# ENVIRONMENTAL COMPLIANCE STATUS REPORT

*FOR*

## 1040 MW (2 x 520 MW) THERMAL POWER PLANT
## VISAKHAPATNAM, ANDHRA PRADESH

**OCTOBER 2020 - MARCH 2021**

***Sponsor:***

## HINDUJA NATIONAL POWER CORPORATION LIMITED
VISAKHAPATNAM, ANDHRA PRADESH

***Prepared by:***

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# PREFACE

## HINDUJA NATIONAL POWER CORPORATION LIMITED

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### FOR
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### VISAKHAPATNAM, ANDHRA PRADESH

**OCTOBER 2020 – MARCH 2021**

For and on behalf of VIMTA Labs Limited

Approved by : **M. Janardhan**

Signed : 

Designation : **Head & Vice President (Environment)**

Date : **21st June, 2021**

This report has been prepared by **Vimta Labs Limited** with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

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# Introduction

# 1.0 INTRODUCTION

## 1.1 The Background

**Hinduja National Power Corporation Limited (HNPCL)** is part of Hinduja Group to realize the ambitions of the Group in Power Sector. HNPCL is planning to create a power generation capacity of 10,000 MW over the next ten years at an expected investment of over $10 billion across India. The total projected capacity will be a mix of thermal, hydro, nuclear and renewable energy.

As a first step in power sector, HNPCL is setting up a 1,040 MW coal based merchant power plant and is located on the coast of the Bay of Bengal at Palavalasa, Pedagantyada Mandal, Visakhapatnam District in the State of Andhra Pradesh, India. The project configuration is 2x520 MW.

The earlier Environmental Clearance (EC) has been confirmed from Ministry of Environment & Forests, Consent for Establish (CFE) and Consent for Operation (CFO) from Andhra Pradesh Pollution Control Board (APPCB) has been obtained.

**Hinduja National Power Corporation Limited (HNPCL)** has retained M/s **VIMTA LABS LIMITED, Hyderabad** to undertake Environmental Data Generation for various environmental factors on monthly and seasonal basis, which may be affected due to the likely impact arising out of the existing Power plant. Environmental data has been collected for various environmental components viz. Air, water, Noise and Soil quality during October 2020 to March 2021 and prepared compliance to Environmental clearance involved by MOEF vide Letter No:J-13011/11/90-IA-II(T) dated 3rd September, 1996, No: J-13012/92/2008.IA.II(T) dated 4th March 2009, No. J 13012/92/2008-IA.II(T) dated 10th June 2010 and CRZ Clearance vide letter F. No 11-58/2011-1A-III dated 3rd January 2014, F. No: 11-58/2011-IA-III dated 17/19th March, 2015, Letter No: 245/Env/CZMA/2015, dated 05th June, 2015, F. No: 11-58/2011-IA-III dated 01th October, 2015, F. No: 11-58/2011-IA-III dated 01th 2019, 2015 (Amendment), CFO No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March, 2020.

## 1.2 Project Setting

The existing plant is located in Palavalasa, Pedagantyada Mandal, Visakhapatnam District of Andhra Pradesh and the same is identified on the survey of India toposheet no 65 O/2, O/6 at the Latitude $17^0$34’30” North and Longitude $83^0$07’30” East at an elevation of 8.5 m above Mean Sea Level (MSL).

The present study of various environmental attributes establishes the post operational characteristics and this will help in identifying the incremental concentrations if any, due to the operation of the existing plant.

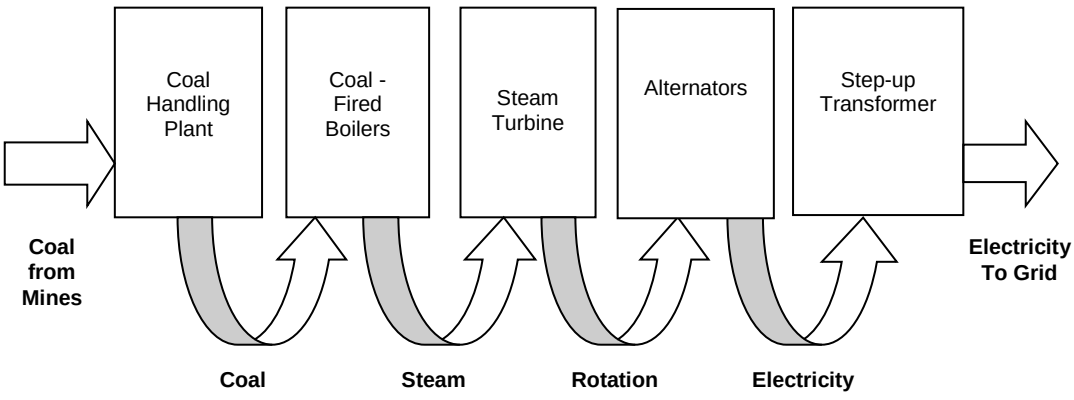
The geographical location of the plant is shown in **Figures-1.1.** The topographical features of the project area (within 10 km radius of plant site) are depicted in **Figures-1.2.**

The long-term data recorded at India Meteorological Center at Visakhapatnam indicates temperature in the range of 15.8°C to 37.7°C. The mean total rainfall is about 1300 mm for the whole year. The relative humidity is generally high during the period from September to January and is least during the summer afternoons.

The predominant wind direction and wind speed as recorded by IMD Visakhapatnam during the winter season are E (32.4%) followed by ESE (19.9 %) and during the Pre monsoon season are SW (42.5%) followed by SSW (35.8%). This variation in wind pattern can be attributed to the hilly terrain prevailing in the region. The Relative Humidity was observed to be in the range of 63 to 80% during the winter and Pre monsoon seasons.

## 1.3 Process Description

Each of the coal-fired power projects currently in development would employ pulverized coal combustion (PCC) technology. In the PCC process, the coal-handling plants receive coal, crush it to the required size and feed it to the boiler plants. The boiler plants then use coal pulverisers to grind the coal to a finer size before it is fed to the boiler furnace. The boilers are enclosures encased by tubes filled with flowing water. As the boiler furnace heats, the water flowing in the boiler tubes is converted into high pressure and high temperature steam. This steam is conveyed to the turbine through steam pipelines. The steam produced in the boiler drives steam turbines, making the turbines' rotors rotate at high speeds. Alternators are coupled to the steam turbines and rotate with the turbines' rotors. The alternators convert the energy generated by the rotation of the turbines' rotors into electricity. Step-up transformers then steps up the voltage of generated electricity before it is fed to the grids for transmission. Transmission of electricity is done at very high voltage to minimize transmission losses.
The coal-fired power process is illustrated below:




The process of generation of power from coal (water steam cycle) essentially entails two main stages. In the first stage, the chemical energy stored in coal is converted into heat energy in the coal-fired boilers. In the second stage, the high-pressure steam, which is generated in the boilers, is passed through turbines (conversion of heat energy into mechanical energy) which in turn is coupled to generators (conversion of mechanical energy into electrical energy), thereby generating electricity.

The water steam cycle essentially contains the coal fired steam generator, the steam turbine with condenser, feed-water tank, low-pressure (LP) heaters and high-pressure (HP) heaters and the connecting pipelines. The superheated steam produced in the steam generator is supplied to the steam turbine, which drives the three-phase AC generator. After leaving the HP turbine, the steam is reheated in the steam generator and fed to the Intermediate Pressure (IP) turbine. In the LP turbine the steam coming directly from the IP turbine expands to condenser pressure and is condensed in the condenser.

Once through system is used for cooling of the condenser. The condensate collected in the condenser hot well is discharged by the condensate pumps and supplied via the LP condensate heaters into the feed water tank. The feed water is further heated by bled steam from turbine and dissolved gases from the feed-water are liberated. The boiler feed pumps discharge feed water from the feed-water tank via the HP heaters to the economizer. Steaming starts from this point onwards. The high temperature steam-water mix is further converted into steam in water walls and finally passed through the super heaters sections for converting the saturated steam into superheated steam.

The power station would be designed with two power generating units of 520 MW each, along with the auxiliaries and common utility services like plant water system, coal handling system, ash handling plant, and switchyard for power evacuation, plant electrical system and workshop.

The main sections of the power generating unit include Steam Generator along with milling system and electrostatic precipitator, integral piping, integral control system, turbine and generator unit, boiler feed pump, regenerative heaters, condensate extraction pump, circulating and auxiliary cooling water pumps and the generator transformer with bus duct. The main sections of the utility system are the coal handling system, ash handling system, fire fighting system, AC & Ventilation system, switchyard and the plant water system. The power generated at lower voltage of 21 KV would be stepped up to 400 KV and will be connected to the proposed 400 KV switchyard for dispatch.

The plant layout is shown in **Figure-1.3**.

## 1.4 Scope of the Study

Under the scope of the study, an area of 10 km radius from the centre of the existing plant was covered in detail for various environmental components viz Air, water, Noise and Soil based on the guidelines of Ministry of Environment and Forests, Government of India.

### 1.4.1 Micrometeorological data

The meteorological and micro-climatic parameters were also recorded simultaneously using automatic weather station located within the plant site. Wind speed, Wind Direction, Relative Humidity and Rainfall were recorded on hourly basis during the study period. Minimum and maximum temperatures were also recorded.

1.4.2 Air Environment

The baseline status of the existing ambient air quality within the study region has been assessed through a monitoring network of Eight Ambient Air Quality (AAQ) sampling stations during study period (October 2020 – March 2021). The monitoring network has been established depending on the available climatological norms of predominant wind directions and wind speeds of the study region in the Post monsoon, winter and part of Pre monsoon season. The baseline status of air environment was monitored for Fine Respirable Particulate Matter (PM2.5), Respirable particulate matter PM10 (RPM) and gaseous pollutants like Sulphur dioxide ($SO_2$), Nitrogen dioxide ($NO_2$) and Carbon monoxide (CO), Ammonia ($NH_3$), Ozone ($O_3$), Benzene ($C_6H_6$) and metals like Benzo(a)pyrene, Lead (Pb), Arsenic (As) and Nickel (Ni).

1.4.3 Fugitive Dust Emission Monitoring

Fugitive dust emission monitoring was carried out at 5 locations within the plant site to assess the uncontrolled emissions from the sources like dust handling areas, construction areas and roads etc.

1.4.4 Water Quality

Information on water resources (ground) was collected during the study period. The parameters of prime importance were selected under physical, chemical, inorganic, chemical organic and heavy metal groups. Samples were collected for basic nutrient demand; toxic parameters and baseline data on bacteriological aspects were also collected from the existing dug and bore wells. Open well and bore well samples were collected within 10 Km around the existing site.

1.4.5 Noise Quality

A detailed survey on noise environment was carried out in and around the project site to study the levels of noise, as the high dB (A) levels may cause adverse effect on human beings and associated environment. Spot noise levels were measured using a precision noise level meter, at residential areas, schools, hospitals, bus stands and commercial centers etc. The major noise generating sources were identified in the existing plant and were monitored to study noise environment. Ambient noise levels were measured at 8 locations in 5 Km radial distance.

## 1.5 Compliance to Environmental Clearance

Compliance to Environmental Clearance obtained for 2x520 MW Thermal Power Plant near Visakhapatnam. **Vide Letter No: J-13011/11/90-IA-II (T) dated 3rd September, 1996 and**

CRZ Clearance for the Seawater intake & outfall system and Rail line for Coal transport at palavalasa, Visakhapatnam **Vide Letter F.No: 11-58/2011-IA-III dated 3rd January, 2014 and 17/19th March, 2015.**

Consent Order **No:APPCB/VSP/VSP/19/HO/CFO/2020,**dated:**06thMarch, 2020**. A compliance Status Report is prepared for 6 months' period from **October 2020 – March 2021** is given in **Chapter-2.**

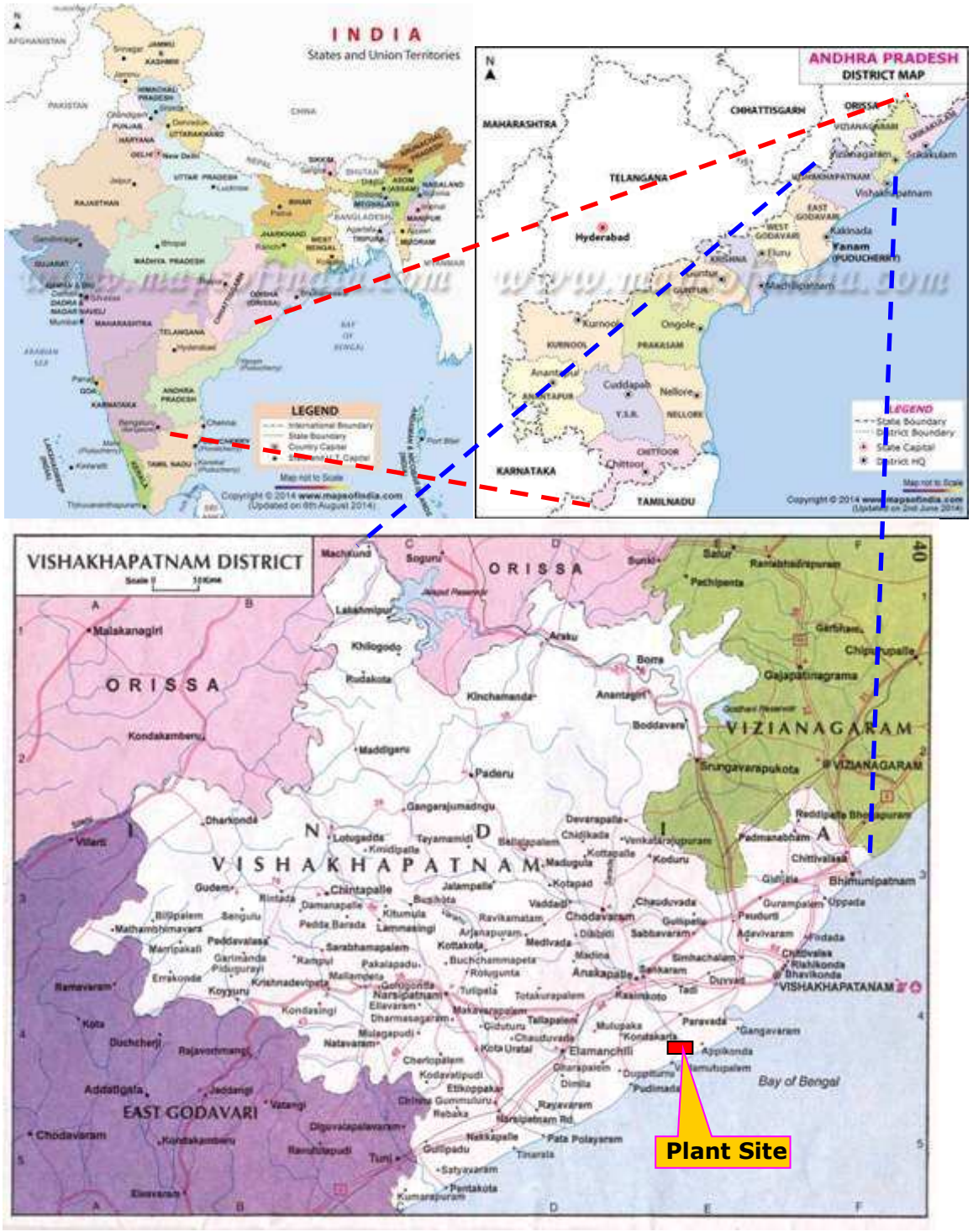



**FIGURE-1.1**
**GEOGRAPHICAL LOCATION MAP**

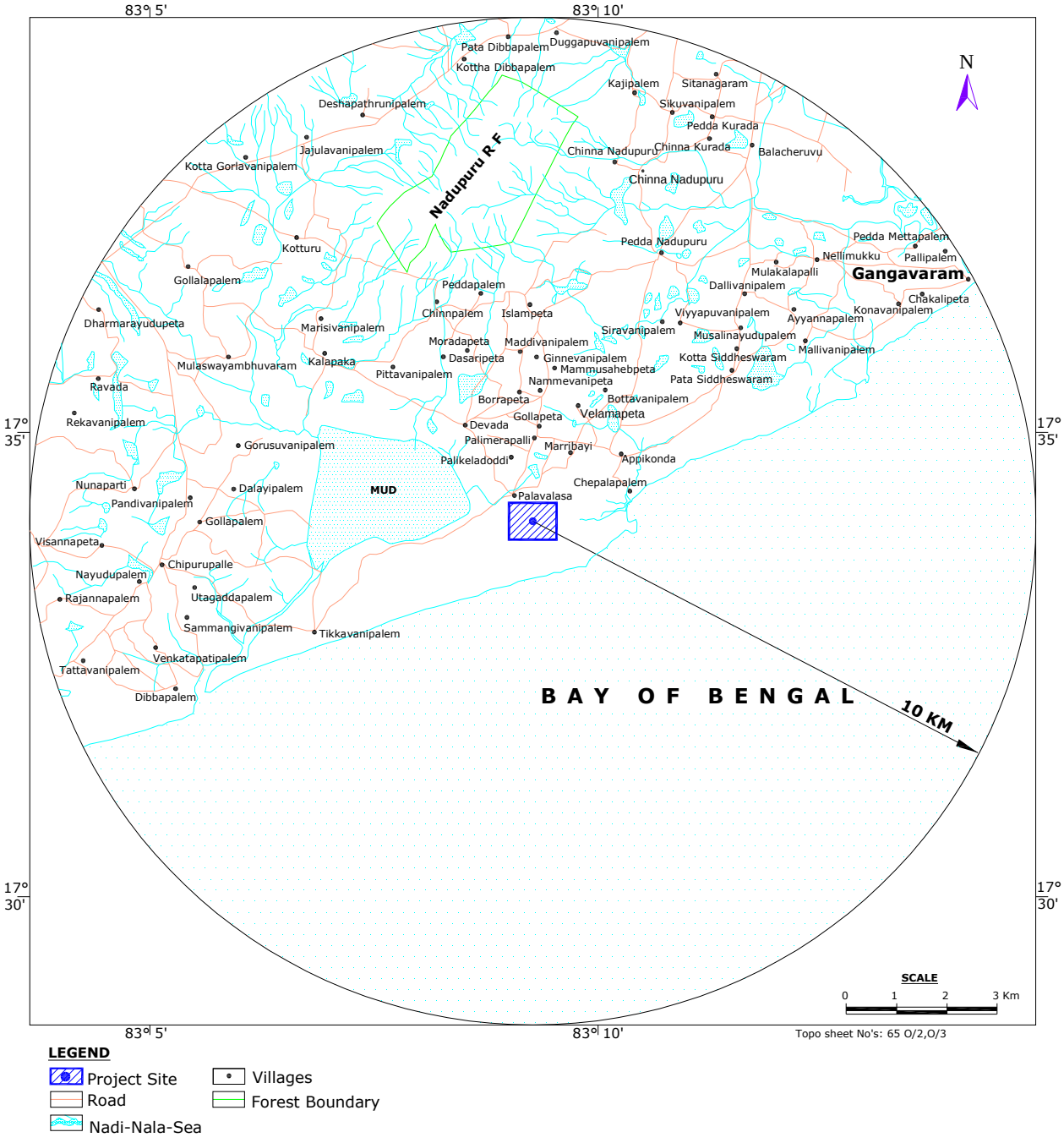



**FIGURE-1.2**
**LOCATION MAP-10KM RADIUS**

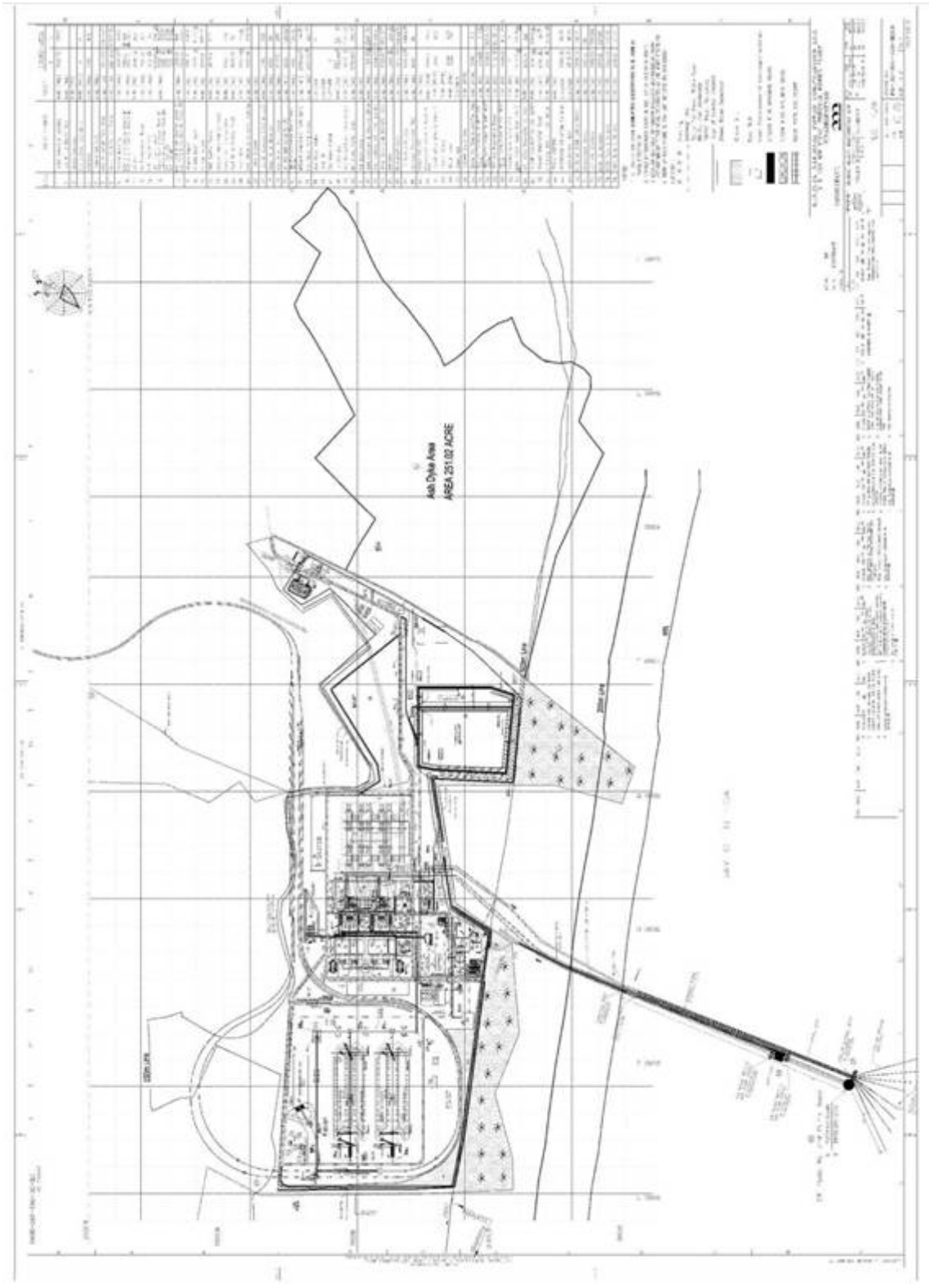



**FIGURE-1.3**

**PLANT LAYOUT FOR HNPCL'S 2 X 520 MW THERMAL POWER PLANT AT VISHAKAPATNAM**

# Chapter-2

# Compliance Status Report

## COMPLIANCE STATUS REPORT – OCTOBER 2020 TO MARCH 2021

**Ref: Environment Clearance & Amendments to Environment Clearance Letter and Consent for Operation as mentioned below:**

1. Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996
2. Letter No: J–13011/11/90-IA-II(T) dated 10th September, 1996
3. Letter No: J-13011/11/90-IA.II dated 15th November, 1996
4. Letter No: J-13011/11/90-IA.II(T) dated 20th April, 1999
5. Letter No: J-13012/92/2008.IA.II(T) dated 4th March, 2009
6. Letter No: J-13012/92/2008-IA.II(T) dated 10th June, 2010
7. F. No: 11-58/2011-IA-III dated 3rd January, 2014
8. F. No: 11-58/2011-IA-III dated 17/19th March, 2015
9. Letter No: 245/Env/CZMA/2015, dated 05th June, 2015
10. F. No: 11-58/2011-IA-III dated 01st October, 2015
11. F. No: 11-58/2011-IA-III dated 01st October, 2015 (Amendment)
12. Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020- dated :06th March,2020

| Sr. No. | Condition (*Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996)* | Status |
|---|---|---|
| ***Specific Conditions*** | | |
| i) | All the conditions stipulated by Andhra Pradesh Pollution Control board vide their letter No.19/PCB/ C.Estt./RO/VSP/AEE/V111/95-4433 dated 13th November, 1995 should be strictly implemented | Noted and are being complied as applicable. A monthly environmental monitoring report is being submitted to APPCB every month. |
| ii) | A bi-flue stack of 275 m with continuous stack monitoring system should be installed. | A bi-flue stack of 275 m has been constructed with continuous stack monitoring system. |
| iii) | Electrostatic precipitator having efficiency of not less than 99.8% should be installed and it should be ensured that particulate emissions would not exceed the prescribed limit of 150 mg/Nm3. | An ESP with 99.8% efficiency has been installed to control the Particulate matter emissions below 50 mg/Nm3. |
| iv) | Once through cooling system should be provided and the rise in temperature should be maintained within 7 degrees centigrade of the ambient water. The proposed pipeline for sea water intake and outlet should conform to the regulations of the coastal zone notification of February, 1991. Desalination plant should be provided for meeting the water requirement of the power project and other auxiliary activities. | Water balance of the power plant enclosed as **Annexure-II** (Please check with HNPCL Engineering for Latest WBD). We have obtained the CRZ clearance from MoEF has been obtained for sea water intake//outfall system.<br><br>Once through cooling system has been designed to maintain temperature differential within 7 deg centigrade over and above the ambient temperature of receiving water body and being maintained the same during operation of the Plant.<br><br>Desalination plant with a capacity of 12.5 MLD has been installed to meet the sweet water requirement. |
| v) | Adequate space should be provided for installation of flue gas desulphurization plant | Space provision for installing FGD if required, has been provided in the plant layout in future for |

| Sr. No. | Condition (*Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996)* | Status |
|---|---|---|
| | in future for control of sulphur dioxide. | control Sulphur dioxide, if necessary. |
| vi) | Acquisition of land should be restricted to 2682 acres including 890 acres for ash disposal. | The land requirement for the power project is 923 acres. |
| vii) | Only beneficiated coal to the tune of 16080 MT/day should be used with ash content not exceeding 34%. Fly ash generated should be collected in dry form in silos and fully utilized in a phased manner. As indicated in the Environmental Management plan, increase in the dyke height above 8 m should be undertaken through use of fly ash. For avoiding contamination of ground water, ash pond area should be suitably lined and dyked. As provided in the layout, adequate space should be earmarked for getting up of ash user plants to avoid long distance transportation to fly ash. | MoEF vide its letter mentioned in Ref:3 has modified this condition to be read as<br><br>"Only beneficiated coal to the tune of 16080 metric tonne.s/day should be used with average annual ash content supplied by Mahanadi Coalfields Limited not exceeding 34+ or - 1-2%. Fly ash generated should be collected in dry form in silos and fully utilized in a phased manner. As indicated in the Environmental Management plan, increase in the dyke height above 8 m should be undertaken through use of fly ash. For avoiding contamination of ground water, ash pond area should be suitably lined and dyked. As provided in the layout, adequate space should be earmarked for getting up of ash user plants to avoid long distance transportation to fly ash."<br><br>Further vide letter mentioned in Ref:4 MoEF has accorded "no objection to the use of fuel from alternative sources which will have the same coal quality as beneficiated coal".<br><br>• With respect to the above we confirm that: Total coal expected to be used in a day will be well within the quantity recommended. Fly ash will be fully utilized in a phased manner as mentioned in the condition.<br>• Ash pond is being lined with HDPE to prevent contamination of ground water. Further the Ground water monitoring is being undertaken by a third party on Monthly basis as per the monitored data the levels are within permissible limits.<br>• Pond ash and Fly ash will be utilized by the following Agencies:<br><br>1) Simhadri Constructions<br><br>plant is under reserved shutdown. |
| viii) | Noise level should be limited to 85 dBA and regular maintenance of equipments be undertaken. For people working in the area of generator halls and other high noise areas, ear plugs should be provided. | Noise levels are being monitored by third part at locations within the plant area and the results are within prescribed limits.<br><br>Requisite personnel protective equipment has already been provided to people working in high noise areas. |
| ix) | For controlling fugitive dust, regular sprinkling of water in coal handling and other vulnerable areas of the plant should be ensured. | Dust Suppression system installed and regular sprinkling of water on coal in stock yard and conveyors is being ensured. |

| Sr. No. | Condition (*Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996)* | Status |
|---|---|---|
| x) | Afforestation plan should be formulated in consultation with the local DFO and implemented by creating a greenbelt of 500 m along the sea side from High Tide Line. A strip of greenbelt of 150-200 m should also be created along the ash pond area and about 100 m in available spaces within the colony along the road etc. A norm of 1500-2000 trees per ha should be followed and aftercare and monitoring should also be ensured. | Out of 923 acres, the construction activities for the power project including ash pond is restricted to 533 acres. Presently green belt is being developed in and around the power project area and an area of 249.14 acres has already been developed.<br><br>Further development of Green belt continues. |
| xi) | Continuous monitoring of ground water should be undertaken by establishing good network of observation wells in consultation with the Central ground water board. Results and data collected should be analysed to ascertain the status of water quality and findings should be submitted for evaluation. | Continuous ground water monitoring is being carried out at six locations on Monthly basis and the monthly data is being submitted to APPCB. As per the results the limits are within the prescribed norms. The same has been compiled and is enclosed in **Chapter-3, Section-3.5.** |
| xii) | All effluents generated in various plant activities should be collected in the Central Effluent Treatment Plant and treated to ensure adherence to specified standards of discharge. The concept of zero discharge should be adopted to a maximum possible extent. | As per specification, all the effluents generated are treated in the Effluent Treatment Plant (ETP). The outflow is being monitored by continuous monitoring system, and then it is sent to sea through outfall<br><br>The concept of zero discharge has been adopted to the maximum possible extent by adopting the following:<br><br>1. Recirculation of ash water in ash handling system.<br>2. Recirculation of filter backwash water into the system.<br>3. DM Plant effluent is sent to the ash slurry sump and then recycled back.<br><br>Plant clarifier sludge is put into ash slurry pump house for disposal in ash pond, which is recycled. |
| | Keeping in view the fact that 2x500 MW thermal power plant by M/s. National Thermal Power Corporation limited proposed in the vicinity of 1040 MW thermal power project, common facilities for coal transportation, laying of rail lines etc. should be worked out with mutual consultation to avoid duplication of facilities and acquisition of additional land. | Noted |
| xiv) | A financial provision of Rs. 250 crores should be provided for implementation of environmental mitigative measures with adequate scope for its enhancement in future. These funds should not be diverted for any other activities and separate account should be maintained. | Found Noted |
| xv) | Regular monitoring for SPM, $SO_2$ and NOx around the power plant may be carried out and records maintained. The data also | Monitoring is being carried out at eight ambient air quality monitoring stations within the 10 km radius study area from the existing power plant complex, |

| Sr. No. | Condition (*Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996)* | Status |
|---|---|---|
| | collected should be properly analysed and submitted to the Ministry every six months. | with two in the predominantly downward wind direction.<br><br>Data on ambient air quality is being submitted to APPCB on monthly basis and also to the regional office of MOEF. As per the AAQ data, the results are within limits. The same has been compiled and is enclosed in **Chapter-3, Section-3.2.** |
| xvi) | Full cooperation should be extended to the Scientists/officers from the Regional Office of the Ministry at Bangalore and also to the State Pollution Control Board who would be monitoring the compliance of environmental status. Complete set of impact assessment report and the Management Plans should be forwarded to the Regional Office for their use during monitoring. | Noted. |
| xvii) | Monitoring committee should be constituted for reviewing the compliance to various safeguard measures by involving recognized local NGOs, Pollution Control Board experts etc. | An Environmental Monitoring Committee is in place. |
| 3 | The Ministry reserves the right to revoke the clearance if conditions stipulated are not implemented to the satisfaction of the Ministry | Noted |
| 4 | For any deviation or alteration in the project proposed from those submitted to this Ministry for clearance, a fresh reference should be made to the Ministry to assess the adequacy of the conditions imposed and to add additional environmental protection measures required, if any. | Noted |
| 5 | The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981 the Environment (Protection) Act, 1986, the public liability Insurance Act, 1991, the Impact Assessment Notification of January, 1994 and its amendments. | Noted |

| **Ref Letter No J-13012/ 92/2008. IA.II ( T) dated 4th March, 2009** | | |
|---|---|---|
| S.No. | **Conditions** | **Compliance status** |
| 6 | Map indicating CRZ area duly certified by the approved agency and authenticated by the state coastal zone management authority may be submitted on Top priority. | Map has already been submitted to MOEF, |
| 7 | Compliance status w.r.to stipulated EC conditions should be uploaded in the company web site and updated twice in a year and the same will also be sent by e-mail to the MOEF regional office located at Bangalore. | Six monthly compliance reports are being regularly uploaded on the company web site. The link is as below.<br><br>http://www.hindujanationalpower.com/images/compliance-status October 2020-March 2021 -website-version.pdf |
| 8 | The ambient levels of criteria pollutants ( SO2, NOX & SPM) should be uploaded and displaced on your website and also at a convenient place in the plant premises periodically. | Display is kept at the entrance of power project. |

| **Sr. No** | **Condition (Letter No: 11/58/2011 IA.III dated 3rd January, 2014 )** | **Compliance Status** |
|---|---|---|
| **SPECIFIC CONDITIONS** | | |
| | | |
| (i) | "Consent for Establishments" shall be obtained from State Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site. | "Consent for Establishment" was issued by state pollution control board vide their order no 19/PCB/C.ESTI/RO/VSPI AEE- VIII/95 -4433 signed dated 13/11/1995 and complied with. |
| (ii) | Shall maintain the existing vegetation cover in the area between HTL and 500m line which is approximately 180 acres, belonging to government, located adjacent to the project area, in consultation with the State Government and there shall be no industrial development with in this area as committed. | Noted. There is already plantation exist in part of this area. Additional plantation in this area and in the land owned by HNPCL is in progress. |
| (iii) | The railway line has been shifted from mud flat area and as per the modified line only 160m is with in mud flat area as against the original plan on 1500m. Railway line in CRZ area shall be on stilt. | Noted. Correction in the design has been done for implementation and as per revised proposal length of Railway line in CRZ3 area is 0.375 Route Km and Railway line does not pass through CRZ1 area or Inter tidal waters of mud flat. The proposal has been approved by MOEF&CC vide letter No.F.No.11-58/2011-IA-III dated:1st |

| Sr. No | Condition (Letter No: 11/58/2011 IA.III dated 3rd January, 2014 ) | Compliance Status |
|---|---|---|
| | | October, 2015. |
| (iv) | There shall be no construction in mudflat except part of railway line on stilt as committed. | Noted. Shall be complied with. |
| (v) | Adequate spare diffuser arms for operation and maintenance of the marine outfall systems shall be Provided. | Spare diffusers arm shall be kept for O&M. |
| (vi) | Pipelines shall be laid with more care to minimize the impact to sand dunes | Noted. |
| (vii) | The double story switchgear, electro chlorination building and two numbers of storage tanks Proposed between 200 and 500 m from HTL shall be located beyond 500 m from HTL as committed. | Complied. The electro chlorination building and the storage tanks have been constructed beyond 500 m from the HTL with in the plant premises. |
| (viii) | Periodic monitoring of water quality in terms of temperature chlorine content if applicable, salinity etc at the outfall locations shall be carried out. If the impact of temperature and salinity is found significant in future, necessary remediation measures shall be taken by extending the outfall as well as the intake lines and/or providing augmentation in inland cooling facilities. | Periodic monitoring of water quality is going on at outfall location.<br><br>Agreed. |
| (ix) | Installation of trash bar/screens shall be put in place at the intake well to avoid fish entrapment | Complied. Trash rack has been installed. |
| (x) | All the conditions laid by the SCZMA shall be strictly adhered to. | Agreed |
| (xi) | Construction activity shall be carried out strictly as per the provisions of CRZ Notification, 2011. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area. | Agreed |
| (xii) | The project shall be executed in such a manner that there shall not be any Disturbance to the fishing activity. | Noted. There is no disturbance to fishing activity |
| | It shall be ensured that there is no displacement of people, houses or fishing activity as a result of the project | Shall be ensured |
| (xiii) | The project proponents shall set up separate Environment management cell for effective implementation of the stipulated environmental Safeguard under the supervision of a Senior executive. | The Environment management is done by senior management personnel .One officer has already been appointed to monitor the implementation on continuous basis. |
| | The funds earmarked for environment management shall be included in the budget and this shall not be diverted for any other purposes. | Noted. |
| **General Conditions** | | |
| **Sr.No** | **Condition (Letter F.No: 11-58/2011-IA-III dated 3rd January, 2014 )** | **Compliance Status** |
| (i) | Appropriate measures must be take while undertaking digging activities to avoid any likely degradation of water quality. | Noted. |
| (ii) | Full supports shall be extended to the officer of this | |

| Sr. No | Condition (Letter No: 11/58/2011 IA.III dated 3rd January, 2014 ) | Compliance Status |
|---|---|---|
| | Ministry/Regional office at Bengaluru by the project proponent during inspection of the project for monitoring purposes by furnishing full details and action plan including action taken reports in respect of mitigation measures and other environment protection activities. | Noted. |
| (iii) | A six-Monthly monitoring report shall need to be submitted by the project proponents to the Regional Office of this Ministry at Bengaluru regarding the implementation of the stipulated Conditions. | Noted and being complied with. |
| (iv) | Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environment and the same shall be complied with. | Agreed. |
| (v) | The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry. | Noted |
| (vi) | In the event of a change in project profile or change in the implementation agency, fresh references shall be made to the Ministry of Environment and Forests. | Noted |
| (vii) | The project proponent shall inform the Regional office as well as the Ministry, the date-of financial closure and final approval of the project by the concerned Authorities and the date of start of land Development work. | Complied. |
| (viii) | A copy of the clearance letter shall be marked to concerned Panchayat/local NGO, if any, from whom any suggestion /representation has been Made received while processing the Proposal. | Agreed. |
| (ix) | State Pollution Control Board shall display a copy of the clearance letter at the Regional Office, District Industries Center and Collector's Office/ Tehsildar's office for 30 days. | NA |

| Sr. No. | Condition (Letter No: F.NO. 11-58/ 2011-IA.III dated 17/19th March 2015) | Compliance Status |
|---|---|---|
| (i) | Railway line, in the CRZ, shall be on embankment with clear openings or on stilt so as to ensure free flow of water. | Noted. Being complied with. |
| (ii) | PP shall get an expert opinion on the design of alignment on CRZ area on embankment with clear openings or on stilt so as to ensure free flow of water and submit to Ministry prior to commencement of Railway line work in CRZ area. | Noted |
| (iii) | The water bodies present adjacent to the proposed to the Railway alignment shall not be disturbed. | Noted. Shall be adhered to. |

| Sr. No. | Condition (Letter No: F.NO. 11-58/ 2011-IA-III dated 01th October 2015) (Amendment in CRZ Clearance-reg) | Compliance Status |
|---|---|---|
| (i) | All the conditions/recommendation stipulated by Andhra Pradesh Coastal zone Management Authority | Noted. Details are furnished below |

| Sr. No. | Condition (Letter No: F.NO. 11-58/ 2011-IA-III dated 01th October 2015) (Amendment in CRZ Clearance-reg) | Compliance Status |
|---|---|---|
| | (APCZMA) vide letter No.245/Env/CZMA/2015 dated 05.06.2015 shall strictly be complied with | |
| (ii) | All the condition stipulated in the clearance vide letter No.11-58/2011-IA-III dated 3rd January, 2014 and subsequent amendment dated 17th March, 2015 shall remain unchanged. | Noted and complied as detailed above |

| Sr. No. | Condition (Letter No: F.NO. 11-58/ 2011-IA-III dated 01th October 2015) (Interim arrangement for the sea water intake and outfall system-reg) | Compliance Status |
|---|---|---|
| (i) | All the conditions/recommendation stipulated by Andhra Pradesh Coastal zone Management Authority (APCZMA) vide letter No.245/Env/CZMA/2015 dated 06.07.2015 shall strictly be complied with | Noted. Details are furnished below |
| (ii) | All the condition stipulated in the clearance granted by this Ministry vide letter No.11-58/2011-IA-III dated 3rd January, 2014 and subsequent amendment dated 17th March, 2015 shall remain unchanged. | Noted and being complied with |
| (iii) | The PP shall use multi diffuser in the outfall. As suggested by NCSCM, the thermal water shall be release at 10 m depth from the 8 diffuser. | Noted and being complied with |
| (iv) | A monitoring system shall be deployed by the PP to assess the movement of thermal plume in and around the outfall coolant water jetty due to the occurrence of thermal plume oscillation in south-north direction during monsoon and also to monitor the impact of hot water discharge in to the sea water flora and fauna. The PP shall comply with at the direction of the APCZMA and take necessary corrective measures wherever required. | Noted and being complied with |
| (v) | The PP shall take all necessary clearance from the concerned authorities viz-a-viz from the concerned State Pollution Control Board | Noted and being complied with |
| (vi) | Care should also be take to ascertain minimal impact on the shore line change due to construction of coastal structures. For this purpose, shoreline change shall be monitored using the satellite imaginary and by beach profile studies at regular intravels. | Noted and being complied with |

| Sr. No. | Condition (Letter No: 245/Env/CZMA/2015, dated 05th June 2015) | Compliance Status |
|---|---|---|
| 1 | The proposed pipeline shall conform to the norms prescribed in the CRZ Notification issued by the Ministry of Environment and Forests, Government of India S. 0. No.19(E), dated 06-01-2011 | Complied |
| 2 | No activity on the ground shall be undertaken without obtaining Environmental Clearance from the Ministry of Environment and Forests, Government of India as per | Noted |

| Sr. No. | **Condition (Letter No: 245/Env/CZMA/2015, dated 05th June 2015)** | Compliance Status |
|---|---|---|
| | S. 0. No.19(E), dated 06-01-2011 and the amendments issued thereof | |
| 3 | There shall be minimum disturbance to the sand dunes and other vegetation | Noted |
| 4 | On account of inversion process occurring along the Vizag coast, wherein the temperature profile gets reversed in such a way that bottom temperature tend to become higher than surface temperature on seasonal basis. Hence, it is suggested that a constant monitoring system shall be established to monitor the physical, chemical and biological activity near the outfall point and its surroundings. The industry shall take necessary steps to attain the safe diffusion of used ballast sea water discharged through outfall system | Regularly monitoring at discharge point is being carried out. All necessary steps has taken for safe discharge of ballast sea water. |
| 5 | Marker buoy and light indicators shall be established close to the intake and outfall points to avoid fishing net damage | Exploring the suitable items from market. |
| 6 | Residual chlorine in the return water shall be kept at a very low concentration at discharge point. If possible, de-chlorination by hypo may be taken up before disposal of warm water into the sea | Noted |
| 7 | Additional diffusers shall be installed to enhance the dispersion of the hot water to facilitate the dissipation of temperature | Noted. |
| 8 | Regular monitoring of water quality at bottom and surface shall be carried out for pH, TSM, Salinity, DO, BOD, dissolved phosphate, nitrate, ammonia and PHC | Water quality monitoring in sea water carried out regularly |
| 9 | Inter-tidal region shall be analyzed for texture, phosphorous, chromium, nickel, copper, cadmium, lead, mercury and PHC | Noted and being complied with |
| 10 | Biological characteristics shall be assessed based on primary productivity, phytopigments, phytoplankton populations and their generic diversity, biomass, population and community diversity of benthos, fisheries composition and density as well as species diversity | Noted and being complied with |
| 11 | Regular (seasonal) monitoring of temperature at the outfall to take necessary mitigation measures. Online monitoring of salinity and temperature may be implemented | Is being complied |
| 12 | Shoreline evolution to be predicted by using Mathematical Model preferably `LITPACK of MIKE.21' due to the impact that may be caused by the piers constructed to carry intake and outfall pipelines | Noted and being complied with |
| 13 | Shoreline monitoring shall be carried out regularly by a reputed organization having requisite experience, in order to take up suitable preventive measures. | Noted and being complied with |
| 14 | The geographical position of the present HTL, LTL and slope of the beaches shall be maintained i.e. any erosion that may occur need to be prevented. The beach front shall be restored to the normal condition by adopting suitable engineering and vegetative | Noted and will be complied |

| Sr. No. | **Condition (Letter No: 245/Env/CZMA/2015, dated 05th June 2015)** | Compliance Status |
|---|---|---|
| | measures | |
| 15 | The Ash generated shall be utilized as per the norms stipulated in Fly Ash Notification dated 14-09-1999 | Noted and being complied with |
| 16 | Environmental audit shall be taken up periodically by the independent agency and submit the report to the Regulatory Agencies | Noted and Form-v is being submitted |

| **Sr. No.** | **Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II** | **Compliance Status** |
|---|---|---|
| | **SCHEDULE-A** | |
| 1 | Any up-set condition in any industrial plant / activity of the industry, which result in, increased effluent / emission discharge and/ or violation of standards stipulated in this order shall be informed to this Board, under intimation to the Collector and District Magistrate and take immediate action to bring down the discharge / emission below the limits. | Noted and shall be complied when such condition arises. |
| 2 | The industry should carryout analysis of waste water discharges or emissions through chimneys for the parameters mentioned in this order on quarterly basis and submit to the Board. | Noted and being complied with |
| 3 | All the rules & regulations notified by Ministry of Law and Justice, Government of India regarding Public Liability Insurance Act, 1991 should be followed as applicable | Public liability insurance is obtained |
| 4 | The industry should put up two sign boards (6x4 ft. each) at publicly visible places at the main gate indicating the products, effluent discharge standards, air emission standards, hazardous waste quantities and validity of CFO and exhibit the CFO order at a prominent place in the factory premises | Noted and being complied with |
| 5 | Notwithstanding anything contained in this consent order, the Board hereby reserves the right and powers to review / revoke any and/or all the conditions imposed herein above and to make such variations as deemed fit for the purpose of the Acts by the Board. | Noted |
| 6 | The applicant shall submit Environment statement in Form V before 30th September every year as per Rule No.14 of E(P) Rules, 1986 & amendments thereof | Noted and being complied with |
| 7 | The applicant should make applications through Online for renewal of Consent (under Water and Air Acts) and Authorization under HWM Rules at least 120 days before the date of expiry of this order, along with prescribed fee under Water and Air Acts and detailed compliance of CFO conditions for obtaining Consent & HW Authorization of the Board. The industry should immediately submit the revised application for consent to this Board in the event of any change in the raw material used, processes employed, quantity of trade effluents & quantity of emissions. Any change in the management shall be informed to the Board. The person authorized should not let out the premises / lend / sell / transfer their industrial premises without obtaining prior permission of the State Pollution Control Board. | Noted and being complied with |
| 8 | Any person aggrieved by an order made by the State Board under Section 25, Section 26, Section 27 of Water Act, 1974 or | Noted and being complied with |

<table>
<tr><th>Sr. No.</th><th>Condition<br>(Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II</th><th>Compliance Status</th></tr>
<tr><td></td><td>Section 21 of Air Act, 1981 may within thirty days from the date on which the order is communicated to him, prefer an appeal as per Andhra Pradesh Water Rules, 1976 and Air Rules 1982, to Appellate authority constituted under Section 28 of the Water(Prevention and Control of Pollution) Act, 1974 and Section 31 of the Air(Prevention and Control of Pollution) Act, 1981.</td><td></td></tr>
<tr><td>9</td><td>The industry may explore the possibility of tapping the solar energy for their energy requirement.</td><td>Will be reviewed.</td></tr>
<tr><td></td><td>SCHEDULE – B</td><td></td></tr>
<tr><td></td><td>WATER POLLUTION</td><td></td></tr>
<tr><td>1</td><td>The effluent discharged shall not contain constituents in excess of the tolerance limits mentioned below
<table>
<tr><th>Outlet</th><th>Parameter</th><th>Limiting Standards</th></tr>
<tr><td>1</td><td>pH</td><td>6.50 — 8.50</td></tr>
<tr><td></td><td colspan="2">Temperature-not more than 7°C higher than intake water as per MoEF Communication dated 20.04.1999.</td></tr>
<tr><td></td><td>Total Suspended Solids(at 103—105° C)</td><td>100 mg/I</td></tr>
<tr><td></td><td>Oil and Grease</td><td>20 mg/I</td></tr>
<tr><td></td><td>Free chlorine</td><td>0.5 mg/I</td></tr>
<tr><td></td><td>Phosphate as PO4</td><td>20 mg/I</td></tr>
<tr><td></td><td>Chromium (Total)</td><td>0.2 mg/I</td></tr>
<tr><td></td><td>Copper (Total)</td><td>1mg/I</td></tr>
<tr><td></td><td>Iron</td><td>1 mg/I</td></tr>
<tr><td></td><td>Zinc</td><td>1 mg/I</td></tr>
<tr><td>2</td><td>pH</td><td>6.50 — 8.50</td></tr>
<tr><td></td><td>Oil and Grease</td><td>10 mg/l</td></tr>
<tr><td></td><td>BOD (3 days at 27 °C)</td><td>30 mg/l</td></tr>
<tr><td></td><td>Total Suspended Solids</td><td><100 mg/I</td></tr>
<tr><td></td><td>Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml</td><td><1000MPN /100 ml</td></tr>
</table></td><td>Noted and the effluent is Within the prescribed limits</td></tr>
<tr><td>2</td><td>The industry water consumption shall not exceed the quantities mentioned below:
<table>
<tr><th>S.No</th><th>Purpose</th><th>Quantity (m3/hr)</th></tr>
<tr><td></td><td>Condenser & Auxiliary Cooling Water System</td><td>175580</td></tr>
<tr><td></td><td>Ash water sump</td><td>2600</td></tr>
<tr><td></td><td>Dust Suppression system</td><td>220</td></tr>
<tr><td></td><td>For Desalination Plant feed</td><td>1600</td></tr>
<tr><td></td><td>Total</td><td>180000</td></tr>
<tr><td colspan="3">Details of specific consumption:</td></tr>
<tr><td>4 A</td><td colspan="2">From Desalination Plant to Reservoir</td></tr>
<tr><td>4 A 1</td><td>From reservoir to UF/RO System</td><td>503</td></tr>
<tr><td></td><td>RO Plant to Boiler Make Up, CPU Regeneration & other utilities</td><td>110</td></tr>
<tr><td></td><td>Blow down Quenching</td><td>90</td></tr>
<tr><td></td><td>Domestic Water</td><td>30</td></tr>
<tr><td></td><td>HVAC & Ventilation</td><td>80</td></tr>
<tr><td></td><td>Seal Water</td><td>75</td></tr>
<tr><td></td><td>Service water</td><td>52</td></tr>
<tr><td></td><td>APH & ESP Wash (As and when required)</td><td>06</td></tr>
<tr><td></td><td>RO Plant to Clarifier</td><td>---</td></tr>
<tr><td></td><td>UF , RO & EDI reject</td><td>70</td></tr>
<tr><td>4 A B</td><td>Water remain in recovery</td><td>11</td></tr>
</table>
Separate meters with necessary pipe-line shall be maintained for assessing the quantity of water used for each of the purposes mentioned above for Cess assessment purpose.</td><td>Noted and being complied with</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>Condition<br>(Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II</th><th>Compliance Status</th></tr>
<tr><td>3</td><td>The industry shall maintain water meters for recording consumption of Sea water and maintain proper records for daily water consumption and shall submit monthly reports to the RO, Visakhapatnam.</td><td>Noted and being complied with</td></tr>
<tr><td>4</td><td>The industry shall install water meters at service water, domestic, ash water sumps by 31.03.2020.</td><td>All water meters installed including Ash water meter.</td></tr>
<tr><td>5</td><td>The industry shall maintain flow meters preferably Electro Magnetic flow meters with totalizers for water and effluent quantity measurements for different streams of effluents and different categories of water usage stipulated in this order. The industry shall recycle the ash pond and D.M. Plant effluent</td><td>Noted and being complied with</td></tr>
<tr><td>6</td><td>The run-off water from coal yard shall be treated to on land for irrigation standards before final disposal.</td><td>Noted</td></tr>
<tr><td>7</td><td>The industry shall discharge the cooling water into sea through a suitable submarine pipeline</td><td>Noted</td></tr>
<tr><td>8</td><td>The industry shall monitor all ground water peizo wells and submit report to RO Visakhapatnam every three months indicating trends</td><td>Noted and being complied</td></tr>
<tr><td>9</td><td>The industry shall maintain proper arrangements for collection of seepage from ash pond and pumped back into the ash water system, so as to avoid ground water pollution in the surrounding area.</td><td>Noted</td></tr>
<tr><td>10</td><td>The industry shall treat the domestic effluents by adopting suitable technologies such as oxidation ponds aerated lagoons and discharge the treated effluents on the land for the irrigation/gardening.</td><td>Noted and being complied</td></tr>
<tr><td>11</td><td>The cooling water used in the once through system if treated with biocide will affect the Biota of the sea and fishing also, in the proximity of the discharge point. It should be controlled properly designed outfall into the sea.</td><td>Noted</td></tr>
<tr><td></td><td>AIR POLLUTION</td><td></td></tr>
<tr><td>1</td><td>The emissions shall not contain constituents in excess of the prescribed limits mentioned below.
<table>
<tr><th>Chimney No.</th><th>Parameter</th><th>Emission Standards</th></tr>
<tr><td>1</td><td>Particulate matter</td><td>50 mg/Nm3</td></tr>
<tr><td></td><td>SO2</td><td>200 mg/Nm3</td></tr>
<tr><td></td><td>NOx</td><td>300 mg/Nm3</td></tr>
<tr><td></td><td>Mercury</td><td>0.03 mg/Nm3</td></tr>
</table></td><td>Noted.</td></tr>
<tr><td>2</td><td>The industry shall comply with emission limits for DG sets of capacity upto 800 KW as per the Notification G.S.R.520 (E), dated 01.07.2003 under the Environment (Protection) Amendment Rules, 2003 and G.S.R.448(E), dated 12.07.2004 under the Environment (Protection) Second Amendment Rules, 2004. In case of DG sets of capacity more than 800 KW shall comply with emission limits as per the Notification G.S.R.489 (E), dated 09.07.2002 at serial No.96, under the Environment (Protection) Act, 1986.</td><td>Noted and being complied with.<br>The DG sets are standby and used only in the absence of grid power supply.</td></tr>
<tr><td>3</td><td>The industry shall comply with ambient air quality standards of PM10 (Particulate Matter size less than 10µm) - 100 µg/m3; PM2.5 (Particulate Matter size less than 2.5 µm)60 µg/m3; SO2 - 80 µg/m3; NO2 - 80 µg/m3 outside the factory premises at the periphery of the industry. Standards for other parameters as mentioned in the National Ambient Air Quality Standards CPCB Notification No.B-29016/20/90/PCI-I, dated 18.11.2009</td><td>Noted and being complied with<br><br>The Ambient air Quality and noise parameters with in the stipulated standards and reports are being</td></tr>
</table>

| Sr. No. | Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II | Compliance Status |
|---|---|---|
| | **Noise Levels**: Day time (6 AM to 10 PM) - 75 dB (A)<br>Night time (10 PM to 6 AM) - 70 dB (A). | submitted regularly |
| 4 | The industry shall provide interlocking facility between APC equipment (ESP) and fuel feeding system, in such a way that the feeding of the fuel shall be stopped automatically, in case, the ESP fails/ tripping's are occurred within 3 months. | Noted |
| 5 | The industry shall rectify CAAQM station at Coal Handling plant made in working condition by 10.04.2020. | Procurement process is in progress. Plant is under reserved shut down since July' 2020. |
| 6 | The industry shall maintain online Stack and ambient monitoring systems with connection to the Board's website | Online monitoring systems are available and Connected to board through online website. |
| 7 | The industry shall take necessary measures like Ammonia dosing to maintain ESPs attached to the Boilers so as to meet SPM standards all the time. | Noted and being complied |
| 8 | The industry maintain the data logging facility provided for storing online stack emission data properly, for retrieval as and when necessary. Industry shall submit monthly report to the RO Visakhapatnam | Noted. The data is being directly connected to APPCB website for online monitoring. |
| | | |
| | **GENERAL:** | |
| 1 | The industry shall not increase the capacity beyond the permitted capacity mentioned in this order. | Noted |
| 2 | The industry shall provide temperature indicator at marine out fall for assessing the temperature between the intake water and discharge water within three months. | Noted and being complied with |
| 3 | The industry shall discharge off once through cooling effluents from Unit – 1 & 2 at a distance of 900 mts from the shoreline. | Noted and being complied with |
| 4 | The industry shall install permanent mechanical sprinklers for suppression of dust on the haul roads in between the villages and report the compliance to RO-Visakhapatnam | Complied. Mobile water tankers are being used for water sprinkling on roads. |
| 5 | The industry shall comply with CPCB directions dated 05.02.2014 / 02.03.2015 and guidelines issued regarding online monitoring systems issued from time to time. The online monitoring system shall be calibrated periodically as per equipment suppliers manual / CPCB guidelines | AAQ and Stack Emission of online monitoring systems are connected to APPCB and CPCB web site. |
| 6 | The industry shall maintain the following records and the same shall be made available to the Board Officials during the inspection.<br>• Daily power generation details.<br>• Quantity of Effluents generated and disposed.<br>• Log Books for pollution control systems.<br>• Daily Fly ash generated and disposed. | Noted and being complied with |
| 7 | The industry shall dispose fly ash to cement / brick units and export, excess to ash pond. | Pond ash and Fly ash will be utilized by the following Agencies:<br><br>1) Simhadri Constructions.<br><br>plant is under reserved shutdown. |
| 8 | The industry shall submit detailed action plan for fly ash utilization as per the Fly Ash Notification on MoEF to the Board to achieve 100% utilisation of fly ash | Complied |

| Sr. No. | Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II | Compliance Status |
|---|---|---|
| 9 | The industry shall achieve 100 % of fly ash utilization within 3 months | Noted |
| 10 | The industry shall maintain water curtain in ash ponds as the fly ash is exposing to atmosphere and causing dust emissions during wind blow. | Noted and being complied with |
| 11 | The industry shall establish a dedicated Environmental cell for continuous monitoring of plant environment to ensure compliance of CFO conditions. | The Environment management is done by a senior management personnel .One senior officer has been given the responsibility to monitor the implementation on continuous basis. |
| 12 | Thick green belt shall be maintained by the industry covering an area of 33% of total area. | Presently green belt is being developed in and around the power project area in consultation with DFO and an area of 249.14 acres has already been developed.<br><br>Further development of Green belt continuous. |
| 13 | The industry shall not exceed of emissions standards at any point of time. In case the industry exceeds the standards in the CEMS data, environmental compensation will be levied. | Noted |
| 14 | The industry shall treat the cooling waste waters to the marine coastal standards and the domestic waste waters to the on land for irrigation standards stipulated under Environmental (protection) Rules, 1986 as amended upto date, notified under Environment (Protection) Act,1986 by Ministry of Environment and Forest, Govt of India. | Noted |
| 15 | The industry shall maintain suitable control equipment facilities in the coal handling plant and dust suppression in all coal and material handling areas shall be achieved through appropriate methods. | Noted and being complied |
| 16 | The industry shall maintain duly compacted soil cover of requisite thickness as per norms for the ash ponds to avoid dust pollution and report the compliance to RO Visakhapatnam. | Noted |
| 17 | All the conditions/recommendations stipulated by A.P. Coastal Zone Management Authority vide letter No. 245/Env/CZMA/2015 dated 06.07.2015 shall be complied with. | Noted and being complied |
| 18 | All the conditions stipulated in the CRZ clearance granted by this Ministry vide letter No. 11-58/2011-IA-III dated 3rd January, 2014 and subsequent amendment dated 17th March, 2015 shall remain unchanged. | Noted and being complied |
| 19 | The PP shall use multi diffuser in the outfall. As suggested by NCSCM, the thermal water release shall be release at 10 m depth from the 8 diffuser. | Noted and being complied with |
| 20 | A monitoring system shall be deployed by the PP to assess the movement of thermal plume in and around the outfall coolant water jetty due to the occurrence of thermal plume oscillation in south-north direction during monsoon and also to monitor the impact of hot water discharge into the Sea and the flora and fauna. The PP shall comply with at the directions of APCZMA and take necessary corrective measures wherever required. | Noted and being complied with |
| 21 | The PP shall take all necessary clearance from the concerned authorities viz-a-viz from the concerned State Pollution Control | Noted and being complied with |

| Sr. No. | Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II | Compliance Status |
|---|---|---|
| | Board. | |
| 22 | Care should be taken to ascertain minimal impact on the shoreline change due to construction of coastal structures. For this purpose, shoreline change shall be monitored using satellite imagery and by beach profile studies at regular intervals. | Noted and being complied with |
| 23 | The industry shall comply with the conditions stipulated in MoEF&CC,GoI amendment in CRZ Clearance Order dated 01.10.2015. | Noted and being complied with |
| 24 | The industry shall comply with the conditions stipulated in Amendment to the EC order dated 01.10.2015 regarding interim arrangement for the sea water intake and outfall system. | Noted and being complied with |
| | SCHEDULE – C [*see rule 6(2)]* | |
| | **[CONDITIONS OF AUTHORISATION FOR OCCUPIER OR OPERATOR HANDLING HAZARDOUS WASTES]** | |
| 1 | The authorized person shall comply with the provisions of the Environment (Protection) Act, 1986, and the rules made there under. | Noted and being complied with |
| 2 | The authorisation shall be produced for inspection at the request of an officer authorised by the State Pollution Control Board. | Noted |
| 3 | The person authorised shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this authorization. | Noted |
| 4 | Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization. | Noted |
| 5 | The person authorised shall implement Emergency Response Procedure (ERP) for which this authorisation is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time; | Noted and being complied with |
| 6 | The person authorized shall comply with the provisions outlined in the Central Pollution Control Board guidelines on "Implementing Liabilities for Environmental Damages due to Handling and Disposal of Hazardous Waste and Penalty". | Noted and being complied with |
| 7 | It is the duty of the authorised person to take prior permission of the State Pollution Control Board to close down the facility. | Noted |
| 8 | An application for the renewal of an authorization shall be made as laid down under these Rules. | Noted and being complied |
| 9 | Any other conditions for compliance as per the Guidelines issued by the Ministry of Environment, Forest and Climate Change or Central Pollution Control Board from time to time. | Noted |
| | **Specific Conditions:** | |
| 10 | Annual return shall be filed by June 30th for the period ensuring 31st March of the year. | Noted and being complied |
| 11 | The industry shall comply with the provisions of HWM Rules, 2016 in terms of interstate transport of Hazardous Waste and manifest document prescribed Under Rule 18 and 19 of the HWM Rules, 2016. | Noted and being complied |
| 12 | The industry shall not store hazardous waste for more than 90 days as per the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016. | Noted and being complied |
| 13 | The industry shall store Used / Waste Oil and Used Lead Acid Batteries in a secured way in their premises till its disposal to the manufacturers / dealers on buyback basis. | Noted and being complied |
| 14 | The industry shall transport the hazardous waste through vehicle fitted with GPS tracking system. | Noted and being complied |

| Sr. No. | Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2020, dated 06th March 2020) for Unit – I & Unit – II | Compliance Status |
|---|---|---|
| 15 | The industry shall maintain 7 copy manifest system for transportation of waste generated and a copy shall be submitted to concerned Regional Office of APPCB. The driver who transports Hazardous Waste should be well acquainted about the procedure to be followed in case of an emergency during transit. The transporter should carry a Transport Emergency (TREM) Card. | Noted and being complied |
| 16 | The industry shall maintain proper records for Hazardous and Other Wastes stated in Authorisation in Form-3 i.e., quantity of Incinerable waste, land disposal waste, recyclable waste etc., and file annual returns in Form-4 as per Rule 20 (2) of the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016. | Noted and being complied |

# Chapter-3

# Description of the Environment

# 3.0 BASELINE ENVIRONMENTAL STATUS

## 3.1 Meteorology

Micro - Meteorological data within the project area during the air quality survey period is an indispensable part of the air pollution study. A meteorological station was installed on the top of Plant Security office, which is about 10 m height from the ground level in plant site free from obstructions to free flow of winds.

Wind speed and Wind direction data recorded during the study period are useful for the calculation of relative percentage frequencies of different wind directions and are plotted as wind roses of sixteen directions Viz. N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW for twenty four hours duration respectively.

Maximum and Minimum temperatures including the percentage relative humidity were also recorded simultaneously.

### 3.1.1 Wind Pattern during October 2020 - March 2021

The area is marked by high wind speeds in the range of calm to 19 KMPH winds. During the 00-24 hrs, the predominant wind directions were from NE (16.4%), E(12.7%), ENE(9.7%), SW (8.1%) and NNE (7.0%) of the total time. The calm conditions prevailed for 12.8% of the total time. The winds prevailed for 33.2% of the total time in other directions. The average wind rose for the study period is shown in **Figure-3.1.**

- ***Temperature and Relative Humidity Levels during October 2020 - March 2021***

  Maximum and minimum temperatures recorded during the study period were 33.0 and 15.0°C respectively. Maximum and minimum relative humidity recorded during the study period was 96 and 32 % respectively. Rainfall was observed during the study period is about 320.5 mm which is given in **Table-3.1.**

**TABLE-3.1**
**METEOROLOGICAL DATA GENERATED AT PROJECT SITE**

| Sr. No | Parameters | October 2020 - March 2021 | |
|---|---|---|---|
| | | Min | Max |
| 1 | Temperature (°C) | 15.0 | 33.0 |
| 2 | Relative humidity (%) | 32 | 96 |
| 63 | Atmospheric Pressure (mb) | 1007.4 | 1015.3 |
| 4 | Rainfall (mm) | 320.5 | |

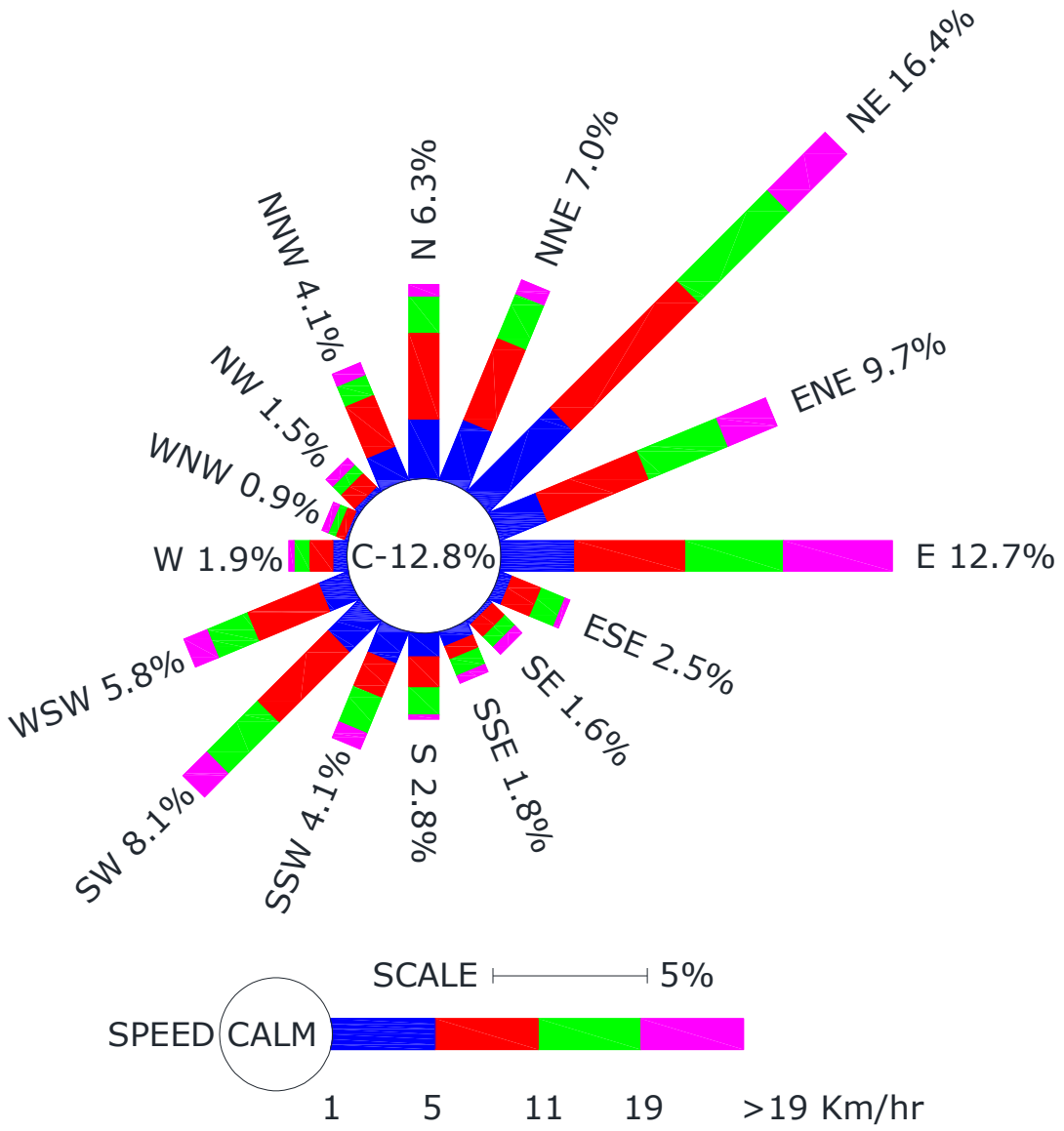



**FIGURE-3.1**
**WINDROSE FOR OCTOBER 2020 TO MARCH 2021**

## 3.2 Ambient Air Quality

Dispersion of different air pollutants released into the atmosphere has significant impacts on neighborhood air environment of an industrial project. The existing ambient air quality status with respect to the study zone of 10 km radial distance from the plant site has been assessed through a monitoring network of 8 AAQ stations during the **October 2020 - March 2021.**

The design of monitoring network in the air quality surveillance programme has been based on the GLC's obtained using long term screening model considering the following:

(i) Meteorological conditions on synoptic scale;
(ii) Topography of the study area;
(iii) Representation of regional background levels;
(iv) Representation of plant site; and
(v) Representation of cross sectional distribution in the downward direction.

The existing status of Air environment was monitored for PM2.5, PM10, and gaseous pollutants like Sulphur dioxide ($SO_2$), Nitrogen dioxide (NO2) and Carbon monoxide (CO), Ammonia ($NH_3$), Ozone ($O_3$), Benzene ($C_6H_6$) and metals like Benzo(a)pyrene, Lead (Pb), Arsenic (As) and Nickel (Ni).

Ambient Air Quality Monitoring (AAQM) stations were set up at 8 locations with due consideration to the above mentioned points. **Table-3.2** gives the details of environmental setting around each monitoring station. The location of the selected stations with reference to the plant site is given in the same table and depicted in **Figure–3.2**.

### 3.2.1 Frequency and Parameters for Sampling

The following frequency has been adopted for sampling:

Ambient air quality monitoring has been carried out with a frequency of 2 days per week at 8 locations. (October 2020 - March 2021).

The Post monitoring of air environment is generated for the following parameters:

- Fine Respirable Particulate Matter (PM2.5);
- Respirable Particulate Matter (PM10);
- Sulphur dioxide ($SO_2$);
- Nitrogen dioxide ($NO_2$);
- Carbon Monoxide (CO);
- Ammonia ($NH_3$);
- Ozone ($O_3$);
- Benzene ($C_6H_6$);
- Benzo(a)pyrene;
- Lead (Pb);
- Arsenic (As) and
- Nickel (Ni).

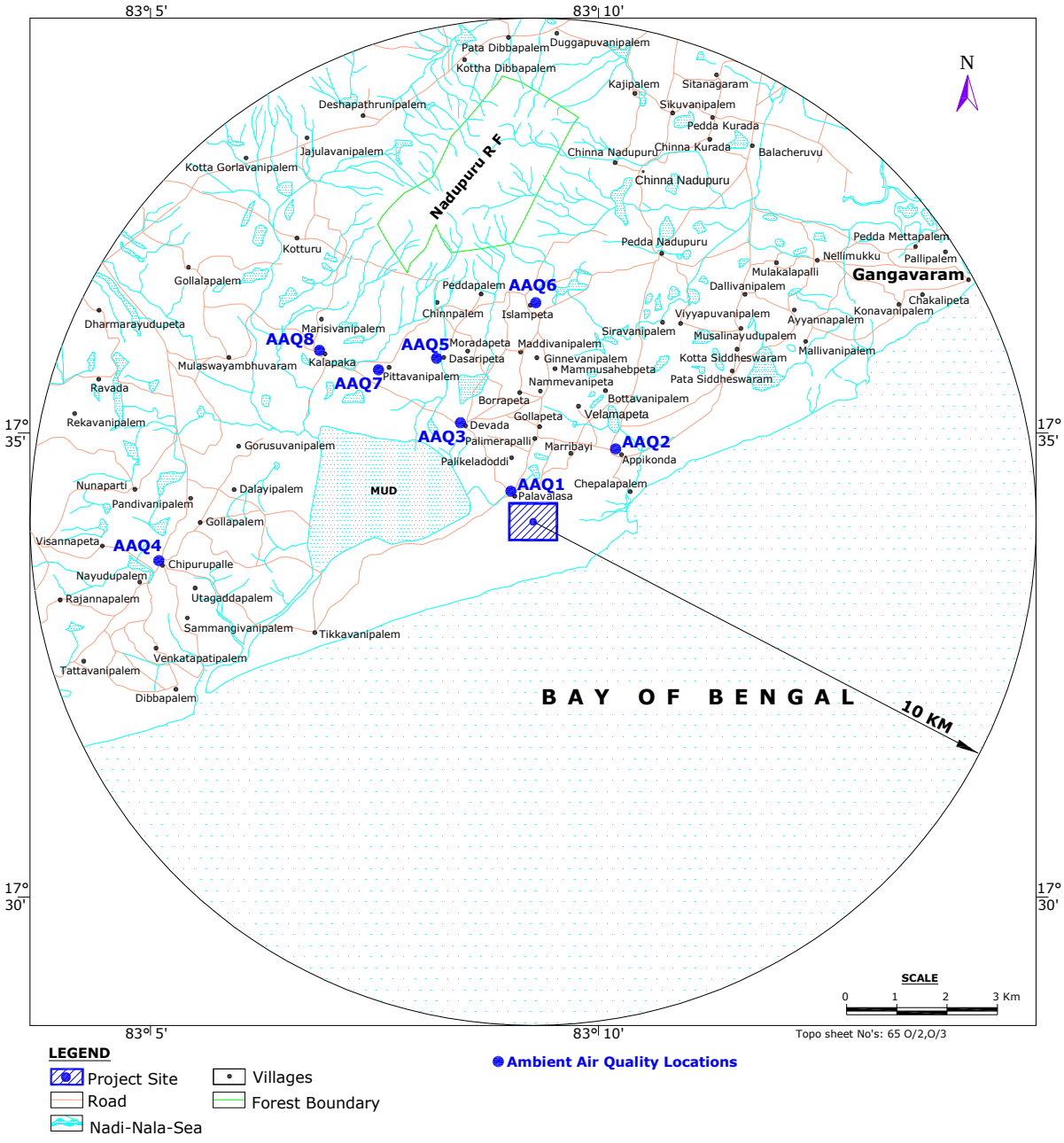



**FIGURE-3.2**
**AIR QUALITY SAMPLING LOCATIONS**

**TABLE-3.2**
**DETAILS OF AMBIENT AIR QUALITY MONITORING LOCATIONS**

| Station Code | Name of the Station | Distance w.r.t. site (km) | Direction w.r.t. site | Environmental Setting |
|---|---|---|---|---|
| AAQ1 | Palavalasa | 0.5 | N | Rural/Residential activities |
| AAQ2 | Appikonda | 2.2 | NE | Rural/Residential activities |
| AAQ3 | Devada | 2.3 | NW | Rural/Residential activities |
| AAQ4 | Cheepurupalli | 7.4 | W | Rural/Residential activities |
| AAQ5 | Dasaripeta | 3.7 | NNW | Rural/Residential activities |
| AAQ6 | Islampeta | 4.3 | N | Rural/Residential activities. |
| AAQ7 | Pittavanipalem | 4.2 | NW | Rural/Residential activities |
| AAQ8 | Kalapaka | 5.3 | NW | Rural/Residential activities |

3.2.2 Duration of Sampling

The sampling duration for Particulate Matter PM2.5, PM10, $SO_2$, NO2, Ammonia, Benzo(a)Pyrene, Benzene, Arsenic, Nockel and Lead is twenty four hourly continuous sample per day and CO and Ozone is sampled for 8 hours continues thrice a day. This is to allow a comparison with the present revised standards mentioned in the latest Gazette notification of the Central Pollution Control Board (CPCB).

3.2.3 Method of Analysis

The air samples were analyzed as per standard methods specified by Central Pollution Control Board (CPCB) (16th November, 2009); IS: 5182 and American Public Health Association (APHA).

3.2.4 Details of the Sampling Locations

**AAQ1: PALAVALASA**

The monitoring station was installed on top of a residential building at a height of 4.5 m from ground level at a distance of 0.5 km in the N direction from the proposed plant site. This station was selected to assess the air quality levels in the crosswind direction. This location is situated within rural/residential activities.

**AAQ2: APPIKONDA**

The monitoring station was installed on top of a residential building at a height of 5.0 m from ground level at a distance of 2.2 km in the NE direction from the plant site. This station was selected to assess the air quality levels in the Down wind direction. This location is situated within rural/residential activities.

**AAQ3: DEVADA**

The monitoring station was installed on top of a residential building at a height of 4 m from ground level at a distance of 2.3 km in the North West direction from the

plant site. This station was selected to assess the air quality levels in the crosswind direction. This location is situated within rural/residential activities.

**AAQ4: CHEEPURUPALLE**

The location has been finalized to assess the air quality levels in the Up wind direction to the proposed plant site. The monitoring station is located at a distance of about 7.4 km west of the proposed plant site. The sampler is installed on a residential building at a height of about 4.5 m from ground level. Rural residential activities surround the station.

**AAQ5: DASARIPETA**

The sampling station has been finalized to assess the air quality levels in the crosswind direction to the proposed plant site. The monitoring station is located NNW of the plant site at about 3.7 km. The sampler was installed on top of residential building at a height of about 5.0 m from ground level free from any obstructions. This location is situated in rural/residential activities with village activities.

**AAQ6: ISLAMPETA**

The monitoring station was installed on top of a residential building at a height of 4.5 m from ground level at a distance of 4.3 km in the N direction from the plant site. This station was selected to assess the air quality levels in the crosswind direction. This location is situated within rural/residential activities.

**AAQ7: PITTAVANIPALEM**

The location has been finalized to assess the air quality levels in the downwind direction to the proposed plant site. The monitoring station is located at a distance of about 4.2 km North West of the proposed plant site. The sampler is installed on a residential building at a height of about 6.0 m from ground level. Rural residential activities surround the station.

**AAQ8: KALAPAKA**

At this monitoring station the sampler was installed on top of a residential building at a height of 5.0 m from ground level at a distance of 5.3 km in the NW direction from the proposed plant site. This station was selected to assess the air quality levels in the cross wind direction. This location is situated within rural/residential activities.

3.2.5 Selection of Instruments for Air Quality Sampling

Respirable Dust Samplers of Envirotech instruments are being used for monitoring Respirable Particulate Matter (PM10), Respirable fraction (<10 microns), Fine Respirable Particulate Matter (PM2.5), Respirable fraction (<2.5 microns), and gaseous pollutants like $SO_2$ and NO2. Gas Chromatography techniques have been used for the estimation of CO.

3.2.6 Sampling and Analytical Techniques

**1] Fine Respirable Particulate matter (PM2.5) and Respirable Particulate matter (PM10)**

Fine Respirable Particulate Matter – FRPM (PM2.5) and particles below 10 μ (PM10), which are more likely Respirable (Respirable Particulate matter – RPM). RPM Present in ambient air is measured by Gravemetric method by using Respirable Dust Sampler with a cyclone attachment over a period of 24 hours by sucking known quantity of air through Glass micro fibre filter paper and PM2.5 by Teflon filter paper. Respirable Dust (<10μ) is computed by measuring weight of collected matter in known volume of air sampled (BIS:5182 part IV, 1973; ASTM D-4096 -91).

**2] Sulphur Dioxide**

The most commonly used method for measuring atmospheric $SO_2$ is based on colorimetry and is known as modified West - Gaeke method. In this method $SO_2$ from a measured quantity of air is absorbed in a solution of sodium tetrachloromercurate to form a stable and non-volatile dichlorosulphitomercurate complex. This is then reacted with formaldehyde and bleached pararosaniline, yielding magenta - coloured pararosaniline methyl sulfonic acid. The colour intensity of this acid is detected photometrically at 560 nm (A.P.H.A and BIS: 5182 Part-II, 1969).

**3] Nitrogen Dioxide**

Concentration of nitrogen dioxide is estimated in ambient air by using Jacob and Hochheiser method. Nitrogen dioxide are collected by bubbling air through a sodium hydroxide solution to form a stable solution of sodium nitrite. The nitrite ion produced during sampling is determined colorimetrically by reacting the exposed absorbing reagent with phosphoric acid, sulfanilamide, and NEDA (1-naphthyl ethylenediamine dihydrochloride) at 540 nm (BIS: 5182 Part-VI, 1975).

**4] Carbon Monoxide**

A sample of the air containing carbon monoxide is adsorbed on Charcoal plugged into a glass tube. The adsorbed charcoal is eluted using the solvent, which in turn is projected into the gas chromatograph where it is carried from one end of the column to the other. During its movement, the constituents of the sample undergo distribution at different rates and ultimately get separated from one another. The separated constituents emerge from the end of the column one after the other and are detected by suitable means whose response is related to the amount of a specific component leaving the column [CO- IS: 5182 (Part-X)].

The details of the methods used for monitoring studies are presented in **Table-3.3.**

**TABLE-3.3**
**TECHNIQUES USED FOR AMBIENT AIR QUALITY MONITORING**

| Sr. No. | Parameter | Method of Mesuarement |
|---|---|---|
| 1 | Fine Respirable Particulate Matter | Respirable Dust Sampler (Gravimetric method) |
| 2 | Respirable Particulate Matter | Respirable Dust Sampler (Gravimetric method) |
| 3 | Sulphur Dioxide | Improved West and Gaeke method |
| 4 | Nitrogen Oxide | Modified Jacob & Hochheiser method |
| 5 | Carbon Monoxide | NDIR (Non Dispersive Infrared Spectroscopy) |
| 6 | Ammonia ($NH_3$) | Indophenol Blue method |
| 7 | Ozone ($O_3$) | Spectrophotometric method |
| 8 | Benzene ($C_6H_6$) | Gas Chromatography |
| 9 | Benzo(a)pyrene | Solvent extraction followed by GC MS |
| 10 | Lead (Pb) | AAS / ICP-MS method |
| 11 | Arsenic (As) | AAS / ICP-MS method |
| 12 | Nickel (Ni) | AAS / ICP-MS method |

3.2.7 Presentation of Primary Data

**a) Observations of Primary Data – October 2020 to March 2021**

Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ1) Palavalasa village**

The maximum concentration for PM2.5 is recorded as 26.4 μg/m$^3$ with minimum concentration as 19.5 μg/m$^3$. The 98th percentile values are observed as 25.9 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 58.2 μg/m$^3$ with minimum concentration as 46.3 μg/m$^3$. The 98th percentile values are observed as 57.6 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 13.9 μg/m$^3$ with minimum concentration as 9.1 μg/m$^3$. The 98th percentile values are observed as 13.7 μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.6 μg/m3 with minimum concentration as 11.2 μg/m$^3$. The 98th percentile values are observed as 15.5 μg/ m$^3$ respectively.

The maximum CO concentration is recorded as 264 μg/m3 with minimum concentration as 177 μg/m$^3$. The 98th percentile values are observed as 282 μg/ m$^3$ respectively.

The maximum $O_3$ concentration is recorded as 8.1 μg/m3 with minimum concentration as 4.3 μg/$m^3$. The 98th percentile values are observed as 7.8 μg/$m^3$ respectively.
The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ2) Appikonda village**

The maximum concentration for PM2.5 is recorded as 26.7 μg/$m^3$ with minimum concentration at 18.7 μg/$m^3$. The 98th percentile values are observed as 26.3 μg/$m^3$ respectively.

The maximum concentration for PM10 is recorded as 54.2 μg/$m^3$ with minimum concentration as 41.8 μg/$m^3$. The 98th percentile values are observed as 53.6 μg/$m^3$ respectively.

The maximum $SO_2$ concentration is recorded as 13.4 μg/$m^3$ with minimum concentration as 9.2 μg/$m^3$. The 98th percentile values are observed as 13.3 μg/$m^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.6 μg/$m^3$ with minimum concentration as 11.7 μg/$m^3$. The 98th percentile values are observed as 15.1 μg/$m^3$ respectively.

The maximum CO concentration is recorded as 284 μg/m3 with minimum concentration as 187 μg/$m^3$. The 98th percentile values are observed as 290 μg/ $m^3$ respectively.

The maximum $O_3$ concentration is recorded as 7.7 μg/m3 with minimum concentration as 3.8 μg/$m^3$. The 98th percentile values are observed as 7.5 μg/$m^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ3) Devada villag5**

The maximum concentration for PM2.5 is recorded as 26.7 μg/$m^3$ with minimum concentration as 18.8 μg/$m^3$. The 98th percentile values are observed as 27.1 μg/$m^3$ respectively.

The maximum concentration for PM10 is recorded as 52.7 μg/$m^3$ with minimum concentration as 40.1 μg/$m^3$. The 98th percentile values are observed as 51.8 μg/$m^3$ respectively.

The maximum $SO_2$ concentration is recorded as 14.5 μg/$m^3$ with minimum concentration as 9.5 μg/$m^3$. The 98th percentile values are observed as 14.1μg/$m^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.7 μg/m$^3$ with minimum concentration as 12.1 μg/m$^3$. The 98th percentile values are observed as 15.6 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 268 μg/m3 with minimum concentration as 192 μg/m$^3$. The 98th percentile values are observed as 264 μg/ m$^3$ respectively.

The maximum $O_3$ concentration is recorded as 7.0 μg/m3 with minimum concentration as 3.5 μg/m$^3$. The 98th percentile values are observed as 6.7 μg/m$^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ4) Cheepurupalle village**

The maximum concentration for PM2.5 is recorded as 26.4 μg/m$^3$ with minimum concentration as 17.2 μg/m$^3$. The 98th percentile values are observed as 26.3 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 57.2 μg/m$^3$ with minimum concentration as 43.2 μg/m$^3$. The 98th percentile values are observed as 56.3 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 13.6 μg/m$^3$ with minimum concentration as 9.2 μg/m$^3$. The 98th percentile values are observed as 13.1μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 16.1 μg/m$^3$ with minimum concentration as 12.3 μg/m$^3$. The 98th percentile values are observed as 15.8 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 272 μg/m3 with minimum concentration as 192 μg/m$^3$. The 98th percentile values are observed as 269 μg/ m$^3$ respectively.

The maximum $O_3$ concentration is recorded as 8.6 μg/m3 with minimum concentration as 3.8 μg/m$^3$. The 98th percentile values are observed as 8.0 μg/m$^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ5) Dasaripeta village**

The maximum concentration for PM2.5 is recorded as 26.3 μg/m$^3$ with minimum concentration as 19.8 μg /m$^3$. The 98th percentile values are observed as 25.9 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 54.2 μg/m$^3$ with minimum concentration as 42.6 μg/m$^3$. The 98th percentile values are observed as 53.9 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 13.9 μg/m$^3$ with minimum concentration as 9.3 μg/m$^3$. The 98th percentile values are observed as 13.9 μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.8 μg/m$^3$ with minimum concentration as 11.6 μg/m$^3$. The 98th percentile values are observed as 15.6 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 274 μg/m3 with minimum concentration as 167 μg/m$^3$. The 98th percentile values are observed as 273 μg/ m$^3$ respectivel

The maximum $O_3$ concentration is recorded as 7.6 μg/m3 with minimum concentration as 3.8 μg/m$^3$. The 98th percentile values are observed as 7.3 μg/m$^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ6) Islampeta village**

The maximum concentration for PM2.5 is recorded as 25.3 μg/m$^3$ with minimum concentration as 18.4 μg/m$^3$. The 98th percentile values are observed as 24.8 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 56.7 μg/m$^3$ with minimum concentration as 43.2 μg/m$^3$. The 98th percentile values are observed as 55.4 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 13.6 μg/m$^3$ with minimum concentration as 9.4 μg/m$^3$. The 98th percentile values are observed as 12.8 μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.6 μg/m$^3$ with minimum concentration as 11.6 μg/m$^3$. The 98th percentile values are observed as 15.0 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 246 μg/m3 with minimum concentration as 175 μg/m$^3$. The 98th percentile values are observed as 246 μg/ m$^3$ respectively.

The maximum $O_3$ concentration is recorded as 6.9 μg/m3 with minimum concentration as 3.4 μg/m$^3$. The 98th percentile values are observed as 6.7 μg/m$^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ7) Pittavanipalem village**

The maximum concentration for PM2.5 is recorded as 28.1 μg/m$^3$ with minimum concentration as 19.8 μg/m$^3$. The 98th percentile values are observed as 28.1 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 66.2 μg/m$^3$ with minimum concentration as 43.6 μg/m$^3$. The 98th percentile values are observed as 64.6 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 14.0 μg/m$^3$ with minimum concentration as 10.2 μg/m$^3$. The 98th percentile values are observed as 13.7 μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 16.2 μg/m$^3$ with minimum concentration as 12.4 μg/m$^3$. The 98th percentile values are observed as 15.6 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 276 μg/m3 with minimum concentration as 204 μg/m$^3$. The 98th percentile values are observed as 274 μg/ m$^3$ respectively.

The maximum $O_3$ concentration is recorded as 7.8 μg/m3 with minimum concentration as 3.7 μg/m$^3$. The 98th percentile values are observed as 7.4 μg/m$^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

**AAQ8) Kalapaka village**

The maximum concentration for PM2.5 is recorded as 25.3 μg/m$^3$ with minimum concentration as 18.4 μg/m$^3$. The 98th percentile values are observed as 25.2 μg/m$^3$ respectively.

The maximum concentration for PM10 is recorded as 58.3 μg/m$^3$ with minimum concentration as 45.2 μg/m$^3$. The 98th percentile values are observed as 57.6 μg/m$^3$ respectively.

The maximum $SO_2$ concentration is recorded as 14.2 μg/m$^3$ with minimum concentration as 9.4 μg/m$^3$. The 98th percentile values are observed as 14.1 μg/m$^3$ respectively.

The maximum $NO_2$ concentration is recorded as 15.8 μg/m$^3$ with minimum concentration as 12.2 μg/m$^3$. The 98th percentile values are observed as 15.6 μg/m$^3$ respectively.

The maximum CO concentration is recorded as 256 μg/m3 with minimum concentration as 195 μg/$m^3$. The 98th percentile values are observed as 259 μg/ $m^3$ respectively.

The maximum $O_3$ concentration is recorded as 7.4 μg/m3 with minimum concentration as 4.2 μg/$m^3$. The 98th percentile values are observed as 7.2 μg/$m^3$ respectively.

The concentration of NH3, Pb, As, Ni, B(a)P and C6H6 values are well within the detectable limits.

3.2.8 Regional Scenario

The ambient air quality survey was carried out for **October 2020 to March 2021** at eight locations in the 10 Km radial distance. The monitoring was carried out for Fine Respirable Particulate Matter (PM2.5), Respirable Particulate Matter (PM10), Sulphur dioxide ($SO_2$), Nitrogen dioxide ($NO_2$) and Carbon monoxide (CO), Ammonia ($NH_3$), Ozone ($O_3$), Benzene ($C_6H_6$) and metals like Benzo(a)pyrene, Lead (Pb), Arsenic (As) and Nickel (Ni). The results of monitoring carried out during study period are presented in **Annexure-II** for **October 2020 to March 2021.**

Various statistical parameters like Maximum, Minimum, Average and 98th percentile have been computed from the observed raw data for all sampling stations. The ambient air quality Summary of concentrations of different parameters (PM2.5, PM10, $SO_2$, $NO_2$, CO, NH3, O3, C6H6, B(a)P, As, Ni and Pb is presented in **Tables 3.4 and 3.5**

The AAQ levels observed at all the sampling locations were within the limits specified by CPCB for Industrial/Mixed use and Residential/Rural use.

## TABLE - 3.4
## SUMMARY OF AMBIENT AIR QUALITY DATA (OCTOBER 2020 TO MARCH 2021)

| Location Code | Location | PM2.5 | | | | PM10 | | | | $SO_2$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Avg | 98% Tile | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% tile |
| AAQ1 | Palavalasa village | 19.5 | 26.4 | 22.7 | 25.9 | 46.3 | 58.2 | 53.0 | 57.6 | 9.1 | 13.9 | 11.7 | 13.7 |
| AAQ2 | Appikonda village | 18.7 | 26.7 | 23.1 | 26.3 | 41.8 | 54.2 | 48.9 | 53.6 | 9.2 | 13.4 | 11.4 | 13.3 |
| AAQ3 | Devada village | 18.8 | 26.7 | 22.5 | 25.4 | 40.1 | 52.7 | 46.8 | 51.8 | 9.5 | 14.5 | 11.7 | 14.1 |
| AAQ4 | Cheepurupalle village | 17.2 | 26.4 | 23.0 | 26.3 | 43.2 | 57.2 | 51.4 | 56.3 | 9.2 | 13.6 | 11.6 | 13.1 |
| AAQ5 | Dasaripeta village | 19.8 | 26.3 | 23.1 | 25.9 | 42.6 | 54.2 | 49.5 | 53.9 | 9.3 | 13.9 | 11.6 | 13.9 |
| AAQ6 | Islampeta village | 18.4 | 25.3 | 21.7 | 24.8 | 43.2 | 56.7 | 49.3 | 55.4 | 9.4 | 13.6 | 11.3 | 12.8 |
| AAQ7 | Pittavanipalem village | 19.8 | 28.1 | 24.4 | 28.1 | 43.6 | 66.2 | 54.5 | 64.6 | 10.2 | 14.0 | 11.8 | 13.7 |
| AAQ8 | Kalapaka village | 18.4 | 25.3 | 22.5 | 25.2 | 45.2 | 58.3 | 51.1 | 57.6 | 9.4 | 14.2 | 11.7 | 14.1 |

| Location Code | Location | $NO_2$ | | | | CO | | | | O3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Avg | 98% Tile | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% Tile |
| AAQ1 | Palavalasa village | 11.2 | 15.6 | 13.7 | 15.5 | 177 | 284 | 234 | 282 | 4.3 | 8.1 | 5.9 | 7.8 |
| AAQ2 | Appikonda village | 11.7 | 15.6 | 13.6 | 15.1 | 187 | 295 | 237 | 290 | 3.8 | 7.7 | 5.5 | 7.5 |
| AAQ3 | Devada village | 12.1 | 15.7 | 13.9 | 15.6 | 192 | 268 | 230 | 264 | 3.5 | 7.0 | 5.1 | 6.7 |
| AAQ4 | Cheepurupalle village | 12.3 | 16.1 | 14.1 | 15.8 | 192 | 272 | 234 | 269 | 3.8 | 8.6 | 5.6 | 8.0 |
| AAQ5 | Dasaripeta village | 11.6 | 15.8 | 13.8 | 15.6 | 167 | 274 | 231 | 273 | 3.8 | 7.6 | 5.5 | 7.3 |
| AAQ6 | Islampeta village | 11.6 | 15.6 | 13.7 | 15.0 | 175 | 246 | 218 | 246 | 3.4 | 6.9 | 5.2 | 6.7 |
| AAQ7 | Pittavanipalem village | 12.4 | 16.2 | 14.1 | 15.6 | 204 | 276 | 241 | 274 | 3.7 | 7.8 | 5.6 | 7.4 |
| AAQ8 | Kalapaka village | 12.2 | 15.8 | 13.8 | 15.6 | 195 | 259 | 227 | 259 | 4.2 | 7.4 | 5.4 | 7.2 |

**Note: (Concentrations are expressed in $\mu g/m^3$)*

## TABLE - 3.5
## SUMMARY OF AMBIENT AIR QUALITY DATA (OCTOBER 2020 TO MARCH 2021)

| Location Code | Location | $NH_3$ | | | | Pb | | | | As | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% tile |
| AAQ1 | Palavalasa village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ2 | Appikonda village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ3 | Devada village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ4 | Cheepurupalle village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ5 | Dasaripeta village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ6 | Islampeta village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ7 | Pittavanipalem village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |
| AAQ8 | Kalapaka village | <20 | <20 | <20 | <20 | <0.001 | <0.001 | <0.001 | <0.001 | <1.0 | <1.0 | <1.0 | <1.0 |

| Location Code | Location | Ni | | | | B(a)P | | | | C6H6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% tile | Min | Max | Avg | 98% tile |
| AAQ1 | Palavalasa village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ2 | Appikonda village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ3 | Devada village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ4 | Cheepurupalle village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ5 | Dasaripeta village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ6 | Islampeta village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ7 | Pittavanipalem village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| AAQ8 | Kalapaka village | <1.0 | <1.0 | <1.0 | <1.0 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.0 | 1.0 | 1.0 |

**Note: (Concentrations are expressed in μg /m³ except As, Ni and B(a)p are ng /m³)*

## 3.3 Fugitive Dust Emission Monitoring

Fugitive dust emission monitoring has been carried out eight hours monitoring during the **October 2020 to March 2021**. The monitoring has been carried out in five locations. The analysis results of fugitive dust monitoring are represented in **Table-3.6.**

**TABLE-3.6**
**FUGITIVE DUST MONITORING RESULTS**

*All values are in ($\mu g/m^3$)*

| Sr.No | Location Name | Oct 2020 | Nov 2020 | Dec 2020 | Jan 2021 | Feb 2021 | Mar 2021 |
|---|---|---|---|---|---|---|---|
| 1 | Plant Main gate | Plant Shutdown | | Plant Shutdown | | Plant Shutdown | |
| 2 | Power Plant service building | | | | | | |
| 3 | Coal handling plant | | | | | | |
| 4 | Work shop building | | | | | | |
| 5 | Ash handling plant | | | | | | |

## 3.4 Ambient Noise Quality

Eight locations were monitored for ambient noise levels within the 10-km radius of the Thermal power plant and three locations for Inside the Plant. The monitoring will be carried out every month and details of presented in **Table-3.7** and are shown in **Figure-3.3.**

**TABLE-3.7**
**AMBIENT NOISE MONITORING LOCATIONS**

| Sampling Code | Name of the Location | Direction w.r.t to Plant |
|---|---|---|
| N1 | Palavalasa village | N |
| N2 | Appikonda village | NE |
| N3 | Devada village | NW |
| N4 | Cheepurapalli village | W |
| N5 | Dasaripeta village | NNW |
| N6 | Islampeta village | N |
| N7 | Pittavanipalem village | NW |
| N8 | Kalapaka village | NW |
| | **Inside the Plant Area** | |
| N9 | Near HNPCL Office | - |
| N10 | Near Boiler Area | - |
| N11 | Near Power Mech Stores | - |

Sound Pressure Level (SPL) measurements were measured by noise meter at all the above locations. Noise level monitoring was carried continuously for 24-hours with one hour interval. During each hour parameters like $L_{10}$, $L_{50}$, $L_{90}$, $L_{eq}$, $L_{day}$ and $L_{night}$ were directly computed by the instrument based on the sound pressure levels. The day noise levels have been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am.

3.4.1 Noise Quality

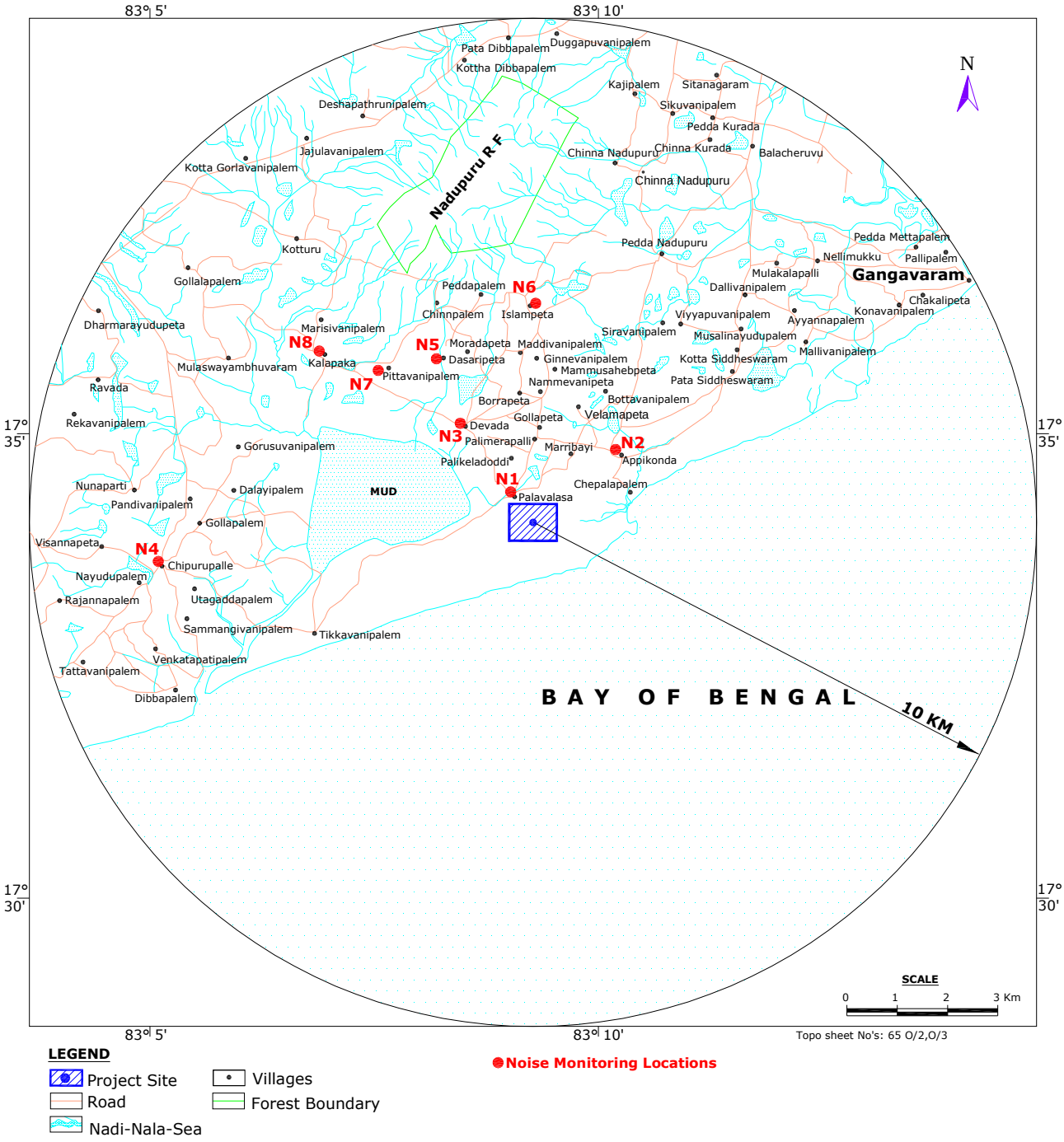
Noise levels were measured in 8 villages for 24 hours on monthly basis and the measured noise levels in day time and night time from **October 2020 to March 2021** are given below in **Table-3.8 and 3.9.** The noise levels are well within the CPCB norms for Rural Residential zones.

**TABLE-3.8**
**AMBIENT NOISE LEVEL MONITORING RESULTS**
**(OCTOBER 2020 TO MARCH 2021)**

| S.No | Sources | October 2020 | | November 2020 | | December 2020 | | January 2021 | | February 2021 | | March 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| 1 | Palavalasa | 45.9 | 42.3 | 45.2 | 41.6 | 46.6 | 43.0 | 45.2 | 41.6 | 46.1 | 42.5 | 45.4 | 41.8 |
| 2 | Appikonda | 44.4 | 40.8 | 46.9 | 43.3 | 44.4 | 40.8 | 44.0 | 40.4 | 45.2 | 41.6 | 46.3 | 42.7 |
| 3 | Devada | 46.3 | 42.7 | 44.7 | 41.1 | 45.1 | 41.5 | 46.1 | 42.5 | 44.4 | 40.8 | 44.7 | 41.1 |
| 4 | Cheepurupalle | 47.0 | 43.4 | 45.3 | 41.7 | 47.0 | 43.4 | 47.4 | 43.8 | 46.2 | 42.6 | 47.3 | 43.7 |
| 5 | Dasaripeta | 44.7 | 41.1 | 46.5 | 42.9 | 45.5 | 41.9 | 46.0 | 42.4 | 45.6 | 42.0 | 44.5 | 40.9 |
| 6 | Islampeta | 46.4 | 42.8 | 44.8 | 41.2 | 46.2 | 42.6 | 47.1 | 43.5 | 44.5 | 40.9 | 46.3 | 42.7 |
| 7 | Pittavanipalem | 45.6 | 42.0 | 45.2 | 41.6 | 44.0 | 40.4 | 46.5 | 42.9 | 47.2 | 43.6 | 45.2 | 41.6 |
| 8 | Kalapaka | 44.8 | 41.2 | 46.4 | 42.8 | 45.3 | 41.7 | 47.2 | 43.6 | 45.3 | 41.7 | 46.5 | 42.9 |
| **CPCB Limits** | | **55** | **45** | **55** | **45** | **55** | **45** | **55** | **45** | **55** | **45** | **55** | **45** |

**TABLE-3.9**
**NOISE LEVEL MONITORING RESULTS INSIDE THE PLANT**
**(OCTOBER 2020 TO MARCH 2021)**

| S.No | Sources | October 2020 | | November 2020 | | December 2020 | | January 2021 | | February 2021 | | March 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night | Day | Night |
| **1** | Near Plant main gate | - | - | - | - | - | - | - | - | - | - | - | - |
| **CPCB Limits** | | **75** | **75** | **70** | **75** | **70** | **75** | **70** | **75** | **70** | **75** | **70** | **70** |
| **2** | Near Boiler area | Plant Shutdown | | | | Plant Shutdown | | | | Plant Shutdown | | | |
| **3** | Near Turbine area | | | | | | | | | | | | |
| **CPCB Limits** | | **90** | | **90** | | **90** | | **90** | | **90** | | **90** | |




## FIGURE-3.3
## NOISE MONITORING LOCATIONS

## 3.5 WATER QUALITY

Water quality of ground water samples is collected to assess the quality of water with in the 10Km radius. Water samples were collected from six Ground water locations and four Surface water locations.

These samples were taken as grab samples and preservation and transportation of the samples are done as per the standard sampling procedures and analyzed in laboratory. The details of the sampling locations are given below in **TABLE-3.10** and shown in **Figure-3.4**

**TABLE-3.10**
**WATER QUALITY SAMPLING LOCATIONS**

| Sampling Code | Name of the Location | Direction w.r.t to Plant |
|---|---|---|
| **I** | **Ground Water Samples** | |
| GW1 | Devada village | NW |
| GW2 | Islampeta village | N |
| GW3 | Velama Appikonda village | NNE |
| GW4 | Dasaripeta village | NNW |
| GW5 | Palavalasa village | N |
| GW6 | Rajiv Nagar | NE |
| GW7 | Gouruvanipalem village | N |
| **III** | **Creek Water Samples** | |
| SW1 | At Vade cheepurapalli | WSW |
| **II** | **Surface water Samples (**Marine Water) | |
| SW2 | Appikonda beach | ENE |
| SW3 | Tikavanipalem beach | SW |
| **III** | **Waste Water Samples** | |
| SW4 | ETP Outlet | - |
| SW5 | Outfall water at diffusion point | SE |

The details of the Water Quality Analysis of **(October 2020 to March 2021)** are given below in **Table-3.11 to Table-3.19.**

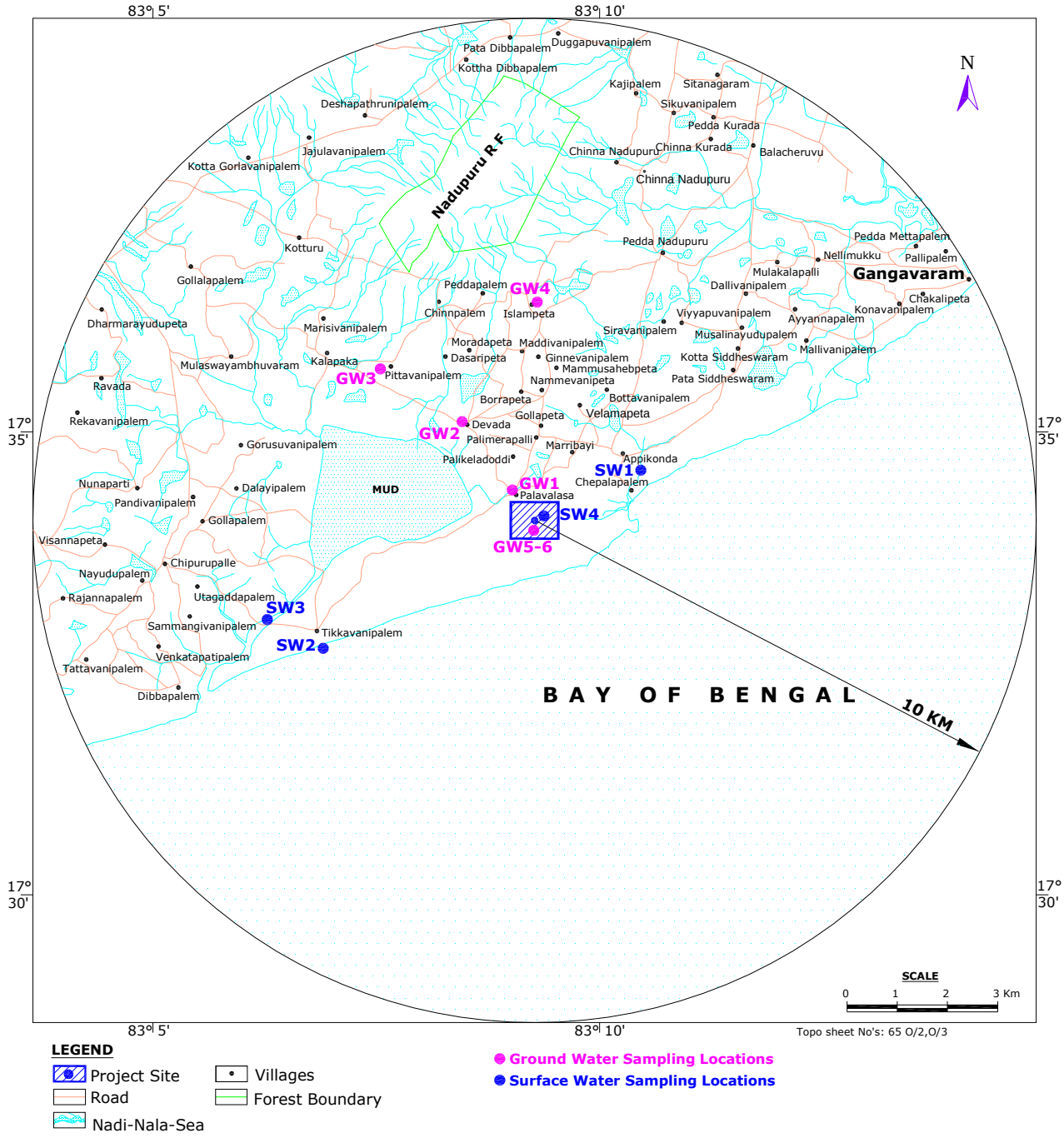



**FIGURE-3.4**
**WATER SAMPLING LOCATIONS**

## TABLE-3.11
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW1 - Devada village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 13.10.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.4 | 7.6 | 7.8 | 7.5 | 7.4 | 7.8 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 1 | 1 | 1 | 1 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1282 | 1178 | 1230 | 1307 | 1207 | 1078 | $ |
| 6 | Turbidity | NTU | 2 | 1 | 1 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 843 | 743 | 775 | 823 | 761 | 680 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 287.8 | 270.2 | 321.4 | 351.4 | 292.3 | 248.5 | 200(600) |
| 9 | Total Alkalinity | mg/l | 262.1 | 241.3 | 253.6 | 272.4 | 245.6 | 208.5 | 200(600) |
| 10 | Calcium as Ca | mg/l | 52.4 | 48.5 | 55.3 | 60.4 | 51.9 | 47.4 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 38.1 | 36.2 | 44.5 | 48.7 | 39.5 | 31.6 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 186.3 | 168.3 | 179.8 | 184.8 | 183.3 | 167.7 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 98.7 | 93.4 | 89.4 | 102.7 | 82.7 | 77.8 | 200(400) |
| 16 | Fluorides as F | mg/l | 0.5 | 0.7 | 0.9 | 0.6 | 0.8 | 0.5 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 11.3 | 10.5 | 11.3 | 12.4 | 12.2 | 11.9 | 45(NR) |
| 18 | Sodium as Na | mg/l | 158.6 | 140.7 | 128.3 | 134.2 | 138.6 | 129.2 | $ |
| 19 | Potassium as K | mg/l | 5.6 | 8.2 | 9.6 | 7.3 | 7.2 | 6.6 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.10 | 0.18 | 0.21 | 0.13 | 0.14 | 0.17 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.33 | 0.28 | 0.32 | 0.36 | 0.25 | 0.18 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.12
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW2 – Islampeta village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.8 | 7.5 | 7.4 | 7.7 | 7.6 | 7.5 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 1 | 2 | 1 | 1 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1197 | 1256 | 1161 | 1215 | 1167 | 1266 | $ |
| 6 | Turbidity | NTU | 1 | 2 | 1 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 785 | 817 | 755 | 753 | 759 | 823 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 269.6 | 286.6 | 284.4 | 298.1 | 269.0 | 309.6 | 200(600) |
| 9 | Total Alkalinity | mg/l | 225.8 | 230.4 | 225.7 | 243.7 | 232.2 | 258.2 | 200(600) |
| 10 | Calcium as Ca | mg/l | 50.3 | 62.3 | 58.8 | 54.7 | 64.3 | 68.2 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 29.5 | 31.8 | 33.4 | 39.2 | 26.3 | 33.8 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 191.8 | 205.3 | 181.4 | 192.5 | 187.6 | 195.1 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 83.4 | 91.2 | 84.6 | 78.4 | 71.4 | 84.5 | 200(400) |
| 16 | Fluorides as F | mg/l | 1.0 | 0.4 | 0.7 | 0.5 | 0.9 | 0.7 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 12.2 | 9.6 | 10.5 | 11.3 | 11.3 | 12.2 | 45(NR) |
| 18 | Sodium as Na | mg/l | 147.0 | 152.3 | 131.4 | 138.4 | 140.6 | 144.5 | $ |
| 19 | Potassium as K | mg/l | 5.1 | 6.5 | 7.8 | 6.6 | 6.8 | 7.3 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | 0.01 | 0.01 | 0.01 | 0.01 | <0.01 | <0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.12 | 0.08 | 0.07 | 0.18 | 0.18 | 0.21 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.41 | 0.36 | 0.24 | 0.28 | 0.32 | 0.24 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.13
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW3 – Velama Appikonda village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.9 | 7.5 | 7.7 | 7.4 | 7.8 | 7.6 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 2 | 2 | 2 | 1 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1334 | 1298 | 1329 | 1267 | 1284 | 1326 | $ |
| 6 | Turbidity | NTU | 2 | 2 | 2 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 868 | 831 | 851 | 810 | 822 | 849 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 322.3 | 316.6 | 344.7 | 325.1 | 314.4 | 328.6 | 200(600) |
| 9 | Total Alkalinity | mg/l | 308.3 | 298 | 285.3 | 278.2 | 274.7 | 283.4 | 200(600) |
| 10 | Calcium as Ca | mg/l | 57.8 | 59.8 | 62.5 | 57.3 | 58.6 | 61.8 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 43.2 | 40.6 | 45.8 | 44.2 | 40.8 | 42.3 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 173.6 | 180.2 | 198.8 | 180.4 | 202.8 | 20.7.8 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 97.3 | 82.3 | 79.3 | 83.6 | 69.6 | 73.2 | 200(400) |
| 16 | Fluorides as F | mg/l | 0.7 | 0.5 | 0.8 | 0.7 | 0.3 | 0.8 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 10.9 | 8.6 | 9.4 | 10.8 | 8.7 | 9.7 | 45(NR) |
| 18 | Sodium as Na | mg/l | 153.8 | 146.3 | 139.8 | 136.7 | 145.8 | 149.8 | $ |
| 19 | Potassium as K | mg/l | 7.8 | 9.4 | 8.8 | 7.9 | 7.6 | 6.9 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.17 | 0.12 | 0.17 | 0.07 | 0.16 | 0.18 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.26 | 0.33 | 0.18 | 0.21 | 0.31 | 0.22 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.14
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW4 – Dasaripeta village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.5 | 7.9 | 7.5 | 7.2 | 7.6 | 7.9 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 1 | 2 | 1 | 2 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1261 | 1154 | 1206 | 1154 | 1255 | 1308 | $ |
| 6 | Turbidity | NTU | 1 | 2 | 2 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 795 | 728 | 784 | 750 | 791 | 811 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 309.1 | 287.2 | 294.8 | 302.0 | 314.0 | 324.3 | 200(600) |
| 9 | Total Alkalinity | mg/l | 263.6 | 252.3 | 261.3 | 257.6 | 270.3 | 277.8 | 200(600) |
| 10 | Calcium as Ca | mg/l | 65.2 | 60.4 | 69.7 | 63.5 | 73.4 | 70.3 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 35.5 | 33.1 | 29.3 | 34.8 | 31.7 | 36.1 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 168.5 | 147.3 | 160.2 | 152.7 | 178.4 | 186.4 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 112.8 | 100.2 | 95.8 | 89.8 | 88.3 | 93.6 | 200(400) |
| 16 | Fluorides as F | mg/l | 0.8 | 0.3 | 0.5 | 0.4 | 0.6 | 0.9 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 10.1 | 11.6 | 12.3 | 11.7 | 13.1 | 15.3 | 45(NR) |
| 18 | Sodium as Na | mg/l | 143.1 | 128.5 | 135.6 | 121.5 | 139.1 | 146.5 | $ |
| 19 | Potassium as K | mg/l | 8.1 | 7.4 | 8.1 | 8.5 | 7.9 | 8.4 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.19 | 0.23 | 0.21 | 0.04 | 0.22 | 0.25 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.37 | 0.24 | 0.36 | 0.29 | 0.18 | 0.27 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.15
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW5 – Palavalasa village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.8 | 7.4 | 7.9 | 7.3 | 7.5 | 7.8 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 2 | 1 | 2 | 2 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1308 | 1243 | 1318 | 1287 | 1139 | 1367 | $ |
| 6 | Turbidity | NTU | 2 | 1 | 2 | 2 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 838 | 796 | 857 | 797 | 718 | 862 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 338.3 | 300.6 | 328.6 | 293.4 | 284.3 | 365.7 | 200(600) |
| 9 | Total Alkalinity | mg/l | 288.0 | 275.3 | 281.4 | 273.3 | 256.8 | 292.3 | 200(600) |
| 10 | Calcium as Ca | mg/l | 59.1 | 55l2 | 61.3 | 55.8 | 53.8 | 63.5 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 46.3 | 39.5 | 42.6 | 37.4 | 36.4 | 50.3 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 179.8 | 172.3 | 178.3 | 182.2 | 144.6 | 174.6 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 94.5 | 88.3 | 103.4 | 94.3 | 92.8 | 121.5 | 200(400) |
| 16 | Fluorides as F | mg/l | 1.0 | 0.6 | 0.8 | 0.9 | 0.4 | 0.6 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 10.8 | 9.2 | 13.6 | 12.9 | 12.8 | 16.8 | 45(NR) |
| 18 | Sodium as Na | mg/l | 139.2 | 143.2 | 146.2 | 155.6 | 126.1 | 141.2 | $ |
| 19 | Potassium as K | mg/l | 9.8 | 7.7 | 8.0 | 7.6 | 8.6 | 8.1 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.13 | 0.20 | 0.24 | 0.22 | 0.26 | 0.29 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.24 | 0.37 | 0.20 | 0.18 | 0.22 | 0.18 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.16
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW6 – Rajiv Nagar | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.4 | 7.8 | 7.4 | 7.8 | 7.6 | 7.4 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 3 | 2 | 1 | 1 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1413 | 1332 | 1288 | 1188 | 1007 | 1232 | $ |
| 6 | Turbidity | NTU | 2 | 2 | 1 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 919 | 866 | 812 | 736 | 655 | 789 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 370.6 | 350.6 | 360.3 | 296.5 | 238.9 | 322.4 | 200(600) |
| 9 | Total Alkalinity | mg/l | 321.7 | 297.3 | 302.3 | 282.4 | 262.2 | 289.9 | 200(600) |
| 10 | Calcium as Ca | mg/l | 63.3 | 60.9 | 56.4 | 48.3 | 44.7 | 52.9 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 51.6 | 48.2 | 53.3 | 42.7 | 30.9 | 46.2 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 181.8 | 178.3 | 171.6 | 158.5 | 123.5 | 155.7 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 110.3 | 98.3 | 81.7 | 72.6 | 53.4 | 89.2 | 200(400) |
| 16 | Fluorides as F | mg/l | 0.6 | 0.9 | 0.7 | 0.5 | 0.7 | 0.4 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 11.5 | 10.3 | 11.9 | 10.6 | 9.6 | 12.6 | 45(NR) |
| 18 | Sodium as Na | mg/l | 148.4 | 139.4 | 124.5 | 131.7 | 115.9 | 129.3 | $ |
| 19 | Potassium as K | mg/l | 9.6 | 8.4 | 8.9 | 7.8 | 9.3 | 8.7 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.11 | 0.18 | 0.20 | 0.15 | 0.19 | 0.22 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.43 | 0.26 | 0.33 | 0.27 | 0.14 | 0.28 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

## TABLE-3.17
## GROUND WATER QUALITY

| Sr.No. | Parameters | Unit | GW7 – Gouruvanipalem village | | | | | | Limits as per IS:10500 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | |
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 | |
| 1 | pH | - | 7.5 | 7.6 | 7.7 | 7.4 | 7.8 | 7.6 | 6.5 – 8.5 (NR) |
| 2 | Colour | Hazen | 1 | 1 | 1 | 1 | 1 | 1 | 5(15) |
| 3 | Taste | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 4 | Odour | - | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable | Agreeable |
| 5 | Conductivity | µS/cm | 1198 | 1275 | 1164 | 1037 | 1167 | 1174 | $ |
| 6 | Turbidity | NTU | 1 | 2 | 1 | 1 | 1 | 1 | 1(5) |
| 7 | TDS | mg/l | 755 | 804 | | 663 | 724 | 752 | 500(2000) |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 302.5 | 327.6 | 299.0 | 260.9 | 316.6 | 332.4 | 200(600) |
| 9 | Total Alkalinity | mg/l | 248.2 | 256.2 | 243.8 | 226.7 | 248.6 | 252.1 | 200(600) |
| 10 | Calcium as Ca | mg/l | 55.5 | 58.6 | 53.6 | 49.2 | 56.2 | 59.2 | 75(200) |
| 11 | Magnesium as Mg | mg/l | 39.8 | 44.0 | 40.1 | 33.5 | 42.8 | 44.8 | 30(100) |
| 12 | Residual Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2(1) |
| 13 | Boron | mg/l | <0.01 | <0.01 | 0.01 | 0.01 | <0.01 | <0.01 | 0.5(1) |
| 14 | Chlorides as Cl | mg/l | 175.5 | 183.4 | 169.3 | 149.3 | 180.7 | 177.2 | 250(1000) |
| 15 | Sulphates as $SO_4$ | mg/l | 84.7 | 105.1 | 76.1 | 67.0 | 68.2 | 71.6 | 200(400) |
| 16 | Fluorides as F | mg/l | 0.7 | 0.4 | 0.6 | 0.8 | 0.5 | 0.7 | 1.0(1.5) |
| 17 | Nitrates as $NO_3$ | mg/l | 10.3 | 11.4 | 9.8 | 9.2 | 8.7 | 9.3 | 45(NR) |
| 18 | Sodium as Na | mg/l | 131.6 | 136/7 | 119.9 | 112.9 | 117.3 | 111.6 | $ |
| 19 | Potassium as K | mg/l | 7.2 | 9.0 | 9.7 | 8.8 | 8.8 | 9.2 | $ |
| 20 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(0.002) |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.05 (NR) |
| 22 | Anionic Detergents | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.2 (1.0) |
| 23 | Mineral Oil | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.5 (NR) |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 (NR) |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (0.05) |
| 26 | Copper as Cu | mg/l | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.05 (1.5) |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 (NR) |
| 28 | Manganese as Mn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.1 (0.3) |
| 29 | Iron as Fe | mg/l | 0.14 | 0.07 | 0.12 | 0.11 | 0.11 | 0.14 | 0.3(NR) |
| 30 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.05(NR) |
| 31 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01(NR) |
| 32 | Zinc as Zn | mg/l | 0.33 | 0.22 | 0.17 | 0.15 | 0.25 | 0.13 | 5(15) |
| 33 | Aluminum as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.03(0.2) |
| 34 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001(NR) |
| 35 | Pesticides | µg/l | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 36 | E. Coil | - | Absent | Absent | Absent | Absent | Absent | Absent | Absent |
| 37 | Total Coliforms | MPN/100 | <2 | <2 | <2 | <2 | <2 | <2 | 10 |

Note: *$ - Limits not specified;*
*NR - No Relaxation*
*Limits are shown in IS 10500 are Acceptable limits (Requirement) and in parenthesis are Permissible limit in absence of alternate source*

**TABLE-3.18**
**SURFACE WATER QUALITY (MARINE WATER SAMPLES) FROM OCTOBER 2020 TO MARCH 2021**

| S. No. | Parameter | Units | Oct 20 | | Nov 20 | | Dec 20 | | Jan 21 | | Feb 21 | | Mar 210 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SW2 | SW3 | SW2 | SW3 | SW2 | SW3 | SW2 | SW3 | SW2 | SW3 | SW2 | SW3 |
| | | | 13.10.20 | 13.10.20 | 14.11.20 | 14.11.20 | 11.12.20 | 11.12.20 | 19.01.21 | 19.01.21 | 12.02.21 | 12.02.21 | 15.03.21 | 15.03.21 |
| 1 | pH | - | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 8.0 | 7.5 | 7.6 | 7.8 | 8.0 | 8.0 | 7.9 |
| 2 | Color | Hazen | 6 | 4 | 5 | 7 | 6 | 4 | 5 | 3 | 6 | 5 | 5 | 4 |
| 3 | Conductivity | µS/cm | 52100 | 50700 | 50600 | 51300 | 51500 | 52100 | 50710 | 49940 | 51830 | 52040 | 49720 | 50540 |
| 4 | Total Dissolved Solids | mg/l | 38560 | 37020 | 37450 | 38490 | 38110 | 37980 | 38030 | 36960 | 38360 | 37990 | 36795 | 36895 |
| 5 | DO | mg/l | 5.3 | 5.5 | 5.5 | 5.4 | 5.4 | 5.3 | 5.1 | 5.0 | 5.3 | 5.1 | 5.2 | 5.3 |
| 6 | BOD | mg/l | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| 7 | COD | mg/l | 109 | 117 | 112 | 108 | 104 | 115 | 112 | 118 | 109 | 113 | 118 | 122 |
| 8 | Total Hardness as $CaCO_3$ | mg/l | 4910.3 | 5022.0 | 4813.5 | 5145.7 | 4855.6 | 5020.4 | 4696.6 | 4642.5 | 4802.9 | 4931.9 | 277.2 | 311.0 |
| 9 | Total Alkalinity as $CaCO_3$ | mg/l | 301.8 | 371.0 | 289.4 | 338.0 | 296.1 | 302.4 | 288.3 | 292.6 | 323.8 | 363.5 | 277.2 | 311.0 |
| 10 | Calcium as $Ca^{+2}$ | mg/l | 471.3 | 434.9 | 465.3 | 487.3 | 472.6 | 486.2 | 458.4 | 460.8 | 491.2 | 477.6 | 415.8 | 392.1 |
| 11 | Magnesium as $Mg^{+2}$ | mg/l | 906.9 | 956.2 | 887.0 | 948.2 | 892.8 | 924.6 | 862.8 | 848.2 | 868.7 | 908.3 | 812.5 | 847.2 |
| 12 | Chlorides as Cl | mg/l | 17125.4 | 15992.0 | 16345 | 16610 | 16897.6 | 16982.3 | 16798.6 | 16482.3 | 16998.0 | 17098.1 | 16508.7 | 16811.0 |
| 13 | Residual free Chlorine | mg/l | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 14 | Phosphates $PO_4$ | mg/l | 1.7 | 2.6 | 2.5 | 3.2 | 1.8 | 2.3 | 1.6 | 2.0 | 2.3 | 1.5 | 1.9 | 3.2 |
| 15 | Sulphates as $SO_4$ | mg/l | 1287.8 | 1889.0 | 1443 | 1507 | 1265.4 | 1354.7 | 1255.4 | 1328.9 | 1311.2 | 1187.0 | 1100.0 | 1007.4 |
| 16 | Fluorides as F | mg/l | 0.7 | 0.9 | 0.8 | 0.5 | 0.6 | 0.7 | 0.8 | 0.6 | 0.7 | 0.9 | 0.4 | 0.7 |
| 17 | Nitrates as $NO_3$ | mg/l | 11.1 | 12.6 | 10.6 | 11.3 | 12.3 | 16.6 | 13.1 | 14.8 | 13.6 | 15.8 | 14.8 | 16.2 |
| 18 | Sodium as $Na^+$ | mg/l | 9511.8 | 9112.8 | 9230 | 9194 | 9402.6 | 9428.3 | 9322.7 | 9142.5 | 9509.9 | 9454.6 | 9234.7 | 9349.9 |
| 19 | Potassium as K | mg/l | 355.7 | 384.4 | 337.5 | 392.3 | 328.7 | 402.6 | 298.7 | 345.9 | 336.6 | 411.1 | 307.3 | 365.5 |
| 20 | Total Boron as B | mg/l | 0.03 | 0.07. | 0.05 | 0.02 | 0.03 | 0.04 | 0.02 | 0.03 | 0.04 | 0.02 | 0.05 | 0.03 |
| 21 | Cyanides | mg/l | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 22 | Phenol compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 23 | Oil and Grease | mg/l | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 24 | Cadmium as Cd | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 25 | Arsenic as As | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 26 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 27 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 28 | Iron as Fe | mg/l | 0.26 | 0.13 | 0.18 | 0.25 | 0.21 | 0.23 | 0.28 | 0.21 | 0.18 | 0.23 | 0.24 | 0.29 |
| 29 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 30 | Selenium as Se | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 31 | Zinc as Zn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 32 | Aluminium as Al | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 33 | Mercury as Hg | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |

***SW2- Appikonda beach(marine); SW3-Tikkavanipalem beach(marine);***

## TABLE-3.19
## SURFACE WATER QUALITY (CREEK WATER SAMPLES)
## FROM OCTOBER 2020 TO MARCH 2021

| S.No | Parameters | Units | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 |
|---|---|---|---|---|---|---|---|---|
| | | | 13.10.20 | 14.11.20 | 11.12.20 | 19.01.21 | 12.02.21 | 15.03.21 |
| 1 | pH | - | 7.5 | 7.8 | 7.6 | 7.9 | 7.8 | 7.9 |
| 2 | Suspended solids | mg/l | 42 | 34 | 39 | 42 | 36 | 44 |
| 3 | Conductivity | µS/cm | 35630 | 33780 | 34260 | 32740 | 33620 | 32630 |
| 4 | TDS | mg/l | 24230 | 23650 | 23300 | 23220 | 23205 | 22515 |
| 5 | DO | mg/l | 5.4 | 5.5 | 5.6 | 5.3 | 5.6 | 5.4 |
| 6 | BOD | mg/l | <3 | <3 | <3 | <3 | <3 | <3 |
| 7 | Turbidity | NTU | 32 | 27 | 24 | 26 | 34 | 29 |
| 8 | Salinity | ppt | 22 | 21 | 21 | 20 | 21 | 20 |
| 9 | Total Alkalinity as $CaCO_3$ | mg/l | 253.3 | 236.3 | 221.5 | 214.8 | 198.4 | 158.7 |
| 10 | Calcium as Ca | mg/l | 208.8 | 191/3 | 195.3 | 181.6 | 183.4 | 169.3 |
| 11 | Magnesium as Mg | mg/l | 434.2 | 397.4 | 408.2 | 388.6 | 374.2 | 365.3 |
| 12 | Chlorides as Cl | mg/l | 12254.7 | 11598 | 11789.2 | 11316.7 | 11587.0 | 11234 |
| 13 | Phosphates as $PO_4$ | mg/l | 3.1 | 2.2 | 3.4 | 2.4 | 3.1 | 2.2 |
| 14 | Sulphates as $SO_4$ | mg/l | 165.4 | 171.2 | 164.8 | 148.7 | 137.0 | 109.4 |
| 15 | Fluorides as F | mg/l | 1.0 | 0.6 | 0.9 | 0.7 | 0.9 | 0.6 |
| 16 | Nitrates as $NO_3$ | mg/l | 9.8 | 12.1 | 13.6 | 12.4 | 11.9 | 10.7 |
| 17 | Sodium as Na | mg/l | 7071.5 | 6735 | 6798.4 | 6508.4 | 6737.7 | 6542.4 |
| 18 | Potassium as K | mg/l | 92.4 | 112 | 133.8 | 124.4 | 122.9 | 119.7 |
| 19 | Phenolic Compounds | mg/l | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 20 | Copper as Cu | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 21 | Lead as Pb | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 22 | Iron as Fe | mg/l | 0.15 | 0.23 | 0.27 | 0.7 | 0.24 | 0.28 |
| 23 | Chromium as $Cr^{+6}$ | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 24 | Zinc as Zn | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

*Creek water in Mud flat area at Vade cheepurapalli.*

## 3.6 Soil Quality

Soil Samples were collected from eight locations around the plant site area, out of which, three locations (S1 to S3) are monthly and the remaining five locations (S4 to S8) are quarterly samples. The soil quality is given below in **Table-3.20** and **Table-3.25.**

**TABLE-3.20**
**SOIL QUALITY RESULTS**

| S. No | Parameters | Unit | S1 –Palavalasa Village | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 |
| | | | 15.10.20 | 16.11.20 | 12.12.20 | 18.01.21 | 13.02.21 | 22.03.21 |
| 1 | Texture | -- | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay |
| a | Sand | % | 51 | 48 | 46 | 48 | 53 | 49 |
| b | Silt | % | 16 | 15 | 13 | 16 | 13 | 13 |
| c | Clay | % | 33 | 37 | 41 | 36 | 34 | 38 |
| 2 | Bulk Density | g/cc | 1.1 | 1.2 | 1.1 | 1.2 | 1.2 | 1.2 |
| 3 | pH (1:5 Aq.Extraction) | | 7.34 | 7.46 | 7.2 | 7.4 | 6.95 | 7.3 |
| 4 | Conductivity (1:5 Aq.Extraction) | µS/cm | 374 | 352 | 416 | 436 | 583 | 428 |
| 5 | Cation Exchange Capacity | (meq/100gm) | 19.44 | 20.51 | 27.31 | 27.83 | 31.40 | 27.42 |
| 6 | Exchangeable Calcium | (meq/100gm) | 12.16 | 13.37 | 16.07 | 16.82 | 19.48 | 16.94 |
| 7 | Exchangeable Magnesium | (meq/100gm) | 6.83 | 6.55 | 10.52 | 10.18 | 11.04 | 9.88 |
| 8 | Exchangeable Potassium | (meq/100gm) | 0.29 | 0.23 | 0.43 | 0.51 | 0.56 | 0.30 |
| 9 | Exchangeable Sodium | (meq/100gm) | 0.22 | 0.36 | 0.28 | 0.32 | 0.35 | 0.31 |
| 10 | Sodium Absorption Ratio (SAR) | ---- | 0.1 | 0.16 | 0.11 | 0.13 | 0.12 | 0.15 |
| 11 | Available Nitrogen as N | Kg/ha | 68.23 | 62.44 | 98.8 | 96.3 | 101.4 | 76.5 |
| 12 | Available Phosphorous as P | Kg/ha | 92.22 | 99.38 | 53.5 | 49.6 | 103.3 | 58.0 |
| 13 | Available Potassium as K | Kg/ha | 156.35 | 166.84 | 289.2 | 305.6 | 402.7 | 214.6 |
| 14 | Organic Carbon | % | 0.37 | 0.34 | 0.54 | 0.49 | 0.51 | 0.37 |
| 15 | Organic Matter | % | 0.64 | 0.59 | 0.93 | 0.84 | 0.87 | 0.64 |
| 16 | Water Soluble Chlorides as Cl | mg/kg | 120.46 | 102.64 | 127.3 | 118.6 | 134.6 | 63.7 |
| 17 | Water Soluble Sulphates as SO4 | mg/kg | 48.76 | 51.47 | 37.5 | 38.6 | 58.85 | 36.1 |
| 18 | Aluminium | % | 0.79 | 0.84 | 0.76 | 0.72 | 0.89 | 0.73 |
| 19 | Total Iron | % | 1.51 | 1.43 | 1.28 | 1.36 | 1.27 | 1.36 |
| 20 | Manganese | mg/kg | 354 | 398 | 426 | 396 | 432 | 397 |
| 21 | Boron | mg/kg | 31.3 | 26.7 | 34.5 | 41.8 | 36.5 | 28.7 |
| 22 | Zinc | mg/kg | 28.7 | 34.8 | 42.6 | 39.8 | 43.6 | 51.3 |

## TABLE-3.21
## SOIL QUALITY RESULTS

| S. No | Parameters | Unit | S2 –Appikonda Village | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 |
| | | | 15.10.20 | 16.11.20 | 12.12.20 | 18.01.21 | 13.02.21 | 22.03.21 |
| 1 | Texture | -- | Clay | Clay | Clay | Clay | Clay | Clay |
| a | Sand | % | 30 | 28 | 23 | 25 | 28 | 27 |
| b | Silt | % | 18 | 17 | 17 | 18 | 14 | 11 |
| c | Clay | % | 52 | 55 | 60 | 57 | 58 | 62 |
| 2 | Bulk Density | g/cc | 1.0 | 1.1 | 1.0 | 1.3 | 1.1 | 1.1 |
| 3 | pH (1:5 Aq.Extraction) | | 7.21 | 7.19 | 7.6 | 7.8 | 7.64 | 7.6 |
| 4 | Conductivity (1:5 Aq.Extraction) | µS/cm | 489 | 461 | 634 | 586 | 762 | 631 |
| 5 | Cation Exchange Capacity | (meq/100gm) | 25.39 | 25.22 | 37.99 | 39.27 | 42.79 | 32.07 |
| 6 | Exchangeable Calcium | (meq/100gm) | 16.38 | 17.09 | 23.28 | 24.36 | 26.99 | 17.65 |
| 7 | Exchangeable Magnesium | (meq/100gm) | 8.15 | 7.2 | 13.65 | 14.05 | 14.70 | 13.53 |
| 8 | Exchangeable Potassium | (meq/100gm) | 0.48 | 0.45 | 0.57 | 0.62 | 0.62 | 0.44 |
| 9 | Exchangeable Sodium | (meq/100gm) | 0.43 | 0.48 | 0.26 | 0.24 | 0.48 | 0.45 |
| 10 | Sodium Absorption Ratio (SAR) | ---- | 0.17 | 0.2 | 0.16 | 0.15 | 0.13 | 0.19 |
| 11 | Available Nitrogen as N | Kg/ha | 110.89 | 145.21 | 135.2 | 124.8 | 119.1 | 116.7 |
| 12 | Available Phosphorous as P | Kg/ha | 101.44 | 110.46 | 85.0 | 82.3 | 81.2 | 74.7 |
| 13 | Available Potassium as K | Kg/ha | 262.57 | 300.76 | 346.3 | 362.4 | 412.8 | 293.9 |
| 14 | Organic Carbon | % | 0.66 | 0.79 | 0.81 | 0.76 | 0.65 | 0.62 |
| 15 | Organic Matter | % | 1.14 | 1.36 | 1.40 | 1.31 | 1.12 | 1.11 |
| 16 | Water Soluble Chlorides as Cl | mg/kg | 145.17 | 131.06 | 145.1 | 152.3 | 159.4 | 113.4 |
| 17 | Water Soluble Sulphates as SO4 | mg/kg | 63.32 | 69.85 | 61.6 | 64.3 | 80.01 | 60.2 |
| 18 | Aluminium | % | 1.21 | 1.09 | 1.21 | 1.16 | 1.23 | 1.18 |
| 19 | Total Iron | % | 1.87 | 1.91 | 1.83 | 1.67 | 1.54 | 1.46 |
| 20 | Manganese | mg/kg | 583 | 611 | 764 | 742 | 698 | 578 |
| 21 | Boron | mg/kg | 46.6 | 54.3 | 67.2 | 58.2 | 64.3 | 41.2 |
| 22 | Zinc | mg/kg | 54.3 | 67.4 | 74.6 | | 72.6 | 68.7 |

## TABLE-3.22
## SOIL QUALITY RESULTS

| S. No | Parameters | Unit | S3 –Devada Village | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 |
| | | | 15.10.20 | 16.11.20 | 12.12.20 | 18.01.21 | 13.02.21 | 22.03.21 |
| 1 | Texture | -- | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay | Sandy Clay |
| a | Sand | % | 45 | 49 | 51 | 50 | 46 | 51 |
| b | Silt | % | 19 | 13 | 13 | 12 | 14 | 12 |
| c | Clay | % | 36 | 38 | 36 | 38 | 40 | 37 |
| 2 | Bulk Density | g/cc | 1.1 | 1.2 | 1.1 | 1.2 | 1.3 | 1.3 |
| 3 | pH (1:5 Aq.Extraction) | | 7.56 | 7.34 | 7.4 | 7.2 | 6.89 | 7.5 |
| 4 | Conductivity (1:5 Aq.Extraction) | µS/cm | 423 | 398 | 367 | 357 | 476 | 512 |
| 5 | Cation Exchange Capacity | (meq/100gm) | 17.51 | 18.94 | 30.76 | 32.36 | 29.64 | 25.43 |
| 6 | Exchangeable Calcium | (meq/100gm) | 11.16 | 12.74 | 18.21 | 19.64 | 18.77 | 14.57 |
| 7 | Exchangeable Magnesium | (meq/100gm) | 5.93 | 5.68 | 11.92 | 12.08 | 10.10 | 10.26 |
| 8 | Exchangeable Potassium | (meq/100gm) | 0.25 | 0.19 | 0.39 | 0.43 | 0.49 | 0.31 |
| 9 | Exchangeable Sodium | (meq/100gm) | 0.21 | 0.33 | 0.24 | 0.21 | 0.29 | 0.29 |
| 10 | Sodium Absorption Ratio (SAR) | ---- | 0.1 | 0.15 | 0.09 | 0.11 | 0.11 | 0.16 |
| 11 | Available Nitrogen as N | Kg/ha | 58.51 | 76.59 | 81.9 | 84.6 | 91.8 | 96.9 |
| 12 | Available Phosphorous as P | Kg/ha | 81.48 | 87.65 | 64.9 | 66.8 | 120.7 | 47.1 |
| 13 | Available Potassium as K | Kg/ha | 139.13 | 136.9 | 259.7 | 245.8 | 381.6 | 244.4 |
| 14 | Organic Carbon | % | 0.32 | 0.38 | 0.45 | 0.52 | 0.39 | 0.43 |
| 15 | Organic Matter | % | 0.55 | 0.66 | 0.77 | 0.89 | 0.67 | 0.78 |
| 16 | Water Soluble Chlorides as Cl | mg/kg | 109.81 | 99.2 | 109.5 | 124.8 | 138.1 | 74.4 |
| 17 | Water Soluble Sulphates as SO4 | mg/kg | 37.03 | 41.2 | 40.2 | 42.8 | 46.56 | 29.1 |
| 18 | Aluminium | % | 0.92 | 0.74 | 0.68 | 0.62 | 0.74 | 0.81 |
| 19 | Total Iron | % | 1.38 | 1.26 | 1.01 | 1.26 | 1.13 | 1.05 |
| 20 | Manganese | mg/kg | 421 | 374 | 731 | 711 | 646 | 482 |
| 21 | Boron | mg/kg | 19.5 | 17.8 | 23.4 | 36.4 | 31.5 | 34.6 |
| 22 | Zinc | mg/kg | 32.2 | 28.2 | 31.6 | 35.4 | 32.6 | 29.4 |

## TABLE-3.23
## SOIL QUALITY RESULTS (QUARTERLY)

[

| S. No | Parameters | Unit | S4 | S5 | S6 | S7 | S8 |
|---|---|---|---|---|---|---|---|
| | Sampling date | | 15.10.20 | 15.10.20 | 15.10.20 | 15.10.20 | 15.10.20 |
| 1 | Texture | -- | Sandy | Sandy Clay | Sandy Clay | Sandy Clay | Sandy |
| A | Sand | % | 68 | 46 | 48 | 51 | 65 |
| B | Silt | % | 13 | 17 | 13 | 11 | 14 |
| C | Clay | % | 19 | 37 | 39 | 38 | 21 |
| 2 | Bulk Density | g/cc | 1.0 | 1.1 | 1.2 | 1.0 | 1.2 |
| 3 | pH (1:5 Aq.Extraction) | | 7.4 | 7.3 | 7.4 | 7.2 | 7.8 |
| 4 | Conductivity (1:5 Aq.Extraction) | µS/cm | 398 | 342 | 412 | 465 | 376 |
| 5 | Cation Exchange Capacity | (meq/100gm) | 34.3 | 33.8 | 27.5 | 31.6 | 27.5 |
| 6 | Exchangeable Calcium | (meq/100gm) | 23.3 | 19.4 | 14.9 | 15.6 | 15.6 |
| 7 | Exchangeable Magnesium | (meq/100gm) | 10.4 | 13.8 | 11.9 | 15.4 | 11.3 |
| 8 | Exchangeable Potassium | (meq/100gm) | 0.30 | 0.34 | 0.25 | 0.37 | 0.33 |
| 9 | Exchangeable Sodium | (meq/100gm) | 0.38 | 0.29 | 0.35 | 0.28 | 0.27 |
| 10 | Sodium Absorption Ratio (SAR) | ---- | 0.19 | 0.14 | 0.19 | 0.15 | 0.15 |
| 11 | Available Nitrogen as N | Kg/ha | 29.0 | 44.0 | 12.5 | 45.3 | 19.2 |
| 12 | Available Phosphorous as P | Kg/ha | 60.1 | 95.8 | 47.5 | 74.5 | 54.0 |
| 13 | Available Potassium as K | Kg/ha | 184.0 | 228.8 | 183.6 | 220.7 | 241.1 |
| 14 | Organic Carbon | % | 0.17 | 0.24 | 0.06 | 0.27 | 0.10 |
| 15 | Organic Matter | % | 0.30 | 0.41 | 0.11 | 0.47 | 0.17 |
| 16 | Water Soluble Chlorides as Cl | mg/kg | 165.2 | 187.4 | 154.8 | 176.4 | 136.5 |
| 17 | Water Soluble Sulphates as SO4 | mg/kg | 121.3 | 134.2 | 116.4 | 141.2 | 112.6 |
| 18 | Aluminium | % | 1.98 | 2.34 | 1.85 | 1.78 | 1.43 |
| 19 | Total Iron | % | 2.34 | 2.78 | 2.98 | 2.64 | 2.91 |
| 20 | Manganese | mg/kg | 398 | 478 | 564 | 476 | 329 |
| 21 | Boron | mg/kg | 19.4 | 26.6 | 34.8 | 31.6 | 26.5 |
| 22 | Zinc | mg/kg | 54.3 | 64.2 | 75.3 | 63.3 | 47.9 |

***Soil Sampling Locations***
***S4- Islampeta village***
***S5- Namidoddi village***
***S6- Palikiladoddi village***
***S7- Dasaripeta village***
***S8- 8th feet road (Near Islampet village)***

## TABLE-3.24
## SOIL QUALITY RESULTS (QUARTERLY)

[

| S. No | Parameters | Unit | S4 | S5 | S6 | S7 | S8 |
|---|---|---|---|---|---|---|---|
| | | | 18.01.21 | 18.01.21 | 18.01.21 | 18.01.21 | 18.01.21 |
| 1 | Texture | -- | Sandy | Sandy Clay | Sandy Clay | Sandy Clay | Sandy |
| A | Sand | % | 64 | 49 | 52 | 50 | 61 |
| B | Silt | % | 15 | 16 | 14 | 18 | 17 |
| C | Clay | % | 21 | 35 | 35 | 32 | 22 |
| 2 | Bulk Density | g/cc | 1.2 | 1.3 | 1.3 | 1.2 | 1.3 |
| 3 | pH (1:5 Aq.Extraction) | | 7.2 | 7.0 | 7.5 | 7.8 | 7.6 |
| 4 | Conductivity (1:5 Aq.Extraction) | µS/cm | 408 | 368 | 431 | 475 | 421 |
| 5 | Cation Exchange Capacity | (meq/100gm) | 33.23 | 27.75 | 27.65 | 27.42 | 24.81 |
| 6 | Exchangeable Calcium | (meq/100gm) | 22.9 | 18.8 | 15.2 | 16.2 | 15.5 |
| 7 | Exchangeable Magnesium | (meq/100gm) | 9.8 | 8.4 | 11.9 | 10.5 | 8.6 |
| 8 | Exchangeable Potassium | (meq/100gm) | 0.31 | 0.28 | 0.23 | 0.41 | 0.38 |
| 9 | Exchangeable Sodium | (meq/100gm) | 0.22 | 0.27 | 0.32 | 0.31 | 0.33 |
| 10 | Sodium Absorption Ratio (SAR) | ---- | 0.21 | 0.15 | 0.21 | 0.17 | 0.16 |
| 11 | Available Nitrogen as N | Kg/ha | 31.2 | 43.2 | 13.6 | 42.5 | 21.3 |
| 12 | Available Phosphorous as P | Kg/ha | 58.6 | 93.8 | 52.6 | 76.8 | 55.8 |
| 13 | Available Potassium as K | Kg/ha | 176.8 | 233.8 | 176.9 | 224.8 | 235.8 |
| 14 | Organic Carbon | % | 0.21 | 0.32 | 0.30 | 0.38 | 0.34 |
| 15 | Organic Matter | % | 0.36 | 0.55 | 0.52 | 0.65 | 0.58 |
| 16 | Water Soluble Chlorides as Cl | mg/kg | 152 | 194 | 142 | 187 | 149 |
| 17 | Water Soluble Sulphates as SO4 | mg/kg | 118 | 142 | 108 | 82 | 96 |
| 18 | Aluminium | % | 2.11 | 2.46 | 1.68 | 1.73 | 1.52 |
| 19 | Total Iron | % | 2.68 | 3.05 | 3.11 | 2.78 | 3.24 |
| 20 | Manganese | mg/kg | 421 | 496 | 582 | 448 | 364 |
| 21 | Boron | mg/kg | 24.3 | 28.6 | 36.9 | 32.8 | 29.8 |
| 22 | Zinc | mg/kg | 58.6 | 67.2 | 71.8 | 59.8 | 52.3 |

***Soil Sampling Locations***
***S4- Islampeta village***
***S5- Namidoddi village***
***S6- Palikiladoddi village***
***S7- Dasaripeta village***
***S8- 8th feet road (Near Islampet village)***

## 3.7 Waste Water Quality

3.7.1 Effluent Treatment Plant and Outfall water at diffusion point water Quality

There are one ETP water inside plant and two Outfall water at diffusion point these sample were collected and these were as per analyzed as per the standards to know the quality of water. The Summary of analyzed parameters results is given in **Table-3.25.**

**TABLE-3.25**
**ETP OUTLET ANALYSIS RESULT AT PLANT SITE**

| Sr.no | Parameters | Unit | Oct 20 | Nov 20 | Dec 20 | Jan 21 | Feb 21 | Mar 21 | Standards |
|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | - | Plant ShutdowN | | | Plant Shutdow | | | 6.50—8.50 |
| 2 | Total Suspended Solids (at 103—105° C) | mg/l | | | | | | | 100 mg/l |
| 3 | Oil and Grease | mg/l | | | | | | | 20 mg/l |
| 4 | Free chlorine | mg/l | | | | | | | 0.5 mg/l |
| 5 | Phosphate as PO4 | mg/l | | | | | | | 20 mg/l |
| 6 | Chromium (Total) | mg/l | | | | | | | 0.2 mg/l |
| 7 | Copper (Total) | mg/l | | | | | | | 1 mg/l |
| 8 | Iron | mg/l | | | | | | | 1 mg/l |
| 9 | Zinc | mg/l | | | | | | | 1 mg/l |
| 10 | BOD (3 day 27$^{O}$C) | mg/l | | | | | | | 30 mg/l |
| 11 | Fecal Coliform | MPN/100 ml | | | | | | | 1000 MPN/100 ml |

## 3.8 Stack Emission Monitoring

The power plant has stack of height 275.0-m, which is the major source of air pollution. The stack emission monitoring for Unit–I and Unit-II has been carried out and results are given in **Table-3.26.**

**TABLE-3.26**
**STACK EMISSION MONITORING**

| Sr. No. | Parameters | UOM | Unit-I&II | Unit-I&II | Unit-I&II | Unit-I&II | Unit-I&II | Unit-I&II | Methods of Testing |
|---|---|---|---|---|---|---|---|---|---|
| | | | Oct 2020 | Nov 2020 | Dec 2020 | Jan 21 | Feb 21 | Mar 21 | |
| | Sampling date | | Plant Shutdown | | | Plant Shutdown | | | |
| 1 | Capacity | MW | | | | | | | - |
| 2 | Stack Height | M | | | | | | | - |
| 3 | Stack diameter | M | | | | | | | - |
| 4 | Cross sectional area of the duct | $m^2$ | | | | | | | - |
| 5 | Flue gas Temperature | °C | | | | | | | - |
| 6 | Velocity of the flue gas | m/s | | | | | | | IS: 11255(P-3) 2008 |
| 7 | Gas volumetric flow rate | $Nm^3/s$ | | | | | | | IS: 11255(P-3) 2008 |
| 8 | Particulate Matter | $mg/Nm^3$ | | | | | | | IS: 11255(P-1) 2009 |
| 9 | Sulphur dioxide | $mg/Nm^3$ | | | | | | | IS: 11255(P-7) 2012 |
| 10 | Oxides of Nitrogen | $mg/Nm^3$ | | | | | | | IS: 11255(P-2) 1985 |

## 3.9 Pizeo wells Monitoring

Pizeo wells Monitoring of ground water has been carried out for 6 locations around the plant site and the Pizeo wells water level monitoring are given in **Table-3.27.**

**TABLE-3.27**
**PIZEO WELLS MONITORING FOR GROUND WATER**

| Sr.No. | Location Name | Depth of Water levels (m) | |
|---|---|---|---|
| | | 14.10.20 | 20.01.21 |
| 1 | Appikonda village | 4.1 | 4.5 |
| 2 | Palavalasa village | 3.8 | 4.2 |
| 3 | Velama Appikonda village | 4.0 | 3.7 |
| 4 | Gouruvanipalem village | 3.9 | 4.0 |
| 5 | Islampet village | 4.9 | 4.6 |
| 6 | Dasaripeta village | 4.5 | 4.8 |

## 3.10 Sewage Treatment Plant Outlet Water Quality (STP)

Two Sewage water samples are collected one is from Plant site and other is Colony and analyzed for various parameters. The survey analytical results are given in **Table-3.28.**

**TABLE-3.28**
**SEWAGE OUTLET WATER QUALITY (OCTOBER 2020 TO MARCH 2021)**

| Sr. No | Parameter | UOM | Oct 20 | | Nov 21 | | Dec 20 | | Jan 21 | | Feb 21 | | Mar 21 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Plant Site | Colony | Plant Site | Colony | Plant Site | Colony | Plant Site | Colony | Plant Site | Colony | Plant Site | Colony |
| | Sampling date | | 14.10.20 | 14.10.20 | 17.11.20 | 17.11.20 | 19.12.20 | 19.12.20 | 20.01.21 | 20.01.21 | 23.02.21 | 23.02.21 | 16.03.21 | 16.03.21 |
| 1 | pH | - | 7.4 | 7.8 | 7.6 | 7.9 | 7.4 | 7.6 | 7.2 | 7.4 | 7.8 | 7.6 | 7.5 | 7.8 |
| 2 | Total Dissolved Solids | mg/l | 578 | 621 | 604 | 581 | 583 | 562 | 613 | 587 | 591 | 544 | 562 | 528 |
| 3 | Total Suspended Solids | mg/l | 58 | 63 | 60 | 55 | 58 | 53 | 62 | 58 | 55 | 65 | 61 | 57 |
| 4 | Bio Chemical Oxygen Demand for 3 day $27^{O}C$ | mg/l | 18 | 16 | 15 | 17 | 18 | 16 | 17 | 18 | 15 | 17 | 18 | 16 |

## 3.8 Beach Profile Study

Hinduja National Power Corporation Limited (HNPCL) is a Hinduja Group company to realize the ambitions of the Group in Power Sector. HNPCL is setting up a 1,040 MW coal based merchant power plant at Vizag, Andhra Pradesh. Once Through (Open Cycle) Cooling System has been recommended by MoEF for the power plant and Sea Water Intake-Outfall System has been installed.
The present study involves quarterly monitoring of shoreline and beach profile changes as part of environmental monitoring and compliance to MoEF:

1. shoreline within 3 km on either side of HNPCL Sea Water Intake-Outfall System (Jetty) and
2. beach profile at HNPCL Jetty and at 100 m, 250 m and 500 m intervals on either side of Jetty

### 3.8.1 Shoreline

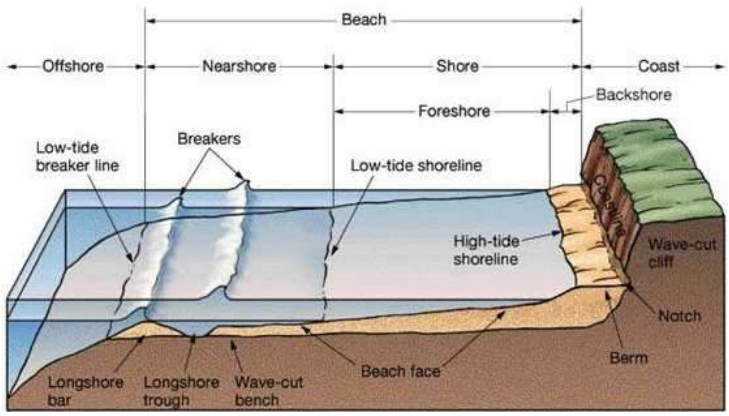
The coastal areas are always physically and ecologically changing that depends to natural and human factors. Monitoring of coastal areas is an important fact in steady development and environment maintenance. To monitor a coastal area, shoreline extraction in various times is an essential task. Shoreline is one the most important linear features on the Earth's surface showing a dynamic nature. It is important to produce shoreline map and to determine the changes for a secure shipping, resource management, environment maintenance, planning and coastal steady-development.

Remote sensing is one of the best and most reliable methods in monitoring and management off environment and resources. Since, the reflection of water in IR bands are almost zero and most of vegetation have a bigger reflection versus water, shoreline can be extracted from even one band of the image.

Cartosat 1 with improved spatial resolution capability it will provide enhanced inputs for large scale mapping applications and stimulate newer applications in the urban and rural development, land and water resources management, coastal mapping etc. Hence, high resolution satellite data during October/November 2020 has been proposed to carry out investigation on spatial changes of shoreline monitoring. Since could free 2.5 m resolution data close to field profile study i.e., 28-Oct-2020 is not available, Resourcesat 2A L4FMX multispectral satellite data of 5 m resolution on 17-November-2020 has been procured to draw shore lines during November 2020. The Resourcesat 2A L4FMX satellite data of 5 m resolution of 17-November-2020 obtained from NRSC is geometrically corrected with respect to Survey of India toposheet and GCPs collected from field. To carry out the geo-referencing, ground control points (GCPs) were identified on the maps and raw satellite data. The coefficients for two co-ordinate transformation equations were computed based on polynomial regression between GCPs on map and satellite data. Alternate GCPs were generated till the Root Mean Square (RMS) error was less than 0.5 pixel and then both the images were co-registered.

Shore line and High Tide Shore lines are delineated from processed Resourcesat 2A L4FMX image of 17-November-2020 using visual interpretation technique in conjunction with LTL, HTL and CRZ Map prepared by National Institute of Oceanography and field data provided by VIMTA Labs Ltd. The above-mentioned satellite data covering 3.5 km on either side of Jetty point has been used to present shore line changes. "The line on the land up to which the highest water line reaches during the spring tide" indicated by vegetation line and clear beach is delineated as Shore Line (SL). High Tide Shore Line (HTSL) is plotted following line of moisture indication along the tidal zone on the satellite image. Mapping of SL and HTSL is done on scale of 1:8000.

The observations in respect of SL and HTSL are presented in **Figure-3.5** for 17-November-2020. From the shoreline map, it is observed that there is no major change in SL and no activity or discharge around jetty. The difference in HTSL observed may be due to fluctuations caused by changes in seasonal tides/gravitational forces exerted by the moon and the sun, and the rotation of the Earth.




East of HNPCL Jetty

West of HNPCL Jetty

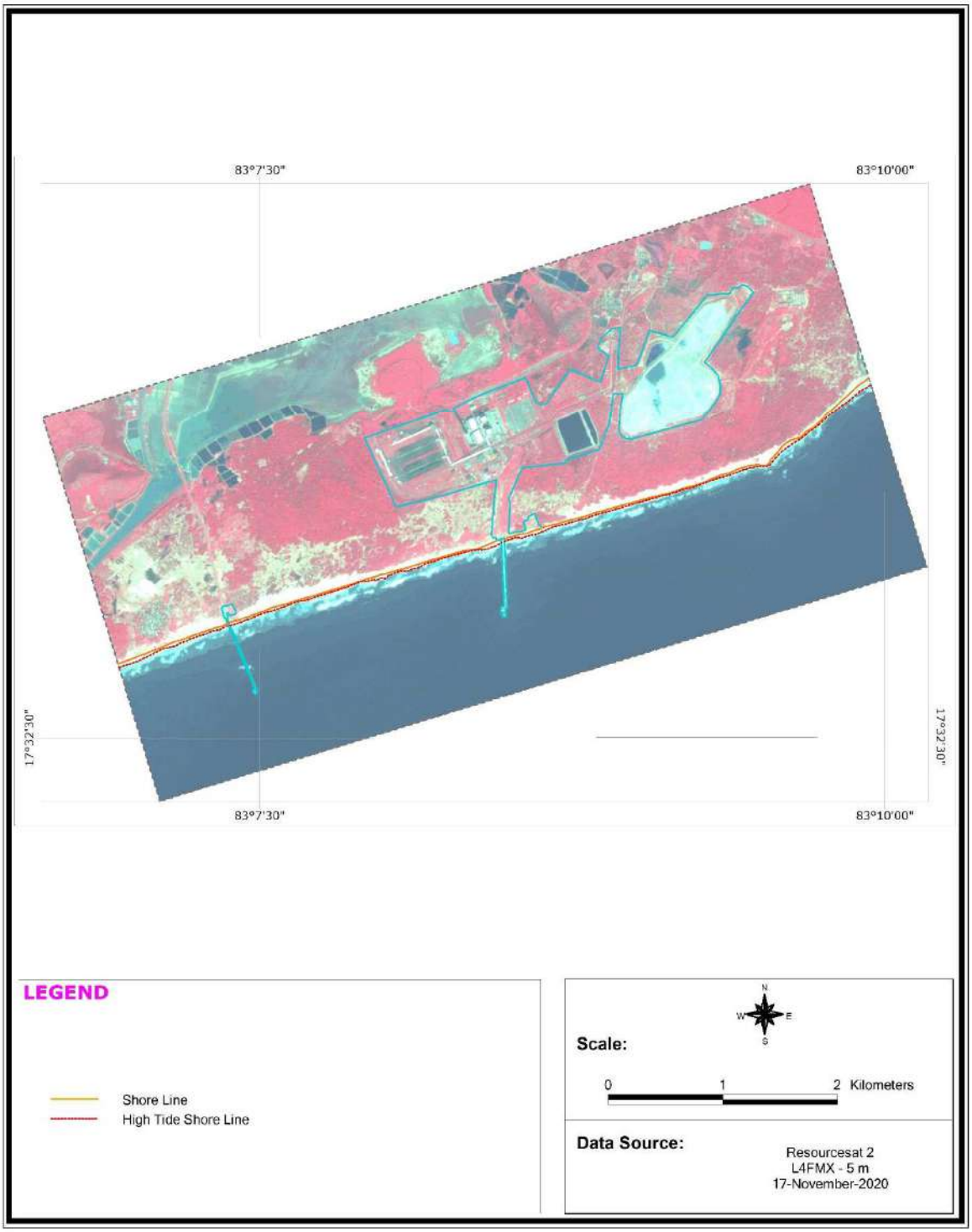



**FIGURE-3.5**
**SHORELINE SATELLITE IMAGERY OF HTSL, RESOURCESAT 2A L4FMX-5M (17 NOV 2020)**

3.8.2 Beach Profiles

Measuring beach profiles is an ideal activity for science-based assessments and science fair projects. Beach size often changes so quickly – in a matter of days – that interesting results can be guaranteed in short time period. Furthermore, the information gathered may also be useful for environmental management and planning.

The monitoring consists of surveying the beach profile from a fixed point set up behind the beach. The fixed point is called the reference mark and is the starting point the measurement. The reference mark is usually painted on a permanent feature like wall or tree or a pillar established. In the absence of any permanent features here, 1'x1'x3' pillar stones are installed (at 7.1 m, 100 m, 250 m & 500 m towards east of Jetty and 8.1 m, 100 m, 250 m & 500 m towards west of Jetty) as reference marks and painted with profile identification numbers. Reference marks, profile sections and profile line along the beach are shown in **Figure 3.3**. Beach profile measurements are run from the installed reference marks at right angles across the beach on 28.10.2020. Beach profile measurements are done using an Abney Level & Clinometer placing ranging poles at each break of slope and ensuring the line of profile follows the fixed orientation. The measurements are continued a few meters into the sea water beyond low tide.


**FIGURE-3.3**
**HNPCL JETTY AND PROFILE LOCATIONS ON GOOGLE EARTH MAP**

High and low tide levels are measured as observed on the day and time of measurements considering the moisture indication and current tide level respectively. Summary of profiles carried out giving the details of length, vertical drop w.r.t reference mark and area of profile are presented in **Table-3.29** and individual profiles are presented in **Figure 3.4 to 3.7.**

Total length of profiles ranges from 28.50 m to 53.08 m from the reference mark in to the offshore with vertical drop w.r.t reference mark ranging from 3.630 m to 5.795 m and sectional profile area ranging from 49.57 sq m to 158.22 sq m.

**TABLE-3.29**
**DETAILS OF PROFILES ON 28.10.2020**

| Sr.No. | Profile ID | Latitude | Longitude | Elevation at Ref. Mark (m amsl) | Total Length (m) | Vertical Drop w.r.t Ref. Mark (m) | Profile Area (sq m) |
|---|---|---|---|---|---|---|---|
| 1 | E7.1 | 17 $^0$ 33' 17.7''N | 83 $^0$ 08' 26.3''E | 3.62 | 36.90 | 3.945 | 84.36 |
| 2 | E100 | 17 $^0$ 33' 18.6''N | 83 $^0$ 08' 29.2''E | 3.31 | 38.73 | 4.250 | 91.47 |
| 3 | E250 | 17 $^0$ 33' 20.2''N | 83 $^0$ 08' 34.0''E | 5.32 | 48.54 | 5.795 | 158.22 |
| 4 | E500 | 17 $^0$ 33' 22.2''N | 83 $^0$ 08' 42.4''E | 3.31 | 39.00 | 5.400 | 114.60 |
| 5 | W8.1 | 17 $^0$ 33' 17.6''N | 83 $^0$ 08' 24.9''E | 4.54 | 40.65 | 4.564 | 123.35 |
| 6 | W100 | 17 $^0$ 33' 16.5''N | 83 $^0$ 08' 21.9''E | 4.40 | 53.08 | 3.630 | 122.00 |
| 7 | W250 | 17 $^0$ 33' 15.2''N | 83 $^0$ 08' 16.9''E | 3.60 | 32.15 | 4.891 | 75.30 |
| 8 | W500 | 17 $^0$ 33' 13.0''N | 83 $^0$ 08' 08.6''E | 3.50 | 28.50 | 4.184 | 49.57 |

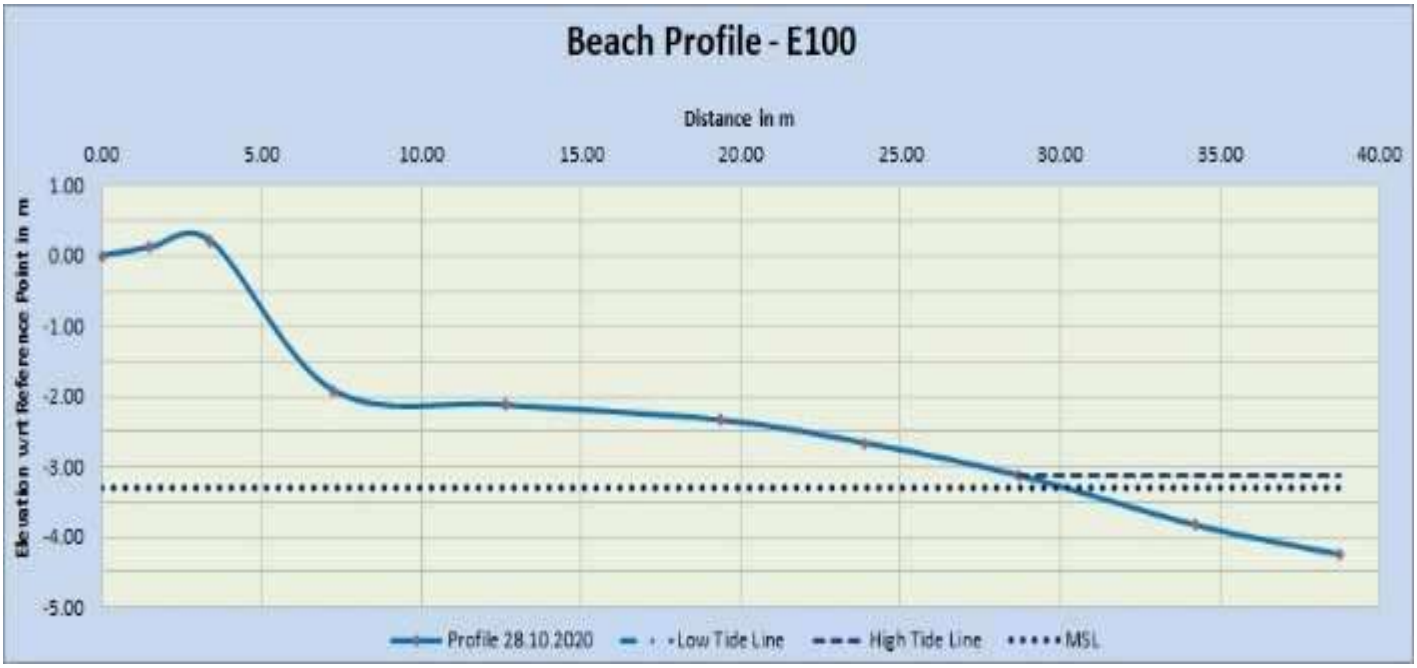




**FIGURE-3.4**
**BEACH PROFILE – EAST 7.1 & EAST 100 METERS FROM JETTY 28.10.2020**



**FIGURE-3.5**
**BEACH PROFILE – EAST 250 & EAST 500 METERS FROM JETTY 28.10.2020**



**FIGURE-3.6**
**BEACH PROFILE – WEST 8.1 & WEST 100 METERS FROM JETTY 28.10.2020**



**FIGURE-3.7**
**BEACH PROFILE – WEST 250 & WEST 500 METERS FROM JETTY 28.10.2020**

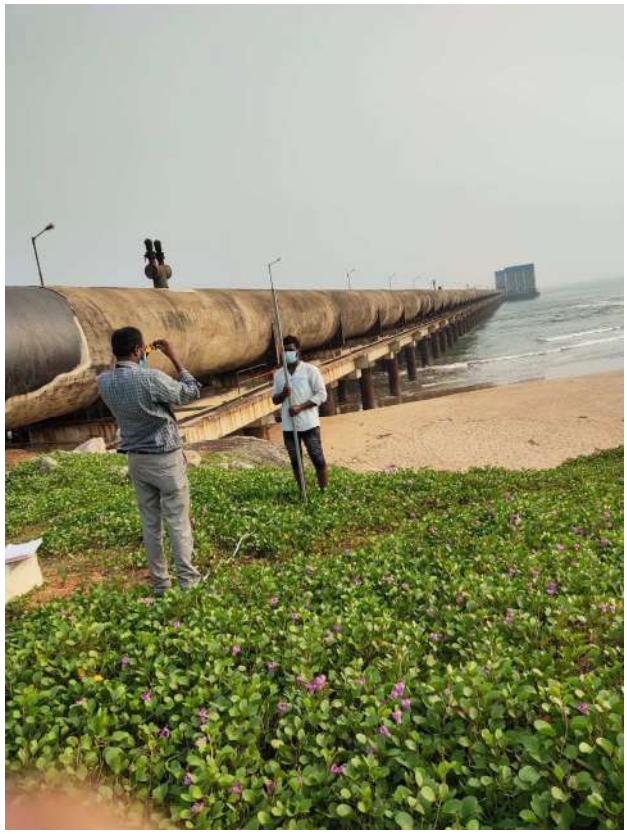


**FIGURE 3.8**
**SITE PHOTO GRAPHS OF BEACH PROFILE STUDY AREA**

## 3.9 Biological characteristics

3.9.1 Phytoplankton

**Phyto-pigments:** Phyto-pigments such as Chlorophyll-a / Chlorophyll-b Chlorophyll-c, Carotenoids / Phaeopigments.

3.9.1.1 The Genetic diversity of the Phyto-planktons is presented in the **Table-3.30.**

**TABLE-3.30**
**PHYTOPLANKTON GENETIC DIVERSITY**

| **Phytoplankton Genetic Diversity** | | |
|---|---|---|
| **Chlorophyaceae** | | **Genetic Diversity** |
| 1 | *Cosmarium* | 13 |
| 2 | *Chara* | 9 |
| 3 | *Cladophora* | 8 |
| 4 | *Chlorilla* | 5 |
| 5 | *Chlamydomonas* | 3 |
| 6 | *Volvox* | 4 |
| 7 | *Hydrodicto* | 6 |
| 8 | *Spirodictiona* | 7 |
| 9 | *Spirozyra* | 4 |
| 10 | *Zygenema* | 11 |
| **Cyanophyaceae** | | |
| 11 | *Spirulina* | 8 |
| 12 | *Anabaena* | 4 |
| 13 | *Nostoc* | 6 |
| **Bacillariophyaceae** | | |
| 14 | *Pinnularia* | 8 |
| 15 | *Navicula* | 10 |
| Shannon Wiener Diversity Index for Species Diversity | | 0.88 |
| Species Richness | | 3.0021 |

Population of biomass comprises of 15 species of phyto-planktons.

3.9.1.2 The genetic diversity of the Zooplankton is given in the **Table-3.31**

**TABLE-3.31**
**ZOOPLANKTON GENETIC DIVERSITY**

| **Zooplankton Genetic Diversity** | | |
|---|---|---|
| **Copepoda** | | **Genetic Diversity** |
| 1 | *Cyclops* sp | 6 |
| 2 | *Nauplius* larvae | 12 |
| **Rotifera** | | |
| 1 | *Brachionus* sp | 11 |
| 2 | *Allonella* sp | 9 |
| 3 | *Moina* sp | 13 |
| **Protozoa** | | |
| 1 | *Pinnularia* sp | 5 |
| Shannon Wiener Diversity Index for Species Diversity | | 0.89 |
| Species Richness | | 1.2421 |

## 3.9.2 Benthos

*3.9.2.1 Meiobenthos*

Community of Benthos are represented by Meiobenthos and Macro benthos. The Meiobenthos communities are represented such as Copepods, and turbellarians, Listed in **Table-3.32.**

**TABLE-3.32**
**MEIOBENTHIC GROUP**

| **Sr. No.** | **Meiobenthos** | **Genetic Diversity** |
|---|---|---|
| 1 | *Copepods* | 10 |
| 2 | *Nematodes* | 6 |
| 3 | *Turbellarians* | 8 |
| 4 | *Nemertins* | 12 |
| 5 | *Foraminifera* | 5 |
| 6 | *Kinorynchs* | 14 |
| 7 | *Halacarids* | 7 |
| **Shannon Wiener Diversity Index - Species Diversity** | | 1.89 |
| **Species Richness** | | 1.4538 |

*3.9.2.2 Macro benthos*

Represented by *Polychaetes*, *Molluscs*, *Amphipods*, *Isopods*, *Cnidarians*, listed in **Table-3.33.**

**TABLE-3.33**
**MACROBENTHIC GROUP**

| Sr. No. | Macrobenthos | Genetic Diversity |
|---|---|---|
| 1 | *Polychaetes* | 6 |
| 2 | *Molluscs* | 11 |
| 3 | *Cumceans* | 10 |
| 4 | *Amphipods* | 13 |
| 5 | *Isopods* | 6 |
| 6 | *Cnidarians* | 8 |
| 7 | *Oligochaetes* | 10 |
| 8 | *Tanaidacea* | 16 |
| **Shannon Wiener Diversity Index - Species Diversity** | | 2.04 |
| **Species Richness** | | 1.5974 |

**Fishes**

The list of fish found near the study area, near the plant site listed in **Table-3.34.**

**TABLE-3.34**
**LIST OF FISHES IN THE STUDY AREA**

| Sr. No | Name of the Species | Number of Individuals | Common Name |
|---|---|---|---|
| **Fishes** | | | |
| 1 | *Rasterliger kanagurta* | 18 | Indian Mackerel |
| 2 | *Sarinella longiceps* | 13 | Indian Oil Sardine |
| 3 | *Canos charios* | 24 | White Mullet |
| **Shannon Wiener Diversity Index - Species Diversity** | | 1.06 | |
| **Species Richness** | | 0.4991 | |

Thus indicating the Genetic diversity of Phytoplankton, *Meiobenthos* and *Macrobenthos* and fishes in the study area.

# *Annexure-I*

# *Ambient Air Quality Levels*

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ1 - Palavalasa village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 08/10/2020 | 23.2 | 52.3 | 11.3 | 12.2 | 242 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 09/10/2020 | 24.5 | 54.1 | 10.5 | 13.1 | 213 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 12/10/2020 | 20.9 | 54.5 | 12.1 | 11.2 | 233 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 13/10/2020 | 19.9 | 56.6 | 10.9 | 13.8 | 194 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 22/10/2020 | 21.7 | 51.4 | 9.8 | 14.6 | 256 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 23/10/2020 | 25.5 | 53.2 | 11.3 | 13.4 | 221 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 26/10/2020 | 22.4 | 55.2 | 12.6 | 11.7 | 189 | 6.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 27/10/2020 | 21.8 | 51.8 | 10.9 | 12.9 | 224 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 05/11/2020 | 22.0 | 50.7 | 12.1 | 14.1 | 230 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 06/11/2020 | 23.3 | 52.5 | 11.3 | 13.6 | 201 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 09/11/2020 | 19.7 | 48.5 | 10.7 | 12.6 | 221 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 10/11/2020 | 22.8 | 55.0 | 11.7 | 14.9 | 182 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 19/11/2020 | 20.5 | 49.8 | 10.6 | 15.3 | 244 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 20/11/2020 | 24.3 | 57.4 | 12.1 | 14.8 | 209 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 23/11/2020 | 21.2 | 53.6 | 13.4 | 15.1 | 177 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 24/11/2020 | 25.9 | 50.2 | 11.7 | 13.6 | 212 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 03/12/2020 | 23.7 | 50.8 | 11.9 | 13.9 | 249 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 04/12/2020 | 20.6 | 54.6 | 12.1 | 14.5 | 220 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 07/12/2020 | 21.4 | 50.6 | 13.3 | 15.0 | 240 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 08/12/2020 | 24.5 | 56.9 | 12.5 | 14,2 | 201 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 17/12/2020 | 22.2 | 47.4 | 10.4 | 12.6 | 253 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 18/12/2020 | 24.7 | 56.2 | 11.2 | 13.6 | 228 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 21/12/2020 | 22.9 | 55.7 | 10.8 | 12.2 | 196 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 22/12/2020 | 23.5 | 52.3 | 11.2 | 14.2 | 231 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 30/12/2020 | 21.4 | 51.7 | 10.4 | 13.4 | 248 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 31/12/2020 | 23.4 | 49.5 | 11.7 | 12.7 | 227 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 04/01/2021 | 24.5 | 52.1 | 12.6 | 14.6 | 272 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 05/01/2021 | 21.4 | 55.9 | 12.8 | 13.2 | 243 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 15/01/2021 | 22.2 | 51.9 | 13.9 | 15.6 | 263 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 16/01/2021 | 25.3 | 58.2 | 13.2 | 12.4 | 224 | 7.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 18/01/2021 | 23.0 | 48.7 | 11.1 | 13.3 | 276 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 19/01/2021 | 25.5 | 57.5 | 10.8 | 14.3 | 251 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 28/01/2021 | 19.8 | 57.0 | 11.5 | 12.9 | 219 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 29/01/2021 | 20.5 | 53.6 | 11.9 | 14.8 | 254 | 6.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 01/02/2021 | 25.3 | 49.7 | 11.3 | 13.4 | 253 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 02/02/2021 | 22.7 | 53.5 | 10.8 | 12.0 | 267 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 11/02/2021 | 23.5 | 52.3 | 12.7 | 14.4 | 282 | 7.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 12/02/2021 | 26.4 | 55.8 | 10.7 | 13.3 | 197 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 15/02/2021 | 24.3 | 46.3 | 12.4 | 14.5 | 281 | 6.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 16/02/2021 | 20.2 | 56.2 | 10.9 | 13.1 | 224 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 25/02/2021 | 21.1 | 54.6 | 12.8 | 14.0 | 243 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 26/02/2021 | 20.6 | 51.2 | 13.2 | 15.1 | 278 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 01/03/2021 | 23.7 | 51.1 | 10.9 | 15.3 | 244 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 02/03/2021 | 25.6 | 55.3 | 12.5 | 13.9 | 258 | 7.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 12/03/2021 | 21.9 | 53.7 | 13.4 | 15.2 | 273 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 13/03/2021 | 24.8 | 57.2 | 9.1 | 13.1 | 188 | 8.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 15/03/2021 | 22.5 | 49.3 | 13.7 | 14.2 | 236 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 16/03/2021 | 20.4 | 46.4 | 10.2 | 12.3 | 224 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 25/03/2021 | 22.7 | 48.1 | 12.0 | 14.7 | 284 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 26/03/2021 | 20.5 | 57.6 | 10.5 | 13.3 | 215 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 29/03/2021 | 19.5 | 56.0 | 12.4 | 13.6 | 234 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 30/03/2021 | 23.3 | 54.4 | 12.8 | 15.5 | 269 | 7.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **19.5** | **46.3** | **9.1** | **11.2** | **177** | **4.3** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **26.4** | **58.2** | **13.9** | **15.6** | **284** | **8.1** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **22.7** | **53.0** | **11.7** | **13.7** | **234** | **5.9** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **25.9** | **57.6** | **13.7** | **15.5** | **282** | **7.8** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ2 - Appikonda village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 01/10/2020 | 24.3 | 51.8 | 10.3 | 13.0 | 219 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 03/10/2020 | 21.4 | 52.4 | 13.4 | 12.1 | 243 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 05/10/2020 | 23.8 | 54.2 | 11.6 | 13.4 | 220 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 06/10/2020 | 22.6 | 50.9 | 12.2 | 14.3 | 223 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 15/10/2020 | 24.9 | 47.4 | 10.4 | 12.5 | 234 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 16/10/2020 | 23.5 | 51.4 | 10.4 | 13.6 | 226 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 19/10/2020 | 22.4 | 53.4 | 9.9 | 14.1 | 219 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 20/10/2020 | 23.9 | 47.9 | 11.5 | 12.8 | 235 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 29/10/2020 | 22.8 | 52.6 | 12.1 | 13.3 | 226 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 30/10/2020 | 22.1 | 51.3 | 10.6 | 12.4 | 231 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 02/11/2020 | 23.1 | 49.8 | 11.1 | 14.4 | 207 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 03/11/2020 | 24.1 | 46.7 | 10.8 | 13.5 | 231 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 12/11/2020 | 22.6 | 52.6 | 12.4 | 14.8 | 208 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 13/11/2020 | 20.8 | 49.3 | 13.1 | 15.0 | 211 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 16/11/2020 | 25.0 | 45.8 | 11.2 | 13.9 | 222 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 17/11/2020 | 24.7 | 49.8 | 12.2 | 15.0 | 214 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 25/11/2020 | 21.2 | 51.8 | 10.7 | 12.8 | 207 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 26/11/2020 | 22.7 | 46.3 | 12.3 | 14.2 | 223 | 5.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 30/11/2020 | 23.6 | 50.5 | 11.5 | 13.6 | 214 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 01/12/2020 | 21.5 | 51.0 | 12.3 | 15.1 | 239 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 10/12/2020 | 22.6 | 48.1 | 11.7 | 14.4 | 241 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 11/12/2020 | 24.5 | 44.5 | 10.5 | 13.2 | 240 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 14/12/2020 | 21.3 | 50.7 | 12.5 | 14.2 | 243 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 15/12/2020 | 24.2 | 47.2 | 12.1 | 14.8 | 235 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 24/12/2020 | 19.5 | 50.4 | 11.2 | 13.1 | 246 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 25/12/2020 | 23.4 | 46.3 | 11.6 | 12.4 | 239 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 28/12/2020 | 20.5 | 47.7 | 12.9 | 14.6 | 228 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 29/12/2020 | 24.3 | 48.2 | 10.7 | 12.5 | 246 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 07/01/2021 | 22.8 | 49.1 | 11.4 | 14.4 | 266 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 08/01/2021 | 23.9 | 46.2 | 10.8 | 13.7 | 234 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 11/01/2021 | 18.7 | 42.6 | 9.6 | 12.5 | 267 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 12/01/2021 | 21.4 | 50.4 | 11.6 | 13.5 | 238 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 21/01/2021 | 25.2 | 45.3 | 11.2 | 14.8 | 212 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 22/01/2021 | 20.8 | 48.5 | 10.3 | 12.4 | 248 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 25/01/2021 | 24.7 | 44.4 | 10.7 | 11.7 | 266 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 27/01/2021 | 19.4 | 45.8 | 12.1 | 13.9 | 255 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 04/02/2021 | 24.2 | 51.2 | 10.8 | 13.7 | 272 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 05/02/2021 | 25.8 | 48.4 | 12.0 | 14.1 | 252 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 08/02/2021 | 20.6 | 51.5 | 11.1 | 13.9 | 244 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 09/02/2021 | 26.3 | 52.4 | 12.8 | 15.6 | 256 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 18/02/2021 | 19.6 | 47.5 | 11.3 | 13.5 | 230 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 19/02/2021 | 22.7 | 50.4 | 10.8 | 12.9 | 187 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 22/02/2021 | 22.4 | 46.6 | 11.9 | 13.1 | 244 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 23/02/2021 | 21.3 | 48.0 | 9.2 | 12.5 | 273 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 04/03/2021 | 26.2 | 53.1 | 11.3 | 13.2 | 236 | 7.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 05/03/2021 | 24.1 | 50.1 | 12.5 | 14.1 | 269 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 08/03/2021 | 23.3 | 46.5 | 11.6 | 13.7 | 295 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 09/03/2021 | 25.3 | 53.6 | 13.3 | 14.7 | 273 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 18/03/2021 | 26.7 | 41.8 | 10.2 | 13.8 | 195 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 19/03/2021 | 25.6 | 42.0 | 9.4 | 12.5 | 204 | 7.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 22/03/2021 | 24.1 | 48.3 | 12.7 | 14.4 | 261 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 23/03/2021 | 22.5 | 50.4 | 10.2 | 13.4 | 290 | 7.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **18.7** | **41.8** | **9.2** | **11.7** | **187** | **3.8** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **26.7** | **54.2** | **13.4** | **15.6** | **295** | **7.7** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **23.1** | **48.9** | **11.4** | **13.6** | **237** | **5.5** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **26.3** | **53.6** | **13.3** | **15.1** | **290** | **7.5** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ3 - Devada village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 01/10/2020 | 23.3 | 45.9 | 12.5 | 12.1 | 213 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 03/10/2020 | 21.2 | 47.2 | 11.2 | 13.6 | 248 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 05/10/2020 | 22.7 | 45.3 | 10.7 | 12.4 | 232 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 06/10/2020 | 24.6 | 49.6 | 9.7 | 15.2 | 218 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 15/10/2020 | 25.4 | 46.5 | 11.3 | 14.5 | 231 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 16/10/2020 | 21.0 | 43.2 | 10.3 | 12.4 | 224 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 19/10/2020 | 23.7 | 46.8 | 9.5 | 13.1 | 238 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 20/10/2020 | 20.9 | 48.3 | 10.2 | 12,9 | 204 | 5,3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 29/10/2020 | 22.2 | 47.8 | 11.8 | 14.3 | 227 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 30/10/2020 | 23.4 | 46.1 | 10.9 | 12.6 | 216 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 02/11/2020 | 22.1 | 43.6 | 10.7 | 13.5 | 222 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 03/11/2020 | 20.0 | 45.6 | 12.0 | 14.6 | 236 | 4.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 12/11/2020 | 21.5 | 43.7 | 11.5 | 13.8 | 220 | 3.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 13/11/2020 | 23.4 | 48.0 | 10.5 | 13.4 | 206 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 16/11/2020 | 24.2 | 44.9 | 12.1 | 14.7 | 219 | 3.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 17/11/2020 | 19.8 | 47.1 | 11.1 | 13.8 | 212 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 25/11/2020 | 22.5 | 45.2 | 10.3 | 12.5 | 226 | 3.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 26/11/2020 | 19.7 | 46.7 | 11.0 | 13.2 | 192 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 30/11/2020 | 21.0 | 44.6 | 12.6 | 14.8 | 215 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 01/12/2020 | 20.4 | 45.2 | 11.3 | 12.8 | 237 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 10/12/2020 | 19.3 | 47.6 | 12.2 | 13.5 | 198 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 11/12/2020 | 22.9 | 46.1 | 10.6 | 14.9 | 222 | 5.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 14/12/2020 | 24.8 | 45.6 | 13.4 | 14.5 | 233 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 15/12/2020 | 23.4 | 47.3 | 10.9 | 13.5 | 205 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 24/12/2020 | 21.2 | 46.6 | 12.3 | 14.2 | 238 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 25/12/2020 | 23.9 | 47.6 | 11.5 | 13.6 | 234 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 28/12/2020 | 21.1 | 44.2 | 12.2 | 13.3 | 226 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 29/12/2020 | 22.4 | 45.8 | 11.6 | 14.5 | 205 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 07/01/2021 | 21.3 | 47.5 | 10.7 | 13.7 | 242 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 08/01/2021 | 20.2 | 48.1 | 12.9 | 12.1 | 223 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 11/01/2021 | 23.8 | 42.8 | 9.8 | 13.2 | 247 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 12/01/2021 | 25.3 | 47.9 | 14.1 | 15.4 | 259 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 21/01/2021 | 18.8 | 49.6 | 11.6 | 14.4 | 230 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 22/01/2021 | 22.1 | 48.9 | 13.0 | 15.2 | 238 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 25/01/2021 | 24.8 | 44.6 | 12.2 | 14.5 | 244 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 27/01/2021 | 22.0 | 46.5 | 12.9 | 14.2 | 251 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 04/02/2021 | 22.8 | 49.9 | 11.8 | 14.3 | 257 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 05/02/2021 | 19.3 | 46.8 | 12.3 | 13.7 | 249 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 08/02/2021 | 24.3 | 45.2 | 11.4 | 14.8 | 219 | 3.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 09/02/2021 | 23.5 | 50.3 | 9.5 | 12.5 | 241 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 18/02/2021 | 20.9 | 51.8 | 13.2 | 14.2 | 238 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 19/02/2021 | 21.7 | 48.2 | 12.1 | 14.3 | 264 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 22/02/2021 | 20.5 | 40.1 | 13.8 | 12.6 | 224 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 23/02/2021 | 23.8 | 47.5 | 11.4 | 13.7 | 243 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 04/03/2021 | 24.4 | 46.7 | 12.6 | 14.9 | 248 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 05/03/2021 | 20.9 | 50.1 | 13.0 | 15.3 | 240 | 7.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 08/03/2021 | 23.5 | 45.8 | 12.1 | 15.7 | 210 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 09/03/2021 | 26.7 | 50.9 | 11.4 | 14.1 | 268 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 18/03/2021 | 25.2 | 52.7 | 13.9 | 15.3 | 229 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 19/03/2021 | 23.3 | 42.8 | 11.8 | 13.4 | 255 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 22/03/2021 | 22.1 | 43.5 | 14.5 | 15.6 | 215 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 23/03/2021 | 25.4 | 51.3 | 12.5 | 14.3 | 234 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **18.8** | **40.1** | **9.5** | **12.1** | **192** | **3.5** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **26.7** | **52.7** | **14.5** | **15.7** | **268** | **7.0** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **22.5** | **46.8** | **11.7** | **13.9** | **230** | **5.1** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **25.4** | **51.8** | **14.1** | **15.6** | **264** | **6.7** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ-4 Cheepurupalle village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 01/10/2020 | 24.2 | 53.4 | 12.1 | 14.2 | 225 | 7.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 03/10/2020 | 23.5 | 50.7 | 11.6 | 13.7 | 272 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 05/10/2020 | 26.3 | 52.4 | 12.1 | 15.1 | 243 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 06/10/2020 | 22.4 | 54.8 | 10.1 | 13.3 | 232 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 15/10/2020 | 24.0 | 55.9 | 11.0 | 12.3 | 212 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 16/10/2020 | 23.0 | 50.7 | 12.1 | 14.3 | 268 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 19/10/2020 | 22.3 | 51.8 | 11.7 | 14.2 | 205 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 20/10/2020 | 25.1 | 52.9 | 10.3 | 13.8 | 220 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 29/10/2020 | 23.1 | 57.2 | 12.1 | 14.1 | 237 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 30/10/2020 | 26.1 | 51.3 | 11.8 | 13.6 | 219 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 02/11/2020 | 25.2 | 51.8 | 10.5 | 12.8 | 213 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 03/11/2020 | 22.3 | 48.7 | 12.4 | 15.1 | 260 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 12/11/2020 | 25.1 | 50.8 | 11.5 | 13.8 | 231 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 13/11/2020 | 21.2 | 53.2 | 10.9 | 14.7 | 220 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 16/11/2020 | 22.8 | 54.3 | 11.8 | 13.7 | 200 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 17/11/2020 | 24.2 | 49.1 | 12.9 | 14.8 | 256 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 25/11/2020 | 26.1 | 56.3 | 13.1 | 15.6 | 193 | 5.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 26/11/2020 | 23.9 | 51.3 | 11.1 | 15.2 | 208 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 30/11/2020 | 24.3 | 55.6 | 13.0 | 15.5 | 225 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 01/12/2020 | 23.9 | 54.3 | 11.2 | 13.4 | 235 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 10/12/2020 | 21.0 | 46.6 | 13.1 | 15.7 | 226 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 11/12/2020 | 23.8 | 52.6 | 12.2 | 14.4 | 245 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 14/12/2020 | 25.6 | 51.6 | 11.6 | 15.3 | 235 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 15/12/2020 | 21.5 | 52.7 | 12.5 | 14.3 | 242 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 24/12/2020 | 26.1 | 47.5 | 13.6 | 16.1 | 226 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 25/12/2020 | 24.8 | 54.7 | 12.3 | 14.1 | 235 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 28/12/2020 | 22.6 | 49.7 | 11.8 | 15.8 | 250 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 29/12/2020 | 23.0 | 54.0 | 12.9 | 13.5 | 241 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 07/01/2021 | 22.8 | 52.4 | 10.4 | 12.5 | 259 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 08/01/2021 | 19.9 | 44.7 | 12.3 | 14.8 | 250 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 11/01/2021 | 22.7 | 50.3 | 11.4 | 15.7 | 269 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 12/01/2021 | 24.5 | 49.7 | 10.8 | 14.4 | 238 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 21/01/2021 | 20.4 | 50.8 | 11.7 | 13.4 | 266 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 22/01/2021 | 25.3 | 45.6 | 12.8 | 15.2 | 250 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 25/01/2021 | 23.7 | 52.8 | 11.5 | 13.2 | 259 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 27/01/2021 | 21.5 | 47.5 | 11.0 | 14.1 | 248 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 04/02/2021 | 23.5 | 53.4 | 11.2 | 13.2 | 241 | 7.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 05/02/2021 | 20.4 | 43.2 | 10.6 | 12.8 | 225 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 08/02/2021 | 23.3 | 53.6 | 11.6 | 14.6 | 253 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 09/02/2021 | 26.4 | 50.3 | 12.5 | 13.7 | 220 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 18/02/2021 | 23.1 | 52.3 | 13.1 | 14.4 | 248 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 19/02/2021 | 24.1 | 47.1 | 10.3 | 12.9 | 232 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 22/02/2021 | 22.5 | 51.3 | 12.2 | 14.4 | 215 | 6.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 23/02/2021 | 20.3 | 52.5 | 10.1 | 13.0 | 194 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 04/03/2021 | 19.4 | 53.5 | 11.2 | 13.2 | 232 | 6.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 05/03/2021 | 18.6 | 45.3 | 9.7 | 12.4 | 240 | 8.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 08/03/2021 | 21.1 | 55.7 | 10.7 | 14.0 | 262 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 09/03/2021 | 24.3 | 50.3 | 11.6 | 13.0 | 192 | 8.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 18/03/2021 | 17.2 | 51.4 | 12.2 | 14.3 | 212 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 19/03/2021 | 21.9 | 45.0 | 10.6 | 12.6 | 247 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 22/03/2021 | 20.3 | 53.4 | 11.3 | 13.2 | 256 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 23/03/2021 | 23.6 | 54.6 | 9.2 | 14.3 | 209 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **17.2** | **43.2** | **9.2** | **12.3** | **192** | **3.8** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **26.4** | **57.2** | **13.6** | **16.1** | **272** | **8.6** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **23.0** | **51.4** | **11.6** | **14.1** | **234** | **5.6** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **26.3** | **56.3** | **13.1** | **15.8** | **269** | **8.0** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ-5 Dasaripeta village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **C6H6** |
| 1 | 08/10/2020 | 22.7 | 51.8 | 10.1 | 12.4 | 234 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 09/10/2020 | 25.1 | 53.4 | 11.6 | 13.6 | 221 | 6.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 12/10/2020 | 20.2 | 49.3 | 10.2 | 12.5 | 255 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 13/10/2020 | 23.0 | 50.2 | 9.3 | 11.8 | 234 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 22/10/2020 | 22.3 | 52.4 | 10.5 | 12.3 | 217 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 23/10/2020 | 24.6 | 48.8 | 11.1 | 13.7 | 243 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 26/10/2020 | 22.9 | 47.2 | 9.6 | 12.3 | 237 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 27/10/2020 | 21.4 | 51.4 | 10.7 | 14.2 | 218 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 05/11/2020 | 20.5 | 50.2 | 10.9 | 13.8 | 222 | 4.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 06/11/2020 | 23.9 | 47.3 | 12.4 | 15.0 | 209 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 09/11/2020 | 22.6 | 47.7 | 11.0 | 13.9 | 243 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 10/11/2020 | 25.3 | 48.6 | 10.1 | 12.7 | 222 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 19/11/2020 | 24.5 | 52.4 | 11.3 | 13.7 | 205 | 4.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 20/11/2020 | 23.4 | 46.9 | 11.9 | 14.3 | 231 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 23/11/2020 | 21.7 | 50.3 | 10.4 | 12.8 | 225 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 24/11/2020 | 20.7 | 49.8 | 11.5 | 13.7 | 206 | 4.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 03/12/2020 | 22.3 | 47.5 | 11.6 | 13.4 | 216 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 04/12/2020 | 21.6 | 49.7 | 10.5 | 14.2 | 224 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 07/12/2020 | 24.4 | 50.1 | 12.4 | 14.7 | 215 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 08/12/2020 | 21.5 | 48.6 | 11.5 | 13.9 | 196 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 17/12/2020 | 22.6 | 47.5 | 12.7 | 14.6 | 224 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 18/12/2020 | 21.6 | 48.3 | 10.5 | 12.5 | 231 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 21/12/2020 | 23.5 | 46.7 | 11.8 | 13.6 | 215 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 22/12/2020 | 22.5 | 49.5 | 10.5 | 12.8 | 225 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 30/12/2020 | 20.9 | 47.8 | 12.5 | 14.1 | 222 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 31/12/2020 | 21.5 | 45.6 | 11.9 | 13.8 | 236 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 04/01/2021 | 23.6 | 49.6 | 12.3 | 14.5 | 239 | 7.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 05/01/2021 | 22.1 | 51.8 | 10.7 | 12.3 | 247 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 15/01/2021 | 25.7 | 52.2 | 13.1 | 15.8 | 254 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 16/01/2021 | 22.8 | 46.8 | 11.8 | 15.1 | 188 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 18/01/2021 | 23.9 | 49.6 | 13.4 | 11.6 | 241 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 19/01/2021 | 21.8 | 50.4 | 9.8 | 13.6 | 254 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 28/01/2021 | 24.8 | 43.7 | 12.5 | 14.7 | 234 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 29/01/2021 | 23.8 | 51.6 | 11.2 | 13.9 | 229 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 01/02/2021 | 25.9 | 51.2 | 12.7 | 15.2 | 267 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 02/02/2021 | 24.4 | 53.4 | 11.8 | 13.8 | 252 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 11/02/2021 | 26.3 | 50.8 | 12.5 | 14.3 | 248 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 12/02/2021 | 25.1 | 48.4 | 13.9 | 15.0 | 216 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 15/02/2021 | 19.8 | 42.6 | 12.7 | 13.4 | 265 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 16/02/2021 | 24.1 | 52.0 | 10.2 | 12,6 | 236 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 25/02/2021 | 23.6 | 45.3 | 13.6 | 15.0 | 168 | 3.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 26/02/2021 | 21.5 | 47.5 | 12.3 | 14.2 | 257 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 01/03/2021 | 24.1 | 53.1 | 10.9 | 13.4 | 266 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 02/03/2021 | 22.7 | 50.8 | 12.8 | 15.6 | 274 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 12/03/2021 | 20.8 | 52.3 | 12.3 | 14.6 | 183 | 7.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 13/03/2021 | 25.6 | 48.6 | 10.9 | 13.6 | 273 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 15/03/2021 | 23.6 | 52.7 | 12.3 | 15.3 | 266 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 16/03/2021 | 25.5 | 54.2 | 11.3 | 13.2 | 215 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 25/03/2021 | 21.9 | 44.5 | 13.2 | 15.0 | 268 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 26/03/2021 | 20.4 | 53.9 | 11.2 | 14.1 | 235 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 29/03/2021 | 24.7 | 47.2 | 10.7 | 13.6 | 167 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 30/03/2021 | 23.6 | 49.4 | 13.9 | 14.5 | 256 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **19.8** | **42.6** | **9.3** | **11.6** | **167** | **3.8** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **26.3** | **54.2** | **13.9** | **15.8** | **274** | **7.6** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **23.1** | **49.5** | **11.6** | **13.8** | **231** | **5.5** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **25.9** | **53.9** | **13.9** | **15.6** | **273** | **7.3** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in μg/m³ except Pb,As,Ni and Bap are ng/m³**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ-6 Islampeta village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 08/10/2020 | 21.9 | 51.5 | 11.2 | 13.3 | 223 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 09/10/2020 | 20.5 | 47.4 | 10.6 | 14.9 | 237 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 12/10/2020 | 24.3 | 49.3 | 11.7 | 13.2 | 213 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 13/10/2020 | 21.6 | 52.9 | 10.7 | 12.7 | 222 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 22/10/2020 | 22.1 | 54.8 | 12.8 | 14.2 | 242 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 23/10/2020 | 21.0 | 46.4 | 11.4 | 12.2 | 209 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 26/10/2020 | 23.6 | 51.9 | 10.9 | 13.9 | 226 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 27/10/2020 | 22.7 | 55.4 | 11.0 | 14.1 | 215 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 05/11/2020 | 24.3 | 49.9 | 12.0 | 14.7 | 211 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 06/11/2020 | 22.1 | 52.3 | 11.4 | 13.4 | 225 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 09/11/2020 | 23.1 | 47.7 | 12.5 | 14.6 | 201 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 10/11/2020 | 25.3 | 56.7 | 11.5 | 14.1 | 210 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 19/11/2020 | 20.9 | 53.2 | 13.6 | 15.6 | 230 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 20/11/2020 | 24.8 | 50.4 | 12.2 | 14.5 | 197 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 23/11/2020 | 22.4 | 50.3 | 11.7 | 13.4 | 214 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 24/11/2020 | 23.4 | 53.8 | 11.8 | 12.6 | 203 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 03/12/2020 | 19.6 | 48.6 | 10.5 | 13.9 | 218 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 04/12/2020 | 21.0 | 51.0 | 12.0 | 14.3 | 196 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 07/12/2020 | 22.0 | 46.4 | 10.6 | 13.8 | 204 | 4.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 08/12/2020 | 24.2 | 54.5 | 12.1 | 13.3 | 199 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 17/12/2020 | 19.8 | 51.9 | 11.4 | 14.2 | 215 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 18/12/2020 | 23.7 | 49.1 | 12.8 | 13.7 | 209 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 21/12/2020 | 21.3 | 48.7 | 12.3 | 14.5 | 219 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 22/12/2020 | 22.3 | 52.5 | 10.5 | 12.7 | 206 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 30/12/2020 | 19.8 | 47.8 | 11.5 | 13.4 | 222 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 31/12/2020 | 21.4 | 45.8 | 12.8 | 14.5 | 216 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 04/01/2021 | 18.8 | 46.9 | 9.6 | 14.6 | 224 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 05/01/2021 | 20.2 | 49.3 | 11.1 | 15.0 | 215 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 15/01/2021 | 21.2 | 44.7 | 9.7 | 14.5 | 237 | 3.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 16/01/2021 | 23.7 | 52.8 | 11.2 | 12.2 | 187 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 18/01/2021 | 19.0 | 50.2 | 10.5 | 14.9 | 234 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 19/01/2021 | 22.9 | 47.4 | 11.9 | 14.4 | 228 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 28/01/2021 | 20.5 | 48.6 | 11.4 | 11.6 | 206 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 29/01/2021 | 21.5 | 50.8 | 10.8 | 13.4 | 225 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 01/02/2021 | 22.1 | 48.2 | 10.2 | 13.4 | 234 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 02/02/2021 | 18.9 | 46.5 | 9.5 | 12.2 | 226 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 11/02/2021 | 19.9 | 43.2 | 10.3 | 12.5 | 240 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 12/02/2021 | 22.4 | 53.5 | 11.3 | 13.3 | 208 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 15/02/2021 | 24.3 | 48.7 | 12.1 | 14.2 | 241 | 3.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 16/02/2021 | 21.6 | 45.9 | 10.8 | 12.5 | 226 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 25/02/2021 | 19.2 | 47.1 | 11.2 | 13.1 | 227 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 26/02/2021 | 20.2 | 49.3 | 9.4 | 14.5 | 246 | 6.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 01/03/2021 | 20.2 | 47.4 | 9.9 | 12.5 | 233 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 02/03/2021 | 21.6 | 45.7 | 11.2 | 13.8 | 224 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 12/03/2021 | 22.6 | 51.2 | 10.4 | 14.3 | 246 | 4.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 13/03/2021 | 18.4 | 44.6 | 9.5 | 13.6 | 175 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 15/03/2021 | 23.5 | 48.3 | 12.2 | 14.6 | 203 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 16/03/2021 | 20.4 | 49.8 | 11.5 | 12.9 | 192 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 25/03/2021 | 20.4 | 46.6 | 10.6 | 12.4 | 243 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 26/03/2021 | 19.3 | 44.7 | 12.7 | 14.5 | 237 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 29/03/2021 | 21.9 | 45.0 | 11.5 | 12.0 | 215 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 30/03/2021 | 22.9 | 47.2 | 11.1 | 14.1 | 185 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **18.4** | **43.2** | **9.4** | **11.6** | **175** | **3.4** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **25.3** | **56.7** | **13.6** | **15.6** | **246** | **6.9** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **21.7** | **49.3** | **11.3** | **13.7** | **218** | **5.2** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **24.8** | **55.4** | **12.8** | **15.0** | **246** | **6.7** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ-7 Pittavanipalem village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **$C_6H_6$** |
| 1 | 01/10/2020 | 24.5 | 56.9 | 10.2 | 13.8 | 253 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 03/10/2020 | 27.2 | 58.7 | 12.4 | 14.2 | 234 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 05/10/2020 | 22.6 | 66.2 | 10.7 | 12.9 | 222 | 5.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 06/10/2020 | 24.9 | 57.2 | 11.2 | 14.8 | 268 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 15/10/2020 | 25.5 | 59.0 | 10.8 | 12.8 | 236 | 7.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 16/10/2020 | 26.2 | 55.7 | 10.3 | 14.6 | 274 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 19/10/2020 | 24.8 | 63.1 | 11.3 | 13.5 | 218 | 7.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 20/10/2020 | 23.1 | 51.8 | 10.4 | 12.4 | 250 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 29/10/2020 | 26.6 | 56.4 | 12.9 | 14.2 | 226 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 30/10/2020 | 24.2 | 52.5 | 11.6 | 13.8 | 232 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 02/11/2020 | 22.5 | 55.3 | 11.0 | 14.3 | 241 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 03/11/2020 | 25.1 | 53.5 | 10.6 | 12.8 | 222 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 12/11/2020 | 21.4 | 64.6 | 11.5 | 14.3 | 210 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 13/11/2020 | 23.7 | 55.6 | 13.2 | 15.6 | 256 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 16/11/2020 | 24.3 | 57.4 | 11.6 | 14.2 | 224 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 17/11/2020 | 25.0 | 52.4 | 13.0 | 15.6 | 262 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 25/11/2020 | 23.6 | 61.5 | 12.1 | 14.9 | 206 | 6.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 26/11/2020 | 26.7 | 49.7 | 11.2 | 13.8 | 238 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 30/11/2020 | 24.4 | 53.6 | 13.7 | 15.6 | 214 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 01/12/2020 | 21.6 | 54.6 | 11.0 | 14.7 | 225 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 10/12/2020 | 25.9 | 52.8 | 10.6 | 13.2 | 239 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 11/12/2020 | 22.2 | 60.5 | 11.5 | 12.6 | 227 | 6.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 14/12/2020 | 24.5 | 54.9 | 13.2 | 14.5 | 234 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 15/12/2020 | 25.1 | 61.5 | 11.6 | 14.6 | 241 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 24/12/2020 | 25.8 | 50.6 | 13.0 | 15.2 | 215 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 25/12/2020 | 24.4 | 60.8 | 12.1 | 14.6 | 223 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 28/12/2020 | 23.5 | 47,5 | 11.2 | 13.7 | 242 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 29/12/2020 | 25.2 | 51.6 | 11.9 | 12.5 | 231 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 07/01/2021 | 23.0 | 52.8 | 11.8 | 15.6 | 244 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 08/01/2021 | 26.2 | 51.0 | 11.4 | 14.1 | 258 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 11/01/2021 | 20.7 | 58.7 | 12.3 | 13.5 | 246 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 12/01/2021 | 25.9 | 53.1 | 14.0 | 15.4 | 261 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 21/01/2021 | 26.5 | 43.6 | 12.4 | 16.2 | 208 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 22/01/2021 | 24.7 | 48.8 | 10.8 | 12.8 | 234 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 25/01/2021 | 25.8 | 54.5 | 12.9 | 15.5 | 242 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 27/01/2021 | 24.9 | 45.7 | 12.0 | 14.6 | 254 | 4.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 04/02/2021 | 24.3 | 53.4 | 12.6 | 14.8 | 265 | 4.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 05/02/2021 | 19.8 | 49.7 | 12.2 | 13.5 | 244 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 08/02/2021 | 22.6 | 55.6 | 13.1 | 15.4 | 233 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 09/02/2021 | 26.5 | 51.8 | 10.6 | 13.4 | 252 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 18/02/2021 | 20.4 | 60.4 | 10.2 | 12.6 | 229 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 19/02/2021 | 26.8 | 47.5 | 11.6 | 14.7 | 255 | 3.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 22/02/2021 | 21.8 | 53.2 | 13.7 | 12.8 | 204 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 23/02/2021 | 24.1 | 57.3 | 12.8 | 13.9 | 243 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 04/03/2021 | 25.8 | 53.4 | 10.7 | 13.2 | 271 | 6.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 05/03/2021 | 23.3 | 51.6 | 12.4 | 15.3 | 267 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 08/03/2021 | 24.1 | 59.3 | 11.4 | 13.5 | 268 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 09/03/2021 | 28.1 | 53.7 | 12.9 | 14.5 | 244 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 18/03/2021 | 21.9 | 44.2 | 11.3 | 13.7 | 264 | 7.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 19/03/2021 | 28.1 | 49.4 | 13.2 | 15.0 | 276 | 4.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 22/03/2021 | 23.3 | 55.1 | 11.8 | 13.6 | 219 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 23/03/2021 | 25.6 | 46.3 | 10.9 | 14.3 | 265 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **19.8** | **43.6** | **10.2** | **12.4** | **204** | **3.7** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **28.1** | **66.2** | **14.0** | **16.2** | **276** | **7.8** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **24.4** | **54.5** | **11.8** | **14.1** | **241** | **5.6** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **28.1** | **64.6** | **13.7** | **15.6** | **274** | **7.4** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# ANNEXURE-I
# AMBIENT AIR QUALITY LEVELS

| AAQ-8 Kalapaka village | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr.No** | **Monitoring Date** | **PM2.5** | **PM10** | **$SO_2$** | **$NO_2$** | **CO** | **$O_3$** | **$NH_3$** | **Pb** | **As** | **Ni** | **Bap** | **C6H6** |
| 1 | 08/10/2020 | 25.1 | 56.5 | 10.5 | 12.9 | 219 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 2 | 09/10/2020 | 23.0 | 54.2 | 11.2 | 13.5 | 248 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 3 | 12/10/2020 | 22.6 | 58.3 | 10.5 | 14.3 | 222 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 4 | 13/10/2020 | 24.8 | 52.6 | 12.5 | 13.4 | 232 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 5 | 22/10/2020 | 21.2 | 50.1 | 9.9 | 13.0 | 224 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 6 | 23/10/2020 | 23.0 | 57.5 | 12.1 | 14.1 | 228 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 7 | 26/10/2020 | 22.1 | 53.2 | 10.2 | 12.6 | 215 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 8 | 27/10/2020 | 22.6 | 51.9 | 10.7 | 12.2 | 212 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 9 | 05/11/2020 | 23.9 | 54.9 | 11.3 | 13.8 | 207 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 10 | 06/11/2020 | 24.1 | 50.4 | 10.8 | 12.5 | 236 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 11 | 09/11/2020 | 21.4 | 56.7 | 12.6 | 14.0 | 210 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 12 | 10/11/2020 | 23.6 | 51.0 | 11.0 | 12.9 | 220 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 13 | 19/11/2020 | 24.7 | 48.5 | 12.4 | 14.8 | 212 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 14 | 20/11/2020 | 24.5 | 55.9 | 10.7 | 12.7 | 216 | 4.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 15 | 23/11/2020 | 20.9 | 51.6 | 11.0 | 13.8 | 203 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 16 | 24/11/2020 | 21.4 | 53.2 | 12.3 | 14.4 | 200 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 17 | 03/12/2020 | 25.1 | 53.4 | 12.1 | 14.7 | 225 | 5.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 18 | 04/12/2020 | 25.3 | 48.5 | 11.6 | 13.4 | 195 | 6.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 19 | 07/12/2020 | 20.8 | 51.3 | 13.0 | 15.0 | 228 | 5.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 20 | 08/12/2020 | 24.8 | 53.7 | 11.8 | 13.8 | 238 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 21 | 17/12/2020 | 24.4 | 49.9 | 10.5 | 12.7 | 216 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 22 | 18/12/2020 | 25.2 | 47.4 | 11.5 | 13.5 | 234 | 5.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 23 | 21/12/2020 | 23.4 | 53.0 | 12.4 | 14.7 | 221 | 5.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 24 | 22/12/2020 | 22.6 | 51.7 | 13.1 | 15.0 | 218 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 25 | 30/12/2020 | 19.8 | 48.7 | 11.1 | 12.8 | 236 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 26 | 31/12/2020 | 22.7 | 51.2 | 12.6 | 13.5 | 221 | 5.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 27 | 04/01/2021 | 18.4 | 51.2 | 13.2 | 15.5 | 246 | 6.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 28 | 05/01/2021 | 23.5 | 46.3 | 12.7 | 14.2 | 216 | 7.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 29 | 15/01/2021 | 19.0 | 49.1 | 14.1 | 15.8 | 249 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 30 | 16/01/2021 | 24.7 | 51.5 | 12.9 | 14.6 | 259 | 7.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 31 | 18/01/2021 | 22.6 | 47.7 | 11.6 | 13.5 | 237 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 32 | 19/01/2021 | 22.1 | 45.2 | 10.9 | 14.3 | 208 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 33 | 28/01/2021 | 21.6 | 50.8 | 13.5 | 12.7 | 242 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 34 | 29/01/2021 | 20.8 | 49.5 | 14.2 | 13.8 | 239 | 4.8 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 35 | 01/02/2021 | 25.1 | 49.1 | 12.1 | 14.2 | 251 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 36 | 02/02/2021 | 22.1 | 50.4 | 11.6 | 12.9 | 235 | 5.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 37 | 11/02/2021 | 24.1 | 47.0 | 13.0 | 14.5 | 245 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 38 | 12/02/2021 | 23.8 | 49.4 | 11.8 | 13.3 | 234 | 5.6 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 39 | 15/02/2021 | 21.2 | 45.6 | 10.5 | 12.2 | 251 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 40 | 16/02/2021 | 23.7 | 52.4 | 9.8 | 13.0 | 227 | 6.1 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 41 | 25/02/2021 | 20.2 | 48.7 | 12.4 | 14.1 | 253 | 4.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 42 | 26/02/2021 | 19.4 | 47.4 | 11.5 | 13.3 | 243 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 43 | 01/03/2021 | 21.4 | 47.4 | 10.8 | 14.8 | 225 | 6.3 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 44 | 02/03/2021 | 19.4 | 51.4 | 9.4 | 13.5 | 243 | 4.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 45 | 12/03/2021 | 20.7 | 45.3 | 11.7 | 13.3 | 228 | 6.0 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 46 | 13/03/2021 | 22.7 | 47.7 | 10.5 | 13.9 | 259 | 6.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 47 | 15/03/2021 | 19.8 | 52.3 | 11.2 | 14.2 | 233 | 4.4 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 48 | 16/03/2021 | 20.1 | 48.5 | 10.9 | 12.8 | 216 | 5.7 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 49 | 25/03/2021 | 24.3 | 47.5 | 12.1 | 14.9 | 227 | 4.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 50 | 26/03/2021 | 20.6 | 50.3 | 10.5 | 13.6 | 254 | 4.9 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 51 | 29/03/2021 | 19.1 | 47.0 | 11.1 | 14.3 | 221 | 5.2 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| 52 | 30/03/2021 | 23.5 | 45.7 | 11.8 | 13.1 | 218 | 4.5 | <20 | <1.0 | <1.0 | <1.0 | <0.01 | <0.01 |
| **Minimum value** | | **18.4** | **45.2** | **9.4** | **12.2** | **195** | **4.2** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Maximum value** | | **25.3** | **58.3** | **14.2** | **15.8** | **259** | **7.4** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **Average value** | | **22.4** | **50.6** | **11.6** | **13.7** | **229** | **5.4** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |
| **98th Percentile** | | **25.2** | **57.5** | **14.1** | **15.5** | **259** | **7.2** | **<20** | **<1.0** | **<1.0** | **<1.0** | **<0.01** | **<0.01** |

**All the above values are expressed in $\mu g/m^3$ except Pb,As,Ni and Bap are $ng/m^3$**

# *Annexure-II*

# *Water Balance Diagram*

# ANNEXURE-II
# WATER BALANCE DIAGRAM