southern portion of the study area is almost flat and most of the streams in the area belong to 1st & 2nd order category. While northern part of the study area comprises of Muchukota/Penna hills with an altitudinal variation of 223 to 360 m and have most of the streams of 3rd order.

The Pedda Vanka, a seasonal rivulet also joins Pennar river near Sajjaladinne as a main tributary in the study area. The surface water bodies including Pennar river in the study area are seasonal and water is available only during monsoon and post monsoon season. Various check dams/embankments are constructed on the natural drains in order to store water for irrigation.

Most of the irrigation system in the study area by and large depends on the ground water resources. The ground water flow direction is towards east direction. The ground water occurs under semi confined to confined conditions in the granite and sedimentary areas and in an unconfined state in the alluvium. The depth of weathering is limited to 10 to 12 m but fractures occur intermittently at different depths down to 300 m. Depth of ground water level vary from 15 to 40 m during pre-monsoon and 6-12 m during post monsoon

seasons in granitic terrain while in the sedimentary terrain it ranges from 12-25 m during pre-monsoon and 4-8 m during post monsoon season. The long term water level trends indicate declining water levels in the study area. The yields of the wells, which have pierced both the weathered and fractured zones, are higher than the others.

KGSL proposes to withdraw water from the Gandikota reservoir which is about 22 km from plant site. The salient features of the reservoir are given in **Table 3.2.**

Table 3.2 Salient Features of Gandikota Reservoir

Particulars	Unit	Quantity
FRL (Full Reservoir Level)	(m)	209.000
MDDL (Minimum Draw Down Level)	(m)	202.650
Storage	TMC	16.500
	MCM	467.587
	MLD	1281.060
Permission for Water withdrawal for KGSL		
Million gallons/day	(MGD)	5.000
Million cubic feet	(MCFT)	292.400
Million cubic meters	(MCM)	8.286
Thousand million cubic feet	(TMC)	0.292
Million liters/day	(MLD)	22.800
% Demand with respect to Storage		1.772
% Demand with respect to dead storage.		11.059

As it is evident from the above table, storage capacity of the reservoir compared to the additional demand of 5.0 MGD is marginal (<2% of the total storage).

3.6 Land Use Pattern

Land use pattern/land cover area of the study area was determined by using the GIS and Remote Sensing technology. The details of land use pattern of the study area are depicted in **Figure 3.4** and given in **Table 3.3 (a).**

Table 3.3 (a): Land Use Pattern (Satellite Imagery)

Sn	Particulars	Area (Hectare)	Area (Km2)	% of Total Area
1.	Settlement	883.40	8.83	2.805
2.	Dense Forest	76.03	0.76	0.241
3.	Open Forest	761.16	7.61	2.42
4.	Degraded Forest	0.0	0.0	0.0
5.	Land with Scrub	2045.57	20.46	6.50
6.	Single Cropped Land	6750.53	67.51	21.43
7.	Double Cropped Land	15147.73	151.48	48.10
8.	Barren Land	5424.29	54.24	17.22
9.	River/Tank/Pond/Reservoir/Canal	407.02	4.07	1.292
TOTAL		**31495.73**	**314.96**	**100.008**

Area covered by double cropped agricultural land and single cropped agricultural land contribute 48.10% and 21.43 % of the total study area respectively. Area covered by open forest and dense forest is 2.41 & 0.241% respectively. The vegetation cover of the study area is depicted in **Figure 3.5**. Human settlements as shown in **Figure 3.6** contribute 2.805 % of the study area.

Land use pattern (village wise) of the study area based on the Census of India, 2001 is given in **Annexure 3.1** and the details are summarized in **Table 3.3 (b)**.

Table 3.3 (b): Land Use Pattern (Census of India 2001)

Sn	Particulars	Area (Km^2)	% of Total Area
1	Forest land area	14.8718	36.39
2	Total Irrigated Land area	34.3775	8.41
3	Un-irrigated Land	272.2732	66.63
4	Cultivable Waste Land	14.7005	3.59
5	Area not available for cultivation	72.4006	17.71
	Total	**408.63**	**100**

3.7 Meteorology

The climate of the region is tropical dry. The onset of southwest monsoon is in first week of June and withdraws in the mid of October. The study area has three well defined seasons namely:

- Winter season from November to January;
- Summer season from March to June and; and
- Monsoon season from July to October.

The climate of the region is described on the basis of published data (1951 to 1980) recorded at Anantpur, the nearest Indian Meteorological Department (IMD) observatory station, which is about 70 km from the project site. Summarized data for temperature, relative humidity, rainfall, wind speed and wind direction are given in **Table 3.4a** and **Table 3.4b** and described hereunder:

Table 3.4a: Meteorological Data

Month	Daily mean Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	
	Max	Min	At 8:30 hours	At 17:30 Hours	Total	Rainy Days
January	28.7	21.1	68	38	0.2	0.0
February	32.1	23.2	58	30	1.4	0.1
March	35.5	26.6	51	23	3.4	0.3
April	37.3	29.4	55	25	16.2	1.2
May	36.8	28.9	63	32	65.4	3.5
June	32.7	27.2	69	47	57.8	3.6

Month	Daily mean Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	
	Max	Min	At 8:30 hours	At 17:30 Hours	Total	Rainy Days
July	30.6	26.3	73	55	60.9	4.4
August	30.6	25.8	74	54	62.0	4.5
September	30.7	25.5	76	54	134.8	7.2
October	29.5	25.5	76	56	117.2	6.3
November	28.0	23.6	73	53	31.0	2.1
December	27.2	21.5	73	48	10.7	0.9
Total					561.0	34.1

Table 3.4b: Meteorological Data

Month	Mean Wind Speed (km/hr)	Predominant Wind Direction		Calm (%)	
		At 8:30 hours	At 17:30 hours	At 8:30 hours	At 17:30 hours
January	9.4	E	NE, E	53	7
February	9.5	E, SE	NE, E	46	11
March	9.7	SE, S, SW	NE, E	34	14
April	10.0	SW, W	NE, E	15	19
May	13.3	SW, W	NE, W, NW	8	19
June	17.8	SW, W	SW, W, NW	4	5
July	18.3	SW, W	SW, W	3	3
August	17.2	SW, W	W, NW	2	5
September	12.1	SW, W	W, NW	13	14
October	8.0	NE, E, W	NE, E, W	36	16
November	8.9	NE, E	NE, E	39	9
December	9.1	E	NE, E	53	6

- **Temperature**

The annual mean maximum temperature in the region varied from 27.2 ^{0}C (December) to 37.3 ^{0}C (April) while annual mean minimum temperature varied from 21.1 ^{0}C (January) to 29.4 ^{0}C (April).

- **Relative Humidity**

The annual relative humidity at 8:30 hours varied from 51% (March) to 76% (September & October) while at 17:30 hours it varied from 23% (March) to 56% (October).

- **Rainfall**

The annual total rainfall observed was 561.0 mm. About 76% of total rainfall was observed during the months from June to October.

- **Wind Speed**

The annual mean wind speed varied from 8.0 km/hr (October) to 18.3 km/hr (July).

- **Ground Level Inversion**

The data monitored at nearest station i.e. at Hyderabad by IMD are given as per enclosed **Annexure 3.2.**

3.7.1 Meteorology at Site

The site specific meteorology has been monitored at a central location i.e. at plant site, on hourly basis continuously by installing a weather monitoring system on rooftop of First Aid Station at a height of 10 meter from ground. The data were monitored for a period of three months i.e. from 20th April 2008 to 19th July 2008 for three months (thereafter referred to as **summer season**) and for one month i.e. from 23rd February 2009 to 23rd March 2009 for one month (thereafter referred to as **winter season**). The parameters monitored include temperature, relative humidity, wind speed, wind direction and rainfall. Cloud cover was recorded manually. The location of monitoring station is depicted in Figure **3.7 a & b** for summer and winter season respectively. Data recorded are summarized in **Table 3.5**.

Table 3.5: Meteorology at Site

Sn	Description	Summer Season			Winter Season
		April 20 to May 19	May 20 to June 19	June 20 to July 19	Feb 23 to March 23
1	Coordinate of Location	Lat.14° 52'30.56" N Long.78°02'59.20" E			
2	**Wind Speed (m/sec)**				
	Maximum	6.7	7.6	6.7	4.28
	Minimum	0.0	0.0	0.0	0.42
	Average	2.5	2.9	3.2	0.94
3	**Temperature (°C)**				
	Maximum	43.4	42.1	37.9	42.5
	Minimum	26.0	22.5	21.7	18.7
	Average	34.3	30.8	30.7	31.5
4	**Relative Humidity (%)**				
	Maximum	70.0	97.1	97.9	82.0
	Minimum	9.5	9.5	20.7	16.5
	Average	27.4	48.4	47.1	38.0
5	**Rainfall**				
	Total (mm)	9.7	6.4	38.1	0
	Number of rainy days	4	8	10	0
6	**Cloud Cover (OKTAS)**	0-8	0-8	0-8	0-6

During the summer season, the temperature varied from to 21.7 °C to 43.4°C, relative humidity varied from 9.5% to 97.9 % and the wind speed varied from 0.0 to 7.6 m/sec.
24 hourly wind rose diagrams on monthly basis are depicted in **Figure 3.8** to **3.10**. It is evident from the figures that the calm period varied from 8.88% to 10% and was maximum during the period from 20th April-19th May. Predominant wind directions were blowing from north and north east.

During the winter season, temperature varied from 18.7 °C to 42.5 °C, relative humidity varied from 16.5 % to 82.0% and wind speed varied from 0.4 to 4.3 m/sec.

24 hourly wind rose diagram on monthly basis is depicted in **Figure 3.11**. It is evident from the figure that the calm period was recorded as 3.25%. Predominant wind direction was blowing from north and north east.

3.8 Air Emission

❑ Source Emission

Monitoring of source emissions from the existing facilities to assess the emissions from the various processes. The results are as per given in **Table 3.6.**

Table 3.6: Details of Source Emission

Sn	Parameters	Sources							
		Granulated Slag Unit	Furnace Oil Fired Boiler	BF Stoves	Raw Material Storage Hopper	DG Set 1250 KVA		DG Set 250 KVA	
						I	II	I	II
1.	Stack Height	45	45	60	30	24	24	12	12
2.	Stack Internal Diameter (m)	0.8	1.0	0.75	0.60	0.15	0.15	0.10	0.10
3.	Flue Gas Temperature (°C)	56-130	125-131	110-164	40-97	195-237	203-251	130-140	135-140
4.	Flue Gas Exit Velocity (m/s)	4.51-6.84	6.7-6.75	5.71-7.52	5.08-6.94	20.12-20.64	20.04-20.9	16.67-16.92	16.80-16.81
5.	Flow Rate (cum/hr)	8150-12361	18934-19075	9065-11938	9144 - 12492	1274.8-1320	1274.1-1369	471-478	474-475
6.	Particulate Matter (mg/Nm^3)	41-80	85-86	68-94	42-77	62-78	68-86	60-70	64-66
7.	Sulphur di Oxides (mg/Nm^3)	27-38	78	29-67	35-40	26-229	209-268	103-121	110-114
8.	Oxides of Nitrogen (mg/Nm^3)	16-26	60-61	19-48	21-33	312-440	321-479	180-188	191-195

❑ Fugitive Emissions

Monitoring of fugitive emission is being carried out by external agency for existing operation within the plant site for regulatory compliances at a frequency of once in three months. The results from December 2006 to August 2008 are summarized in **Table 3.7**:

Table 3.7: Details of Fugitive Emissions

Parameters		Locations						CPCB Norms
		Near Main Gate	Near Admin Building	Near Coke Yard	Near DG Room	Near Screen House	Near Bunker House	
SPM ($\mu g/m^3$)	Maximum	246.0	294.0	362.0	287.0	438	433	500
	Minimum	121.0	207.0	280.0	164.0	217	415	
	Average	162.8	233.5	319.1	212.0	327.9	424.0	
RSPM ($\mu g/m^3$)	Maximum	73.0	79.0	92.0	68.0	94	86.0	150
	Minimum	37.0	36.0	63.0	42.0	58	78	
	Average	52.2	65.1	79.8	56.6	78.2	82.0	

Parameters		Locations						CPCB Norms
		Near Main Gate	Near Admin Building	Near Coke Yard	Near DG Room	Near Screen House	Near Bunker House	
SO_2 ($\mu g/m^3$)	Maximum	20.0	20.0	29.0	22.0			120
	Minimum	10.0	7.0	13.0	13.0			
	Average	14.2	12.6	21.4	16.8			
NOx ($\mu g/m^3$)	Maximum	24.0	20.0	26.0	25.0			80
	Minimum	12.0	9.0	11.0	15.0			
	Average	17.1	13.8	17.8	19.4			
CO ($\mu g/m^3$)	Maximum	1900	1300	1600	1400			5000
	Minimum	1000	300	700	500			
	Average	1200	600	1100	900	Not monitored		

All values where recorded 8 Hourly during the Day time

It is evident from the table that the all values are well within the standard prescribed by CPCB for industrial area.

3.9 Ambient Air Quality

The objective of the ambient air quality study is to establish the existing ambient air quality within the study area and its conformity to standards specified by CPCB/APPCB. The main sources of air pollution in the area are mainly due to industrial activities, vehicular traffic, dust arising from unpaved villages roads and domestic fuel burning.

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network and was based on following considerations:

- Meteorological condition on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status; and
- Location of residential areas representing different activities.
- Representation of cross-sectional distribution in the downwind direction

3.9.1 Ambient Air Quality during Summer Season

The existing ambient air quality, in terms of Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) and Carbon monoxide (CO) has been monitored. SPM and RSPM, are monitored on 24 hourly basis while SO2, NOx , CO were monitored on 8 hourly basis. The monitoring was carried out twice in a week during the study period i.e from 20 April 2008 to 19 July 2008. The details of monitoring and testing procedure followed are as per given in **Table 3.8.**

Table 3.8: Methodology of Sampling & Analysis

Sn	Parameters	Code of practice	Sampler	Instruments for Analysis	Method followed
1.	Suspended Particulate Matter (SPM)	IS: 5182 (Part IV)	RDS	Balance, Oven, Decicator	Gravimetric
2.	Respirable Particulate Matter (RPM)	-	RDS	Balance, Oven, Decicator	Gravimetric
3.	Carbon Monoxide (CO)	IS: 5182 (Part XVII)	Bladder and Aspirator	Gas Chromatograph with Methaniser	Flame Ionization Detector
4.	Sulphur Dioxide (SO_2)	- do-	RDS with gaseous attachment	Colorimeter	Colorimetric
5.	Nitrogen Oxide (NO_x)	- do-	RDS with gaseous attachment	Colorimeter	Colorimetric

❑ Sampling Locations and Methodology

Six (06) ambient air quality monitoring stations were set up in surrounding areas of the study area (10 km radius of the project site) while three (03) ambient air quality monitoring stations were set up within the plant premises (Work zone) as shown in **Figure 3.7a** for assessment of the existing ambient air quality. Details of the sampling locations are as per given in **Table 3.9.**

Table 3.9: Ambient Air Quality Monitoring Location during Summer Season

Sn	Location	Location Code	Type of Area	Distance / Direction From Project Site
1.	Aluru	A 1	Mixed and rural area	4 Km/ N
2.	Vanganuru	A 2	Mixed and rural area	5 Km/SE
3.	Chukkaluru	A 3	Mixed and rural area	10 Km/NW
4.	Challavaripalle	A 4	Mixed and rural area	1 Km/W
5.	Tadipatri	A 5	Mixed and rural area	6 Km/NW
6.	Teranapalle	A 6	Mixed and rural area	9 Km/W
7.	Near Raw Material Stock Yard	WA 1	Work Zone	0 Km /within plant site
8.	Blast Furnace area	WA 2	Work Zone	0 Km /within plant site
9.	Near Store Room	WA 3	Work Zone	0 Km /within plant site

❑ Results and Discussions

The detailed ambient air quality of the study is given in **Annexure 3.3** and summarized in **Table 3.10**. Based on the results, following observations are made:

Table 3.10: Ambient Air Quality During Summer Season

	Concentration (µg/m³)								
Station Code	A1	A2	A3	A4	A5	A6	WA 1	WA 2	WA 3
SPM (24 Hourly)									
Maximum	129.80	132.2	148.6	133.2	178.9	122.8	286.8	369.7	192.3
Minimum	86.90	96.9	101.8	96.8	121.8	82.5	141.8	218.4	124.4
Average	110.56	115.0	123.9	118.4	141.6	102.1	243.7	277.4	161.0
98 percentile	129.55	130.4	143.7	132.7	172.7	120.8	285.8	359.3	190.6
CPCB Standard	200	200	200	200	200	200	500	500	500
RSPM (24 Hourly)									
Maximum	33.90	27.2	33.4	32.4	38.1	27.3	72.4	84.2	52.4
Minimum	20.20	19.6	19.8	21.8	24.3	16.6	41.6	43.4	34.9
Average	26.28	24.0	27.0	26.3	31.1	22.0	55.9	62.7	41.7
98 percentile	32.85	27.2	32.3	31.6	37.5	26.9	70.9	82.8	50.4
CPCB Standard	100	100	100	100	100	100	150	150	150
SO_2 (8 Hourly)									
Maximum	12.4	12.2	13.6	12.9	15.8	12.2	18.9	24.2	19.9
Minimum	7.8	7.3	8.5	7.8	8.4	7.2	12.8	10.9	10.4
Average	9.78	9.69	10.8	10.43	11.43	9.14	15.4	18.72	15.11
98 percentile	12.03	11.85	13.04	12.69	14.35	11.68	18.4	23.63	18.6
CPCB Standard	80	80	80	80	80	80	120	120	120
NOx(8 Hourly)									
Maximum	17.1	17.2	19.6	19.9	20.4	15.2	25.80	31.70	26.60
Minimum	10.9	9.7	12.4	9.5	12.2	9.4	17.10	21.40	16.90
Average	13.90	13.78	15.26	14.90	15.98	12.61	20.42	25.32	21.23
98 percentile	16.58	16.69	18.29	19.22	19.8	14.85	24.11	30.31	25.35
CPCB Standard	80	80	80	80	80	80	120	120	120
Carbon Mono oxide (8 Hourly)									
Maximum	225	205	310	210	370	250	890	1000	630
Minimum	BDL	BDL	BDL	BDL	150	BDL	275	290	290
Average	156.09	141.74	199.42	145.77	238.65	161.22	493.97	475.51	417.12
98 percentile	214.6	197.3	297.3	202.3	344.6	230	775.3	928.4	616.9
CPCB Standard	2000	2000	2000	2000	2000	2000	5000	5000	5000
BDL –Below Detection Limit (DL: 100 µg/m³)									

- **Suspended Particulate Matter (SPM)**

Out of the six (06) locations in the study area the maximum concentration for SPM of 178.9 µg/m³ was recorded at Tadipatri while the minimum concentration for SPM of 82.5 µg/m³ was recorded at Teranapalle. The mean values were recorded in the range of 102.1-141.6 µg/m³ at all the locations in the study area.

Out of (03) locations within the plant premises maximum concentration for SPM of 369.7 $\mu g/m^3$ was recorded near Blast Furnace area while the minimum concentration for SPM of 141.8 $\mu g/m^3$ was recorded near Raw Material Handling System. The average values ranged between 161.0 and 277.4 $\mu g/m^3$ within the plant premises.

The SPM values recorded are well within the prescribed CPCB norms for rural and industrial areas respectively.

- **Respirable Particulate Matter (RSPM)**

Out of the six (06) locations in the study area, the maximum concentration for RSPM of 38.1 $\mu g/m^3$ was recorded at Tadipatri while the minimum concentration for RSPM of 16.6 $\mu g/m^3$ was recorded at Teranapalle. The average values ranged between 22.0 and 31.1 $\mu g/m^3$ at all the locations in the study area.

Out of the three (03) locations within the plant area, the maximum concentration for RSPM of 84.2 $\mu g/m^3$ was recorded at near blast furnace area while minimum concentration of RSPM of 34.9 $\mu g/m^3$ was recorded near store room. The average concentration of RSPM ranged between 41.7 and 62.7 $\mu g/m^3$ within the plant premises.

The RSPM values recorded are well within the prescribed CPCB norms for rural and industrial areas respectively.

- **Sulphur Dioxide (SO_2)**

Out of the six (06) locations in the study area, the maximum concentration for SO_2 of 15.8 $\mu g/m^3$ was recorded at Tadipatri while minimum concentration of SO_2 of 7.2 $\mu g/m^3$ was recorded at Teranapalle. The mean values for SO_2 were recorded in the range of 9.14 to 11.43 $\mu g/m^3$ at all the locations in the study area.

Out of the three (03) locations with the plant premises, the maximum concentration for SO_2 of 24.2 $\mu g/m^3$ was recorded near blast furnace area while minimum concentration of 10.4$\mu g/m^3$ was recorded near the store area. The mean values for SO_2 were recorded in the range of 15.11-18.72 $\mu g/m^3$ within the plant premises.

The SO_2 values recorded are well within the prescribed CPCB norms for rural and industrial areas respectively.

- **Nitrogen Oxides (NOx)**

Out of the six (06) locations in the study area, the maximum concentration for NO_x of 20.4 $\mu g/m^3$ was recorded at Tadipatri while minimum concentration of 9.4 $\mu g/m^3$ was recorded at Teranapalle. The mean values of NOx was recorded in the range of 12.61-15.98 $\mu g/m^3$ at all the locations in the study area.

Out of three (03) locations within the plant area, the maximum concentration for NOx of 31.7 $\mu g/m^3$ was recorded near the blast furnace area while the minimum concentration of 16.90 $\mu g/m^3$ was recorded near store room. The mean values of NOx were recorded in the range of 20.14-25.32 $\mu g/m^3$ within the plant premises.

The NOx values recorded are well within the prescribed CPCB norms for rural and industrial areas respectively.

- **Carbon mono-oxides (CO)**

Out of the six (06) locations in the study area, the maximum concentration for CO of 370 $\mu g/m^3$ was recorded at Tadipatri while minimum concentration for CO was recorded below detection limit at almost all locations. The mean values of CO were recorded in the range of 141.74 to 238.65 $\mu g/m^3$ at all the locations in the study area.

Out of three (03) locations in the plant area, the maximum concentration for CO of 1000 $\mu g/m^3$ was recorded near blast furnace area while the minimum concentration for CO of 275 $\mu g/m^3$ was recorded near raw material stock yard. The mean values of CO were recorded in the range of 417.12 to 493.97 $\mu g/m^3$ at all the locations within the plant area.

The CO values recorded are well within the prescribed CPCB norms for rural and industrial areas respectively.

From the above discussion, it is evident that average ambient air quality at all locations is well within the limit prescribed by CPCB for rural area and industrial areas respectively. The maximum concentration of all monitored pollutants in ambient air was observed at Tadipatri which is due to local commercial and domestic activities.

3.9.2 Ambient Air Quality During Winter Season

As per Terms of Reference issued by MOEF dated October 16th 2008, additional ambient air quality monitoring was undertaken at 8 locations for one month i.e. from 23rd February to 23rd March 2009. The samples were collected twice a week for four weeks at each location. In addition to SPM, RSPM, SO_2, NOx and CO, analysis for chemical characterization of RSPM and PAH in SPM was also carried out at all locations. The

details of the sampling location are given as per given in **Table 3.11** and depicted in **Figure 3.7b**

Table: 3.11: Ambient Air Quality Monitoring Locations During Winter Season

Sn	Ambient Air Quality	Code	Latitude/ Longitude	Direction From Plant Site	Distance From Plant Site	Type of Area
1	Plant Site (Jambulapadu)	AQ1	14°52'05.83" N/ 78° 02'40.79" E	SSE	1.5 km	Rural
2	Sirigepalle	AQ2	14°54'39.60" N/ 78°06'50.4" E	ENE	8.5 km	Rural
3	Vanganur	AQ3	14°50'43.36" N/ 78°04'41.65" E	ESE	5 km	Rural
4	Shanagalaguduru	AQ4	14°48'58.31" N/ 78°02'21.59" E	S	7 km	Rural
5	Gandlapadu	AQ5	14°50'42 N/ 78°01'22.8"E	SSW	5 km	Rural
6	Gannevaripalle	AQ6	14°53'06.51" N/ 78°00'38.04" E	W	4 km	Rural
7	Tadipatri	AQ7	14°54'22.61" N/ 78°00'33.07" E	NW	6 km	Urban
8	Aluru	AQ8	14°54'39.6" N/ 78°02'46.43" E	N	4 km	Rural

❑ Results and Discussions

The detailed ambient air quality of the study is given in **Annexure 3.4** and summarized in **Table 3.12** as per give below. Based on the results following observation was made.

Table 3.12 : Ambient Air Quality During Winter Season

	Concentration (µg/m³)							
Station Code	**AQ1**	**AQ2**	**AQ3**	**AQ4**	**AQ5**	**AQ6**	**AQ7**	**AQ8**
SPM (24 Hourly)								
Maximum	134.6	120.6	130.9	102.8	130.6	112.4	160.2	132.6
Minimum	116.8	94.9	115.4	76.8	99.6	78.9	132.8	99.8
Average	125.7	109.1	123.4	92.9	115.0	99.2	147.9	116.8
98 percentile	134.3	120.3	130.4	102.2	129.5	111.6	159.7	132.1
CPCB Standard	200	200	200	200	200	200	200	200
RSPM (24 Hourly)								
Maximum	39.5	33.7	29.9	28.4	34.2	29.2	44.9	35.6
Minimum	28.6	24.8	26.4	21.6	28.4	22.7	36.4	26.6
Average	34.5	29.8	27.9	24.7	32.1	26	41.7	32.4
98 percentile	39.4	33.6	29.8	28.1	34.1	28.9	44.9	35.5
CPCB Standard	100	100	100	100	100	100	100	100
SO_2 (8 Hourly)								
Maximum	13.9	11.9	14.5	10.9	13.2	11.8	15.6	12.2
Minimum	11.6	8.8	8.5	8.3	9.1	8.2	11.8	8.1
Average	12.8	10.1	12.6	9.7	11.1	9. 7	13.9	10.2
98 percentile	13.9	11.8	14.5	10.8	13.1	11.7	15.5	12.1
CPCB Standard	80	80	80	80	80	80	80	80
NOx (8 Hourly)								
Maximum	17.1	14.8	16.9	14.5	15.3	13.9	19.2	14.9
Minimum	12.6	11.4	12.7	10.1	11.6	10.2	14.2	11.9
Average	15.0	13.1	14.7	12.5	13.4	11.9	17.0	13.4
98 percentile	17.0	14.8	16.9	14.4	15.1	13.9	19.1	14.9
CPCB Standard	80	80	80	80	80	80	80	80

Concentration (µg/m³)								
Station Code	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
Carbon Mono oxide (8 Hourly)								
Maximum	230.0	190.0	210.0	230.0	230.0	210.0	360.0	250.0
Minimum	130.0	120.0	110.0	BDL	110.0	110.0	210.0	110.0
Average	180.4	152.1	159.2	163.8	157.5	155.8	284.2	176.3
98 percentile	230.0	185.4	205.4	225.4	225.4	210.0	355.4	245.4
CPCB Standard	2000	2000	2000	2000	2000	2000	2000	2000
BDL –Below Detection Limit (DL: 100 µg/m³)								

- **Suspended Particulate Matter (SPM)**

Out of 8 locations in the study area, the maximum concentration of SPM of 160.2 µg/m³ was recorded at Tadipatri and minimum concentration of 76.8 µg/m³ was recorded at Shanagalaguduru. The average values (in the range of 92.9 to 147.9 µg/m³) at all the locations are below the CPCB norms for rural, residential areas.

- **Respirable Particulate Matter (RSPM)**

Out of 8 locations in the study area the maximum concentration of RSPM of 44.9 µg/m³ was recorded at Tadipatri and minimum concentration of 21.6 µg/m³ was recorded at Shanagalaguduru. The average values (in the range of 24.7 to 41.7 µg/m³) at all the locations are below the CPCB norms for rural, residential areas.

- **Sulphur Di-Oxide (SO_2)**

Out of the 8 locations in the study area the maximum concentration of SO_2 of 15.6 µg/m³ was recorded at Tadipatri and minimum concentration of 8.2 µg/m³ which was recorded at Gannevaripalle. The average values (in the range of 9.7 to 13.9 µg/m³) at all the locations are below the CPCB norms for rural, residential areas.

- **Oxides of Nitrogen (NOx)**

Out of the 8 locations in the study area the maximum concentration NOx of 19.2 µg/m³ was recorded at Tadipatri and minimum concentration of 10.1 µg/m³ which was recorded at Shanagalaguduru. The average values (in the range of 11.9 to 17.0 µg/m³) at all the locations are below the CPCB norms for rural, residential areas.

- **Carbon mono-oxide (CO)**

Out of 8 locations in the study area the maximum concentration of CO of 360 µg/m³ was recorded at Tadipatri and the minimum concentration of below detection limit (Detection Limit 100 µg/m³) was recorded at Shanagalaguduru. The average values (in the range of

152.1 to 284.2 µg/m^3) at all the locations are below the CPCB norms for rural, residential areas.

From the above discussion, it is evident that average ambient air quality at all locations is well within the limit prescribed by CPCB for rural & residential areas. The maximum concentration of all monitored pollutants in ambient air was observed at Tadipatri which is due to local commercial and domestic activities.

❑ **Chemical Characterization of RSPM**

• **Average Concentration of metals in RSPM**

Average concentration of the metals was analyzed in composite sample of each location. The results as per given in **Table 3.13.**

Table 3.13: Average Concentration of metals in RSPM (µg/m^3)

Sampling Locations							
AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL: Below Detection Limit (Instrument Detection Limit : 0.1 mg/l)

From the study area average concentration of metals in RSPM was recorded below detection limit at all location.

• **Average ionic concentration in RSPM**

Average ionic concentration in RSPM was analyzed in composite sample of each location. The results are as per given in **Table 3.14**.

Table 3.14: Average Ionic Concentration in RSPM (µg/m^3)

Sampling Locations							
AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
12.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL

An average ionic concentration in RSPM in the study area was found maximum at Jambulapadu (12.8 µg/m^3) while minimum values of below detection limit was recorded at other locations.

❑ **Poly-nuclear Aromatic Hydrocarbon (PAH) in SPM**

PAH can be formed mainly as a result of incomplete combustion (pyrolysis) or high temperature pyrolytic process during combustion of fossil fuel/organic materials as well as in natural processes such as carbonization (pyrosynthesis). The sources of atmospheric poly-nuclear aromatic hydrocarbons can be both natural as well as anthropogenic.

The PAH in SPM was analyzed in composite sample of each location by using IS 5182 (Part 12) :2004. The details of the results are as per given in **Table 3.15**;

Table 3.15: PAH in SPM (µg/m³)

Sampling Locations							
AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
0.0758	BDL	0.0084	0.0046	0.0156	0.011	0.0178	0.0083

BDL: Below Detection Limit (Instrument Detection Limit: 10µg/l)

The maximum PAH concentrations of 0.0758 µg /m^3 was recorded at Jambulapadu. The PAH concentrations values in the study area ranged between below detection limit to 0.0758 µg/m^3.

3.10 Noise Levels

3.10.1 Within Plant Premises

Noise monitoring is being carried our within plant premises (work zone) on monthly basis as a part of their regulatory compliances. The summarized details of the noise levels recorded are as per given in **Table 3.16.**

Table 3.16 Noise levels within plant site

Locations	Maximum dB (A)		Minimum dB (A)		CPCB Norms Industrial Areas	
	Day Time	Night Time	Day Time	Night Time	Day Time dB (A)	Night Time dB (A)
Near Main Gate	58.8	54.3	53.8	51	75	70
Near Stores	67.2	56.9	56.1	50		
Near Coal Yards	67.8	56.1	56.5	50.8		
Near Admin. Building	65.1	58.9	54.7	48.9		
Near BF Stoves	74.8	69.9	59.1	54.6		
Near DG Set area	75	70	63	58		
Near Blower House	72.1	67.4	60.9	56.3		
Near Pump House	73.5	68.3	66.2	59.9		
Near Thickener House	66.8	59.2	61.2	55.8		
Near Granulated Slag Cast House	73.3	68.1	65.7	61.3		

3.10.2 Ambient Noise Level during Summer Season

In order to assess the existing noise level in the study area, noise monitoring has been carried out at six (06) locations within the study area and at three (03) locations within plant premises once during the study period as per details given in **Table 3.17** and depicted in **Figure 3.7a.**

Table 3.17 : Noise Level Monitoring Locations During Summer Season

Sn	Location	Location Code	Distance & Direction Plant Site	Area
1.	Near raw material stack yard	WN 1	0 Km/Plant Site	Industrial
2.	Blast Furnace area	WN 2	0 Km/Plant Site	Industrial
3.	Near Store Room	WN 3	0 Km/Plant Site	Industrial
4.	Aluru Village	N 4	4 Km/N	Residential
5.	Vanganuru Village	N 5	5 Km/SE	Residential
6.	Chukkaluru Village	N 6	10 Km/NW	Residential
7.	Tadpatri Village	N 7	6 Km/NW	Commercial
8.	Challavaripalle Village	N 8	1.5 Km/W	Residential
9.	Teranapalle Village	N 9	9 Km/W	Residential

At each monitoring station, noise level as Leq has been recorded on hourly basis for 24 hours continuously. The summarized results of noise levels as Leq $_{day}$ (Ld) and Leq $_{night}$ (Ln) are as per given in **Table 3.18.**

Table 3.18: Ambient Noise Level During Summer Season

Sn	Location	Code	Noise level (dB(A))		CPCB Norms (dB(A))	
			Day Time (Ld)	Night Time (Ln)	Day Time	Night Time
1.	Near raw material stack yard	W N 1	64.9	54	75	70
2.	Blast Furnace area	W N 2	59	51	75	70
3.	Near Store Room	W N 3	59	43	75	70
4.	Aluru Village	N 4	48.2	40.4	55	45
5.	Vanganuru Village	N 5	46.5	40.1	55	45
6.	Chukkaluru Village	N 6	48.8	41.8	55	45
7.	Tadipatri Village	N 7	52.3	43.1	65	55
8.	Challavaripalle Village	N 8	47.4	41	55	45
9.	Teranapalle Village	N 9	48	40	55	45

Day time : 6.00 a.m to 10.00 p.m, Night time: 10.00 p.m to 6.00 a.m

In the study area, maximum noise levels of 52.3 dB (A) during the day and 43.1 dB (A) during night time were recorded at Tadipatri while minimum noise levels of 46.5 dB (A) during day and 40.1 dB (A) during night were recorded at Vanganuru village.

The noise levels recorded are well within the prescribed CPCB norms for Industrial, commercial and residential areas respectively.

3.10.3 Ambient Noise Levels During Winter Season

As per the TOR prescribed by MOEF, representative noise levels at nine locations were monitored within study area. The details of sampling locations are as per given in **Table 3.19** and depicted in **Figure 3.7b**.

Table 3.19 : Ambient Noise Monitoring Locations During Winter Season

Sn	Location	Code	Latitude/ Longitude	Distance & Direction Plant Site	Area
1.	At T1 Station SH 30 Near Tadipatri	N1	14°54'07.22" N/ 78°01'35.84" E	6km/NW	Near Friends Dhaba Near Tadipatri
2.	At T2 Station SH 30 Near Vanganur Crossing	N2	14°51'23.67" N/ 78°05'01.79" E	1.5Km/E	Near Vanganur Crossing
3.	At Plant Boundary	N3	14°52'58.8" N/ 78°02'06.0" E	-	Industrial
4.	Jambulapadu	N4	14°52'15.8" N/ 78°02'45.94" E	1.5km/S	Residential
5.	Challavaripalle	N5	14°52'40.8" N/ 78°01'37.2" E	2.0km/W	Residential
6.	Sirigepalle	N6	14°54'29.13" N/ 78°06'50.85" E	8.5km/ENE	Residential
7.	Shanagalaguduru	N7	14°48'50.4" N/ 78°02'31.20" E	7 km/S	Residential
8.	Aluru	N8	14°54'48.2" N/ 78°02'55.02" E	4 km/N	Residential
9.	Thippa Reddipalle	N9	14°52'40.8" N/ 78°00'10.80" E	4.5km/W	Residential

At each monitoring station, noise level as Leq has been recorded on hourly basis for 24 hours continuously. The summarized results of noise levels as Leq_{day} (Ld) and Leq_{night} (Ln) are as per given in **Table 3.20.**

Table 3.20: Ambient Noise Level During Winter Season

Sn	Location	Code	Noise level dB(A)		CPCB Norms (Rural) dB(A)	
			Day (Ld)	Night (Ln)	Day	Night
1.	At T1 Station (Near Friends Dhaba) at SH 30 Near Tadipatri	N1	57.5	47.6	65	55
2.	At T2 Station SH 30 Near Vanganur Crossing	N2	48.0	40.9	65	55
3.	At Plant Boundary	N3	51.7	43.2	75	70
4.	Jambulapadu	N4	49.1	40.5	55	45
5.	Challavaripalle	N5	51.6	43.8	55	45
6.	Sirigepalle	N6	48.3	40.2	55	45
7.	Shanagalaguduru	N7	53.4	43.6	55	45
8.	Aluru	N8	54.7	46.1	55	45
9.	Thippa Reddipalle	N9	54.6	44.1	55	45

Day time : 6.00 a.m to 10.00 p.m, Night time: 10.00 p.m to 6.00 a.m

In the study area, maximum noise levels of 57.5 dB (A) during the day and 47.6 dB (A) during night time were recorded at traffic density location (T1) near Friends Dhaba at SH-30 near Tadipatri. The noise levels recorded are well within the prescribed CPCB norms for Industrial, commercial and residential areas respectively.

3.11 Traffic Density

To assess the existing traffic through the study area, traffic density was recorded at two (2) locations as per details given in **Table 3.21** and depicted in **Figure 3.7b**

Table 3.21: Details of Traffic Density Locations

Sn	Location	Location Code	Latitude/ Longitude	Distance & Direction Plant Site
1.	Near Tadipatri towards Cuddapah on SH 30	T1	14°54' N/ 78°01'30.0" E	4 Km/NW
2.	Ahead of SJK Steel Plant's Gate Before intersection road to Vanganur	T2	14°51'21.23" N/ 78°05'10.1"0 E	5 Km/SW

Monitoring was carried out on hourly basis for 24 hours continuously, once during the study period. The observations are summarized in **Table 3.22** and **Table 3.23**.

Table 3.22: Existing Traffic Density

Sn	Parameters	Sampling Locations	
		T1	T2
1.	Total Traffic/day	3822	4328
2.	Average Traffic Flow/hr	159.25	180.33
3.	Max Traffic Flow(Nos.)/hr	304	301
4.	Min Traffic Flow(nos.)/hr	29	36
5.	Max Traffic Flow (Time)	1800 hr to 1900 hrs	0800 hrs to 0900 hrs
6.	Min Traffic Flow (Time)	0100 hrs to 0200 hrs	0300 hrs to 0400 hrs

Table 3.23: Composition of Existing Traffic

Locations	Composition of Vehicles (%)											
	Heavy Vehicles			Medium Vehicles			Light Vehicles			Non-Mechanized		
	Day	Night	Total	Day	Night	Total	Day	Night	Total	Day	Night	Total
T1	28.15	9.55	37.7	16.27	2.98	19.26	30.8	2.30	33.10	9.94	0.00	9.94
T2	30.8	7.0	37.8	18.7	4.1	22.7	35.2	2.1	37.3	2.2	0	2.2

- *Day time is considered from 6.00 to 22.00 hrs while night time is considered from 22.00 to 6.00 hrs*
- *Heavy Vehicles: Bus, 2/3 Axle Trucks*
- *Medium Vehicles: Passenger car, matador, commercial mini bus & TATA-407*
- *Light Vehicles: Scooter, Motorcycle & Auto etc.*
- *Non-Mechanized vehicles: Cycle, Cycle Rickshaw, Bullock Cart*

From the above tables, it is observed that during the study period, traffic load is reported to be observed mainly during day time and it is 85.16% and 86.9% of total traffic load at T1 and T2 respectively. Composition wise, traffic load are reported to be varied as:

- Heavy vehicles from 37.7% to 37.8%;
- Medium vehicles from 19.26% to 22.7%;

- Light vehicles from 33.1% to 37.3%; and
- Non-mechanized vehicles from 2.2% to 9.94%.

3.12 Water Quality

The main sources of water in the study area are Pennar river (seasonal), hand pumps, bore wells and Gandikota reservoir. Pennar river is a seasonal river and feeding the water to the area via infiltration wells. Almost all villages are having water supply from PHD.

The surface and ground water quality of study area was assessed by collecting the samples from different sources and compared with the quality as per BIS:10500 for its portability.

3.12.1 Water Quality During Summer Season

Water samples from three (03) surface water and five (05) ground water samples were collected from identified locations in sterilized plastic cans to assess the existing water quality of the study region. The details of the locations are depicted in **Figure 3.7a** and given in **Table 3.24**.

Table 3.24: Water Sampling Locations

Sn	Location	Station No.	Distance & direction from project site	Use
1.	Pennar River near Veerapuram Village	SW 1	3.0 Km/E	Washing & bathing
2.	Pennar River near Tadpatri Village	SW 2	5.0 Km/NW	Washing & bathing
3.	Water Reservoir within KGSL Steel Plant Site	SW 3	0 Km/Plant Site	Domestic & Industrial
4.	Borewell water near Veerapuram Village	GW 1	2.5Km/E	Irrigation
5	Hand Borewell near Challavaripalle Village	GW 2	1.5 Km/SW	Domestic
6.	Borewell at Jambulapadu Village	GW 3	0.5 Km/S	Irrigation
7.	Borewell water near Aluru Village	GW 4	4 Km/N	Irrigation
8.	Borewell water near Gandlapadu Village	GW 5	4 Km/SW	Irrigation

The results for surface and ground water samples are given in **Table 3.25** & **3.26** and described hereunder:

❑ **Surface Water Quality**

It is evident from **Table 3.25**, pH values ranged from 7.88 to 8.8 while Iron values ranged from 0.14 to 0.03 mg/l. Dissolved solids varied from 563 to 734 mg/l while Sulphate ranged from 21-48 mg/l. Arsenic varied from 0.003 to 0.004 mg/l while

cyanide was absent in all (03) locations. Heavy metals were observed either below detection limit or well below the limit prescribed as per BIS 10500.

Table 3.25. Surface water quality During Summer Season

Sn	Parameters	Unit	Desirable Limit as per BIS:10500	Sampling Locations		
				SW1	SW2	SW3
1.	Colour	Hazen	5 (25)	5	5	10
2.	pH	--	6.5-8.5	8.34	7.66	8.8
3.	Iron as Fe	mg/l	0.3 (1)	0.03	0.02	0.14
4.	Chloride as Cl	mg/l	250 (1000)	112	107	67
5.	Dissolved Solids	mg/l	500 (2000)	588	563	734
6.	Copper as Cu	mg/l	0.05 (1.5)	BDL	BDL	BDL
7.	Sulphate as SO_4	mg/l	200 (400)	48	45	21
8.	Fluoride as F	mg/l	1.0 (1.5)	BDL	BDL	BDL
9.	Phenolic Compound as C6H5OH	mg/l	0.001 (DL:0.002)	BDL	BDL	BDL
10.	Mercury as Hg	mg/l	0.001	BDL	BDL	BDL
11.	Cadmium as Cd	mg/l	0.01	BDL	BDL	BDL
12.	Selenium as Se	mg/l	0.01	BDL	0.001	0.02
13.	Arsenic as As	mg/l	0.05	0.003	0.004	BDL
14.	Cyanide as CN	mg/l	0.05	Absent	Absent	Absent
15.	Lead as Pb	mg/l	0.05	BDL	BDL	BDL
16.	Zinc as Zn	mg/l	5(15)	BDL	BDL	BDL
Additional Parameters						
17.	Total Suspended Solids	mg/l	-	<1	<1	12
18.	Dissolved Oxygen	mg/l	-	6.5	6.7	5.3
19.	BOD	mg/l	-	<2	<2	<2
20.	COD	mg/l	-	Nil	Nil	24
21.	Total Chromium	mg/l	-	BDL	BDL	BDL
22.	Barium	mg/l	-	BDL	BDL	BDL
23.	Boron	mg/l	-	0.22	0.2	0.13
24.	Nickel	mg/l	-	BDL	BDL	BDL
25.	Oil & Grease	mg/l	-	<1	<1	1
26.	Phosphate	mg/l	-	0.13	0.09	BDL
27.	Residual Free Chlorine	mg/l	-	BDL	BDL	BDL
28.	Silver	mg/l	-	BDL	BDL	BDL
29.	Sodium	mg/l	-	152	148	80
30.	Sulphide	mg/l	-	BDL	BDL	BDL
31.	Temperature	°C	-	29	29	28
32.	Total Nitrogen	mg/l	-	5	2	42
33.	Ammonical Nitrogen	mg/l	-	BDL	BDL	12

BDL (Below Detection Limit) *Cu (0.006), F (0.1), Phenolic compounds (0.001), Hg (0.001), Cd (0.003), Se (0.001), As (0.001), Pb (0.001), Zn (0.003), Cr (0.03), Ba (0.41), Ni (0.008), Phosphate (0.02), Residual Free Chlorine (0.1), Ag (0.01), Sulphide (0.01), Ammonical Nitrogen (0.01).*

Conclusively, surface water of study area conforms with the BIS:10500 standard for drinking purpose as alternate source.

❑ Ground Water Quality

It is evident from **Table 3.26** that pH values varied in the range of 7.35 to 7.71 while dissolved solids varied from 422 to 3226 mg/l. Sulphate values were recorded high at

two stations and recorded in the range of 21 to 509 mg/l. Arsenic values ranged from 0.002 to 0.01 mg/l. Zinc values recorded in the range of 0.03 to 0.7 mg/l.

Table 3.26: Ground water quality During Summer Season

Sn	Parameters	Unit	Desirable Limit BIS:10500	Sampling Locations				
				GW1	GW2	GW3	GW4	GW5
1.	Colour	Hazen	5 (25)	2	2	2	2	10
2.	pH	-	6.5-8.5	7.57	7.68	7.45	7.71	7.35
3.	Iron as Fe	Mg/l	0.3 (1)	0.07	0.09	0.09	0.04	1.11
4.	Chloride as Cl	Mg/l	250 (1000)	62	603	800	222	424
5.	Dissolved Solids	Mg/l	500 (2000)	422	2664	3226	986	2170
6.	Copper as Cu	Mg/l	0.05 (1.5)	BDL	BDL	0.02	BDL	0.009
7.	Sulphate as SO_4	Mg/l	200 (400)	21	450	509	64	168
8.	Fluoride as F	Mg/l	1.0 (1.5)	BDL	BDL	BDL	BDL	BDL
9.	Phenolic Compound as C_6H_5OH	Mg/l	0.001 (0.002)	BDL	BDL	BDL	BDL	BDL
10.	Mercury as Hg	Mg/l	0.001	BDL	BDL	BDL	BDL	BDL
11.	Cadmium as Cd	Mg/l	0.01	BDL	BDL	BDL	BDL	BDL
12.	Arsenic as As	Mg/l	0.05	0.002	0.01	0.01	0.009	0.005
13.	Cyanide as CN	Mg/l	0.05	Absent	Absent	Absent	Absent	Absent
14.	Lead as Pb	Mg/l	0.05	BDL	BDL	BDL	BDL	BDL
15.	Zinc as Zn	mg/l	5 (15)	0.03	0.2	0.7	0.04	BDL
16.	Boron as B	mg/l	1.0	0.1	1	2	0.4	0.42
Additional Parameter								
17.	Silver	mg/l	-	BDL	BDL	BDL	BDL	BDL
18.	Sodium	mg/l	-	81	890	915	259	393
19.	Residual Free Chlorine	mg/l	-	BDL	BDL	BDL	BDL	BDL
20.	Oil & Grease	mg/l	-	<1	<1	<1	<1	2
21.	Nickel	mg/l	-	BDL	BDL	BDL	BDL	BDL
22.	Total Nitrogen	mg/l	-	1	5	4	1	BDL
23.	COD	mg/l	-	Nil	12	12	12	12
24.	Chromium	mg/l	-	BDL	BDL	BDL	BDL	BDL
25.	T.S.S	mg/l	-	<1	<1	<1	<1	29
26.	Sulphide	mg/l	-	BDL	BDL	BDL	BDL	BDL
27.	Ammonical Nitrogen	mg/l	-	BDL	BDL	BDL	BDL	BDL
28.	B.O.D	mg/l	-	<2	<2	<2	<2	<2
29.	Barium	mg/l	-	BDL	BDL	BDL	BDL	BDL
30.	Phosphate as PO_4	mg/l	-	0.09	0.06	0.05	0.09	BDL

BDL (Below Detection Limit) *Cu (0.006), F (0.1), Phenolic Compounds (0.001), Hg (0.001), Cd (0.003), Pb (0.01), Zn (0.003), Ag (0.01), Residual Free Chlorine (0.1), Ni (0.008), Cr (0.03), Sulphide (0.01), Ammonical Nitrogen (0.01), Ba (0.41), Phosphate (0.02)*

From the above discussion, it is evident that the ground water quality of the study area conforms water quality with BIS:10500 standard for drinking purposes as alternate source for GW1 and GW4.

3.12.2 Water Quality during Winter Season

As per TOR issued by MOEF, water quality was to be monitored from eight (8) surface water sources and eight (8) ground water sources within the study area. During the study period, SGS team found no water in surface water sources including river Pennar.

Hence water from two (02) surface water sources and nine (09) ground water sources were collected from identified locations in sterilized plastic cans to assess the existing water quality of the study region. The details of the locations are depicted in **Figure 3.7b** and given in **Table 3.27**.

Table 3.27 : Water Monitoring Locations During Winter Season

Sn	Location	Latitude/ Longitude	Station No.	Distance/ direction from project site	Use
1.	Gandikota Reservoir	14°48'28.8" N/ 78°15'43.2" E	SW1	20 km /NE	Domestic and Industrial
2.	Reservoir at Plant Site	14°52'17.2" N/ 78°03'22.27" E	SW2	-	Industrial
3.	Challavaripalle- Hand pump	14°52'35.99" N/ 78°01'46.48" E	GW1	2 km /W	Domestic
4.	Jambulapadu- Hand pump	14°51'56.55" N/ 78°02'49.04" E	GW2	1.5 km /S	Domestic
5	Sirigepalle- Hand pump	14°54'52.3"N/ 78°06'49.95" E	GW3	8.5 km /ENE	Domestic
6.	Aluru – Hand pump	14°54'36.22" N/ 78°02'59.07" E	GW4	4 km /N	Domestic
7.	Gannevaripalle-Hand pump	14°53'17.65" N/ 78°00'44.58" E	GW5	4 km /W	Domestic
8.	Tadipatri-Hand pump	14°54'41.81" N/ 78°00'22.77" E	GW6	6 km /NW	Domestic
9.	Shanagalaguduru-Hand pump	14°48'40.43" N/ 78°02'33.26" E	GW7	7 km /S	Washing & bathing
10.	Kondepalle-Hand pump	14°50'16.8" N/ 78°04'04.6"E	GW8	5 km /SE	Washing & bathing
11.	Vanganuru (Tap Water)	14°50'52.8" N/ 78°04'44.4" E	GW9	5 km /ESE	Domestic

The quality of surface and ground water is given in **Table 3.28** & **3.29** respectively and described hereunder:

- **Surface Water Quality**

Surface water quality could be only monitored at two locations as major rivers, village ponds and other major surface water bodies within the study area are seasonal and availibity of water is only during the monsoon season.

It is evident from **Table 3.28** that pH values were reported in the range of 8.46-8.47. Iron values varied from 0.004 mg/l to 0.3 mg/l. Dissolved solid values varied from 484 mg/l to

588 mg/l.. The heavy metals at both the stations were either below detection limits or below prescribed limits of drinking water standards.

Table 3.28: Surface Water Quality in the Study Area During Winter Season

Sn	Parameters	Unit	Desirable Limit as per BIS:10500	Sampling Locations	
				SW1	SW2
1.	Colour	Hazan	5 (25)	2	5
2.	pH	--	6.5-8.5	8.46	8.47
3.	Iron as Fe	mg/l	0.3 (1)	0.3	0.004
4.	Chloride as Cl	mg/l	250 (1000)	93	91
5.	Dissolved Solids	mg/l	500 (2000)	588	484
6.	Copper as Cu	mg/l	0.05 (1.5)	0.004	0.002
7.	Sulphate as SO_4	mg/l	200 (400)	43	30
8.	Fluoride as F	mg/l	1.0 (1.5)	0.77	0.7
9.	Phenolic Compound as C6H5OH	mg/l	0.001(0.002)	BDL	BDL
10.	Mercury as Hg	mg/l	0.001	BDL	BDL
11.	Cadmium as Cd	mg/l	0.01	BDL	BDL
12.	Arsenic as As	mg/l	0.01	0.004	BDL
13.	Cyanide as CN	mg/l	0.05	Absent	Absent
14.	Lead as Pb	mg/l	0.05	BDL	BDL
15.	Zinc as Zn	mg/l	5(15)	0.007	0.003
Additional Parameters					
16.	Total Suspended Solids	mg/l	-	34	6
17.	Dissolved Oxygen	mg/l	-	7.2	6.3
18.	BOD	mg/l	-	1	1
19.	COD	mg/l	-	24	24
20.	Total Chromium	mg/l	-	0.002	BDL
21.	Barium	mg/l	-	0.05	0.04
22.	Boron	mg/l	1 (5)	0.1	0.1
23.	Nickel	mg/l	-	0.002	BDL
24.	Oil & Grease	mg/l	-	<1	<1
25.	Phosphate	mg/l	-	0.5	0.5
26.	Residual Free Chlorine	mg/l	-	BDL	BDL
27.	Silver	mg/l	-	0.1	0.1
28.	Sulphide	mg/l	-	BDL	BDL
29.	Total Nitrogen	mg/l	-	5.6	5.0
30.	Ammonical Nitrogen	mg/l	-	BDL	BDL

BDL (Below Detection Limit) *Phenolic Compounds (0.001), Cd (0.001), As (0.001), Pb (0.001), Cr (0.001), Ni (0.001), Residual free Chlorine (0.1), Sulphide (0.08), Ammonical Nitrogen (0.1).*

Conclusively, surface water of study area conforms with the BIS:10500 standard for drinking purpose as alternate source.

- **Ground Water Quality**

Ground water samples at eight locations were analyzed within the study area. One more source of Potable water (i.e., Tap water from Govt. supply from Pennar riverbed) was also analyzed .

It is evident from **Table 3.29** that pH values were recorded in the range of 7.10 to 8.17 while Iron was recorded in the range of 0.002 to 0.23 mg/l. Chlorides values varied in the

range of 72 to 1975 mg/l while Dissolved solids varied in the range of 488 to 7150 mg/l. Sulphate values varied in the range of 25 to 2421 mg/l.

Table 3.29: Ground Water Quality during Winter Season

Sn	Parameters	Unit	Desirable Limit BIS: 10500	Sampling Locations								
				Hand Pump Water								Tap Water
				GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW9
1.	Colour	Hazen	5 (25)	10	10	10	10	10	10	10	25	10
2.	pH	-	6.5-8.5	7.73	7.43	7.41	7.75	7.75	7.79	7.69	7.10	8.17
3.	Iron as Fe	mg/l	0.3 (1)	0.02	0.1	0.07	0.1	0.23	0.05	0.03	0.04	0.002
4.	Chloride as Cl	mg/l	250 (1000)	545	637	179	338	1031	361	252	1975	72
5.	Dissolved Solids	mg/l	500 (2000)	2112	2214	1064	1360	5924	1804	1800	7150	488
6.	Copper as Cu	mg/l	0.05 (1.5)	0.003	0.009	0.002	0.002	0.001	0.006	0.001	0.006	0.003
7.	Sulphate as SO_4	mg/l	200 (400)	882	586	116	107	2421	278	339	742	25
8.	Fluoride as F	mg/l	1.0 (1.5)	3.22	1.0	0.46	0.56	3.01	0.9	0.5	0.85	0.46
9.	Phenolic Compound as C6H5OH	mg/l	0.001 (0.002)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.	Mercury as Hg	mg/l	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.	Cadmium as Cd	mg/l	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.	Arsenic as As	mg/l	0.01	0.005	0.003	BDL	0.002	0.001	0.006	BDL	0.002	0.001
13.	Cyanide as CN	mg/l	0.05	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
14.	Lead as Pb	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.003	BDL
15.	Zinc as Zn	mg/l	5 (15)	0.03	0.03	0.008	0.02	0.34	0.09	0.2	0.10	0.10
16.	Boron as B	mg/l	1.0	0.5	0.9	0.36	0.21	1.0	0.77	0.6	1.3	0.07
Additional Parameters												
17.	Silver	mg/l	-	0.1	0.1	0.14	0.14	0.14	0.14	BDL	BDL	BDL
18.	Sodium	mg/l	-	100	97	350	400	1610	635	531	1375	136
19.	Residual Free Chlorine	mg/l	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.	Oil & Grease	mg/l	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
21.	Nickel	mg/l	-	BDL	BDL	BDL	BDL	BDL	BDL	0.001	0.002	BDL
22.	Total Nitrogen	mg/l	-	18	18	29.8	42.9	4.7	38.4	14.8	15.3	4.7
23.	COD	mg/l	-	16	4	12	16	12	12	4	16	4
24.	Chromium	mg/l	-	0.005	0.004	0.001	0.003	0.002	0.002	0.003	0.008	0.001
25.	T.S.S	mg/l	-	3	<1	3	<1	11	3	2	4	<1
26.	Sulphide	mg/l	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.	Ammonical Nitrogen	mg/l	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.	B.O.D	mg/l	-	1	<1	1	1.5	1	1	0.9	0.9	0.9
29.	Barium	mg/l	-	0.03	0.05	0.06	0.06	0.003	0.03	0.03	0.04	0.06
30.	Phosphate as PO_4	mg/l	-	0.8	0.6	0.06	0.06	0.05	0.1	0.06	0.05	0.06

BDL (Below Detection Limit) *Phenolic Compounds (0.001), Hg (0.001), Cd (0.001), Se (0.001), As (0.001), Pb (0.001), Ag (0.005), Residual Free Chlorine (0.1), Ni (0.001), Sulphide (0.08), Ammonical Nitrogen (0.1).*

From the above discussion, it is evident that the ground water quality of the study area is only fit for washing and bathing.

3.13 Soil Quality

Soil samples were collected from five (5) identified locations during summer season as depicted in **Figure 3.7a** and given in **Table 3.30** to generate primary information on soil

quality prevailing in the study area. These samples were collected once during the study period and preserved in polythene bags / Pet jar having lock facility.

Table 3.30: Soil Sampling Locations

Sn	Location	Location Code	Distance & Direction from project Site	Type of Land
1.	Veerapuram	S1	2.5 Km/E	Agricultural
2.	Vangaluru	S2	5 Km/SE	Agricultural
3.	Gandlapadu	S3	4 Km/SW	Agricultural
4.	Cheravarapally	S4	1.5 Km/W	Agricultural
5.	Aluru Village	S5	4 Km/N	Agricultural
6.	Stack Yard RMHS	S6	0 Km/Plant Site	Industrial

These soil samples were analyzed for physical and chemical parameters. The results of soil samples are presented in **Table 3.31** and described hereunder:

It is evident from the results that the soil within the study area was slightly alkaline in nature with pH value ranging between 8.31 to 9.91. The soil quality at sampling locations was mostly characterized by clay followed by sandy loam. The electrical conductivity in the soil samples varied from 140 to 856 µmho/cm showing it to be favorable for agriculture. The soil samples indicate low levels of Nitrogen and phosphorous but high level of potassium, showing ratio of N:P:K (nitrogen/phosphorous/ potassium) to be unbalanced for agricultural productivity.

Table 3.31: Soil quality in the study area

Parameters		Units	Sampling Location					
			S1	S2	S3	S4	S5	S6
Color		-	Grey	Grey	Grey	Grey	Brown	Grey
Texture	Soil Type		Clay	Clay	Sandy loam	Clay	Clay	Clay
	Clay	%	56.34	58.97	14.28	52.22	71.38	58.73
	Silt	%	8.26	11.86	7.21	4.66	14.87	5.73
	Sand	%	35.41	29.22	78.39	43.23	13.87	35.56
Conductivity		Mmhos/cm (0%Suspension)	856	143	140	564	650	210
Bulk Density		kg/m^3	1058	1050	1758	1160	1084	1038
Moisture holding capacity		%	31.74	13.63	16.71	26.87	13.92	16.07
pH		(10% Suspension)	9.91	8.34	8.31	9.45	9.21	9.17
Total Alkalinity as $CaCO_3$		mg/kg	3742	322	743	19893	1250	1115
Total Nitrogen as N		mg/kg	439	498	703	398	473	486
Phosphorus as P_2O_5		mg/kg	335	477	1015	130	504	247
Potassium as K_2O		mg/kg	3614	2754	2343	3870	2687	3034
Chloride as Cl		mg/kg	530	115	123	683	925	39
Sulphate as SO_4		mg/kg	<1	<1	<1	<1	<1	<1
Total Organic Carbon		%	0.10	0.29	0.46	0.12	0.21	0.19
Calcium as Ca		%	4.33	3.34	1.08	4.48	5.89	3.1
Magnesium as Mg		mg/kg	9638	10500	2545	8476	12400	8398
Iron as Fe		%	2.27	3.17	0.89	1.30	3.78	2.73
Copper as Cu		mg/kg	20.80	34.70	10.70	17.37	50.67	27.90
Lead as Pb		mg/kg	0.96	8.72	BDL	2.18	8.17	2.50
Microbial population (total bacterial count)		Cfu/g	77000	65000	130000	67000	143000	70000
Sodium Absorbing Ratio		Meq/kg	35.16	7.78	26.83	33.18	20.07	15.52

BDL (Below Detection Limit) Pb (0.1)

3.14 Ecology

The detailed ecological assessment of the study area has been carried out with the following objectives:

- Identification of flora and fauna and their biodiversity within the study area
- Preparation of checklist of species which also include endangered, endemic and protected (both floral and faunal categories)
- Evaluation of impact of proposed project on flora and fauna of the area.

❑ Methodology

The study area falls under deccan plateau phyto geographical area. The ecological status of the study area has been assessed based on the following methodology:

- Primary field surveys to establish primary baseline of the study area; and
- Compilation of information available in published literatures and as obtained from Forest survey of India, Environmental Information Centre, Botanical Survey of India and Zoological Survey of India.

The flora and fauna study has been carried out by selecting 10 field monitoring sites representing the entire study area of 10 km radius around the project site. The details of the field monitoring location are given in **Table 3.32**.

Table 3.32: Details of Monitoring Locations – Ecology

Sn	Name of the Site	Type of study
1	Aluru	Terrestrial
2	Talaricheruvu	Terrestrial
3	Veerapuram	Terrestrial
4	Vanganuru	Terrestrial
5	Shanagalaguduru	Terrestrial
6	Gandlapadu	Terrestrial
7	Teranapalle	Terrestrial
8	Challavaripalli	Terrestrial
9	Tadipatri	Terrestrial/aquatic
10	Chukkaluru	Terrestrial/aquatic

- **Flora**

The study of flora included the intensive sample survey of vegetation in the study area by applying standard methods (e.g., Greig-Smith 1983, Caustan 1988). To examine the trees and shrubs, quadrats of 25 x 25 m and for herbs 2 x 2 m were laid. In each of the larger quadrats (i) Species (ii) their number, and (iii) Girth at Breast Height (GBH), were measured. (Chaturvedi and Khanna, 1982).

- **Fauna**

Both direct and indirect observation methods were used to survey the fauna. Visual encounter (search) method was employed to record vertebrate species. Additionally survey of relevant literature was also carried out to consolidate the list of vertebrate fauna distributed in the area (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar1988).

Since birds may be considered as indicators for monitoring and understanding human impacts on ecological systems (Lawton, 1996), attempt was made to gather quantitative data on the group by.

1. **Point Survey Method**: observations were made in each site for 15 minutes duration;
2. **Road Side Counts**: The observer traveled by motor vehicles from site to site, all sightings were recorded (this was done both in the day and night time). An index of abundance of each species was also established; and
3. **Pellet and Track Counts**: All possible animal tracks and pellets were identified and recorded (South Wood, 1978).

Based on the Wildlife Protection Act, 1972 (WPA 1972, Anonymous. 1991, Upadhyay 1995, Chaturvedi and Chaturvedi 1996) species were short-listed as Schedule I or II and considered herein as endangered species. Species listed in Ghosh (1994) were considered as Indian Red List species.

- **Plankton**

The studies on the aquatic biological environment were carried out at selected sites. The analysis of Phyto and Zoo-plankton was carried out as per the procedures of APHA 1987. The concentrated samples were analyzed by Sedge wick rafter cell for plankton density and diversity. Shannon Weaver Index calculations were applied to find out the diversity of Plankton groups and the status of water body (Welch, 1964; Prema Michael, 1972).

3.14.1 Assessment of Flora in the Study Area - Plant Communities

The Vegetation present within a defined area is termed as a plant community. This is determined by the nature of the dominant species it contains. The list of flora is as per given in **Table 3.33.**

Table 3.33: List of Flora in The Study Area

Sn	Botanical Name	Local Name	Family
1.	*Acacia chundra*	Sundra	Mimosaceae
2.	*Acacia nilotica*	Nalla tumma	Mimosaceae
3.	*Aglaia elaeagnoidea*	Yerra Adugu	Meliaceae
4.	*Alangium salvifolium*	Uduga	Alangiaceae
5.	*Albizia amara*	Narlingi	Mimosaceae
6.	*Apluda mutica*	-	Cyperaceae
7.	*Azadirachta indica*	Yapa	Meliaceae

Sn	Botanical Name	Local Name	Family
8.	*Borassus flabellifer*	Karatalamu	Palmae
9.	*Bosewellia serrata*	Anduga	Burseraceae
10.	*Bridelia montana*	Panchavoni	Euphorbiaceae
11.	*Bridelia retusa*	Kora Maddi	Euphorbiaceae
12.	*Calotropis gigantea*	Jilledu	Asclepiadaceae
13.	*Calotropis procera*	Jilledu	Asclepiadaceae
14.	*Caparis divaricata*	Budareni	Capparidaceae
15.	*Careya arborea*	Kumbhi	Lecythidaceae
16.	*Carissa spinarum*	Vaka	Apocynaceae
17.	*Casearia elliptica*	Girugudu	Flacourtiaceae
18.	*Cassia auriculata*	Tangedu	Caesalpinaceae
19.	*Cassia fistula*	Rela	Caesalpinaceae
20.	*Chloroxylum swietenia*	Billudu	Rutaceae
21.	*Cleistanthus collinus*	Kedisa	Euphorbiaceae
22.	*Cochlospermum religiosum*	Konda Gogu	Cochlospermaceae
23.	*Cocos nucifera*	Kobbari	Palmae
24.	*Cordia dichotoma*	Banka Nakkera	Ehretiaceae
25.	*Cynodon dactylon*	Gariki Gaddi	Cyperaceae
26.	*Datura metal*	Ummetha	Solanaceae
27.	*Delonix regia*	Peddaturayi	Caesalpinaceae
28.	*Dichrostachys cinerea*	Velthuru	Mimosaceae
29.	*Dodonaea viscosa*	Puli-vailu	Sapindaceae
30.	*Enterolobium saman*	Nidra ganneru	Mimosaceae
31.	*Erythroxylum monogynum*	Pagadamu Chettu	Linaceae
32.	*Eucalyptus sps.*	Neelagiri	Myrtaceae
33.	*Ficus benghalensis*	Rohi	Moraceae
34.	*Ficus religiosa*	Rai	Moraceae
35.	*Gardenia gummifera*	Bikki	Rubiaceae
36.	*Gardenia latifolia*	Pedda Bikki	Rubiaceae
37.	*Gmelina arborea*	Gumudu-teku	Verbenaceae
38.	*Grewia rothii*	Pedda Cipuru	Tiliaceae
39.	*Helianthus annus*	Surya Kanthi	Asteraceae
40.	*Hugonia mystax*	Pisangi	Linaceae
41.	*Hymnodictyon orixense*	Diddipa	Rubiaceae
42.	*Indigofera articulata*	Surmainil	Fabaceae
43.	*Ipomea aquatica*	Thooti Koora	Convolvulaceae
44.	*Jatropha curcas*	Nepalamu	Euphorbiaceae
45.	*Leucas aspera*	Tella Tummi	Labiatae
46.	*Madhuca longifolia*	Ippa	Sapotaceae
47.	*Mallotus philippensis*	Gandhamu	Euphorbiaceae
48.	*Mangifera indica*	Mamidi	Anacardiaceae
49.	*Manilkara hexandra*	Puttapala	Sapotaceae
50.	*Maytenus emarginata*	Chinni	Celastraceae
51.	*Mimosa instia*	Korintha	Mimosaceae
52.	*Naringi crenulata*	Kukka Velaga	Rutaceae
53.	*Nerium indicum*	Ganneru	Apocynaceae
54.	*Nerium odorum*	Erra Ganneru	Apocynaceae
55.	*Ochna obtusata*	Tammi	Ochnaceae
56.	*Oryza sativa*	Vari	Cyperaceae
57.	*Parthenium hysterophorus*	Congress-Poolu	Asteraceae
58.	*Peltophorum ferrugineum*	Pacha sunkesula	Caesalpinaceae
59.	*Phoenix sylvestris*	Etha Chettu	Palmae
60.	*Phyllanthus emblica*	Nela Usiri	Euphorbiaceae
61.	*Pithecelobium dulci*	Sima chinta	Mimosaceae
62.	*Polyalthia longifolia*	Nara Mamidi	Annonaceae

Sn	Botanical Name	Local Name	Family
63.	*Pongamia pinnata*	Kanuga	Fabaceae
64.	*Prosopis juliflora*	Sarcar thumma	Mimosaceae
65.	*Punia granatum*	Danimma	Punicaceae
66.	*Sorghum bicolor*	Jonna	Cyperaceae
67.	*Sterculia urens*	Konda Tamara	Sterculiaceae
68.	*Sterculia villosa*	Gugal	Sterculiaceae
69.	*Strychnos potatorum*	Induga	Loganiaceae
70.	*Tamarindus indca*	Chinta	Caesalpinaceae
71.	*Tarenna asiatica*	Papidi	Rubiaceae
72.	*Tectona grandis*	Teku	Verbenaceae
73.	*Terminalia chebula*	Karakkai-Chettu	Combretaceae
74.	*Terminalia uliginosa*	Thandra	Combretaceae
75.	*Thespisia populnea*	Ganga Ravi	Malvaceae
76.	*Tribulus terrestris*	Palleru	Zygophyllaceae
77.	*Tridax procumbens*	Gaddi Chamanti	Asteraceae
78.	*Typha anugustata*	Dabbu Jambu	Typhaceae
79.	*Urena lobata*	Nalla Benda	Malvaceae
80.	*Vetiveria zizanioides*	Cus-cus	Gramineae
81.	*Vinca rosea*	Billa Ganneru	Apocynaceae
82.	*Wrightia tinctoria*	Aku Pala	Asclepiadaceae
83.	*Zea mays*	Mokka Jonna	Cyperaceae
84.	*Ziziphus jujuba*	Regu	Rhamnaceae
85.	*Zizyphus xylopyrus.*	Gol	Rhamnaceae

The distribution of vegetation in the study area is as per given in **Table 3.34.**

Table 3.34: Distribution of Vegetation in the Study Area

Agricultural Crops	*Sorghum bicolor, Zea mays, Oryza sativa,*
Commercial Crops	*Helianthus annus*
Plantation	*NIL*
Natural Vegetation	*Acacia chundra, Acacia nilotica, Aglaia elaeagnoidea, Alangium salvifolium, Albizia amara, Apluda mutica, Azadirachta indica, Borassus flabellifer, Bosewellia serrata, Bridelia Montana, Bridelia retusa, Calotropis gigantea, Calotropis procera, Caparis divaricata, Carea arborea, Carissa spinarum, Casearia elliptica, Cassia auriculata, Cassia fistula, Chloroxylum swietenia, Cleistanthus collinus, Cochlospermum religiosum, Cocos nucifera, Cordia dichotoma, Croton sparsiflora, Cynodon dactylon, Datura metal, Delonix regia, Dichrostachys cinerea, Dodonaea viscose, Enterolobium saman, Erythroxylum monogynum, Eucalyptus sps., Ficus benghalensis, Ficus religiosa, Gardenia gummifera, Gardenia latifolia, Gmelina arborea, Grewia rothii, Hugonia mystax, Hymnodictyon orixense, Indigofera sps., Ipomea aquatica, Jatropha curcas, Leucas aspera, Madhuca longifolia, Mallotus philippensis, Mangifera indica, Manilkara hexandra, Maytenus emarginata, Mimosa instia, Naringi crenulata, Nerium indicum, Nerium oleander, Ochna obtusata, Oryza sativa, Parthenium hysterophorus, Peltophorum ferrugineum, Phoenix sylvestris, Phyllanthus emblica, Pithecelobium dulci, Polyalthia longifolia, Pongamia pinnata, Prosopis juliflora, Punia granatum, Sorghum bicolor, Sterculia urens, Sterculia villosa, Strychnos potatorum, Tamarindus indca, Tamilnadia uliginosa, Tarenna asiatica, Tectona grandis, Terminalia chebula, Thespisia populnea, Tribulus terrestris, Tridax*

	procumbens, Typha anugustata, Urena lobata, Vetiveria zizanioides, Vinca rosea, Wrightia tinctoria, Ziziphus jujuba, Zizyphus xylopyrus.
Endangered Species	*Nil*
Endemic Species	*Nil*
Medicinal Plants	*Acacia nilotica, Aglaia elaeagnoidea, Apluda mutica, Azadirachta indica, Borassus flabellifer, Calotropis gigantea, Calotropis procera, Carea arborea, Cassia auriculata, Cassia fistula, Cochlospermum religiosum, Cocos nucifera, Cynodon dactylon, Datura metal, Delonix regia, Eucalyptus sps., Ficus benghalensis, Ficus religiosa, Hugonia mystax, Hymnodictyon orixense, Indigofera sps., Leucas aspera, Madhuca longifolia, Mallotus philippensis, Mangifera indica, Naringi crenulata, Nerium indicum, Nerium oleander, Phoenix sylvestris, Phyllanthus emblica, Pithecelobium dulci, Polyalthia longifolia, Pongamia pinnata, Punia granatum, Sorghum bicolor, Sterculia urens, Sterculia villosa, Strychnos potatorum, Tamaridus indca, Terminalia uliginosa, Tarenna asiatica, Tectona grandis, Terminalia chebula, Thespisia populnea, Tribulus terrestris, Tridax procumbens, Vetiveria zizanioides, Vinca rosea, Wrightia tinctoria, Ziziphus jujuba, Zizyphus xylopyrus.*

It is observed that the flora, which includes herbs, climbers, shrubs, trees, is distributed more densely in Buffer Zone.

Among natural vegetation the common herbs such as *Croton*, common grasses like *Cynodon dactylon, Leucas, and Parthenium*, are found in the study area. Regarding shrubs, *Jatropha, Cassia, Vitex, Dodonea,* and *Calotropis* are thriving well in drought hit areas.

Among tree species, *Acacia, Azadirachta, Borassus, Ficus, Morinda,* and *Prosopis* species show luxuriant growth in the study area. Besides the natural vegetation, the agricultural and commercial crops are cultivated in and around the study area. The types of cultivated plants are determined by the types of soil and climatological factors. The *Sorghum, zea mays and paddy* are found cultivated among the agricultural crops. The sun flower is being commercially cultivated.

❑ Stratification

Stratification, or layering, is the occurrence of plants at different levels in a stand. The number of strata above the ground varied according to the kind of community. The study sites are characterized by scrub and deciduous elements with low thorny trees. The stratification in the study area is as follows:

Stratum 1	Grasses	Common grass, *Cynodon dactylon*
Stratum 2	Herbs	*Crotons parviflora, Tephrosi purpurea, Tribulus terrestris,*
Stratum 3	Shrubs	*Calotropis gigantea, Dichrostachys cineria,* Thorny shrubs
Stratum 4	Trees	*Pongamia pinnata, Tamarindus indica, Thespisia populnea, Ficus sps.,*

The above four strata were found in the entire field monitoring locations with equal representation. This shows the life – forms of the area and its amplitude. This also reflects the light intensity, temperature, and organic content of the soil and other factors of the area.

- **Periodicity (Phenology)**

Periodicity refers to the regular seasonal occurrence of various processes such as photosynthesis, growth, pollination, flowering and ripening of fruits and seeds; and the manifestations of the processes, such as formation of leaves, elongation of shoots, appearance of flowers and dissemination of seeds. This results from the inherent genetic characteristics of each species, under the influence of a particular combination of the environmental conditions.

Periodicity means particularly the recurrence at certain times of these processes and their manifestations, while Phenology refers more to the appearance of the manifestations at certain seasons of the year, rather than to their cyclic nature.

The characteristic species of the scrub forests *Acacia sps*, *Prosopis juliflora*, *Cassia auriculata*, *Dodonea viscosa*, and other dominant plants are in flowering and are well adapted to the seasonal changes in the physical environment.

Periodicity and Phenology is perfectly maintained in the study area among the various species recorded during the survey.

- **Vitality (Vigor)**

Vitality relates to the condition of plant and its capacity to complete the life cycle, while vigor refers more specifically to the state of health or development within a certain stage. The study carried out at different locations reveals that the plant species found in the area are well-developed plants, which regularly complete their life cycle.

- **Life Form**

The life form in a broad sense is meant the characteristic vegetative appearance such as the size, shape, branching etc. The life form observed in the study area reveals that there are several communities ranging from open grassland, succulent perennials (*Opuntia sps.*), and small annual plants. The kinds of life forms, the number of individuals of each kind and their spacing gives a good structure to the community.

❑ **Habitat Forms**

The habitat forms of the study area can be broadly classified into three classes in the order of their dominance.

- **Xerophytes**: NIL
- **Mesophytes**: *Tamarindus indica, Thespisia populnea, Ficus sps*
- **Hydrophytes**: *Ipomea sps*

The Xerophytes group is classified on the basis of its ability to endure drought, plants belonging to the xerophytes group are not seen in the study area. Mesophytes include sun and shade plants and Hydrophytes include submerged floating and amphibious plants.

❑ **Quantitative Characteristics**

The quantitative characteristics are the one, which can be readily measured. It includes density of the plants, basal area dominance and frequency.

a. Relative Density and Dominance

The relative density and dominance values of different species found in the study are shows that the dominant plants of various sites have a high percentage value of density and dominance. These values are incorporated in calculating the Importance value Index.

b. Importance Value Index (IVI)

The Importance Value Index (IVI) is an expression used to summarize the plant data; it is desirable to use as many values as possible. The density of one species gives an idea of the number of plants in a stand; the dominance gives an idea of relative degree to which a species predominate a community by its numbers, size or biomass.

Species that exerts the greatest control or influence in the community are called 'dominants'. Plant dispersion over an area or within a community is another parameter; frequency is the measure of species in a series of plots. Frequency expresses the proportion of equal size sample plots in which at least one plant of that species occur relative to the number of plots taken.

Thus the IVI of species is the combination of relative density, relative dominance and relative frequency values of a species added together to obtain a single expression. Importance value Index (IVI). The Importance value allows quantitative comparison of each species in a stand with the other species in the stand, or allows comparison of the species in one stand with species in other stands.

c. Status of Flora as per Raunkiaer's Frequency Classes

Raunkiaer classified the occurrence of species in an area into five classes of frequency i.e. Class A (1 to 20%), Class – B (21 to 40%) Class – C (41 to 60%) Class – D (61 to 80%) and Class – E (81 to 100). The normal distribution of the frequency percentages derived from such classification is expressed as A>B>C=D<E, and has been named Raunkiaer's "Law of Frequency".

By the term dominant species or dominance, it is understood that species of plants having same life and growth, forms predominating in an area. The distribution of vegetation at different sites, its density, dominance, frequency, Importance Value Index (IVI), economic importance, and medicinal uses were studied and the results are as per given in **Table 3. 35**

Table 3.35: Ecological Parameters of Floral Species

Sn.	Name of the plant (Scientific)	Frequency Class	Relative Abundance	Relative Dominance	Relative Frequency	Relative Density	IVI
1	*Acacia sundra*	E	22.8784	3.791	100	32.738	136.529
2	*Acacia nilotica*	C	5.8422	0.037	60	6.166	66.223
3	*Aglaia elaeagnoidea*	D	7.7889	0.6799	80	7.897	88.5769
4	*Alangium salvifolium*	D	7.1604	15.165	80	8.929	104.094
5	*Albizia amara*	C	9.6831	1.365	60	7.143	68.508
6	*Apluda mutica*	D	5.1932	1.327	80	4.124	85.451
7	*Azadirachta indica*	C	3.4762	1.954	60	3.077	65.031
8	*Borassus flabellifer*	B	4.653	0.067	40	6.751	46.818
9	*Bosewellia serrata*	B	4.3415	1.365	40	2.381	43.746
10	*Bridelia Montana*	B	5.6242	0.165	40	2.823	42.988
11	*Bridelia retusa*	C	5.065	60.661	60	4.167	124.828
12	*Calotropis gigantean*	B	5.3554	0.083	40	5.67	45.753
13	*Calotropis procera*	C	31.1587	0.009	60	41.237	101.246
14	*Caparis divaricata*	C	3.8923	0.036	60	3.03	63.066
15	*Carea arborea*	C	9.1303	1.858	60	8.333	70.191
16	*Carissa spinarum*	D	3.8923	17.834	80	4.04	101.874
17	*Casearia elliptica*	B	1.8712	0.053	40	1.33	41.383
18	*Cassia auriculata*	D	4.7798	0.044	80	5.641	85.685
19	*Cassia fistula*	D	5.65	0.2321	80	10.029	90.2611
20	*Chloroxylum swietenia*	B	8.6831	0.152	40	4.762	44.914
21	*Cleistanthus collinus*	C	6.98	0.5678	60	6.789	67.3568
22	*Cochlospermum religiosum*	C	10.1213	1.752	60	8.243	69.995
23	*Cocos nucifera*	C	3.2503	0.007	60	2.765	62.772
24	*Cordia dichotoma*	D	11.4819	3.791	80	13.69	97.481
25	*Croton sparsiflora*	D	5.98	0.1091	80	9.261	89.3701
26	*Croton sparsiflora*	E	29.8957	1.954	100	44.103	146.057
27	*Cynodon dactylon*	C	3.8923	2.275	60	3.03	65.305

Sn.	Name of the plant (Scientific)	Frequency Class	Relative Abundance	Relative Dominance	Relative Frequency	Relative Density	IVI
28	*Datura metal*	D	3.654	0.3234	80	5.5254	85.8488
29	*Delonix regia*	B	2.9193	0.142	40	1.515	41.657
30	*Dichrostachys cinerea*	B	3.2458	11.288	40	2.577	53.865
31	*Dodonaea viscose*	D	3.9232	18.834	80	4.25	103.084
32	*Enterolobium saman*	B	2.9193	12.034	40	1.515	53.549
33	*Erythroxylum monogynum*	B	1.9462	36.397	40	1.01	77.407
34	*Eucalyptus sps.,*	B	3.2458	11.288	40	2.577	53.865
35	*Ficus benghalensis*	D	3.4058	0.006	80	3.535	83.541
36	*Ficus religiosa*	C	2.5948	0.023	60	2.02	62.043
37	*Gardenia gummifera*	D	3.4058	0.006	80	3.535	83.541
38	*Gardenia latifolia*	C	2.5948	0.023	60	2.02	62.043
39	*Gmelina arborea*	D	7.9834	2.73	80	8.036	90.766
40	*Gossypium barbadense*	D	3.838	1.497	80	2.778	84.275
41	*Grewia rothii*	C	5.1898	0.142	60	4.04	64.182
42	*Helianthus annus*	E	4.454	1.201	100	2.238	103.439
43	*Hugonia mystax*	C	4.9897	0.2321	60	7.2	67.4321
44	*Hymnodictyon orixense*	C	7.2354	22.542	60	5.354	87.896
45	*Indigofera sps.,*	C	5.1898	0.142	60	4.04	64.182
46	*Ipomea aquatica*	E	32.6828	0.008	100	48.854	148.862
47	*Jatropha curcas*	B	1.9462	0.023	40	1.01	41.033
48	*Leucas aspera*	B	2.9193	5.118	40	1.515	46.633
49	*Madhuca longifolia*	E	5.6771	0.019	100	7.143	107.162
50	*Mallotus philippensis*	E	15.7409	0.019	100	22.321	122.34
51	*Mangifera indica*	D	7.7847	2.508	80	8.081	90.589
52	*Manilkara hexandra*	C	7.0954	7.583	60	5.357	72.94
53	*Maytenus emarginata*	B	1.9462	0.023	40	1.01	41.033
54	*Mimosa instia*	D	6.456	0.5672	80	7.22	87.7872
55	*Naringi crenulata*	C	7.0964	23.222	60	5.357	88.579
56	*Nerium indicum*	D	4.5631	1.645	80	4.468	86.113
57	*Ochna obtusata*	B	2.9193	5.118	40	1.515	46.633
58	*Oryza sativa*	D	3.8948	23.038	80	2.062	105.1
59	*Parthenium hysterophorus*	C	5.8422	0.037	60	6.186	66.223
60	*Phoenix sylvestris*	C	3.453	0.678	60	8.678	69.356
61	*Phyllanthus emblica*	C	5.9138	7.583	60	4.464	72.047
62	*Pithecelobium dulci*	A	3.265	0.25	20	1.231	21.481
63	*Pithecelobium dulci*	A	3.265	0.25	20	1.231	21.481
64	*Polyalthia longifolia*	E	3.8948	28.898	100	3.093	131.991
65	*Pongamia glabra*	E	17.2043	1.885	100	35.088	136.973
66	*Pongamia pinnata*	B	4.653	0.067	40	6.751	46.818
67	*Prosopis juliflora*	B	5.3554	0.083	40	5.67	45.753
68	*Punia granatum*	A	2.565	1.211	30	4.343	35.554
69	*Sorghum bicolor*	B	3.8948	0.037	40	2.062	42.099
70	*Sterculia urens*	B	9.7851	59.448	40	5.357	104.805

Sn.	Name of the plant (Scientific)	Frequency Class	Relative Abundance	Relative Dominance	Relative Frequency	Relative Density	IVI
71	*Sterculia villosa*	E	5.6771	0.019	100	7.143	107.162
72	*Strychnos potatorum*	A	1.4154	2.275	20	0.505	22.78
73	*Tamarindus indca*	A	2.1505	10.857	20	0.877	31.734
74	*Tamilnadia uliginosa*	D	7.7847	2.508	80	8.081	90.589
75	*Tarenna asiatica*	C	2.5948	14.217	60	2.02	76.237
76	*Tectona grandis*	B	1.654	0.1091	40	1.121	41.2301
77	*Tephrosia pupurea*	C	4.478	2.982	60	3.455	66.437
78	*Terminalia chebula*	C	3.8923	2.275	60	3.03	65.305
79	*Thespisia populnea*	B	1.9474	5.759	40	1.031	46.79
80	*Tribulus terrestris*	C	3.2503	0.007	60	2.765	62.772
81	*Tridax procumbens*	D	9.6576	0.076	80	10.714	90.79
82	*Typha anugustata*	D	5.98	0.1091	80	9.261	89.3701
83	*Urena lobata*	D	1.9474	3.686	80	1.031	84.717
84	*Vetiveria zizanioides*	D	5.7234	1.243	80	4.8561	86.0991
85	*Vinca rosea*	C	1.2121	0.2313	60	2.987	63.2183
86	*Wrightia tinctoria*	D	4.5631	1.645	80	4.468	86.113
87	*Ziziphus jujube*	D	5.688	0.029	80	6.452	86.481
88	*Zizyphus xylopyrus*	B	2.9193	0.142	40	1.515	41.657

The ecological status of vegetation was calculated using the Raunkiaer's normal frequency diagrams and the results are given in **Table 3.36** and depicted in **Figure. 3.12** for the study area.

Table 3.36: Ecological Status of Vegetation as per Raunkiaer's Law

Dominant Species	Status
Acacia chundra, Acacia nilotica, Aglaia elaeagnoidea, Alangium salvifolium, Albizia amara, Apluda mutica, Azadirachta indica, Borassus flabellifer, Bosewellia serrata, Bridelia montana, Bridelia retusa, Calotropis gigantea, Calotropis procera, Caparris divaricata, Carea arborea, Carissa spinarum, Casearia elliptica, Cassia auriculata, Cassia fistula, Chloroxylum swietenia, Cleistanthus collinus, Cochlospermum religiosum, Cocos nucifera, Cordia dichotoma, Croton sparsiflora, Croton sparsiflora, Cynodon dactylon, Datura metal, Delonix regia, Dichrostachys cinerea, Dodonaea viscosa, Enterolobium saman, Erythroxylum monogynum, Eucalyptus sps., Ficus benghalensis, Ficus religiosa, Gardenia gummifera, Gardenia latifolia, Gmelina arborea, Gossypium barbadense, Grewia rothii, Helianthus annus, Hugonia mystax, Hymnodictyon orixense, Indigofera sps., Ipomea aquatica, Jatropha curcas, Leucas aspera, Madhuca longifolia, Mallotus philippensis, Mangifera indica, Manilkara hexandra, Maytenus emarginata, Mimosa instia, Naringi crenulata, Nerium indicum,	**Heterogeneous Fulfills Raunkiaer's Law**

Ochna obtusata, Oryza sativa, Parthenium hysterophorus, Phoenix sylvestris, Phyllanthus emblica, Pithecelobium dulci, Pithecelobium dulci, Polyalthia longifolia, Pongamia glabra, Pongamia pinnata, Prosopis juliflora, Punia granatum, Sorghum bicolor, Sterculia urens, Sterculia villosa, Strychnos potatorum, Tamaridus indca, Tamilnadia uliginosa, Tarenna asiatica, Tectona grandis, Tephrosia pupurea, Terminalia chebula, Thespisia populnea, Tribulus terrestris, Tridax procumbens, Typha anugustata, Urena lobata, Vetiveria zizanioides, Vinca rosea, Wrightia tinctoria, Ziziphus jujuba, Zizyphus xylopyrus.	

The conclusions are drawn as per the Raunkiaer's law on the basis of the following:

a. Whether the distribution of plants fulfils the Raunkiaer's law of frequency diagram, if it does not fulfill then it indicates that the distribution of plant community is affected by human impact; and
b. A comment on the impact – whether the distribution is Homogeneous or Heterogeneous.

The result shows that the distribution is heterogeneous thus fulfilling the Raunkiaer's law. The heterogeneity observed among the plant community in the study area reveals that, the characteristic species of scrub forests are dominant and occupies the class E. They were recorded in all the stands used for this investigation showing the highest frequency; there is a wide distribution of plant species observed in various stands. 100% Frequency were not recorded for many characteristic species except for *Prosopis glandulosa* and *Acacia nilotica*. Though, these two species are dominant, the distribution of vegetation is heterogeneous in nature. The heterogeneous status indicates that there is no human impact in the buffer zone.

❑ **Habitat Pattern**

The environmental conditions with one kind of habitat exhibit variation from spot to spot. The ecological amplitude of one or more of the species under consideration delimits the extent of a habitat. The habitat pattern is associated with the environmental conditions; this has been very well manifested in the study area. Though the topography is plain with some undulations here and there the presence of scrub elements and deciduous species clearly shows the habitat pattern in this area.

❑ **Changes**

The Changes from the initial establishment of vegetation on an area to the terminal climax community are continuous. However, a given group of species will reach a peak of dominance at a certain stage of the sequence. Then as the dominance of this group

decreases, the dominance of another group of species will develop to a maximum. This kind of change in dominant species have been observed in the study area, among different transects. The dominance of Crotons, *Prosopis juliflora*, *Acacia nilotica* and *Cassia auriculata* are noticed in many sites, but some of these plants were absent in some sites showing the occurrence of a change leading to the dominance of other species like *Crotons parviflora*, *Parthenium* sps., and other thorny plants. This group is then characteristic as an indicator of its respective stage of the directional change sequence.

❑ **Climax**

The Climax community is the one in which no further directional change takes place under the prevailing environmental conditions. This is the terminus of habitat and vegetation development. The climax community of the study area is *Acacia nilotica* and other thorny shrubs like *Prosopis glandulosa*, etc. The climax community is in the steady state with respect to productivity structure and population, with the dynamic balance of its population dependent upon its respective site. The community has a maximum diversity, relative stability and homogeneity of the species populations within and between the stands of a given climax type. The given climax type is characterized in appearance within and between stands.

❑ **Discussions on Vegetation Analysis**

The interpretations based on the above analysis and the floristic composition reveals that, the vegetation encountered in the study area is termed as the original characteristic of Thorn forests/Scrub forests, Southern tropical dry deciduous forests, Northern mixed dry deciduous forests, and tropical dry ever green forests. The buffer zone comprises of agricultural and fallow lands.

The type of forest/vegetation found in the study area is Open scrub along with the representative elements of the deciduous and dry ever green forest types. Physiognomically it occurs in the shape of scrub woodland or thicket, the latter may be dense or discontinuous. Floristically it is distinguished by some characteristic and preferential species (Braun-Blanquet, 1932), exclusively or mostly confined to this vegetation type, in relation to the types described by champion (1936) and champion and Seth (1968).

Status of the Plants: There is no endangered, threatened, or rare species of plants recorded in the study area.

3.14.2 Assessment of Fauna in the Study Area

The details of fauna found in the study area are given in the following **Table 3.37**.

Table 3.37: Fauna in The Study Area

Sn	Common Name	Scientific Name	Status	WPA Schedule
Butterflies and insects				
1	Common crow	*Euploea core core*	C	IV
2	Praying mantis	*Mantis religiosa*	C	IV
3	Dragon fly	*Agrion sp & Petalura sp*	C	IV
4	Praying mantis	*Mantis religiosa*	C	IV
5	Grasshopper	*Hieroglyphus sp*	C	IV
6	Termite	*Hamitermes silvestri*	C	IV
7	Lady bird beetle	*Coccinella septenpunctata*	C	IV
8	Ant	*Monomorium indicum*	C	IV
Amphibians				
1	Common Indian Toad	*Bufo melanrostictus*	C , R	IV
2	Tree frog	*Hyla goedii*	C , R	IV
Reptiles				
1	Common Garden lizard	*Calotes versicolor*	C , R	IV
2	Common skink	*Mabuya carinata*	C , R	IV
3	Russell's Earth boa	*Eryx conicus*	C , R	IV
4	Common rat snake	*Ptyas mucosus*	C , R	IV
5	Common Green whip snake	*Ahaetulla nasuta*	C , R	IV
6	Russell's viper	*Daboia russelii*	C , R	II
Birds				
1	Cormorant	*Phalacrocorax carbo*	C , R	IV
2	Smaller Egret	*Egretta intermedia*	C , R	IV
3	Shikra	*Accipiter badius*	C , R	I
4	Red Wattled Lapwing	*Vanellus indicus*	C , R	IV
5	Plue Rock Pigeon	*Columba livia*	C , R	V
6	Spotted Dove	*Streptopelia chinensis*	C , R	IV
7	Rose ringed Parakeet	*Psittacula krameri*	C , R	IV
8	Koel	*Eudynamys scolopacea*	C , R	IV
9	Crow - Pheasant	*Centropus sinensis*	C , R	IV
10	Spotted owlet	*Athene brama*	C , R	IV
11	Palm swift	*Cypsiurus parvus*	C , R	IV
12	Indian Roller	*Coracias benghalensis*	C , R	IV
13	Crimson Breasted Barbet	*Megalaima haemacephala*	C , R	IV
14	Swallow	*Hirundo rustica*	C , R	IV
15	Black Drongo	*Dicrurus adsimilis*	C , R	IV
16	Brahminy Myna	*Sturnus pagodarum*	C , R	IV
17	Common Myna	*Acridotheres tristis*	C , R	IV
18	Indian Tree pie	*Dendrocitta vagabunda*	C , R	IV
19	House crow	*Corvus splendens*	C , R	V
20	Jungle crow	*Corvus macrorhynchos*	C , R	IV
21	Common Wood Shroke	*Tephrodornis pondicerianus*	C , R	IV
22	Red vented bulbul	*Pycnonotus cafer*	C , R	IV
23	White headed Babbler	*Turdoides affinis*	C , R	IV
24	Ashy Wren Warbler	*Prinia socialis*	C , R	IV

Sn	Common Name	Scientific Name	Status	WPA Schedule
25	Tailor Bird	*Orthotomus sutorius*	C , R	IV
26	Magpie Robin	*Copsychus saularis*	C , R	IV
27	Purple Rumped Sun Bird	*Nectarinia zeylonica*	C , R	IV
28	Baya Weaver Bird	*Ploceus philippinus*	C , R	IV
Mammals				
1	Indian Palm squirrel	*Funambulus palmarum*	C , R	IV
2	Sloth Bear	*Melursus ursinus*	R	I
3	Chital	*Axix axis*	R	III
4	Bandicoot	*Bandicoota indica*	C , R	IV
5	Bat	*Rhinolopus sps.*	C , R	IV
6	Common mongoose	*Herpestes edwardii*	C , R	IV
7	Indian pipistrella	*Pipistrellus coromandra*	C , R	V
C - Common M - Migrant R - Resident Absent				

Based on the above table, the following observations were made:

- **Insects:** The insects in the study area are interrelated with each other and other organisms. They are in perfect balance in their existence. Some of them act as pests, while others are useful and beneficial to the environment and human beings;
- **Amphibians:** The toads and frogs were the amphibians recorded in the study area. Many of them were seen along the Lentic water system and other areas;
- **Reptiles:** The reptiles recorded in the study area include lizards, and snakes;
- **Birds:** Birds play an important role in understanding the ecological balance and its interrelationships. The occurrence of birds in various locations largely depends on the site characteristics and their presence in different study sites reveals that there is a good relationship between the birds and other organisms and the environment. The maintenance of the eco-balance could be seen in the selected study areas;
- **Mammals:** The distribution of mammals is largely dependent upon the environment of the respective areas. The mammals present in the study area includes Indian palm Squirrel, mongoose, Bat, etc. These mammals are spread over the study area;
- **The Plankton**

  The term plankton refers to unattached organisms that are dispersed individually or in colonies in water. Phytoplankton is plant plankton, and zooplanktons are animal plankton. The lentic water body within the 10 km radius was moderately dry. Samples for the plankton study were collected from the Pennar and Pedda vanka river system passing through the buffer zone. Water samples were collected using standard methods and analyzed for plankton diversity. The list of plankton is as per given in **Table 3.39**

❑ **Shannon Weaver Index (SWI)**

The SWI is a measure of diversity and may be considered as an overall index of diversity as it concedes a true picture of the information theory. The species diversity of such a community may be computed by employing the SWI of diversity by applying the Index.

$$H = -\Sigma n/N \log n/N \quad \text{Or}$$
$$H = -\Sigma pi \log pi$$

Where,

n = Number of individual species

N = Total number of individual species

Pi = Importance value for each species n/N

The SWI can be interpreted based on the SWI-H values obtained by computing the values of quantitative plankton analysis. Based on the H-values of SWI, the quality of water can be classified into the following three categories as per given below:

SWI – H VALUE	QUALITY OF WATER
X > 3	Clear
1 TO 3	Moderately polluted
X < 1	Heavily polluted

The SWI – H values were calculated and the results as per given in **Table 3.38** show that it is clear and free from pollution.

Table 3.38: List of Plankton

Sn	Plankton	Pennar River	Pedda vanka
1	Calamus	P	
2	Cyclops	P	P
3	Daphnia	P	P
4	Moina	P	P
5	Nauplius	P	P
6	Rotifer	P	P
7	Notonecta	P	P
8	Streptocephalus		P
9	Conocostrachan	P	
10	Dysticus	P	P
11	Dragonfly nymph		P
12	Frog tadpole	P	P
13	Chironomous		P
H value – 3.642 Status- Clear			

3.15 Socio-Economic Scenario

The study area covers twenty one (21) revenue villages in Tadpatri mandal & four (4) revenue villages in Putluru mandal of Anantpur district and two villages in Kondapuram mandal & four (4) revenue villages in Koduru mandal of Cuddapah district of Andhra Pradesh.

The socio-economic profile of the study area is presented based on Census Hand Books for Census 2001. Site visits and discussions with villagers were also made for collection of data. The detailed data of the study area are given in **Annexure 3.5** to **3.10**.

❑ **Population**

- Total population of the study area is 182446 with 51% males and 49% females;
- The average household size is 4.3;
- Sex ratio is 950 females over 1000 males; and
- Schedule cast contributes 14% of the total population while schedule tribes contribute 6 % of the total population.

❑ **Literacy**

- 56.78% of the total population is literate which is more than the literacy rate at district level (56%) and is less than the literacy rate at state level (60%) and national level (64.8%); and
- 62.6% males and 37.4% females are literate;

❑ **Occupational Pattern**

- 48.2% of total populations are workers;
- Out of total workers, 85.72% are as main workers while 10.6% are as marginal workers.
- Main workers are dominated by 62.6% of males while marginal workers are dominated by 76.2% of females;
- Main workers includes agricultural labourer (25%), cultivators (17%), household workers (8%) and others (50%); and
- Marginal workers includes agricultural labour (36%), cultivators (33%), household workers (28%) and others (3%).

❑ **Infrastructural Facilities**

The study area is equipped with basic infrastructural facilities like education, medical facility; drinking water, postal & telegraph services, mode of communication, approach to village and power supply which are described as hereunder:

- **Education**

Primary level education is available at all the villages however facilities for middle level education are either present at the village itself or present within 5-10 km distance. College level education facility is available within 5-10 km distance. Some villages also possess adult literacy centers and other educational facilities. In due course of time a number of private schools have come up in the study area further empowering the educational facilities in the area.

• **Medical Facility**

Medical facilities are available within 5-10 km areas. Major hospitals are only present at Tadipatri.

• **Drinking Water**

Drinking water facilities are available at all villages. The main sources for drinking water are tap water and hand pump water. Tube wells and earthen wells are also present in the study area.

• **Postal & Telegraph**

Post office is available at village itself or within 5 km distance. Telephones are available within 5 -10 km or more than 10 km distance. With the recent development in information & technology, the telephone facilities are available in most of the villages. Also mobile phones have become quite common in recent times.

• **Communication**

Bus services are available within the village itself or within 5 km distance at almost all villages however Railway station is present at 5-10 to more than 10 km distance. Transportation facilities have improved more in recent times. Also number of private vehicles is also plying in the area on shared basis.

• **Road Network**

Transport and Communication facilities are considered an administrative necessity as well as a public convenience. However, a well-knit transportation system is a pre-requisite for the social and economic development of any district. The linking of one place with the other by road is very essential to provide good transport system. The study area has good road network. About 89% of villages have paved roads.

• **Electricity**

All villages within the study area are having electricity for all purposes.

❑ **Cropping Pattern**

The details of cropping pattern in the study area are as per given hereunder:

Season	Condition	Cropping pattern
Kharif	Rainfed	Groundnut & Red gram, Groundnut, Jowar , Maize, Sunflower
	Irrigated	Paddy, Sunflower, Groundnut , Cotton

Rabi	Rainfed	Bengal gram, Sunflower, Jowar
	Irrigated	Paddy, Groundnut, Sunflower

The Orange and Mango orchards are also developed in the areas which are mainly irrigated through bore wells and canals.

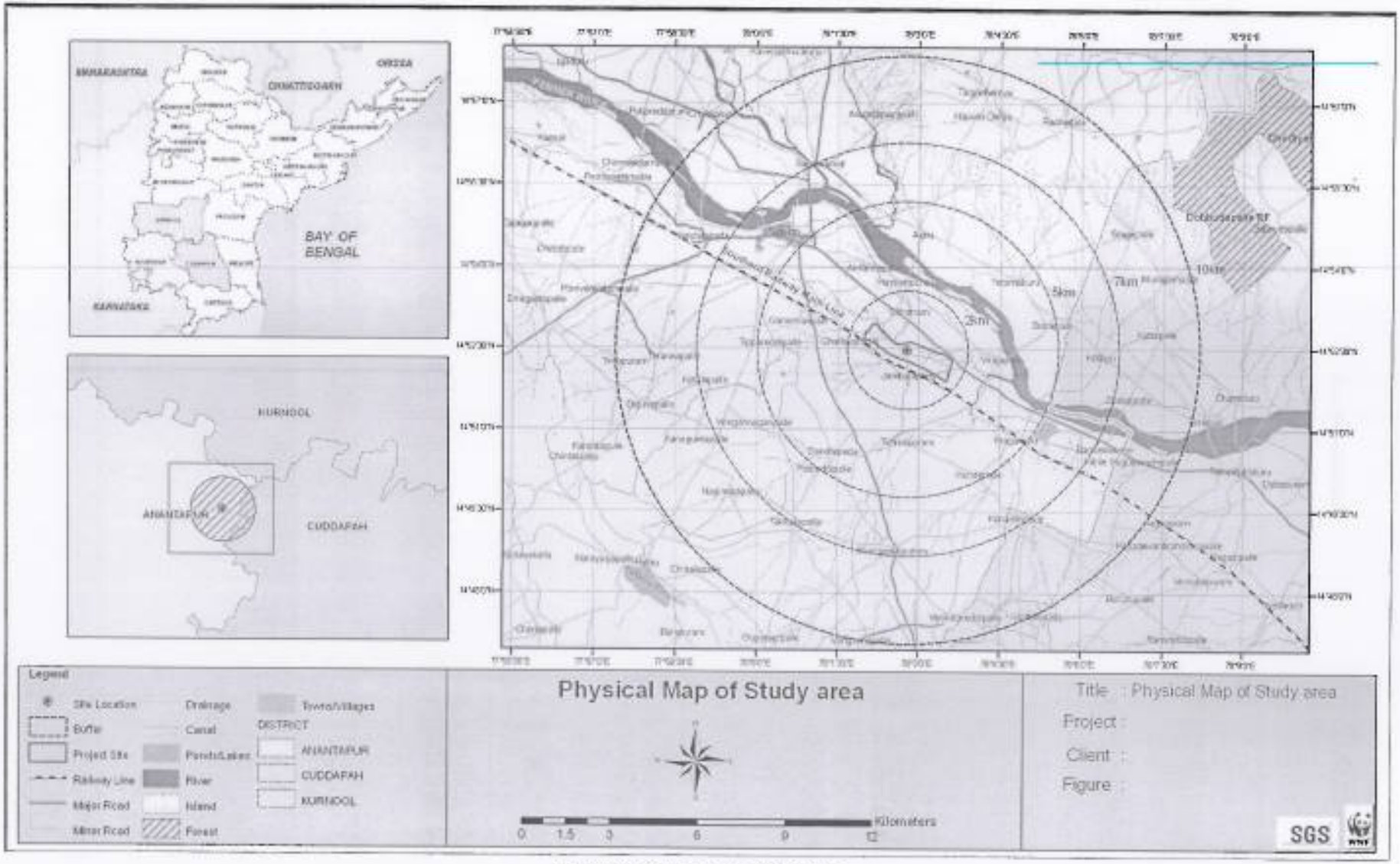

Figure 3.1: Physical Map of Study Area

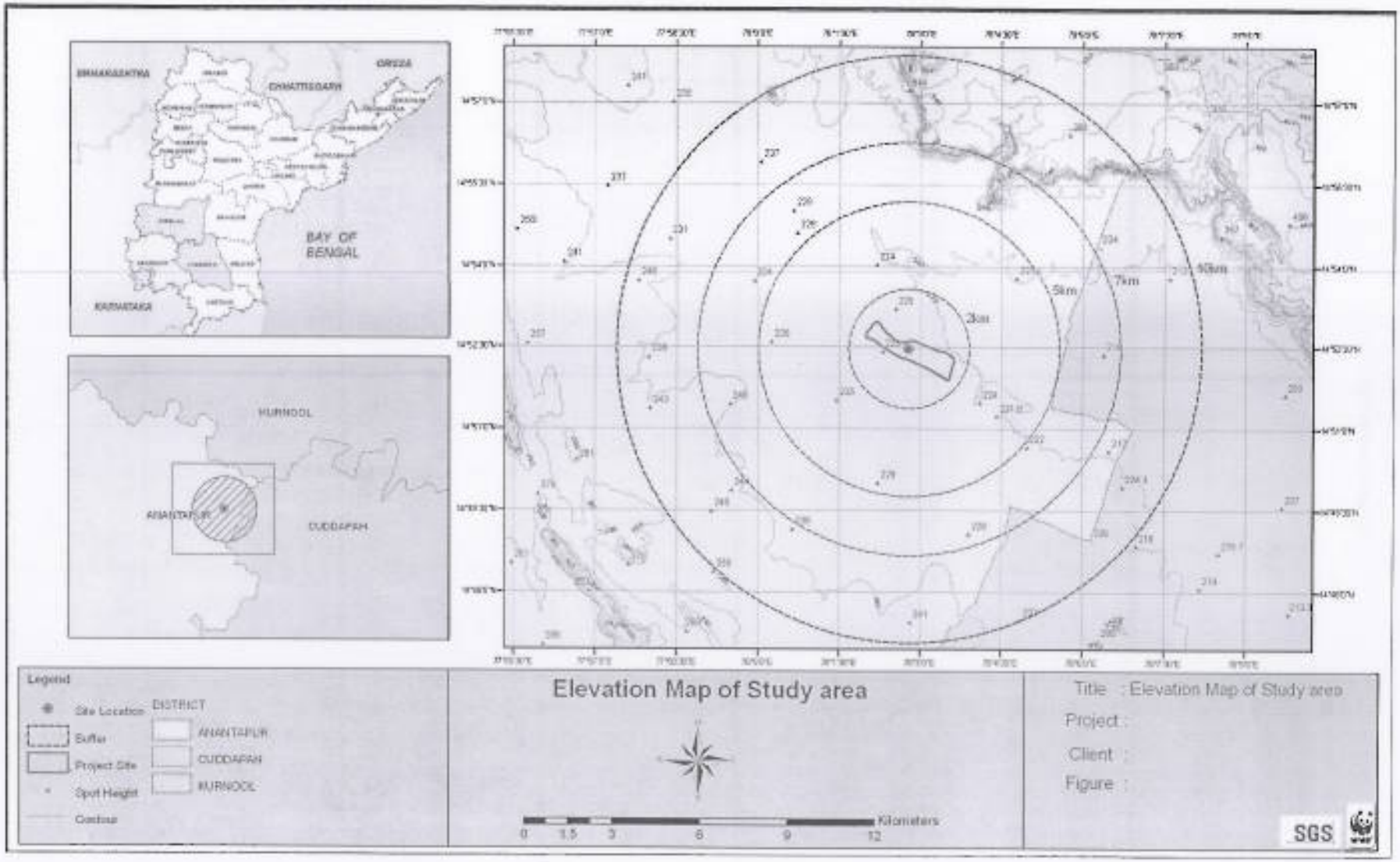

Figure 3.2: Elevation map of Study area

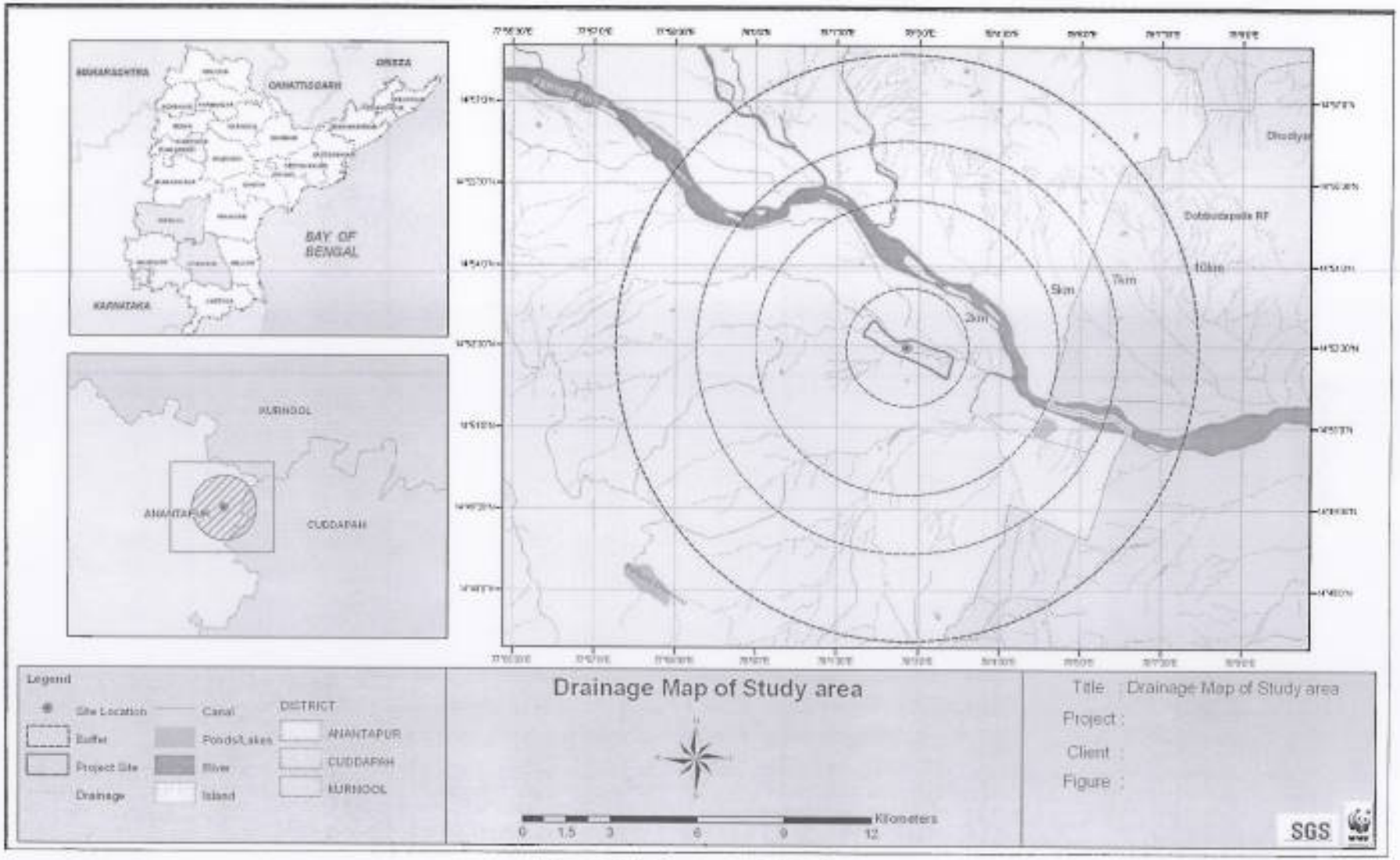

Figure 3.3 : Drainage map of Study Area

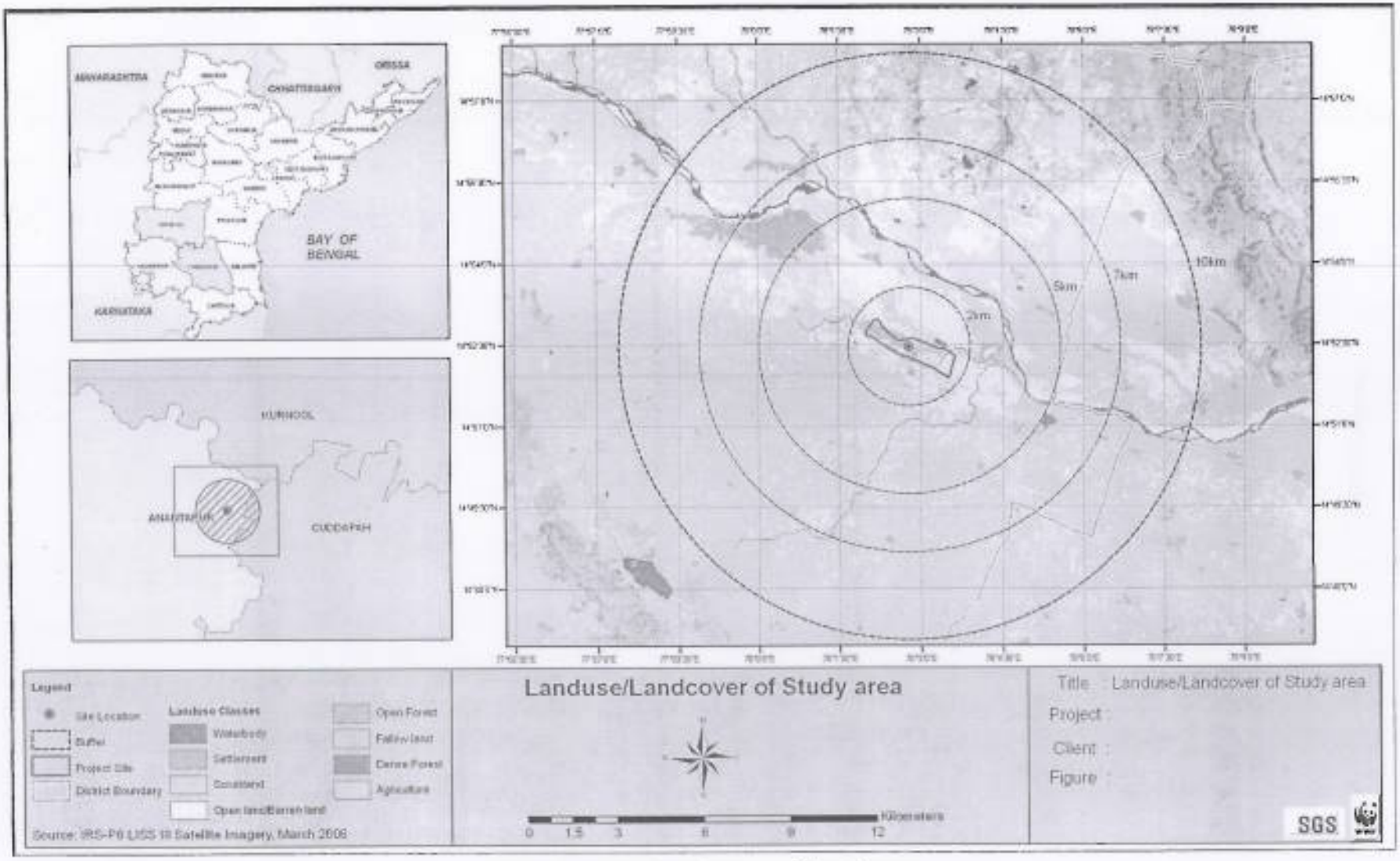

Figure 3.4 : Landuse/Land cover map of the study area

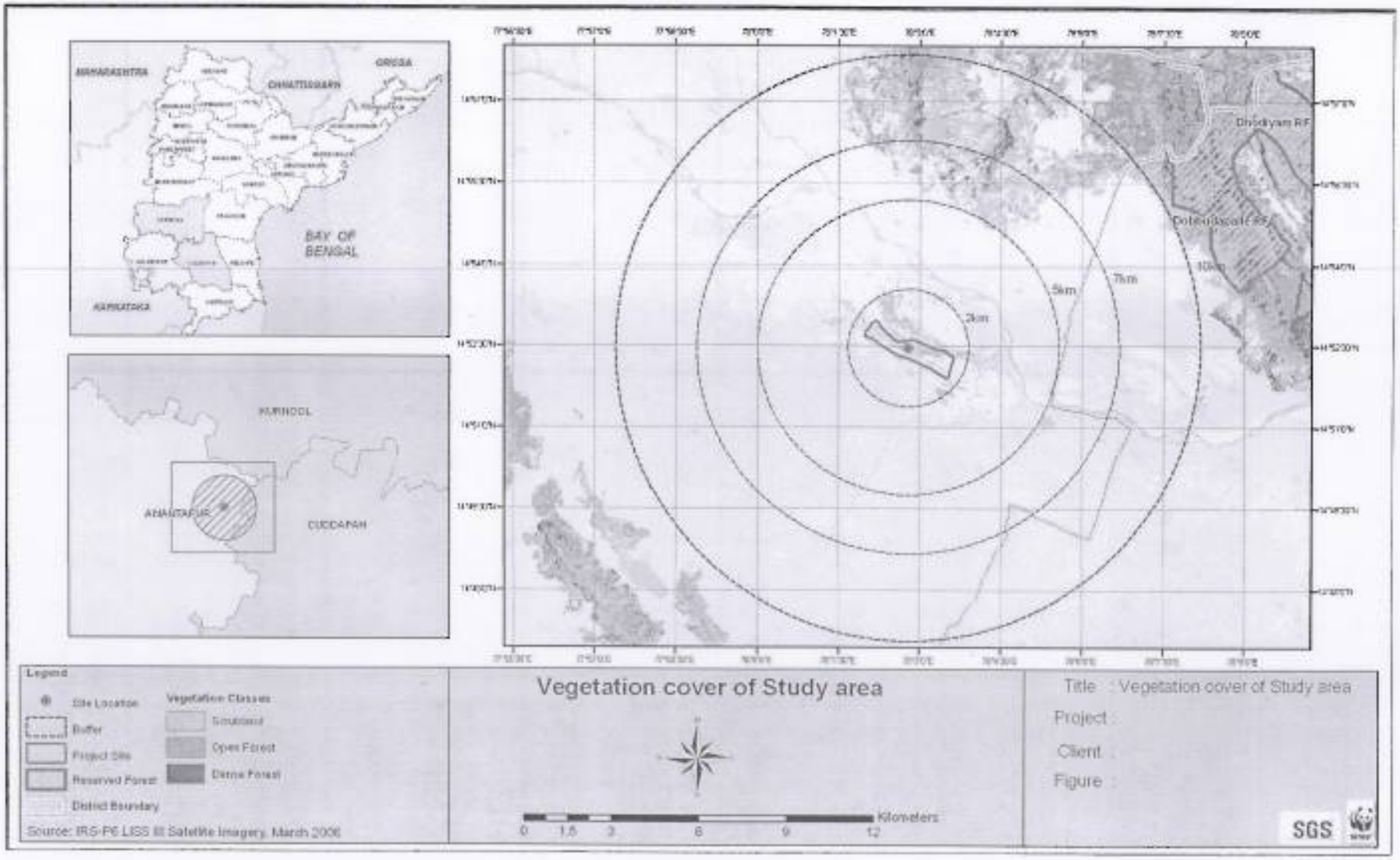

Figure 3.5 : Vegetation Cover of Study Area

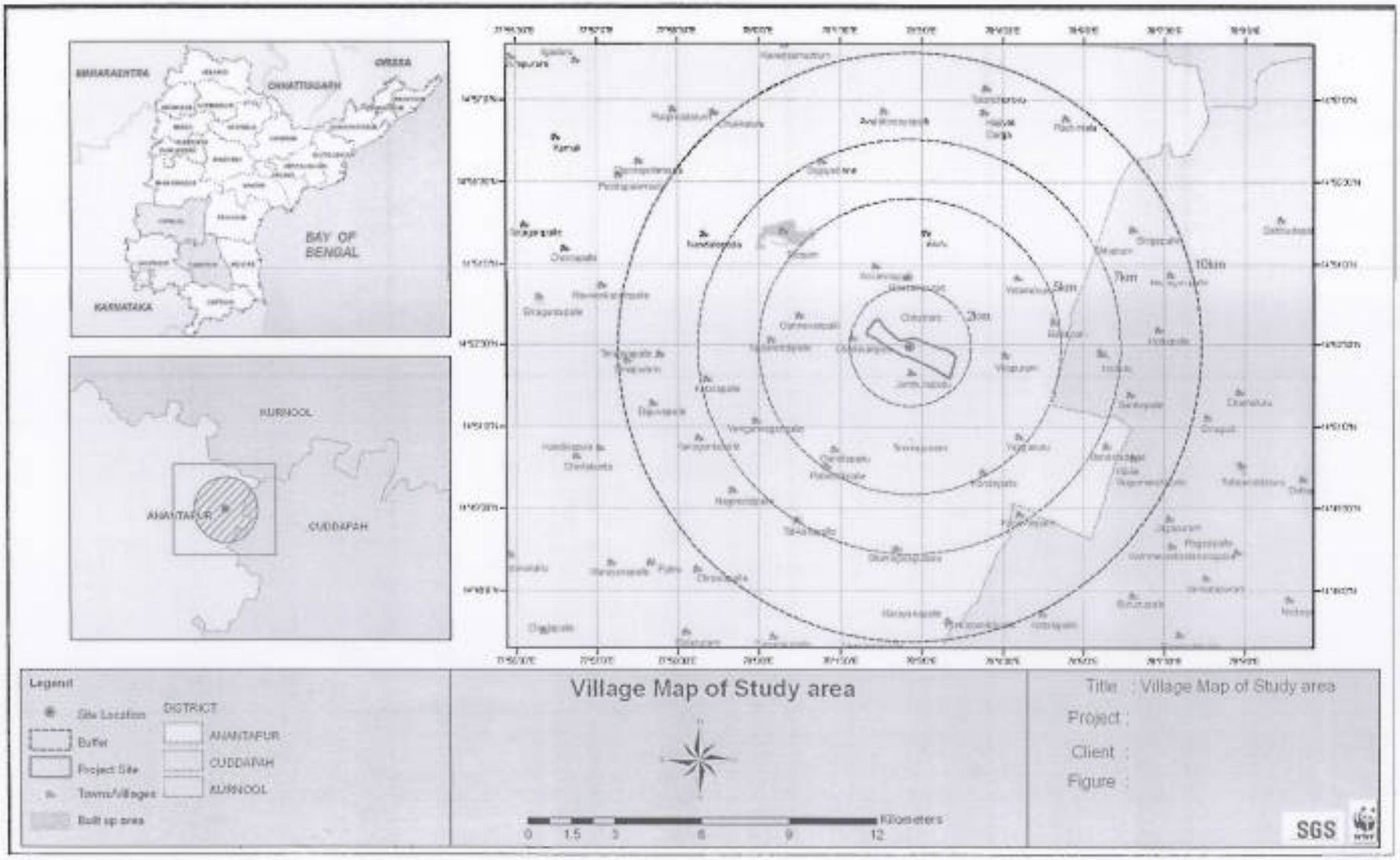

Figure 3.6 : Village Map of Study Area

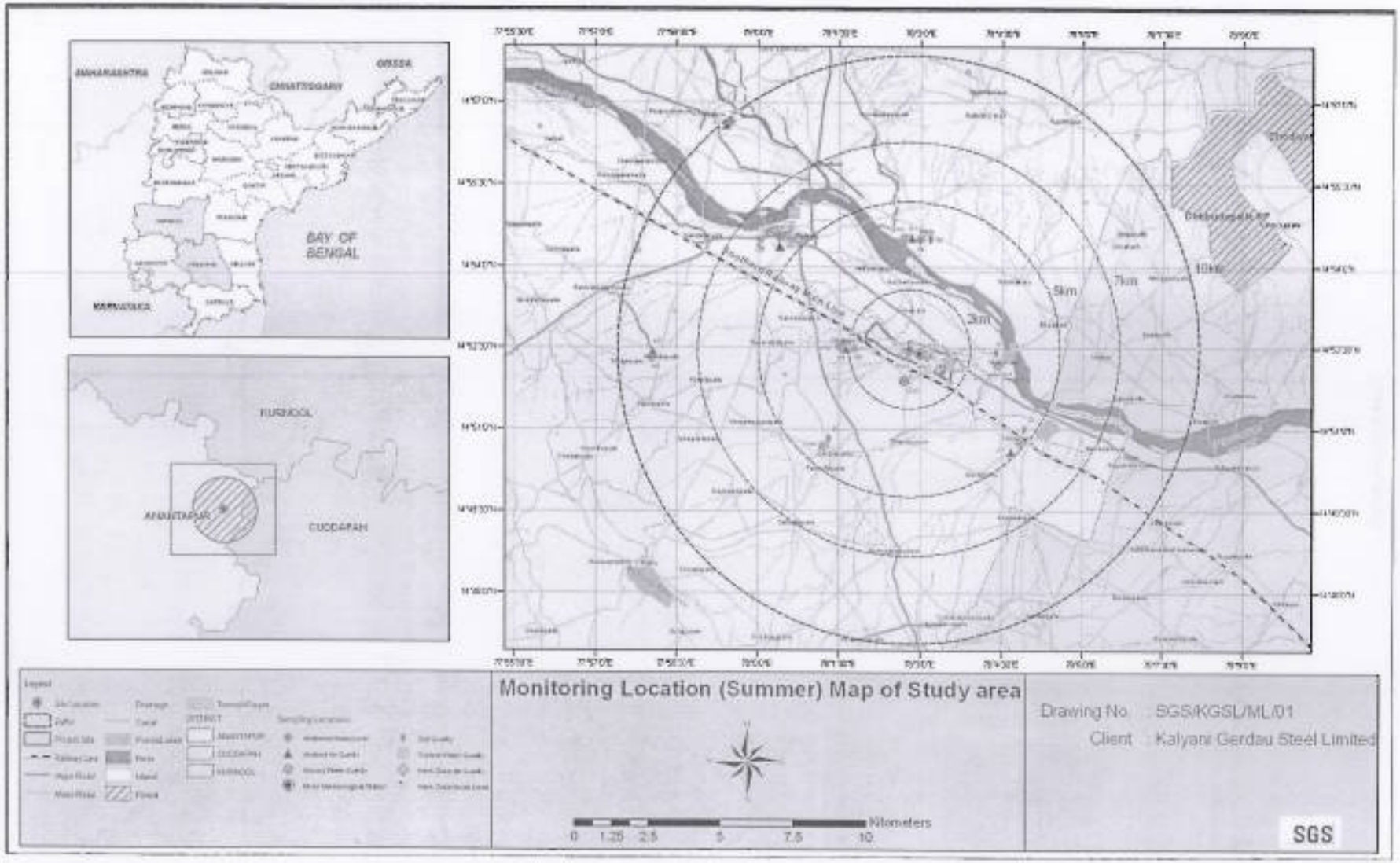

Figure 3.7 a : Monitoring Locations in Summer Season

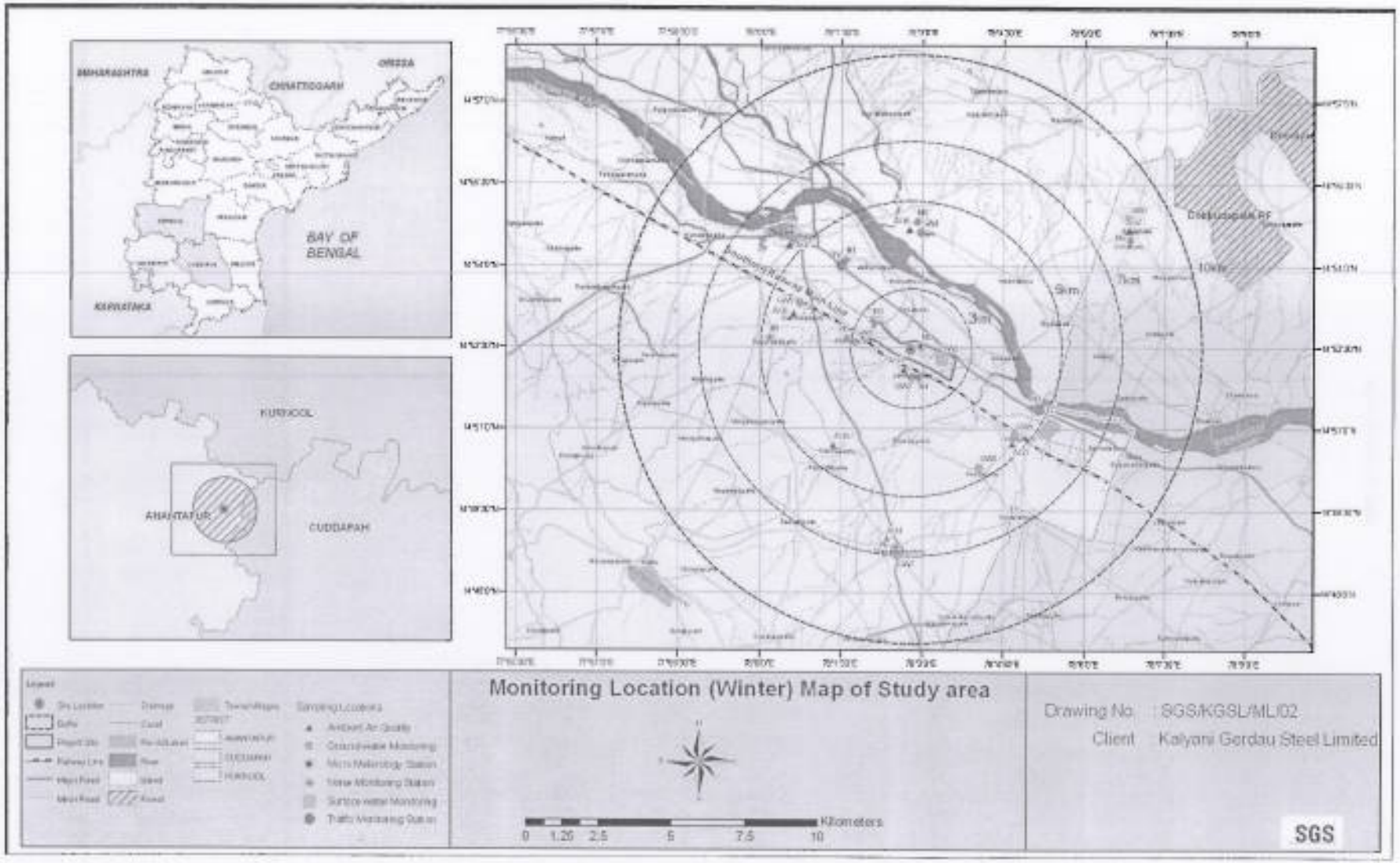

Figure 3.7 b : Monitoring Locations in Winter Season

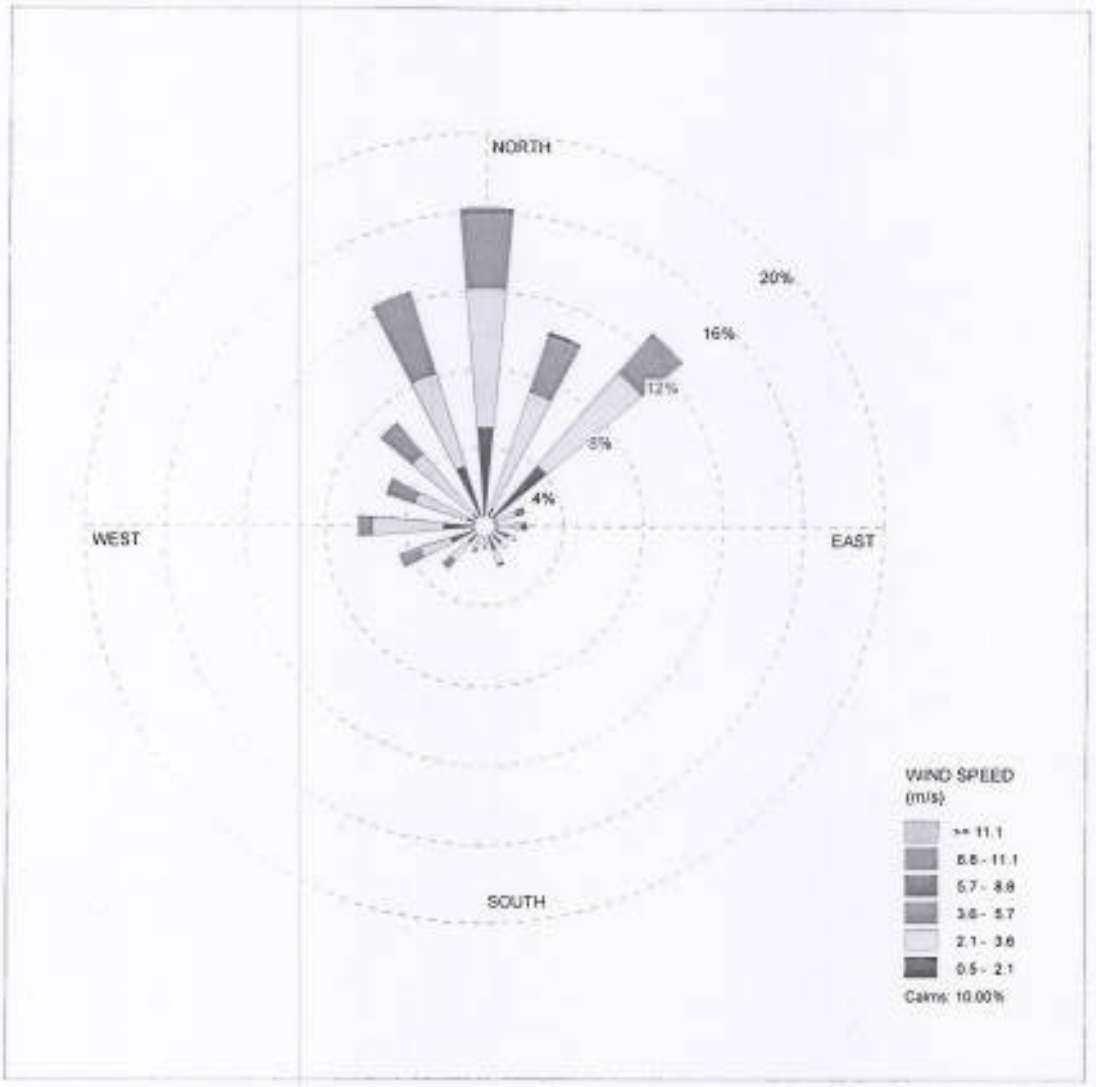

Figure 3.8 : Wind rose Diagram April 20th -May 19th 2008

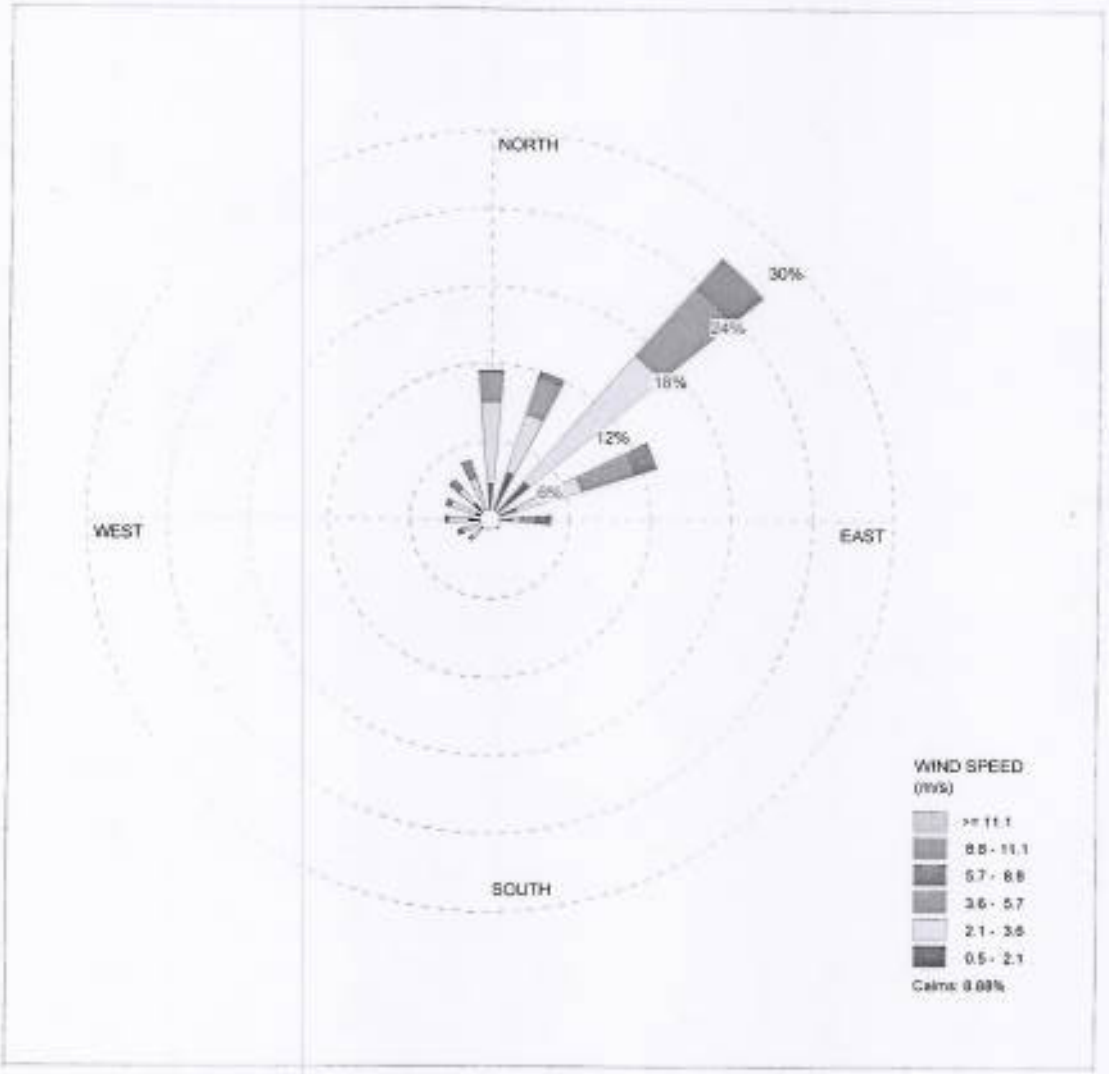

Figure 3.9 : Wind rose Diagram May 20th - June 19th 2008

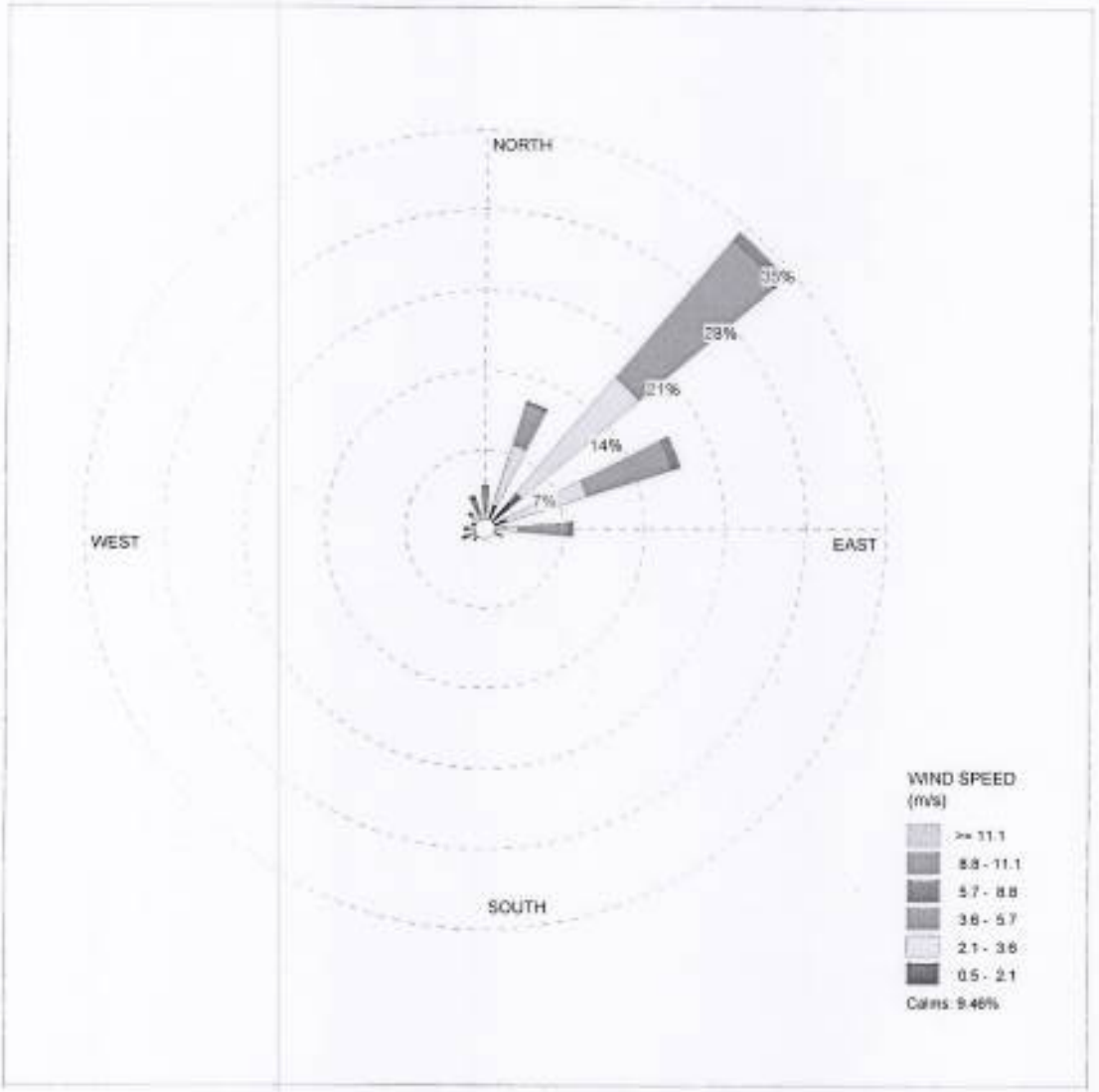

Figure 3.10 : Wind rose Diagram June 20th - July 19th 2008

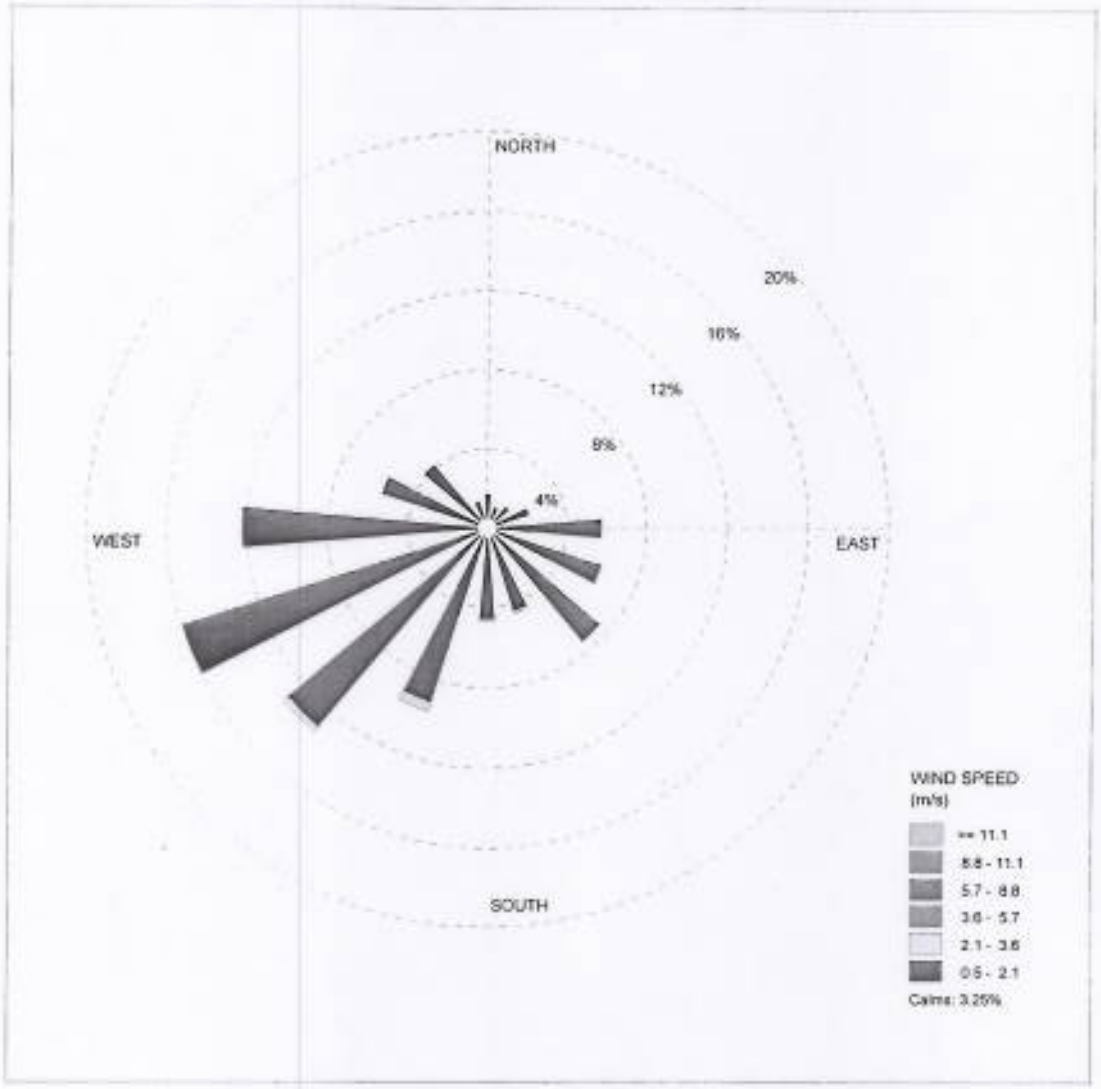

Figure 3.11: Windrose Diagram Feb 23rd to March 23rd 2009

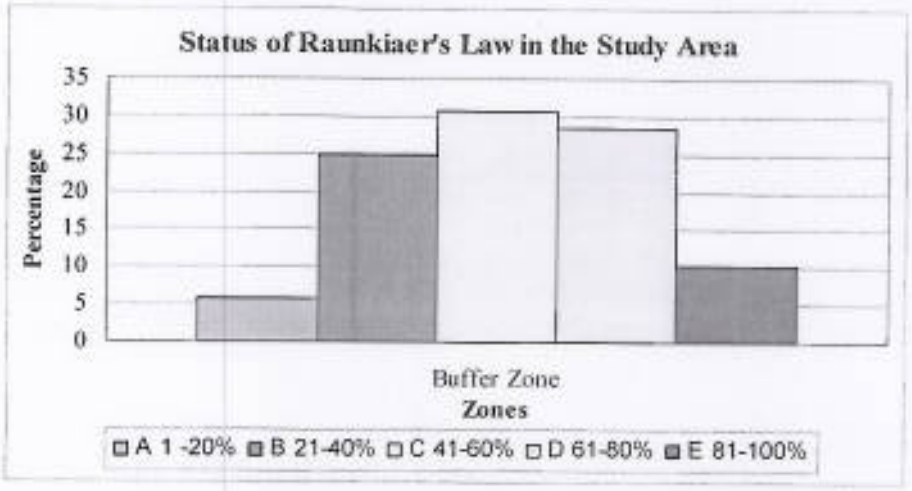

Figure 3.12: Ecological Status of Vegetation as per Raunkiaer's Law

Annexure 3.1
Page 1 of 1

Villages	Area (Hect.)	Forest Land	Irrigated Area	Un-irrigated Area	Cultivable Waste Land	Area not available for cultivation
Within 0-3 km						
Husenapuram	668	0.00	18.00	474.00	2.00	174.00
Challavaripalle	395	0.00	18.00	312.00	13.00	52.00
Jambulapadu	482	0.00	0.00	411.00	3.00	68.00
SubTotal (A)	**1545**	**0.0**	**36.00**	**1197.00**	**18.00**	**294.00**
Within 3-5 km						
Velamakur	1673	0.00	87.00	1150.00	122.00	314.00
Veerapuram	1450	0.00	43.00	906.00	198.00	303.00
Tadpatri	3048	0.00	251.00	2385.00	4.00	408.00
Gandlapadu	841	0.00	0.00	834.36	0.00	6.64
Alur	1681	0.00	133.00	1194.00	45.00	309.00
Sub Total (B)	8693	0.0	514	6469.36	369	1340.64
Within 5-7 km						
Vanganuru	650	0.00	9.00	543.00	27.00	71.00
Bodaipalle	528	0.00	168.00	305.00	4.00	51.00
Koduru	4042	1309.43	169.00	2116.16	389.00	58.00
Shanagalaguduru	4864	0.00	255.46	4469.78	0.00	138.76
Sajjaladinne	1833	0.00	56.00	1335.00	65.00	377.00
Sub Total (C)	**11917**	**1309.43**	**657.46**	**8768.94**	**485**	**695.76**
Within 7-10 km						
Kibile Sugumanchipalle	930	0.00	124.00	685.97	0.00	120.00
Bondaladinne	652	0.00	35.00	502.00	19.00	96.00
Sankepalli	580	0.00	30.17	521.34	0.00	28.00
Murugampalli	220	0.00	0.00	203.15	3.00	13.85
Sirigepalle	870	176.75	77.12	137.23	3.05	475.14
Uruchinthala	2171	1.00	0.00	801.00	58.00	1312.00
Talaricheruvu	2440	0.00	3.00	644.00	67.00	1726.00
Chukkalur	1121	0.00	150.00	658.00	150.00	163.00
Nandalapadu (Rural)	1141	0.00	199.00	821.00	15.00	106.00
Thimmapuram	363	0.00	6.00	286.00	27.00	44.00
Diguvapalle	833	0.00	399.00	414.00	7.00	13.00
Konavaripalli	767	0.00	0.00	736.00	0.00	31.00
Peddapolamada	2392	0.00	622.00	1505.00	38.00	227.00
Chinnapolamada	1989	0.00	510.00	1041.00	173.00	265.00
Kaverisamudram	1002	0.00	58.00	862.00	12.00	70.00
Kottalapalle	416	0.00	5.00	383.33	0.00	27.67
Venkatampalle	821	0.00	12.00	591.00	26.00	192.00
Sub Total (D)	**18708**	**177.75**	**2230.29**	**10792.02**	**598.05**	**4909.66**
Grand Total (A+B+C+D)	**40863**	**1487.18**	**3437.75**	**27227.32**	**1470.05**	**7240.06**

Source; Census 2001

Annexure 3.2

Percentage frequencies of ground based inversions with various top heights (00GMT) at Hyderabad

Range in Meters	January	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
0-100	0	0	0	0	0	0	0	0	0	0	0	0
101-200	0	0	0	0	0	0	0	0	0	0	0	0
201-300	0	0	0	0	0	0	0	0	0	0	0	0
301-400	0	0	0	0	0	0	0	0	0	0	0	0
401-500	0	0	0	0	0	0	0	0	0	1	0	0
501-600	9	4	1	1	0	0	0	0	0	1	4	2
601-700	0	1	1	1	0	0	0	0	2	0	1	0
701-800	0	4	0	0	3	0	0	0	2	0	0	1
801-900	5	1	5	1	0	0	0	0	1	1	0	3
901-1000	1	5	6	10	8	5	0	1	2	4	2	3
1001-1250	7	0	11	5	1	0	0	1	0	3	4	4
1251-1500	3	1	4	0	0	3	0	1	1	0	2	3
Above 1500	0	0	0	0	0	0	0	0	0	0	0	0

Source: Frequencies of Stable Layer in The Planetary Boundary Layer Over India , IMD

Annexure 3.2

Percentage frequencies of ground based inversions with various top heights (12GMT)at Hyderabad

Range in Meters	January	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
0-100	0	0	0	0	0	0	0	0	0	0	0	0
101-200	0	0	0	0	0	0	0	0	0	0	0	0
201-300	0	0	0	0	0	0	0	0	0	0	0	0
301-400	0	0	0	0	0	0	0	0	0	0	0	0
401-500	0	0	0	0	0	0	0	0	0	1	0	0
501-600	0	2	0	0	0	0	0	0	0	0	1	0
601-700	0	0	0	0	0	0	0	0	0	0	0	0
701-800	0	0	0	0	0	0	0	0	0	0	0	0
801-900	0	0	0	0	0	0	0	0	0	0	0	0
901-1000	0	0	0	0	1	0	0	0	1	0	0	0
1001-1250	0	0	0	0	0	0	0	0	0	0	0	0
1251-1500	0	0	0	0	0	0	0	0	0	0	0	0
Above 1500	0	0	0	0	0	0	0	0	0	0	0	0

Source: Frequencies of Stable Layer in The Planetary Boundary Layer Over India , IMD

Annexure 3.3
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SPM Concentration (µg/m^3) in Ambient Air of the Study Area

Date	A1	A2	A3	A4	A5	A6	WA 1	WA 2	WA 3
21.04.2008	103.2	106.5	136.7	104.2	166.4	92.4	266.4	231.6	188.9
22.04.2008	102.1	112.4	148.8	96.8	178.9	86.6	278.9	218.4	172.6
28.04.2008	122.8	118.6	124.8	112.4	154.2	104.6	279.6	248.3	172.4
29.04.2008	98.6	114.9	136.2	109.5	162.8	96.8	284.8	222.4	164.5
05.05.2008	118.4	124.5	138.6	124.3	144.6	112.5	286.8	257.5	184.2
06.05.2008	129.8	122.7	132.4	116.8	159.4	106.4	280.4	238.9	176.4
12.05.2008	128.3	132.2	132.2	132.2	139.4	118.2	281.6	348.9	192.3
13.05.2008	123.6	128.6	134.9	126.8	144.2	113.8	279.8	369.7	181.2
19.05.2008	116.5	116.5	128.6	124.4	142.8	122.8	256.5	321.5	178.2
20.05.2008	119.9	119.9	131.4	122.9	136.4	118.8	261.3	342.8	164.9
26.05.2008	129.3	121.8	134.5	131.8	148.3	116.4	269.5	343.6	184.2
27.05.2008	126.6	116.7	136.8	129.6	142.6	114.6	266.3	329.6	178.6
02.06.2008	118.8	112.6	122.8	122.8	134.6	112.6	244.4	286.4	168.3
03.06.2008	121.4	108.4	125.4	121.4	129.8	108.4	152.9	277.2	164.4
09.06.2008	112.4	108.2	116.8	133.2	141.2	108.3	232.5	274.3	152.8
10.06.2008	108.9	111.4	119.4	128.4	136.8	106.4	141.8	268.6	159.6
16.06.2008	98.8	101.2	112.8	119.8	132.2	96.8	224.6	269.3	138.4
17.06.2008	102.2	96.9	108.6	108.6	128.6	89.4	212.2	284.5	144.6
23.06.2008	86.9	112.4	104.6	112.8	124.2	82.5	208.8	248.6	129.9
24.06.2008	94.8	104.6	101.8	104.6	121.8	85.3	222.3	261.6	142.6
30.06.2008	92.8	119.6	109.8	115.8	132.4	96.6	216.6	259.4	131.4
01.07.2008	96.8	108.8	112.1	109.6	124.8	89.4	234.2	244.8	136.8
07.07.2008	104.2	124.2	116.8	109.6	139.6	89.6	238.9	266.3	124.4
08.07.2008	96.8	118.4	112.4	116.8	132.4	84.9	226.4	254.1	128.9
14.07.2008	112.2	116.8	124.6	118.6	144.3	102.2	249.3	274.2	158.6
15.07.2008	108.4	112.4	116.9	124.3	139.6	98.6	238.4	268.9	166.3
CPCB Norms	**200**	**200**	**200**	**200**	**200**	**200**	**500**	**500**	**500**

RSPM Concentration (µg/m^3) in Ambient Air of the Study Area

Date	A1	A2	A3	A4	A5	A6	WA 1	WA 2	WA 3
21.04.2008	23.3	21.3	24.6	21.8	36.8	19.4	57.1	49.7	39.4
22.04.2008	25.4	23.4	26.7	24.1	38.1	22.8	48.9	43.4	36.8
28.04.2008	26.8	19.6	28.3	24.4	32.8	23.8	62.5	47.6	41.8
29.04.2008	23.5	21.5	29.2	23.6	34.6	21.2	54.9	45.8	38.6
05.05.2008	25.8	25.7	30.8	26.7	29.6	26.4	64.5	48.5	44.7
06.05.2008	28.9	23.2	26.4	24.1	33.4	23.5	56.8	46.2	41.9
12.05.2008	28.8	27.1	28.9	29.5	24.3	27.3	72.4	84.2	52.4
13.05.2008	26.6	25.3	30.7	27.9	26.1	25.6	64.2	72.6	44.2
19.05.2008	26.5	26.5	29.8	26.6	27.2	26.4	66.3	78.6	48.4
20.05.2008	24.8	24.8	27.8	25.4	24.3	24.8	69.4	79.9	46.3
26.05.2008	29.8	24.3	31.2	27.8	28.9	24.4	68.8	81.4	44.3
27.05.2008	26.4	23.6	33.4	26.6	26.2	23.2	65.4	76.4	42.8
02.06.2008	31.8	25.9	28.4	26.8	31.8	22.3	61.2	72.6	42.4
03.06.2008	33.9	22.6	27.6	25.2	30.9	21.2	63.3	69.8	40.8
09.06.2008	28.4	24.2	26.6	30.8	34.8	19.8	56.4	66.5	41.8
10.06.2008	26.2	25.9	29.8	28.6	32.6	18.4	59.8	62.4	43.8
16.06.2008	22.8	22.2	24.3	26.8	32.2	17.9	45.2	62.5	38.5
17.06.2008	24.3	19.8	22.1	24.9	29.6	16.6	42.1	71.4	41.6
23.06.2008	20.2	23.2	21.9	24.4	29.8	18.6	41.6	54.4	35.5
24.06.2008	22.6	21.4	19.8	22.1	27.5	20.4	45.8	62.8	43.9
30.06.2008	23.8	25.4	23.4	25.8	32.4	22.1	43.6	56.4	34.9
01.07.2008	25.2	23.8	25.2	23.6	29.6	21.6	45.7	51.8	38.6
07.07.2008	26.6	27.2	25.2	26.9	34.6	21.2	47.6	62.4	35.9
08.07.2008	24.5	25.9	24.4	27.8	31.8	18.8	42.8	54.8	36.7
14.07.2008	29.8	25.2	28.8	29.6	36.8	23.8	56.2	65.8	42.8
15.07.2008	26.7	24.3	25.9	32.4	32.6	21.6	51.8	62.3	45.4
CPCB Norms	**100**	**100**	**100**	**100**	**100**	**100**	**150**	**150**	**150**

SO_2 Concentration (µg/m^3) in Ambient Air of the Study Area

SNo.	A1			A2			A3			A4			A5			A6			WA 1			WA 2			WA 3		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
21.04.2008	8.3	9.2	8.1	9.2	8.5	7.3	11.3	10.8	9.3	9.6	8.3	8.6	10.2	10.7	9.6	9.9	7.7	7.9	16.7	15.4	14.6	20.8	16.7	12.7	14.9	13.4	11.9
22.04.2008	9.1	8.4	8.9	8.8	8.7	8.1	12.8	11.1	10.7	9.1	7.8	8.2	11.8	9.5	9.3	8.8	8.1	7.3	18.9	16.2	13.1	18.6	15.3	10.9	13.1	12.9	11.6
28.04.2008	9.4	8.8	7.8	10.2	9.4	8.4	10.8	10.5	9.1	10.5	9.6	9.2	11.4	10.8	8.9	10.2	8.4	7.2	17.2	14.5	12.8	18.8	15.4	13.4	16.4	14.6	12.8
29.04.2008	8.8	8.2	8.4	9.4	9.2	7.8	11.6	11.4	10.4	11.6	8.4	8.6	11.2	9.4	8.4	9.6	7.8	7.4	16.6	14.8	13.4	20.4	14.9	11.2	14.8	12.4	10.4
05.05.2008	10.2	9.2	8.6	11.8	10.4	9.2	11.8	9.8	9.4	11.5	9.2	8.5	12.4	11.2	10.2	11.5	10.2	8.5	18.4	15.4	13.2	20.6	14.8	12.8	18.5	16.4	14.5
06.05.2008	11.4	9.8	8.9	10.6	9.8	8.6	11.2	10.6	10.2	10.9	8.8	8.2	13.9	12.4	11.3	10.4	8.6	8.2	17.2	13.6	12.8	22.9	16.5	13.4	16.4	14.5	13.7
12.05.2008	10.9	10.3	9.2	12.2	11.3	10.6	12.2	10.4	9.8	12.8	11.2	10.6	12.2	11.8	10.4	12.2	11.4	9.9	17.2	16.8	14.6	23.4	20.5	17.2	19.9	18.3	15.2
13.05.2008	12.3	10.9	8.6	11.4	10.2	8.8	11.5	10.3	8.5	11.6	10.8	9.9	13.5	12.5	11.8	11.4	10.2	9.3	16.9	15.3	13.9	24.2	21.3	18.6	18.6	17.6	14.9
19.05.2008	10.2	9.8	8.8	10.2	9.8	8.8	11.8	9.8	9.2	11.9	10.8	8.9	11.8	11.2	10.4	11.9	10.8	9.4	16.4	15.4	13.2	21.8	19.5	16.5	18.4	17.2	14.9
20.05.2008	11.4	10.2	8.4	11.4	10.2	8.4	11.2	9.2	8.8	10.8	9.8	9.2	12.4	11.4	9.8	10.8	9.8	9.2	17.2	16.2	13.5	22.4	20.2	17.9	17.9	15.9	14.3
26.05.2008	11.8	10.2	9.6	11.2	10.5	9.8	12.8	11.2	10.5	12.4	11.6	10.3	12.6	11.5	11.1	10.9	10.2	9.2	17.8	16.3	14.5	23.9	21.8	18.4	17.3	16.6	15.3
27.05.2008	11.2	9.8	8.8	10.5	9.6	8.8	13.2	11.6	10.3	11.6	10.2	10.1	11.6	10.9	10.2	11.4	10.8	8.9	18.4	17.4	15.9	21.6	20.4	17.2	16.8	14.9	14.2
02.06.2008	10.9	9.8	8.9	10.8	9.6	8.6	12.4	11.8	9.8	11.8	10.9	9.2	12.2	10.8	9.8	9.8	8.9	8.4	16.2	15.1	14.2	21.8	19.8	18.4	16.6	15.4	14.4
03.06.2008	10.2	9.5	9.1	9.8	9.2	8.2	11.9	11.2	9.5	11.2	9.8	8.8	11.9	10.5	9.5	9.2	8.5	8.1	17.4	16.2	15.2	20.6	19.5	17.4	16.2	14.2	13.6
09.06.2008	10.2	9.6	8.6	10.2	9.4	8.8	11.8	10.6	9.2	12.6	11.4	10.3	14.4	13.2	12.4	9.2	8.6	8.2	16.8	15.4	12.8	20.8	18.2	17.8	15.8	14.4	13.2
10.06.2008	11.4	10.2	9.3	11.6	10.2	9.2	12.6	10.8	8.8	11.8	10.6	9.6	15.8	13.5	11.9	8.8	8.2	7.8	15.4	15.2	13.4	19.8	18.6	16.9	16.4	15.2	14.2
16.06.2008	9.8	9.2	8.4	9.8	9.4	8.2	11.2	10.5	9.4	11.8	11.2	9.8	12.2	11.8	11.2	8.8	8.4	7.9	15.2	14.6	13.2	19.6	18.4	16.9	14.8	13.9	12.8
17.06.2008	10.2	9.6	8.9	9.6	8.8	8.3	10.8	9.8	9.1	10.9	10.2	9.2	11.8	10.9	10.2	8.4	7.8	7.6	14.8	14.3	12.8	21.2	20.2	18.4	15.3	14.2	13.4
23.06.2008	9.8	8.8	8.1	10.2	9.2	8.5	10.8	10.2	9.5	11.4	10.8	9.6	11.8	10.9	10.4	9.2	8.8	8.2	14.8	14.2	13.4	18.8	17.6	15.9	14.8	14.2	13.4
24.06.2008	10.6	9.4	8.5	9.2	8.4	8.2	10.2	9.3	8.8	10.5	9.8	8.9	10.9	10.2	9.6	9.8	9.2	8.4	15.9	15.2	14.3	21.2	19.8	17.8	15.9	14.8	13.2
30.06.2008	10.2	9.6	8.9	11.4	10.2	9.8	11.7	10.8	9.8	12.2	11.4	10.4	12.4	11.7	11.2	9.8	9.2	8.4	15.4	14.8	14.2	19.6	18.4	16.7	15.2	14.6	13.5
01.07.2008	11.2	10.8	9.5	10.8	9.8	8.6	12.1	11.6	10.2	11.2	10.4	9.8	11.4	10.8	9.8	9.4	8.8	8.2	16.2	15.4	14.6	18.2	17.6	16.8	15.8	14.9	13.5
07.07.2008	11.3	10.4	9.8	11.9	10.8	10.2	12.9	11.8	10.2	11.2	10.5	9.8	13.2	12.4	11.6	9.6	8.8	8.2	16.2	15.4	14.4	20.8	19.2	17.8	16.2	14.4	13.2
08.07.2008	10.6	10.2	9.4	10.8	10.4	9.8	11.8	11.2	10.4	12.6	11.2	10.3	12.4	11.6	10.2	9.2	8.4	8.1	15.6	15.2	14.1	19.2	18.2	16.9	15.4	14.3	13.4
14.07.2008	12.4	11.6	10.8	10.8	10.2	9.6	13.6	12.2	11.4	12.4	11.4	10.2	14.3	13.4	12.8	10.2	9.6	8.8	18.2	17.4	16.9	22.8	21.4	20.8	17.9	16.6	15.4
15.07.2008	11.8	11.2	10.4	10.2	9.6	9.2	12.4	11.6	10.8	12.9	11.6	10.5	12.2	11.9	11.2	9.6	9.2	8.4	17.5	16.2	15.8	21.6	20.8	20.1	18.6	17.5	16.9
CPCB Norms	80			80			80			80			80			80			120			120			120		

CO Concentration (µg/m³) in Ambient Air of the Study Area

SNo.	A1			A2			A3			A4			A5			A6			WA 1			WA 2			WA 3		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
21.04.2008	180	190	170	170	160	170	250	270	220	160	170	150	210	200	220	170	150	160	310	330	300	380	360	330	360	350	330
22.04.2008	170	180	160	160	150	140	210	200	230	180	160	140	250	220	270	150	140	150	340	350	320	360	340	310	330	340	320
28.04.2008	175	200	185	175	165	115	190	240	235	130	155	125	260	275	300	110	165	130	645	750	675	310	550	450	410	500	525
29.04.2008	150	170	130	BDL	135	BDL	225	210	195	BDL	130	BDL	190	230	250	BDL	155	130	550	600	350	480	960	675	330	435	380
05.05.2008	190	210	155	160	190	135	255	280	230	150	180	130	210	320	240	160	205	165	475	675	700	375	910	560	390	575	410
06.05.2008	160	150	115	165	195	140	270	300	255	180	210	110	170	280	250	135	175	140	375	480	610	600	880	490	425	600	475
12.05.2008	170	140	BDL	185	205	155	180	225	170	175	195	155	210	240	225	160	205	155	540	510	490	550	1000	390	400	390	360
13.05.2008	190	220	150	BDL	160	130	240	230	155	135	165	130	165	260	240	BDL	250	190	610	400	350	425	650	435	365	450	415
19.05.2008	200	180	135	170	180	BDL	255	295	145	BDL	145	130	270	315	190	155	210	175	720	680	490	330	425	400	410	610	400
20.05.2008	140	165	105	170	155	115	275	310	210	155	180	BDL	160	350	205	170	165	110	380	745	600	365	675	450	395	525	425
26.05.2008	170	195	125	BDL	130	BDL	190	210	130	160	200	145	200	260	310	125	210	160	480	805	445	400	700	475	310	365	290
27.05.2008	165	160	145	135	190	115	155	195	110	145	185	120	165	210	220	115	155	130	350	560	385	370	390	310	360	500	395
02.06.2008	155	170	130	155	200	BDL	200	235	155	BDL	160	130	185	225	200	150	200	175	575	640	500	410	610	350	455	625	480
03.06.2008	160	205	140	BDL	145	BDL	160	205	165	170	195	145	150	265	300	165	185	120	625	745	475	365	550	300	510	545	455
09.06.2008	170	185	BDL	115	135	125	145	185	120	120	170	110	230	285	210	115	190	150	525	890	600	510	620	400	375	425	335
10.06.2008	190	180	155	110	175	135	174	205	170	160	205	150	175	305	245	140	210	150	410	375	520	380	470	375	345	535	375
16.06.2008	140	160	BDL	125	165	BDL	145	250	180	140	170	BDL	180	290	275	BDL	230	200	275	650	490	490	810	500	410	590	455
17.06.2008	BDL	130	115	145	190	130	156	190	125	110	140	BDL	205	265	210	130	160	170	380	630	395	350	685	480	365	395	340
23.06.2008	125	165	140	155	180	120	180	245	160	BDL	130	BDL	200	300	260	170	230	190	330	390	425	415	390	335	310	335	300
24.06.2008	160	180	120	120	150	BDL	165	185	BDL	145	180	125	175	280	170	110	200	BDL	450	700	600	600	475	400	375	465	345
30.06.2008	150	135	110	BDL	135	110	170	210	175	125	185	110	165	300	195	145	180	165	410	590	670	425	510	395	390	545	415
01.07.2008	BDL	115	BDL	105	155	130	135	170	110	120	200	160	170	340	210	160	210	140	370	610	550	510	700	485	465	630	530
07.07.2008	200	225	160	130	160	BDL	185	275	190	BDL	160	170	155	290	205	130	180	200	400	365	315	310	350	290	410	475	380
08.07.2008	155	180	130	145	185	135	200	280	205	115	165	130	210	265	190	BDL	150	BDL	510	445	400	345	450	390	330	395	365
14.07.2008	145	160	115	130	195	BDL	150	175	145	155	185	BDL	255	310	245	145	175	155	335	360	375	400	500	495	300	350	320
15.07.2008	170	195	140	120	155	150	190	245	200	135	170	120	285	370	290	160	200	190	365	390	290	390	470	355	365	505	385
CPCB Norms	2000			2000			2000			2000			2000			2000			5000			5000			5000		

BDL: Below Detection Limit (DL: 100 µg/m³)

NOx Concentration (µg/m³) in Ambient Air of the Study Area

SNo.	A1			A2			A3			A4			A5			A6			WA 1			WA 2			WA 3		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
21.04.2008	12.7	12.9	10.9	12.4	11.6	9.7	15.9	14.6	12.6	13.6	12.9	9.5	14.9	13.3	12.2	11.1	10.9	9.4	24.6	22.9	21.1	31.7	28.8	22.7	22.9	20.7	17.4
22.04.2008	12.9	11.7	11.6	13.8	11.8	9.9	14.1	13.2	13.3	12.9	13.2	10.6	15.8	14.9	13.7	12.9	11.7	10.1	25.8	23.7	18.6	30.9	27.9	21.4	21.8	19.8	16.9
28.04.2008	13.4	12.6	11.8	14.5	13.6	12.8	14.4	13.8	13.4	14.2	13.4	12.4	14.8	14.2	13.6	13.4	12.2	10.8	22.9	20.8	18.6	26.2	24.8	23.4	24.8	22.8	20.4
29.04.2008	12.8	11.9	11.4	13.8	12.4	12.2	15.6	14.6	12.8	13.4	13.1	12.8	15.4	13.8	12.2	12.6	11.3	11.4	21.4	19.8	20.2	27.4	23.9	22.3	23.6	21.4	21.2
05.05.2008	14.8	13.5	12.8	15.8	14.6	13.5	15.2	13.6	13.8	15.8	14.6	13.2	15.8	15.2	13.9	14.8	13.6	11.6	23.2	21.6	19.5	27.5	23.4	23.1	25.4	23.9	21.8
06.05.2008	15.6	14.6	13.4	14.7	13.5	12.7	14.8	13.2	12.4	14.7	14.2	13.5	17.2	16.5	14.8	13.6	12.8	10.8	22.4	20.5	18.6	29.6	26.3	24.8	24	22.5	22.4
12.05.2008	15.2	13.6	12.6	16.3	15.2	14.2	16.2	14.2	12.9	16.6	15.2	13.8	16.2	14.3	13.2	15.2	14.2	12.6	22.5	20.2	18.3	28.8	25.3	24.4	28.6	24.4	22.9
13.05.2008	16.4	15.3	13.2	15.2	14.2	13.8	15.5	13.8	12.5	15.2	13.9	13.2	17.8	15.6	14.8	14.6	13.8	11.3	21.3	20.8	17.4	29.3	26.9	23.9	25.3	23.8	21.6
19.05.2008	14.2	12.8	12.4	14.2	12.8	12.4	17.4	15.4	13.6	15.9	14.8	12.9	15.2	13.8	12.4	14.9	14.2	13.4	21.3	18.6	18.6	27.4	24.1	22.5	25.2	23.3	21.8
20.05.2008	14.9	13.6	13.1	14.9	13.6	13.1	16.3	13.8	12.9	14.8	13.6	11.6	16.4	12.9	12.2	14.5	13.1	12.8	22.6	20.1	19.4	26.5	24.8	21.6	24.3	22.6	20.9
26.05.2008	13.9	13.4	12.8	14.8	13.4	12.5	18.4	16.4	15.4	14.3	13.2	12.6	16.2	15.2	14.3	13.9	13.2	12.8	22.6	20.6	19.5	29.8	27.6	26.9	24.3	22.2	20.2
27.05.2008	13.2	12.8	12.6	14.2	12.8	12.1	19.6	15.2	14.3	13.8	13.1	12.2	15.9	14.2	13.5	14.2	12.4	11.1	23.1	21.8	20.2	28.4	26.5	24.8	22.6	21.8	20.1
02.06.2008	14.2	13.5	12.2	14.2	12.9	11.8	17.5	15.9	14.8	15.2	14.4	13.6	17.2	16.6	15.2	14.2	12.8	11.6	21.6	19.6	18.4	26.5	25.4	23.8	22.8	21.8	18.9
03.06.2008	13.6	12.2	11.6	13.8	12.4	11.2	16.2	16.4	15.3	14.9	13.6	13.2	16.4	15.4	14.5	13.2	12.1	10.4	22.4	20.4	19.2	25.9	24.8	22.6	21.1	19.8	18.2
09.06.2008	15.6	13.6	12.8	13.8	12.5	10.9	16.8	14.8	13.9	16.4	15.2	13.4	19.8	17.5	15.3	13.6	12.9	11.5	22.2	21.4	18.6	27.4	26.2	24.4	21.6	20.4	17.8
10.06.2008	15.9	13.2	12.1	14.9	13.2	12.6	17.8	15.2	14.3	15.6	14.4	12.9	20.4	18.4	16.4	12.9	12.4	10.9	21.6	20.1	18.2	26.8	25.4	23.9	22.4	21.2	17.4
16.06.2008	14.8	13.2	12.2	14.5	13.2	11.6	17.2	15.8	14.4	17.2	14.8	13.9	18.4	16.8	15.1	12.8	12.2	11.2	20.9	18.9	17.4	26.6	25.2	23.8	20.6	18.9	17.4
17.06.2008	15.6	13.5	11.9	13.4	12.8	11.8	16.5	14.9	13.5	16.5	13.8	12.2	17.5	16.2	14.5	12.6	11.8	10.6	19.6	18.3	17.1	27.9	26.4	24.4	21.2	19.2	17.9
23.06.2008	15.4	14.2	13.8	15.6	14.2	12.8	16.8	15.2	14.6	18.4	16.9	15.4	19.8	17.6	16.9	13.2	12.6	11.6	19.8	18.5	17.1	25.8	24.6	23.8	21.2	19.6	17.2
24.06.2008	16.2	14.4	13.9	14.4	13.5	12.9	16.5	14.3	13.5	17.3	15.6	13.8	18.6	18.4	15.7	13.6	12.8	11.9	20.9	19.6	18.8	26.6	25.9	24.2	22.6	20.8	18.8
30.06.2008	16.2	15.2	14.3	16.2	15.3	13.8	16.2	15.4	14.8	19.6	17.8	16.4	18.4	17.2	16.2	14.1	13.4	12.4	20.1	19.4	18.2	24.2	23.8	22.9	20.8	18.9	18.2
01.07.2008	17.1	15.9	14.8	15.2	14.6	13.6	17.1	15.8	14.4	18.2	17.4	16.4	17.3	16.8	15.9	13.9	13.2	12.1	21.1	19.2	18.4	23.8	22.9	22.1	21.1	20.4	18.8
07.07.2008	15.8	14.9	14.4	17.2	16.8	15.3	17.4	16.5	14.9	18.9	17.2	15.6	19.6	18.4	17.8	13.2	12.9	12.2	21.1	19.2	17.6	25.2	24.1	23.4	21.2	19.4	18.2
08.07.2008	16.3	15.2	14.3	16.2	15.4	13.9	16.8	15.4	14.9	19.9	18.2	17.2	18.2	17.3	16.5	12.9	12.2	11.8	22.2	19.3	18.8	24.4	23.5	22.3	20.9	20.2	19.5
14.07.2008	16.8	15.4	14.9	16.8	16.2	15.1	18.2	17.3	15.9	17.8	16.5	15.3	18.6	18.2	17.6	14.5	13.4	12.6	23.2	22.9	22.1	26.6	25.2	24.4	22.8	21.2	20.8
15.07.2008	15.9	15.4	14.6	16.2	15.3	14.8	17.6	16.8	15.6	18.6	17.4	16.8	17.3	16.8	16.2	13.2	11.9	11.4	21.9	20.6	20.2	25.2	24.6	23.8	23.1	22.4	21.1
CPCB Norms	80			80			80			80			80			80			120			120			120		

Annexure 3.4
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SPM Concentration (µg/m^3) in Ambient Air of the Study Area

Date	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
23.02.2009	118.6	98.6	123.2	88.6	116.3	102.4	132.8	102.8
24.02.2009	122.9	106.4	121.4	94.3	102.4	92.6	154.6	116.2
02.03.2009	128.6	112.8	130.9	96.8	99.8	78.9	142.8	124.8
03.03.2009	132.4	94.9	127.3	92.4	122.4	112.4	156.4	108.6
09.03.2009	116.8	120.6	123.1	76.8	130.6	98.8	138.8	99.8
10.03.2009	121.7	116.4	125.6	98.6	109.4	101.9	142.9	120.7
16.03.2009	134.6	104.8	120.5	102.8	118.5	99.8	154.6	132.6
17.03.2009	130.1	118.6	115.4	92.9	120.8	106.5	160.2	128.9
CPCB Norms	200	200	200	200	200	200	200	200

RSPM Concentration (µg/m^3) in Ambient Air of the Study Area

Date	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8
23.02.2009	29.8	25.6	28.5	22.6	32.6	26.9	36.4	26.6
24.02.2009	35.4	28.4	26.4	24.9	30.2	24.6	42.2	30.6
02.03.2009	38.6	32.2	29.9	25.8	28.4	22.7	41.1	33.4
03.03.2009	32.8	24.8	28.1	24.3	33.8	29.2	44.6	32.9
09.03.2009	28.6	33.7	29.2	21.6	34.2	25.1	38.2	31.6
10.03.2009	32.4	32.8	27.2	25.9	31.3	26.4	42.2	34.8
16.03.2009	39.5	27.8	27.1	28.4	32.9	25.9	43.9	35.6
17.03.2009	38.6	33.2	26.4	24.2	33.2	27.2	44.9	33.6
CPCB Norms	100	100	100	100	100	100	100	100

SO_2 Concentration ((µg/m^3) in Ambient Air of the Study Area

Date	AQ1			AQ2			AQ3			AQ4			AQ5			AQ6			AQ7			AQ8		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
23.02.2009	12.6	12.4	11.8	10.3	09.4	08.9	11.1	09.7	08.5	09.9	09.2	08.8	11.9	11.2	10.2	10.6	09.1	08.6	14.2	13.8	12.9	10.6	09.8	08.8
24.02.2009	13.1	13.8	12.4	10.9	09.8	09.1	12.9	12.6	11.4	10.2	09.8	08.9	11.2	10.8	09.8	10.1	08.9	08.4	14.6	13.9	13.1	10.9	10.3	09.2
02.03.2009	13.4	13.1	12.6	11.3	10.2	09.9	14.5	13.9	12.4	10.6	10.1	09.6	10.6	09.8	09.1	09.8	08.7	08.2	13.9	12.6	11.8	11.8	10.4	09.6
03.03.2009	13.8	13.2	12.8	10.1	09.9	09.3	13.9	13.2	11.6	10.1	09.6	08.9	12.7	11.6	10.2	11.6	09.4	08.9	15.3	14.8	13.7	10.7	09.9	08.2
09.03.2009	12.6	12.2	11.7	11.6	10.3	09.8	14.2	13.3	12.6	09.2	08.8	08.3	13.2	12.1	10.8	10.9	09.1	08.6	14.8	13.9	12.5	10.2	09.2	08.1
10.03.2009	13.1	12.8	11.6	11.4	10.2	09.1	13.9	12.6	12.2	10.6	09.9	09.4	12.6	11.8	09.9	11.2	10.4	08.7	14.3	13.6	12.9	11.6	10.4	09.3
16.03.2009	13.9	13.4	12.5	10.8	09.4	08.8	14.5	13.3	12.6	10.9	10.2	09.9	12.2	11.3	09.6	10.9	09.6	08.3	14.9	14.1	13.4	12.2	11.3	10.1
17.03.2009	13.6	13.2	12.6	11.9	10.2	08.9	12.9	12.4	11.6	10.3	09.7	08.7	12.9	11.7	09.8	11.6	10.7	09.2	15.6	14.7	13.8	11.9	10.6	09.7
CPCB Norms	80			80			80			80			80			80			80			80		

NOx Concentration ((µg/m^3) in Ambient Air of the Study Area

Date	AQ1			AQ2			AQ3			AQ4			AQ 5			AQ6			AQ7			AQ8		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
23.02.2009	14.8	14.1	13.4	13.6	12.5	11.8	15.9	15.1	14.6	12.6	12.1	11.6	14.8	13.6	12.4	12.4	12.1	10.6	17.9	16.3	14.8	13.9	12.8	11.9
24.02.2009	15.9	14.8	13.7	13.9	12.8	12.1	14.6	13.8	12.9	13.8	12.6	11.9	14.4	13.1	12.2	12.1	11.9	11.6	18.2	17.1	15.2	14.2	13.1	12.3
02.03.2009	16.1	15.6	14.2	14.6	13.4	13.8	16.7	15.6	13.8	13.9	12.8	12.1	13.9	12.8	11.9	11.8	11.3	10.2	17.6	16.9	14.5	14.8	13.7	12.5
03.03.2009	16.9	15.7	14.6	13.5	12.2	11.4	14.9	13.8	12.7	13.4	12.3	10.9	14.9	13.6	12.8	12.6	11.8	10.9	18.9	17.8	15.5	14.6	13.5	12.9
09.03.2009	14.7	13.4	12.5	14.8	13.4	12.7	16.8	15.2	14.2	12.6	11.4	10.1	15.3	13.9	12.8	12.2	11.7	10.4	18.5	17.2	14.9	13.8	13.7	12.6
10.03.2009	15.6	14.8	13.8	14.7	13.1	12.8	15.2	14.3	13.7	14.2	12.9	11.2	14.9	13.2	11.9	13.5	12.3	11.2	18.2	16.8	14.2	14.5	13.2	12.0
16.03.2009	17.1	16.3	14.9	13.2	12.8	11.6	16.9	14.9	13.2	14.5	13.1	12.6	14.1	12.8	12.2	13.8	12.6	11.7	18.7	17.9	15.1	14.9	13.6	12.9
17.03.2009	14.8	14.1	13.4	14.4	12.9	11.9	15.6	14.3	13.4	12.9	12.8	11.2	14.8	13.2	11.6	13.9	12.8	10.9	19.2	18.8	16.6	14.6	13.2	12.4
CPCB Norms	80			80			80			80			80			80			80			80		

CO Concentration ((µg/m^3) in Ambient Air of the Study Area

Date	AQ1			AQ2			AQ3			AQ4			AQ`5			AQ6			AQ7			AQ8		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
23.02.2009	180	160	150	160	150	140	190	180	140	210	180	160	220	160	130	210	180	160	320	280	220	230	180	160
24.02.2009	190	170	150	170	140	130	200	190	130	220	170	150	230	180	150	180	150	120	340	290	250	220	160	140
02.03.2009	210	160	160	180	160	120	180	140	120	230	180	140	180	150	140	160	140	110	350	310	280	240	180	150
03.03.2009	230	190	160	190	170	140	170	150	130	180	140	110	190	160	120	170	130	110	330	270	240	180	160	120
09.03.2009	170	150	130	180	150	120	160	140	110	190	160	120	160	130	110	180	140	120	320	260	210	210	140	110
10.03.2009	190	180	170	160	140	120	190	170	140	180	150	100	180	140	120	190	150	130	340	280	240	230	160	140
16.03.2009	220	210	190	170	150	130	180	160	120	170	160	110	170	150	110	210	160	110	310	260	210	240	170	150
17.03.2009	230	200	180	180	160	140	210	180	140	210	190	120	200	180	120	200	180	150	360	290	260	250	180	130
CPCB Norms	2000			2000			2000			2000			2000			2000			2000			2000		

Demography profile of Study Area

Annexure 3.5
Page 1 of 1

Name of Village	Rural/ Urban	Number of Households	Total population Persons	Average Household Size	Total population		Sex Ratio	Schedule Casts			Schedule Tribes		
					Males	Females		Person	Male	Female	Person	Male	Female
Within 0-3 km													
Husenapuram	Rural	116	527	4.5	272	255	938	201	110	91	0	0	0
Challavaripalle	Rural	92	346	3.8	177	169	955	5	3	2	0	0	0
Jambulapadu	Rural	75	296	3.9	157	139	885	12	6	6	0	0	0
Sub Total (A)		**283**	**1169**	**4.1**	**606**	**563**	**926**	**218**	**119**	**99**	**0**	**0**	**0**
Within 3-5 km													
Velamakur	Rural	226	998	4.4	514	484	942	150	80	70	0	0	0
Veerapuram	Rural	199	868	4.4	450	418	929	230	122	108	0	0	0
Tadpatri	Rural	11720	50968	4.3	26103	24865	956	8424	4306	4118	663	346	317
Tadpatri	Urban	18759	86843	4.6	44047	42796	972	9758	4910	4848	997	504	493
Gandlapadu	Rural	136	617	4.5	312	305	978	126	64	62	0	0	0
Alur	Rural	274	1160	4.2	599	561	937	150	78	72	0	0	0
Sub Total (B)		**31314**	**141454**	**4.4**	**72025**	**69429**	**952**	**18838**	**9560**	**9278**	**1660**	**850**	**810**
Within 5-7 km													
Vanganuru	Rural	188	812	4.3	412	400	971	124	57	67	0	0	0
Bodaipalle	Rural	256	1124	4.4	569	555	975	184	95	89	0	0	0
Koduru	Rural	559	2562	4.6	1312	1250	953	457	244	213	0	0	0
Shanagalaguduru	Rural	1038	4718	4.5	2423	2295	947	721	367	354	0	0	0
Sajjaladinne	Rural	1159	4396	3.8	2234	2162	968	757	383	374	61	34	27
Sub Total (C)		**3200**	**13612**	**4.3**	**6950**	**6662**	**963**	**2243**	**1146**	**1097**	**61**	**34**	**27**
Within 7-10 km													
Kibile Sugumanchipalle	Rural	244	1062	4.4	546	516	945	306	152	154	0	0	0
Bondaladinne	Rural	224	1063	4.7	521	542	1040	238	117	121	0	0	0
Sankepalle	Rural	185	901	4.9	439	462	1052	0	0	0	23	9	14
Singepalle	Rural	179	784	4.4	407	377	926	32	17	15	198	106	92
Uruchinthala	Rural	219	1023	4.7	502	521	1038	164	81	83	22	8	14
Talaricheruvu	Rural	418	1664	4.0	955	709	742	64	39	25	34	17	17
Murugampalli	Rural	42	200	4.8	103	97	942	0	0	0	0	0	0
Chukkalur	Rural	651	2870	4.4	1453	1417	975	1160	598	562	42	26	16
Nandalapadu	Rural	235	1054	4.5	533	521	977	272	143	129	3	1	2
Timmapuram	Rural	39	146	3.7	71	75	946	0	0	0	168	104	64
Diguvapalle	Rural	381	1897	5.0	945	952	1007	245	115	130	0	0	0
Konavaripalli	Rural	89	442	5.0	227	215	947	1160	598	562	42	26	16
Peddapolamada	Rural	1252	5455	4.4	2806	2649	944	31	21	10	4504	2752	1752
Chinnapolamada	Rural	928	4028	4.3	2029	1999	986	9	6	3	2878	1741	1137
Kaverisamudram	Rural	227	1302	5.7	690	612	887	57	36	21	1003	607	396
Kotallapalle	Rural	380	1455	3.8	720	735	1021	302	151	151	0	0	0
Venkatampalle	Rural	200	865	4.3	445	420	944	18	12	6	411	236	175
Sub Total (D)		**5893**	**26211**	**4.5**	**13392**	**12819**	**960**	**4058**	**2086**	**1972**	**9328**	**5633**	**3695**
Grand Total (A+B+C+D)		**40690**	**182446**	**4.3**	**92973**	**89473**	**950**	**25357**	**12911**	**12446**	**11049**	**6517**	**4532**

Source; Census 2001

Literacy level of the Study Area

Name of Village	Rural/ Urban	Literate			Illiterate			Literacy Rate
		Population	Male	Female	Population	Male	Female	
Within 0-3 km								
Husenapuram	Rural	210	141	69	317	131	186	45.3
Challavaripalle	Rural	241	148	93	105	29	76	75.1
Jambulapadu	Rural	193	131	62	103	26	77	73.4
Sub Total (A)		**644**	**420**	**224**	**525**	**186**	**339**	**64.6**
Within 3-5 km								
Velamakur	Rural	384	270	114	614	244	370	42.9
Veerapuram	Rural	496	311	185	372	139	233	65.3
Tadpatri	Rural	23286	15127	8159	27682	10976	16706	52.8
Tadpatri	Urban	48049	29215	18834	38794	14832	23962	64.1
Gandlapadu	Rural	366	223	143	251	89	162	67.0
Alur	Rural	509	340	169	651	259	392	49.5
Sub Total (B)		**73090**	**45486**	**27604**	**68364**	**26539**	**41825**	**56.9**
Within 5-7 km								
Vanganur	Rural	442	286	156	370	126	244	62.2
Bodaipalle	Rural	822	457	365	302	112	190	82.5
Koduru	Rural	1210	768	442	1352	544	808	54.0
Shanagalaguduru	Rural	2749	1737	1012	1969	686	1283	66.0
Sajjaladinne	Rural	1426	968	458	2970	1266	1704	37.9
Sub Total (C)		**6649**	**4216**	**2433**	**6963**	**2734**	**4229**	**60.52**
Within 7-10 km								
Kibile Sugumanchipalle	Rural	605	366	239	457	180	277	65.5
Bondaladinne	Rural	517	318	199	546	203	343	56.5
Sankepalli	Rural	483	291	192	418	148	270	64.2
Sirigepalle	Rural	341	217	124	443	190	253	50.1
Uruchinthala	Rural	332	226	106	691	276	415	37.9
Talaricheruvu	Rural	859	592	267	805	363	442	63.1
Murugampalli	Rural	65	49	16	135	54	81	37.1
Chukkalur	Rural	1353	884	469	1517	569	948	53.0
Nandalapadu	Rural	493	308	185	561	225	336	53.9
Thimmapuram	Rural	104	64	40	42	7	35	28.6
Diguvapalle	Rural	996	625	371	901	320	581	61.5
Konavaripalli	Rural	293	179	114	149	48	101	75.3
Peddapolamada	Rural	2752	1752	1000	2703	1054	1649	19.4
Chinnapolamada	Rural	1741	1137	604	2287	892	1395	16.0
Kaverisamudram	Rural	607	396	211	695	294	401	17.4
Kotallapalle	Rural	749	484	265	706	236	470	59.7
Venkatampalle	Rural	236	175	61	629	270	359	7.5
Sub Total (D)		**12526**	**8063**	**4463**	**13685**	**5329**	**8356**	**45.1**
Grand Total (A+B+C+D)		**92909**	**58185**	**34724**	**89537**	**34788**	**54749**	**56.78**

Source; Census 2001

Annexure 3.7
Page 1 of 1

Distribution of Workers & Non Workers

Name of Village	Rural/ Urban	Total Worker			Non Workers			Main workers			Marginal Workers		
		Population	Male	Female	Population	Male	Female	Population	Male	Female	Population	Male	Female
Within 0-3 km													
Husenapuram	Rural	328	169	159	199	103	96	294	151	143	34	18	16
Challavaripalle	Rural	149	106	43	197	71	126	100	93	7	49	13	36
Jambulapadu	Rural	124	97	27	172	60	112	68	67	1	56	30	26
Sub Total (A)		**601**	**372**	**229**	**568**	**234**	**334**	**462**	**311**	**151**	**139**	**61**	**78**
Within 3-5 km													
Velamakur	Rural	524	353	171	474	161	313	510	351	159	14	2	12
Veerapuram	Rural	472	276	196	396	174	222	391	269	122	81	7	74
Tadpatri	Rural	27016	16282	10734	23952	9821	14131	23752	15483	8269	3264	799	2465
Tadpatri	Urban	33023	24711	8312	53820	19336	34484	30020	23854	6166	3003	857	2146
Gandlapadu	Rural	377	207	170	240	105	135	325	206	119	52	1	51
Aluru	Rural	612	378	234	548	221	327	584	376	208	28	2	26
Sub Total (B)		**62024**	**42207**	**19817**	**79430**	**29818**	**49612**	**55582**	**40539**	**15043**	**6442**	**1668**	**4774**
Within 5-7 km													
Vanganur	Rural	460	247	213	352	165	187	360	236	124	100	11	89
Bodaipalle	Rural	556	326	230	568	243	325	509	318	191	47	8	39
Koduru	Rural	1269	766	503	1293	546	747	1135	741	394	134	25	109
Shanagalaguduru	Rural	2815	1491	1324	1903	932	971	2391	1419	972	424	72	352
Sajjaladinne	Rural	2558	1471	1087	1838	763	1075	2206	1430	776	352	41	311
Sub Total (C)		**7658**	**4301**	**3357**	**5954**	**2649**	**3305**	**6601**	**4144**	**2457**	**1057**	**157**	**900**
Within 7-10 km													
Kibile Sugumanchipalle	Rural	565	342	223	497	204	293	565	342	223	0	0	0
Bondaladinne	Rural	587	341	246	476	180	296	460	325	135	127	16	111
Sankepalli	Rural	455	279	176	446	160	286	442	278	164	13	1	12
Sirigepalle	Rural	470	259	211	314	148	166	469	259	210	1	0	1
Uruchinthala	Rural	590	330	260	433	172	261	495	317	178	95	13	82
Talaricheruvu	Rural	879	644	235	785	311	474	708	591	117	171	53	118
Murugampalli	Rural	98	69	29	102	34	68	98	69	29	0	0	0
Chukkalur	Rural	1671	934	737	1199	519	680	1388	873	515	283	61	222
Nandalapadu	Rural	566	325	241	488	208	280	523	312	211	43	13	30
Timmapuram	Rural	82	43	39	64	28	36	58	41	17	24	2	22
Diguvapalle	Rural	1058	598	460	839	347	492	1052	596	456	6	2	4
Konavaripalli	Rural	111	259	148	111	79	104	259	148	111	0	0	0
Peddapolamada	Rural	1311	2892	1702	1190	1097	1338	2892	1702	1190	128	7	121
Chinnapolamada	Rural	870	1947	1197	750	796	1129	1947	1197	750	156	36	120
Kaverisamudram	Rural	277	522	395	127	259	335	522	395	127	186	36	150
Kottalapalle	Rural	850	456	394	605	264	341	430	368	62	420	88	332
Venkatampalle	Rural	230	502	274	228	171	190	502	274	228	2	0	2
Sub Total (D)		**17709**	**10742**	**6967**	**11746**	**4977**	**6769**	**12810**	**8087**	**4723**	**1655**	**328**	**1327**
Grand Total (A+B+C+D)		**87992**	**57622**	**30370**	**97698**	**37678**	**60020**	**75455**	**53081**	**22374**	**9293**	**2214**	**7079**

Source; Census 2001

Annexure 3.8
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Occupational Distribution of Main Workers

Name of Village	Rural/ Urban	Main workers as Cultivators			Main workers as Agricultural Labours			Main Workers as Household Industry Workers			Main Workers as Other Workers		
		Persons	Male	Female	Person	Male	Female	Persons	Male	Female	Persons	Male	Female
Within 0-3 km													
Husenapuram	Rural	37	37	0	106	37	69	13	4	9	138	73	65
Challavaripalle	Rural	47	45	2	10	8	2	0	0	0	43	40	3
Jambulapadu	Rural	59	58	1	0	0	0	0	0	0	9	9	0
Sub Total (A)		**143**	**140**	**3**	**116**	**45**	**71**	**13**	**4**	**9**	**190**	**122**	**68**
Within 3-5 km													
Velamakur	Rural	273	208	65	161	75	86	9	8	1	67	60	7
Veerapuram	Rural	175	156	19	169	81	88	3	2	1	44	30	14
Tadpatri	Rural	5704	4556	1148	8271	3912	4359	1378	747	631	8399	6268	2131
Tadpatri	Urban	520	473	47	1505	691	814	3536	1457	2079	24459	21233	3226
Gandlapadu	Rural	167	108	59	129	72	57	7	5	2	22	21	1
Alur	Rural	199	177	22	277	131	146	0	0	0	108	68	40
Sub Total (B)		**7038**	**5678**	**1360**	**10512**	**4962**	**5550**	**4933**	**2219**	**2714**	**33099**	**27680**	**5419**
Within 5-7 km													
Vanganur	Rural	85	74	11	214	109	105	9	6	3	52	47	5
Bodaipalle	Rural	114	113	1	376	190	186	4	3	1	15	12	3
Koduru	Rural	415	328	87	589	311	278	6	4	2	125	98	27
Shanagalaguduru	Rural	1230	792	438	940	453	487	21	18	3	200	156	44
Sajaladinne	Rural	241	220	21	376	127	249	19	11	8	1570	1072	498
Sub Total (C)		**2085**	**1527**	**558**	**2495**	**1190**	**1305**	**59**	**42**	**17**	**1962**	**1385**	**577**
Within 7-10 km													
Kibile Sugumanchipalle	Rural	213	150	63	268	133	135	8	5	3	76	54	22
Bondaladinne	Rural	183	159	24	156	89	67	37	19	18	84	58	26
Sankepalli	Rural	174	146	28	192	72	120	2	2	0	74	58	16
Sirigepalle	Rural	262	139	123	119	47	72	7	3	4	81	70	11
Uruchinthala	Rural	129	98	31	164	66	98	2	1	1	200	152	48
Talaricheruvu	Rural	39	37	2	24	16	8	10	5	5	635	533	102
Murugampalli	Rural	39	36	3	59	33	26	0	0	0	0	0	0
Chukkalur	Rural	345	268	77	842	464	378	24	15	9	177	126	51
Nandalapadu	Rural	129	101	28	325	157	168	0	0	0	69	54	15
Timmapuram	Rural	32	21	11	14	9	5	2	2	0	10	9	1
Diguvapalle	Rural	403	324	79	591	227	364	9	5	4	49	40	9
Konavaripalli	Rural	220	124	96	28	16	12	0	0	0	11	8	3
Peddapolamada	Rural	627	463	164	1552	688	864	134	92	42	579	459	120
Chinnapolamada	Rural	315	277	38	676	327	349	363	192	171	593	401	192
Kaverisamudram	Rural	188	179	9	128	74	54	52	19	33	154	123	31
Kottalapalle	Rural	153	131	22	251	218	33	0	0	0	26	19	7
Venkatampalle	Rural	99	57	42	244	94	150	20	16	4	139	107	32
Sub Total (D)		**3550**	**2710**	**840**	**5633**	**2730**	**2903**	**670**	**376**	**294**	**2957**	**2271**	**686**
Grand Total (A+B+C+D)		**12816**	**10055**	**2761**	**18756**	**8927**	**9829**	**5675**	**2641**	**3034**	**38208**	**31458**	**6750**

Source; Census 2001

Occupational Distribution of Marginal Workers

Name of Village	Rural/ Urban	Marginal Workers as Cultivators			Marginal Workers as Agricultural Labours			Marginal Workers as Household Industry Workers			Marginal Workers as Other Workers		
		Persons	Male	Female	Persons	Male	Female	Persons	Male	Female	Persons	Male	Female
Within 0-3 km													
Husenapuram	Rural	34	18	16	0	0	0	3	0	3	0	0	0
Challavaripalle	Rural	49	13	36	2	1	1	43	11	32	3	0	3
Jambulapadu	Rural	56	30	26	1	0	1	55	30	25	0	0	0
Sub Total (A)		**139**	**61**	**78**	**3**	**1**	**2**	**101**	**41**	**60**	**3**	**0**	**3**
Within 3-5 km													
Velamakur	Rural	14	2	12	1	0	1	13	2	11	0	0	0
Veerapuram	Rural	81	7	74	66	6	60	15	1	14	0	0	0
Tadpatri	Rural	3264	799	2465	411	56	355	2375	559	1816	174	33	141
Tadpatri	Urban	3003	857	2146	19	11	8	1064	231	833	929	95	834
Gandlapadu	Rural	11	0	11	40	1	39	1	0	1	0	0	11
Alur	Rural	28	2	26	22	0	22	6	2	4	0	0	0
Sub Total (B)		**6401**	**1667**	**4734**	**559**	**74**	**485**	**3474**	**795**	**2679**	**128**	**986**	**986**
Within 5-7 km													
Vanganur	Rural	100	11	89	52	2	50	42	4	38	5	4	1
Bodaipalle	Rural	47	8	39	1	0	1	44	6	38	0	0	0
Koduru	Rural	134	25	109	53	14	39	78	11	67	0	0	0
Shanagalaguduru	Rural	146	10	136	237	53	184	10	0	10	31	9	146
Sajjaladinne	Rural	352	41	311	6	3	3	301	22	279	5	1	4
Sub Total (C)		**779**	**95**	**684**	**349**	**72**	**277**	**475**	**43**	**432**	**41**	**14**	**151**
Within 7-10 km													
Kibile Sugumanchipalle	Rural	0	0	0	0	0	0	0	0	0	0	0	0
Bondaladinne	Rural	127	16	111	5	1	4	114	14	100	5	1	4
Sankepalli	Rural	13	1	12	5	0	5	5	1	4	0	0	0
Murugampalli	Rural	0	0	0	0	0	0	0	0	0	0	0	0
Sirigepalle	Rural	1	0	1	0	0	0	1	0	1	0	0	0
Uruchinthala	Rural	95	13	82	1	0	1	86	12	74	0	0	0
Talaricheruvu	Rural	171	53	118	8	7	1	90	23	67	53	9	44
Chukkalur	Rural	283	61	222	27	4	23	241	50	191	6	1	5
Nandalapadu	Rural	43	13	30	5	1	4	35	11	24	0	0	0
Timmapuram	Rural	24	2	22	7	0	7	14	0	14	2	1	1
Diguvapalle	Rural	6	2	4	3	1	2	1	0	1	0	0	0
Konavaripalli	Rural	0	0	0	0	0	0	0	0	0	0	0	0
Peddapolamada	Rural	128	7	121	46	1	45	70	2	68	4	0	4
Chinnapolamada	Rural	156	36	120	10	2	8	128	24	104	0	0	0
Kaverisamudram	Rural	186	36	150	31	3	28	101	16	85	25	1	24
Kottalapalle	Rural	420	88	332	40	2	38	380	86	294	0	0	0
Venkatampalle	Rural	2	0	2	0	0	0	2	0	2	0	0	0
Sub Total (D)		**1655**	**328**	**1327**	**188**	**22**	**166**	**1268**	**239**	**1029**	**95**	**13**	**82**
Grand Total (A+B+C+D)		**8974**	**2151**	**6823**	**1099**	**169**	**930**	**5318**	**1118**	**4200**	**1242**	**155**	**1222**

Source; Census 2001

Annexure 3.10
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General Amenities in the Study Area

Sn	Village	Education	Medical	Drinking Water	Post Telegraph	Commu nication	Approach to Village	Power Supply
Within 0-3 km								
1.	Husenapuram	P, M (<5 km), C(<5 km), ALC	ALH <5 km, MCWC<5 km, PHC >10 km, OC	H	PO <5 km, PHO	BS, RS<5 km	PR	PA
2.	Challavaripalle	P, M (5-10 km), C (5-10 km), ALC	ALH 5-10 km, MCWC5-10 km, PHC >10 km, OC	TP, H	PO, PHO	BS, RS	PR	PA
3.	Jambulapadu	P, M (5-10 km), ALC	ALH 5-10 km, MCWC5-10 km, PHC >10 km,	TP, H	PO< 5 km, PHO	BS, RS <5 km	PR	PA
Within 3-5 km								
4.	Velamakur	P, M (5-10 km),C (>10 km),	ALH >10 km, MCWC>10 km, PHC >10 km, OC	TP, , H	PO, PHO >10 km	BS, RS>10 km	PR	PA
5.	Veerapuram	P, M (5-10 KM), C (>10 km), ALC	ALH >10 km, MCWC>10 km, PHC >10 km, OC	H	PO< 5 km, PHO	BS, RS>10 km	PR	PA
6.	Tadpatri (Rural)	P, M (<5 km), SS, C (<5 km), ALC	ALH<5 km, MCWC <5 km, HC, PHC 5-10 km, OC	TP, TU, H, R	PO, PHO	BS, RS	PR	PA
7.	Tadpatri (Urban)	P, M, C, ALC	ALH, MCWC, PHC, OC	TP, , H	PO, PHO	BS, RS	PR	PA
8.	Gandlapadu	P (5-10 km), M (5-10 km), C (5-10 km)	ALH (> 10 km), MCWC (> 10 km	TP, H	PO <5 km	BS, RS 5-10 km	MR	PA
9.	Aluru	P, M (5-10 KM), C (5-10 km), OSCH	ALH 5-10 km, MCWC 5-10 km, PHC 5-10 km, PHSC, OC	TP, H	PO, PHO	BS, RS <5 km	PR	PA
Within 5-7 km								
10.	Vanganuru	P, M (<5 km), C (>10 km), ALC	ALH >10 km, MCWC >10 km, PHC >10 km, FWC , OC	TP, H	PO, PHO	BS, RS	PR	PA
11.	Bodaipalle	P, M (<5 km), C (>10 km), ALC, OSCH	ALH >10 km, MCWC >10 km, PHC >10 km, OC	H	PO< 5 km, PHO >10 km	BS, RS>10 km	PR	PA
12.	Koduru	P, M, SS, C (>10 km), ALC, OSCH	ALH >10 km, AYD, MCWC >10 km, HC, PHC >10 km, PHSC,	TP, W, TA, TU, H, R, CA, LA, SP, OH	PO, PHO >10 km	BS, RS>10 km	PR	PA
13.	Shanagalagudur u	P, M (5-10 km), C (>10km)	ALH (>10 km), MCWC (>10 km, PHSC	TP, H	PO, PHO	BS, RS >10 km	PR	PA
14.	Sajjaladinne	P, M, C (<5 km)	ALH<5 km, MCWC <5 km, PHC <5 km, PHSC,	TP, H	PO, PHO	BS, RS <5 km	PR	PA
Within 7-10 km								
15.	Kibile Sugumanchipalle	P, M, C (>10 km), OSCH	ALH >10 km, MCWC >10 km, PHC >10 km,	TP, W, TA, TU, H, R, CA, LA, SP, OH	PO, PHO <5 km	BS>10 km	PR	PA
16.	Bondaladinne	P, M, C (<5 km), ALC	ALH >10 km, MCWC >10 km, PHC >10 km, OC	TP,W, H	PO, PHO	BS, RS<5 km	PR	PA
17.	Sankepalli	P, M (<5 km), C (>10 km), OSCH	ALH >10 km, PHC <5 km	TP, W, TU, H, R, CA, LA, SP, OH	PO< 5 km, PHO >10 km	BS, RS>10 km	PR	PA
18.	Sirigepalle	P, M (>10 km), C (>10 km), OSCH	ALH >10 km, MCWC >10 km, PHC >10 km,	TP, W, TA, TU, H, R, CA, LA, SP, OH	PO< 5 km, PHO 5-10km	BS, RS >10 km	MR	PA
19.	Uruchinthala	P, M (>10 km), C (>10 km)	ALH >10 km, PHC >10 km, OC	TP, W, H	PO, PHO >10 km	BS, RS>10 km	PR	PA

Annexure 3.10
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Sn	Village	Education	Medical	Drinking Water	Post Telegraph	Commu nication	Approach to Village	Power Supply
20.	Talaricheruvu	P, M (>10 km), C (>10 km), ALC	ALH >10 km, MCWC >10 km, PHC >10 km, RMP, OC	TP, H	PO< 5 km, PHO	BS, RS >10 km	PR	PA
21.	Murugampalli	P (5-10 km), M (5-10 km), C (5-10 km)	ALH >10 km, MCWC >10 km, PHC >10 km,	TP, H	PO <5 km	BS, RS 5-10 km	PR	PA
22.	Chukkalur	P, M , SS, C (5-10 km), ALC	ALH 5-10 km, MCWC 5-10 km, PHC, PHSC, RMP, OC	TP, H	PO, PHO	BS, RS 5-10 km	PR	PA
23.	Nandalapadu (Urban)	P, M, SS, C (5-10 km),	ALH 5-10 km, MCWC 5-10 km, PHC 5-10 km, OC	TP, H	PO, PHO	BS, RS 5-10 km	PR	PA
24.	Timmapuram	P, M (>10 km), C (5-10 km),	ALH >10 km, PHC 5-10 km, OC	, H	PO< 5 km, PHO< 5 km	BS<5 km, RS<5 km	MR	PA
25.	Diguvapalle	P, M (<5 km), C (<5 km), ALC, OSCH	ALH 5-10 km, MCWC 5-10 km, PHC 5-10 km, OC	TP, H,	PO, PHO	BS, RS 5-10 km	PR	PA
26.	Konavaripalli	P, M (<5 km), C (>10 km), OSCH	ALH >10 km, MCWC>10 km, PHC >10 km, RMP,	TP, W, TA, H, R CA, LA, SP, OH	PO, PHO >10 km	BS, RS >10 km	PR	PA
27.	Peddapolamada	P, M, C (<5 km), ALC	ALH<5 km, MCWC<5 km, PHC <5 km, PHSC, RMP, OC	TU	PO, PHO	BS, RS <5 km	PR	PA
28.	Chinnapolamada	P, M (<5 km), C (<5 km) , ALC, OSCH	ALH<5 km, MCWC<5 km, PHC <5 km, PHSC, OC	TP, H	PO, PHO	BS, RS	PR	PA
29.	Kaverisamudram	P, M (>10 km), C (5-10 km)	ALH 5-10 km, MCWC 5-10 km, PHC 5-10 km, OC	TP, H	PO, PHO	BS 5-10 km	PR	PA
30.	Kottalapalle	P, M (<5 km), C (>10 km), OSCH	ALH >10 km, PHC 5-10 km	TP, W, TA, TU, H, R, CA, LA, SP, OH	PO, PHO >10 km	BS, RS>10 km	PR	PA
31.	Venkatampalle	P (<5 km), C (>10 km) , ALC	ALH<5 km PHC >10 km,, MCWC 5-10 km, PHC >10 km, PHSC, OC	TP, H	PO< 5 km, PHO <5 km	BS, RS >10 km	PR	PA

Source; Census 2001

P- Primary School, M- Middle School, SS-,Secondary School, C- College, ALC – Adult Literacy Center, OSCH- Other Educational Facilities

ALH- Allopathic hospital, AYD- Ayurvedic Dispensary, MCWC- Maternal & Child Welfare Center, HC- Health Center, PHC-Primary Health Center, PHSC-Primary Health Sub Centers, FWC- Family Welfare Center, RMP-Registered Medical Practitioners, OC- Other Medical Facilities

TP- Tap Water, W-Well Water, TA-Tank Water, TU-Tube well water, H-Handpump, R-River, CA-Canal, LA-Lake, SP-Spring, OH-Other Drinking Water Sources

PO- Post Office, PHO-Phone

BS- Bus Service, RS- Railway Service

PR- Paved Road, MR- Mud Road

PA-Electricity for all purposes

(<5 Km) – Facilities available within 5 km, (5-10Km) - Facilities available 5 to 10 km, (> 10 Km) - Facilities available after 10 km.