ENVIRONMENTAL COMPLIANCE STATUS REPORT

FOR

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

APRIL - SEPTEMBER 2019

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

APRIL – SEPTEMBER 2019

For and on behalf of VIMTA Labs Limited

Approved by : **M. Janardhan**

Signed :

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

Date : **04th November, 2019**

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 April to September 2019 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 October, 2015 (Amendment), CFO No:APPCB/VSP/VSP/19/HO/CFO/2017 dated 10th May, 2017.

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.**

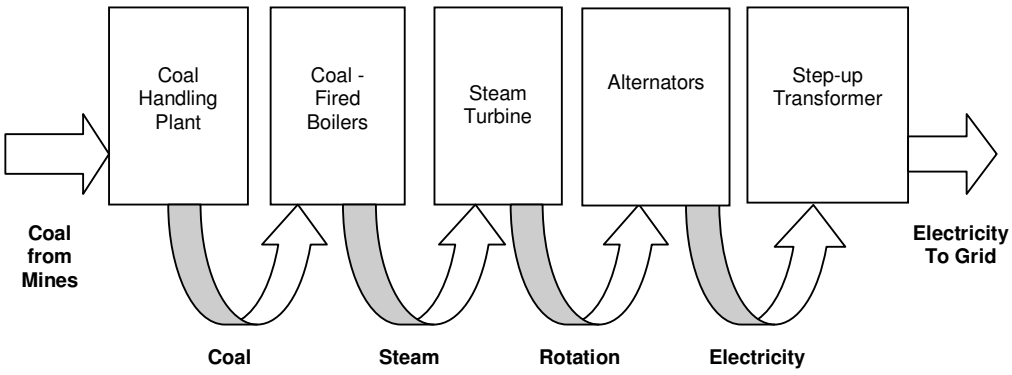
The long-term data recorded at India Meteorological Center at Visakhapatnam indicates temperature in the range of 15.8°C to 37.7°C. The mean total rainfall is

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 (April - September 2019). 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/2017,**dated:10thMay, 2017. A compliance Status Report is prepared for 6 months period from **April - September 2019** is given in **Chapter-2.**

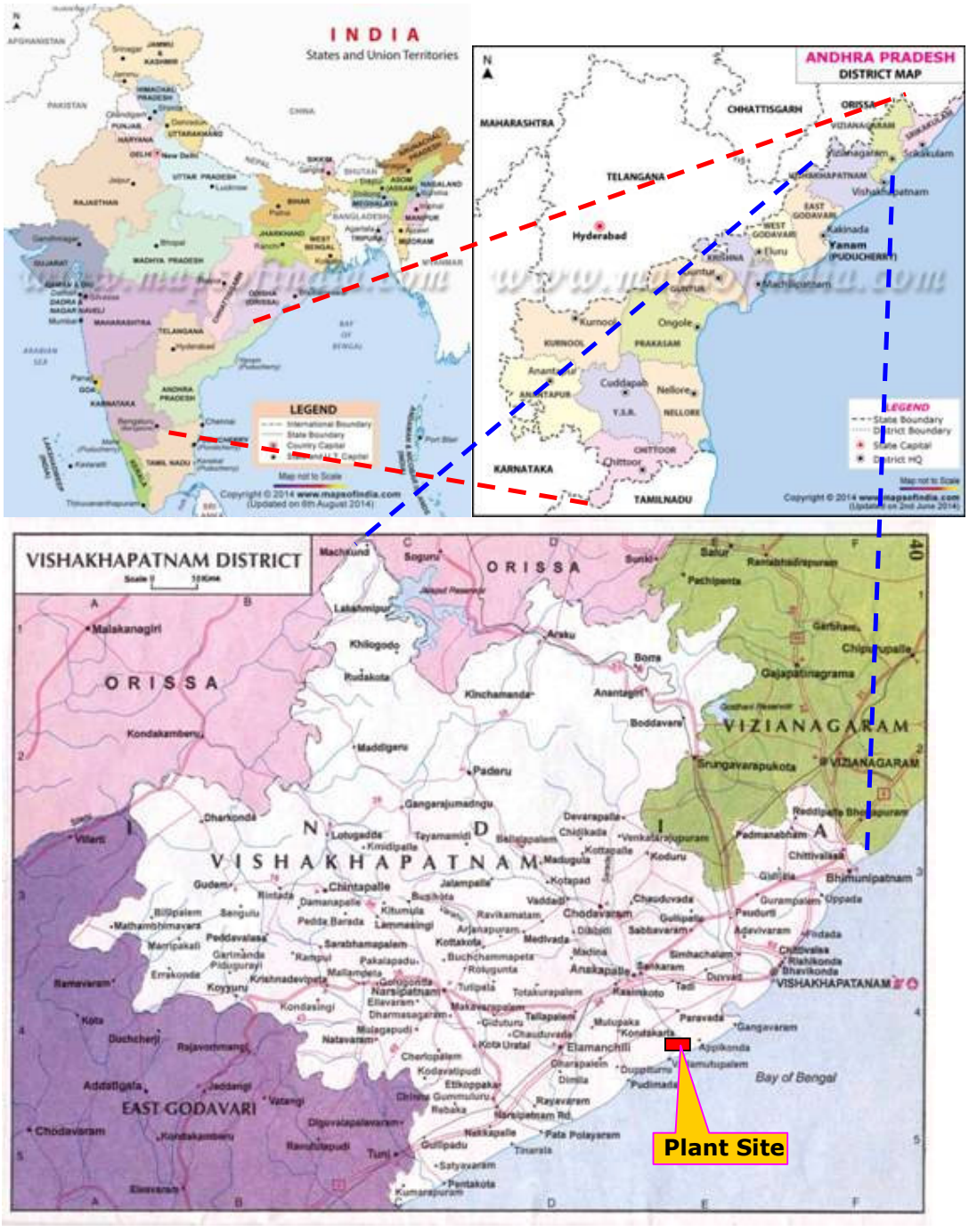


FIGURE-1.1
GEOGRAPHICAL LOCATION MAP

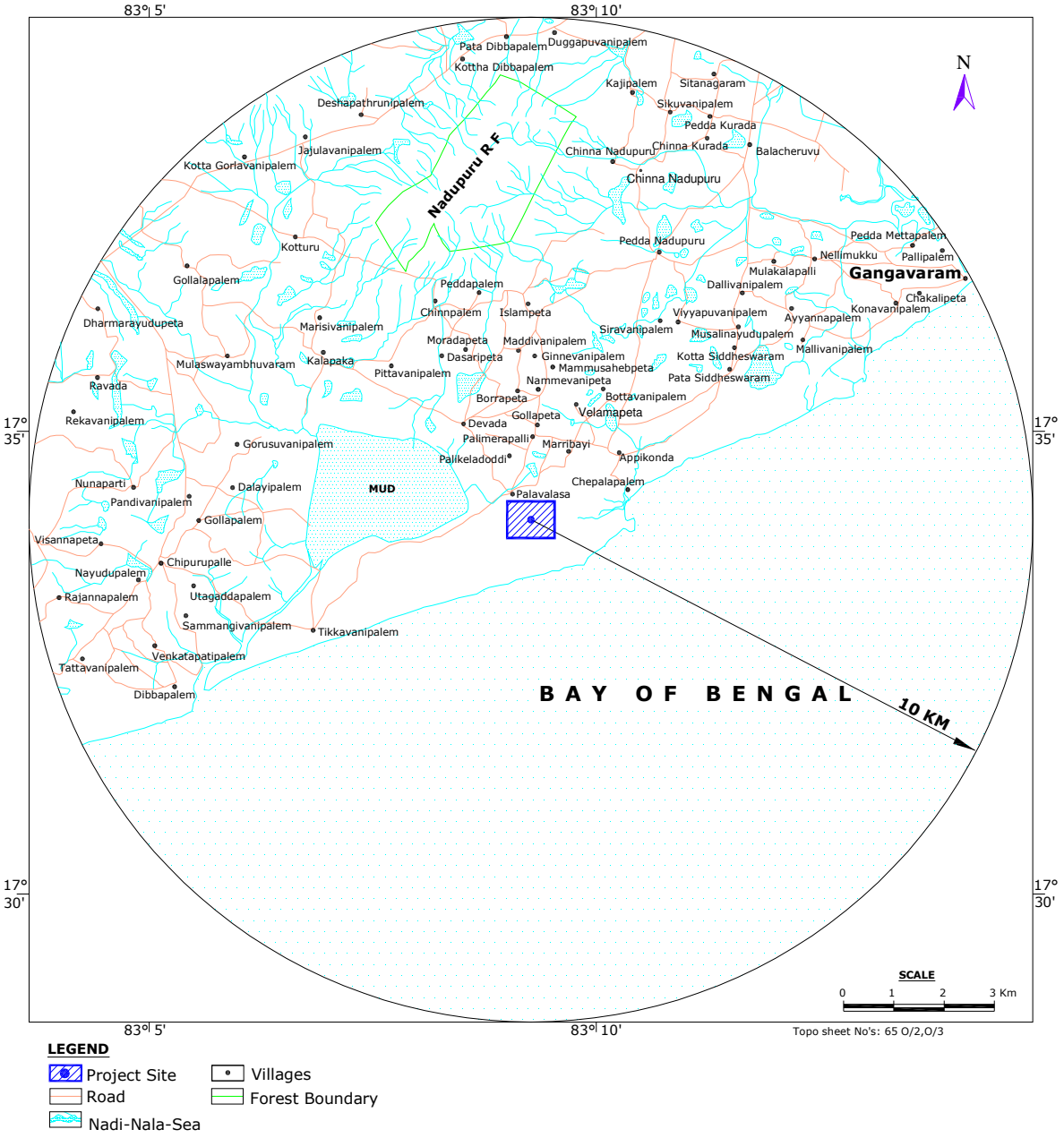


FIGURE-1.2
LOCATION MAP-10KM RADIUS

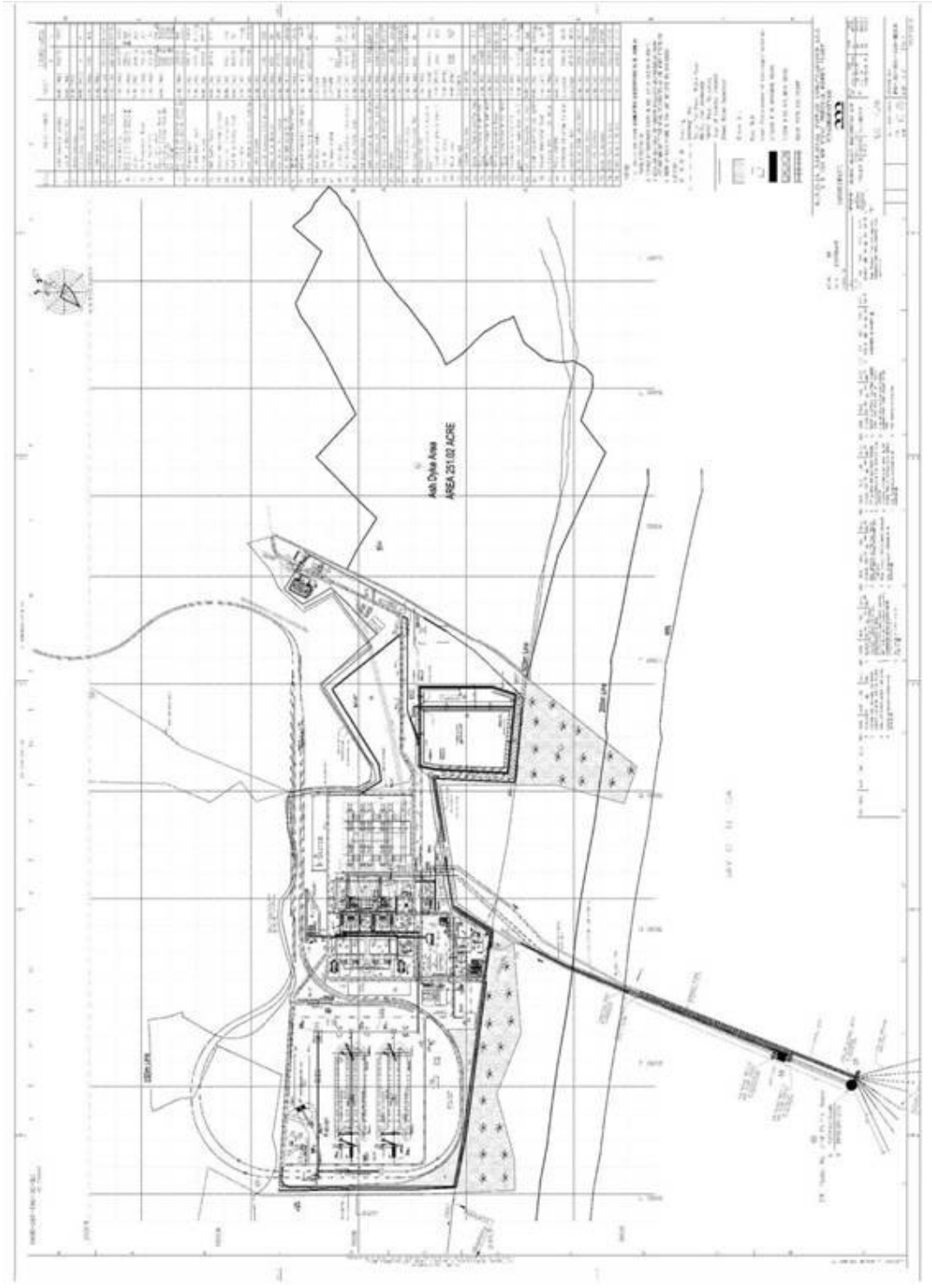


FIGURE-1.3

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

Chapter-2

Compliance Status Report

COMPLIANCE STATUS REPORT – APRIL TO SEPTEMBER 2019

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/2017- dated :10th May, 2017

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 115 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. 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. 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 *"Only beneficiated coal to the tune of 16080 metric tonnes/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."* 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".* • 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. • 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. • Pond ash and Fly ash will be utilized by the following Agencies: 1) Maha cement Ltd 2) Simhadri Constructions 3) Ramco Cements 4) Sagar cements 5) Sri chakra 6) Fly ash brick association members
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. 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	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
	ensured.	
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. 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 The concept of zero discharge has been adopted to the maximum possible extent by adopting the following: 1. Recirculation of ash water in ash handling system. 2. Recirculation of filter backwash water into the system. 3. DM Plant effluent is sent to the ash slurry sump and then recycled back. Plant clarifier sludge is put into ash slurry pump house for disposal in ash pond, which is recycled.
xiii)	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	Monitoring is being carried out at eight ambient air

Sr. No.	Condition (*Letter No: J–13011/11/90-IA-II(T) dated 3rd September, 1996)*	Status
	around the power plant may be carried out and records maintained. The data also collected should be properly analysed and submitted to the Ministry every six months.	quality monitoring stations within the 10 km radius study area from the existing power plant complex, with two in the predominantly downward wind direction. 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. The Committee has already met and suggested some improvements, which are being implemented.
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. http://www.hindujanationalpower.com/images/compliance-status April-September 2019-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 designing 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-

Sr. No	Condition (Letter No: 11/58/2011 IA.III dated 3rd January, 2014)	Compliance Status
		58/2011-IA-III dated:1st 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. 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.

Sr. No	Condition (Letter No: 11/58/2011 IA.III dated 3rd January, 2014)	Compliance Status
(ii)	Full supports shall be extended to the officer of this 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	Noted. Details are furnished

Sr. No.	Condition (Letter No: F.NO. 11-58/ 2011-IA-III dated 01th October 2015) (Amendment in CRZ Clearance-reg)	Compliance Status
	Andhra Pradesh Coastal zone Management Authority (APCZMA) vide letter No.245/Env/CZMA/2015 dated 05.06.2015 shall strictly be complied with	below
(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	Noted

Sr. No.	Condition (Letter No: 245/Env/CZMA/2015, dated 05th June 2015)	Compliance Status
	Environment and Forests, Government of India as per 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	Will be installed
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. Additional diffusers shall be installed to enhance the dispersion of the hot water
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	Noted and will be complied

Sr. No.	**Condition (Letter No: 245/Env/CZMA/2015, dated 05th June 2015)**	Compliance Status
	by adopting suitable engineering and vegetative 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 will be complied

Sr. No.	**Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) 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 industry shall file the water cess returns in Form-I as required under section (5) of Water (Prevention and Control of Pollution) Cess Act, 1977 on or before the 5th of every calendar month, showing the quantity of water consumed in the previous month along with water meter readings. The industry shall remit water cess as per the assessment orders as and when issued by Board	As per APPCB notification APPCB has directed not to file the water cess returns from 1st July 2017 on words. Lr.No.214/PCB/ROV/Tech/2018, Date:15/03/2018
7	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
8	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	Noted and will be complied

<table>
<tr><th>Sr. No.</th><th>Condition
(Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II</th><th>Compliance Status</th></tr>
<tr><td></td><td>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.</td><td></td></tr>
<tr><td>9</td><td>Any person aggrieved by an order made by the State Board under Section 25, Section 26, Section 27 of Water Act, 1974 or 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>Noted and being complied with</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>Temperature-not more than 7°C higher than intake water as per MoEF Communication dated 20.04.199.9.</td><td></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>5.5 — 9.0</td></tr>
<tr><td></td><td>Total Suspended Solids(at 103—105° C)</td><td>200 mg/I</td></tr>
<tr><td></td><td>Bio Chemical Oxygen Demand (BOD 3 at 27 °C)</td><td>100 mg/I</td></tr>
</table></td><td>Noted and the effluent is Within the prescribed limits</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>Condition
(Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II</th><th>Compliance Status</th></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>
<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>115 mg/Nm3</td></tr>
</table></td><td>Noted and the emissions are Within the standard limits</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 will be complied. 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
Noise Levels: Day time (6 AM to 10 PM) - 75 dB (A)
Night time (10 PM to 6 AM) - 70 dB (A).</td><td>Noted and being complied with

The Ambient air Quality and noise parameters with in the stipulated standards and reports are being submitted regularly</td></tr>
<tr><td></td><td>GENERAL:</td><td></td></tr>
<tr><td>1</td><td>The industry shall not increase the capacity beyond the permitted</td><td>Noted</td></tr>
</table>

Sr. No.	Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II	Compliance Status
	capacity mentioned in this order.	
2	As committed vide letter dated 12.04.2017, 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 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: 1) Maha cement Ltd 2) Simhadri Constructions 3) Ramco Cements 4) Sagar cements 5) Sri chakra 6) Fly ash brick association members
4	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
5	The industry shall maintain flow meters preferably Electro Magnetic flow meters with totalizes for water and effluent quantity measurements for different streams of effluents and different categories of water usage stipulated in this order	Noted and being complied with
6	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.
7	The industry shall maintain the following records and the same shall be made available to the Board Officials during the inspection. • Daily power generation details. • Quantity of Effluents generated and disposed. • Log Books for pollution control systems. • Daily Fly ash generated and disposed.	Noted and being complied with
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
9	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. Sprinklers have been provided on the roads besides deploying water tankers
10	Refurbished Environment Management Team with dedicated man power shall be maintained 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.
11	The industry shall maintain online Stack and ambient monitoring systems with connection to the Board's website	Online monitoring systems are available and Connection to board through online website.
12	Thick green belt shall be maintained by the industry covering an	Presently green belt is being

Sr. No.	Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II	Compliance Status
	area of 33% of total area.	developed in and around the power project area in consultation with DFO and an area of 249.14 acres has already been developed. Further development of Green belt continuous.
13	The industry shall recycle the ash pond and D.M. Plant effluent	Complied
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 run-off water from coal yard shall be treated to on land for irrigation-standards before final disposal.	Noted
16	The industry shall discharge the cooling water into sea through a suitable drain /submarine pipeline.	Noted
17	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.	Noted and being complied
18	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	Noted
19	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
20	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
21	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
22	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.
23	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.	Noted and being complied with
24	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.	Noted
25	The industry shall monitor all ground water peizo wells and submit report to RO Visakhapatnam every three months indicating trends.	Noted and being complied
26	The industry shall maintain interlocking facility between APC equipment (ESP) and fuel feeding system for all the units, so that	Noted.

Sr. No.	Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II	Compliance Status
	the feeding of the fuel will be stopped automatically, in case, the ESP fails/ tripping's are occurred.	
27	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
28	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
29	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
30	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
31	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
32	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
33	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
34	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	All the rules and regulations notified by Ministry of Environment and Forests, Government of India under the E(P) Act, 1986 in respect of management, handling, transportation and storage of the Hazardous wastes should be followed.	Noted
2	The industry shall not store hazardous waste for more than 90 days as per the Hazardous & Other wastes (Management and Transboundary Movement) Rules, 2016.	Noted and will be complied
3	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 will be complied
4	The industry shall maintain 6 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 will be complied
5	The industry shall maintain proper records for Hazardous Wastes stated in Authorization in FORM-3 i.e., quantity of	Noted and will be complied

Sr. No.	Condition (Consent Order No:APPCB/VSP/VSP/19/HO/CFO/2017, dated 10th May 2017) for Unit – I & Unit – II	Compliance Status
	Incinerable waste, land disposal waste, recyclable waste etc., and file annual returns in Form-4 as per Rule 6(5) of the Hazardous & other Wastes (Management & Transboundary Movement) Rules, 2016 and amendments thereof.	
6	The industry shall submit the condition wise compliance report of the conditions stipulated in Schedule A, B & C of this order on half yearly basis to Board Office, Hyderabad and concerned Regional Office.	Noted and being complied with
7	The unit should submit the condition wise compliance report of the conditions stipulated in Schedule B & Schedule C of this order on half yearly basis to Board Office, Hyderabad and concerned Regional Office.	Noted and being complied with

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 April - September 2019

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 SW (32.2%), WSW (20.5%), SSW (11.2%), W (5.3%) and S (3.6%) of the total time. The calm conditions prevailed for 13.0% of the total time. The winds prevailed for 14.2% 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 April* - September 2019**

  Maximum and minimum temperatures recorded during the study period were 42.5 and 23.5^{o}C respectively. Maximum and minimum relative humidity recorded during the study period was 98 and 23 % respectively. Rainfall was observed during the study period is about 422.1 mm which is given in **Table-3.1.**

TABLE-3.1
METEOROLOGICAL DATA GENERATED AT PROJECT SITE

Sr. No	Parameters	April - September 2019	
		Min	Max
1	Temperature (^{o}C)	23.5	42.5
2	Relative humidity (%)	23	98
63	Atmospheric Pressure (mb)	997.5	1010.5
4	Rainfall (mm)	422.1	

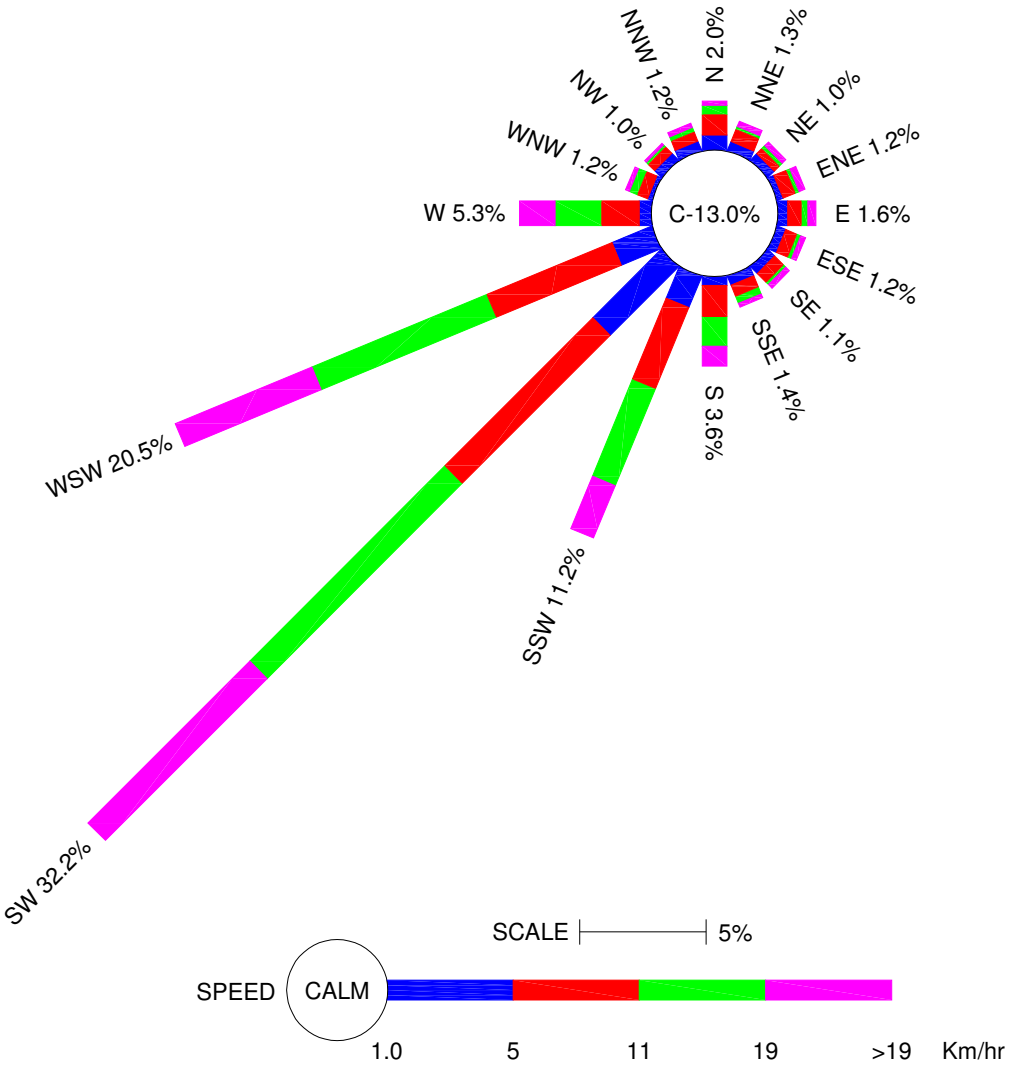


FIGURE-3.1
WINDROSE FOR APRIL TO SEPTEMBER 2019

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 **April - September 2019.**

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. (April - September 2019).

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).

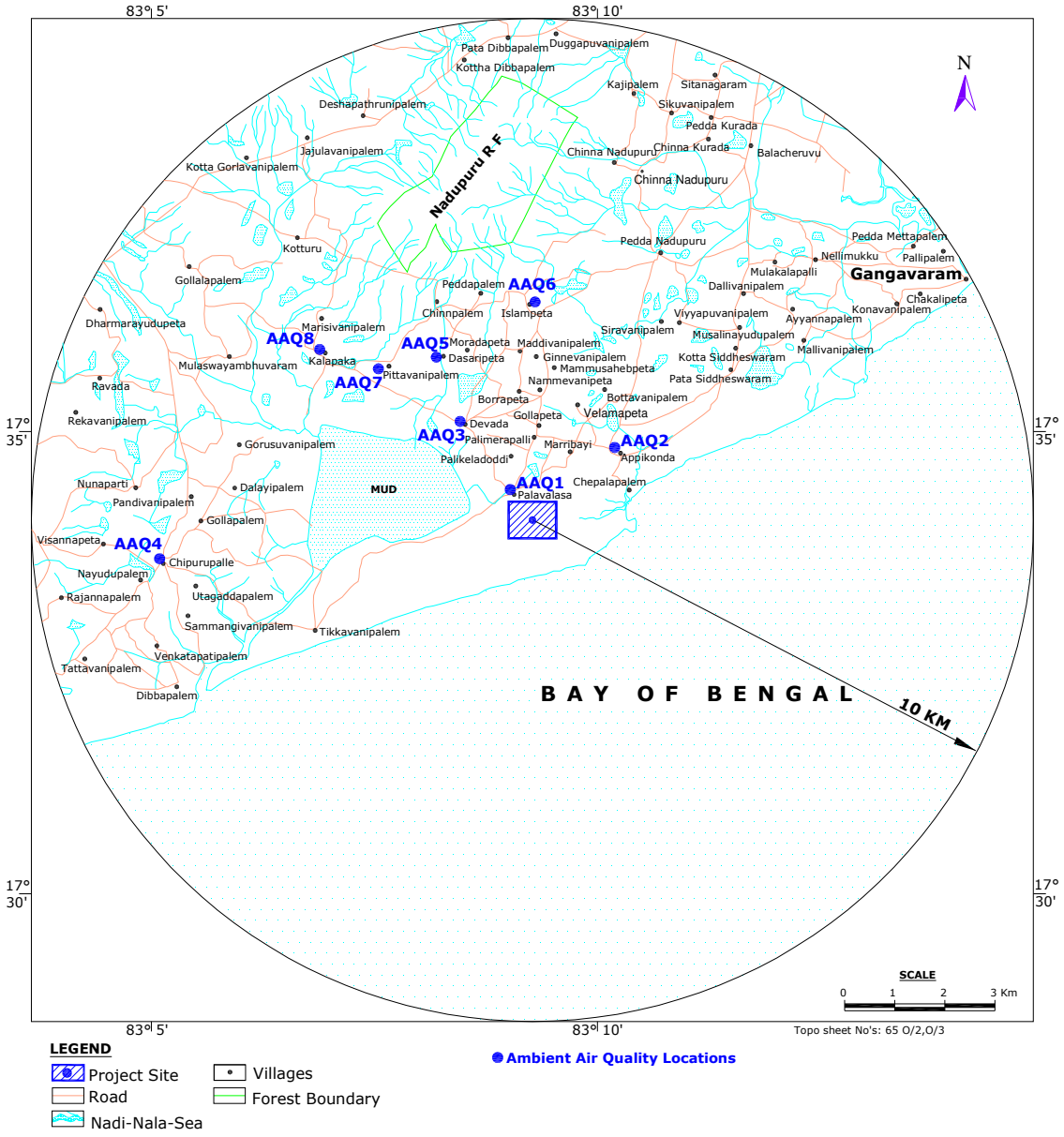


FIGURE-3.2
AIR QUALITY SAMPLING LOCATIONS

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 – April to September 2019

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 33.2 $\mu g/m^3$ with minimum concentration as 24.1 $\mu g/m^3$. The 98th percentile values are observed as 33.1 $\mu g/m^3$ respectively.

The maximum concentration for PM10 is recorded as 68.5 $\mu g/m^3$ with minimum concentration as 57.6 $\mu g/m^3$. The 98th percentile values are observed as 67.4 $\mu g/m^3$ respectively.

The maximum SO_2 concentration is recorded as 14.2 $\mu g/m^3$ with minimum concentration as 10.2 $\mu g/m^3$. The 98th percentile values are observed as 14.2 $\mu g/m^3$ respectively.

The maximum NO_2 concentration is recorded as 16.6 µg/m3 with minimum concentration as 13.1 $\mu g/m^3$. The 98th percentile values are observed as 16.5 $\mu g/m^3$ respectively.

The maximum CO concentration is recorded as 264 µg/m3 with minimum concentration as 215 $\mu g/m^3$. The 98th percentile values are observed as 257 $\mu g/m^3$ respectively.

The maximum O_3 concentration is recorded as 13.0 µg/m3 with minimum concentration as 8.2 µg/m^3. The 98th percentile values are observed as 12.6 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 35.2 µg/m^3 with minimum concentration at 22.3 µg/m^3. The 98th percentile values are observed as 33.5 µg/m^3 respectively.

The maximum concentration for PM10 is recorded as 65.8 µg/m^3 with minimum concentration as 48.6 µg/m^3. The 98th percentile values are observed as 64.2 µg/m^3 respectively.

The maximum SO_2 concentration is recorded as 13.9 µg/m^3 with minimum concentration as 10.2 µg/m^3. The 98th percentile values are observed as 13.6 µg/m^3 respectively.

The maximum NO_2 concentration is recorded as 16.3 µg/m^3 with minimum concentration as 12.7 µg/m^3. The 98th percentile values are observed as 16.1 µg/m^3 respectively.

The maximum CO concentration is recorded as 249 µg/m3 with minimum concentration as 197 µg/m^3. The 98th percentile values are observed as 243 µg/ m^3 respectively.

The maximum O_3 concentration is recorded as 12.2 µg/m3 with minimum concentration as 8.2 µg/m^3. The 98th percentile values are observed as 12.1 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 31.3 µg/m^3 with minimum concentration as 21.0 µg/m^3. The 98th percentile values are observed as 25.8 µg/m^3 respectively.

The maximum concentration for PM10 is recorded as 62.3 µg/m^3 with minimum concentration as 50.3 µg/m^3. The 98th percentile values are observed as 62.1 µg/m^3 respectively.

The maximum SO_2 concentration is recorded as 13.5 µg/m^3 with minimum concentration as 9.3 µg/m^3. The 98th percentile values are observed as 13.1 µg/m^3 respectively.

The maximum NO_2 concentration is recorded as 17.5 μg/m^3 with minimum concentration as 12.0 μg/m^3. The 98th percentile values are observed as 17.3 μg/m^3 respectively.

The maximum CO concentration is recorded as 265 μg/m3 with minimum concentration as 211 μg/m^3. The 98th percentile values are observed as 257 μg/ m^3 respectively.

The maximum O_3 concentration is recorded as 12.5 μg/m3 with minimum concentration as 8.0 μg/m^3. The 98th percentile values are observed as 12.2 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 34.5 μg/m^3 with minimum concentration as 24.3 μg/m^3. The 98th percentile values are observed as 33.0 μg/m^3 respectively.

The maximum concentration for PM10 is recorded as 72.7 μg/m^3 with minimum concentration as 54.2 μg/m^3. The 98th percentile values are observed as 71.3 μg/m^3 respectively.

The maximum SO_2 concentration is recorded as 16.4 μg/m^3 with minimum concentration as 10.7 μg/m^3. The 98th percentile values are observed as 15.3 μg/m^3 respectively.

The maximum NO_2 concentration is recorded as 19.9 μg/m^3 with minimum concentration as 13.8 μg/m^3. The 98th percentile values are observed as 18.7 μg/m^3 respectively.

The maximum CO concentration is recorded as 273 μg/m3 with minimum concentration as 212 μg/m^3. The 98th percentile values are observed as 271 μg/ m^3 respectively.

The maximum O_3 concentration is recorded as 13.2 μg/m3 with minimum concentration as 8.5 μg/m^3. The 98th percentile values are observed as 13.0 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 32.1 μg/m^3 with minimum concentration as 21.8 μg /m^3. The 98th percentile values are observed as 31.8 μg/m^3 respectively.

The maximum concentration for PM10 is recorded as 73.4 μg/m^3 with minimum concentration as 57.6 μg/m^3. The 98th percentile values are observed as 71.7 μg/m^3 respectively.

The maximum SO_2 concentration is recorded as 13.3 μg/m^3 with minimum concentration as 9.6 μg/m^3. The 98th percentile values are observed as 13.1 μg/m^3 respectively.

The maximum NO_2 concentration is recorded as 16.1 μg/m^3 with minimum concentration as 12.1 μg/m^3. The 98th percentile values are observed as 16.1 μg/m^3 respectively.

The maximum CO concentration is recorded as 262 μg/m3 with minimum concentration as 201 μg/m^3. The 98th percentile values are observed as 256 μg/ m^3 respectively.

The maximum O_3 concentration is recorded as 12.6 μg/m3 with minimum concentration as 8.1 μg/m^3. The 98th percentile values are observed as 12.5 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 32.6 μg/m^3 with minimum concentration as 22.4 μg/m^3. The 98th percentile values are observed as 32.0 μg/m^3 respectively.

The maximum concentration for PM10 is recorded as 64.2 μg/m^3 with minimum concentration as 52.3 μg/m^3. The 98th percentile values are observed as 63.2 μg/m^3 respectively.

The maximum SO_2 concentration is recorded as 13.8 μg/m^3 with minimum concentration as 9.2 μg/m^3. The 98th percentile values are observed as 13.1 μg/m^3 respectively.

The maximum NO_2 concentration is recorded as 16.0 μg/m^3 with minimum concentration as 12.0 μg/m^3. The 98th percentile values are observed as 15.5 μg/m^3 respectively.

The maximum CO concentration is recorded as 258 μg/m3 with minimum concentration as 200 μg/m^3. The 98th percentile values are observed as 253 μg/ m^3 respectively.

The maximum O_3 concentration is recorded as 13.3 μg/m3 with minimum concentration as 8.4 μg/m^3. The 98th percentile values are observed as 12.6 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 36.5 $\mu g/m^3$ with minimum concentration as 24.6 $\mu g/m^3$. The 98th percentile values are observed as 35.6 $\mu g/m^3$ respectively.

The maximum concentration for PM10 is recorded as 75.6 $\mu g/m^3$ with minimum concentration as 63.1 $\mu g/m^3$. The 98th percentile values are observed as 73.9 $\mu g/m^3$ respectively.

The maximum SO_2 concentration is recorded as 14.1 $\mu g/m^3$ with minimum concentration as 10.0 $\mu g/m^3$. The 98th percentile values are observed as 13.8 $\mu g/m^3$ respectively.

The maximum NO_2 concentration is recorded as 17.2 $\mu g/m^3$ with minimum concentration as 11.6 $\mu g/m^3$. The 98th percentile values are observed as 16.8 $\mu g/m^3$ respectively.

The maximum CO concentration is recorded as 251 µg/m3 with minimum concentration as 212 $\mu g/m^3$. The 98th percentile values are observed as 250 $\mu g/m^3$ respectively.

The maximum O_3 concentration is recorded as 13.7 µg/m3 with minimum concentration as 7.6 $\mu g/m^3$. The 98th percentile values are observed as 13.5 $\mu g/m^3$ 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 33.6 $\mu g/m^3$ with minimum concentration as 22.0 $\mu g/m^3$. The 98th percentile values are observed as 33.2 $\mu g/m^3$ respectively.

The maximum concentration for PM10 is recorded as 71.8 $\mu g/m^3$ with minimum concentration as 54.7 $\mu g/m^3$. The 98th percentile values are observed as 71.6 $\mu g/m^3$ respectively.

The maximum SO_2 concentration is recorded as 12.5 $\mu g/m^3$ with minimum concentration as 9.3 $\mu g/m^3$. The 98th percentile values are observed as 12.5 $\mu g/m^3$ respectively.

The maximum NO_2 concentration is recorded as 15.7 $\mu g/m^3$ with minimum concentration as 12.1 $\mu g/m^3$. The 98th percentile values are observed as 15.3 $\mu g/m^3$ respectively.

The maximum CO concentration is recorded as 249 μg/m3 with minimum concentration as 209 μg/m^3. The 98th percentile values are observed as 249 μg/ m^3 respectively.

The maximum O_3 concentration is recorded as 12.3 μg/m3 with minimum concentration as 8.5 μg/m^3. The 98th percentile values are observed as 12.2 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 **April to September 2019** 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 **April to September 2019.**

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 (APRIL TO SEPTEMBER 2019)

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	24.1	33.2	29.0	33.1	57.6	68.5	63.0	67.4	10.2	14.2	12.4	14.2
AAQ2	Appikonda village	22.3	35.2	28.5	33.5	48.6	65.8	58.4	64.2	10.2	13.9	11.8	13.6
AAQ3	Devada village	21.0	31.3	27.0	31.1	50.3	62.3	56.7	62.1	9.3	13.5	11.4	13.1
AAQ4	Cheepurupalle village	24.3	34.5	28.9	33.0	54.2	72.7	61.9	71.3	10.7	16.4	12.7	15.3
AAQ5	Dasaripeta village	21.8	32.1	27.0	31.8	57.6	73.4	65.5	71.7	9.6	13.3	11.7	13.1
AAQ6	Islampeta village	22.4	32.6	27.8	32.0	52.3	64.2	58.3	63.2	9.2	13.8	11.2	13.1
AAQ7	Pittavanipalem village	24.6	36.5	30.6	35.6	63.1	75.6	68.8	73.9	10.0	14.1	12.0	13.8
AAQ8	Kalapaka village	22.0	33.6	28.0	33.2	54.7	71.8	64.5	71.6	9.3	12.5	11.3	12.5

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	13.1	16.6	14.7	16.5	215	264	235	257	8.2	13.0	10.9	12.6
AAQ2	Appikonda village	12.7	16.3	14.4	16.1	197	249	224	243	8.2	12.2	10.5	12.1
AAQ3	Devada village	12.0	17.5	14.6	17.3	211	265	232	257	8.0	12.5	10.5	12.2
AAQ4	Cheepurupalle village	13.8	19.9	15.8	18.7	212	273	240	271	8.5	13.2	11.0	13.0
AAQ5	Dasaripeta village	12.1	16.1	14.2	16.1	201	262	231	256	8.1	12.6	10.8	12.5
AAQ6	Islampeta village	12.0	16.0	13.8	15.5	200	258	230	253	8.4	13.3	10.8	12.6
AAQ7	Pittavanipalem village	11.6	17.2	14.3	16.8	212	251	229	250	7.6	13.7	10.8	13.5
AAQ8	Kalapaka village	12.1	15.7	13.8	15.3	209	249	229	249	8.5	12.3	10.5	12.2

**Note: (Concentrations are expressed in μg /m^3)*

TABLE - 3.5
SUMMARY OF AMBIENT AIR QUALITY DATA (APRIL TO SEPTEMBER 2019)

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 /m^3 except As, Ni and B(a)p are ng /m^3)*

3.3 Fugitive Dust Emission Monitoring

Fugitive dust emission monitoring has been carried out eight hours monitoring during the **April to September 2019**. 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	April 2019	May 2019	June 2019	July 2019	August 2019	September 2019
1	Plant Main gate	210	218	229	237	218	205
2	Power Plant service building	223	232	237	256	241	227
3	Coal handling plant	245	256	261	274	266	251
4	Work shop building	226	234	225	246	250	244
5	Ash handling plant	257	268	275	281	273	268

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 **April to September 2019** 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
(APRIL TO SEPTEMBER 2019)

S.No	Sources	April 2019		May 2019		June 2019		July 2019		August 2019		September 2019	
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1	Palavalasa	53.2	43.1	52.9	41.8	53.8	43.2	52.8	42.6	51.5	43.6	50.3	41.5
2	Appikonda	52.0	40.9	51.8	42.0	50.4	41.5	52.2	40.1	50.1	42.0	49.6	40.6
3	Devada	50.6	41.8	52.1	40.7	51.7	42.4	50.6	39.7	49.5	40.3	52.0	43.2
4	Cheepurupalle	52.1	42.6	53.2	43.0	52.4	42.9	51.7	41.4	52.1	43.0	52.6	41.8
5	Dasaripeta	51.8	40.5	50.8	41.7	51.5	40.8	49.6	39.5	50.4	41.4	48.6	42.6
6	Islampeta	50.4	41.6	52.0	42.1	52.5	41.7	51.4	40.7	52.3	42.2	49.5	41.5
7	Pittavanipalem	53.3	43.0	51.8	42.6	53.0	41.8	52.6	42.1	51.0	39.4	50.7	40.3
8	Kalapaka	51.2	42.1	52.1	41.5	51.6	42.7	50.7	41.8	49.3	40.3	48.2	42.6
CPCB Limits		**55**	**45**	**55**	**45**	**55**	**45**	**55**	**45**	**55**	**45**	**55**	**45**

TABLE-3.9
NOISE LEVEL MONITORING RESULTS INSIDE THE PLANT
(APRIL TO SEPTEMBER 2019)

S.No	Sources	April 2019		May 2019		June 2019		July 2019		August 2019		September 2019	
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1	Near Plant main gate	67.5	58.6	65.4	56.2	63.7	54.2	61.5	53.2	60.7	52.2	62.0	53.6
CPCB Limits		**75**	**75**	**70**	**75**	**70**	**75**	**70**	**75**	**70**	**75**	**70**	**70**
2	Near Boiler area	84.3		85.0		84.3		82.5		83.6		84.6	
3	Near Turbine area	83.3		84.3		83.4		84.0		82.0		83.3	
CPCB Limits		**90**		**90**		**90**		**90**		**90**		**90**	

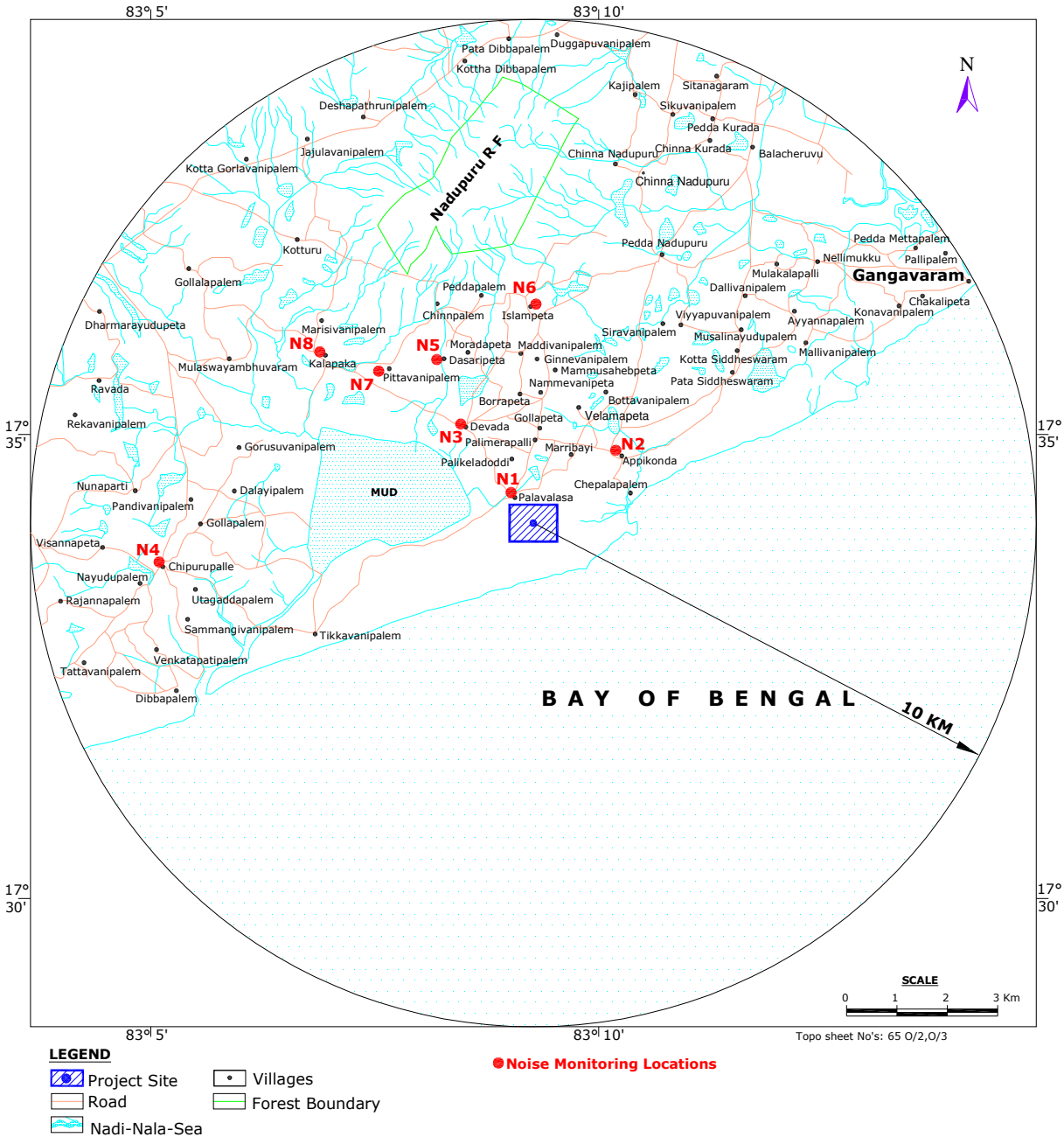


FIGURE-3.3
NOISE MONITORING LOCATIONS

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	Appikonda village (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 **(April to September 2019)** are given below in **Table-3.11 to Table-3.19.**

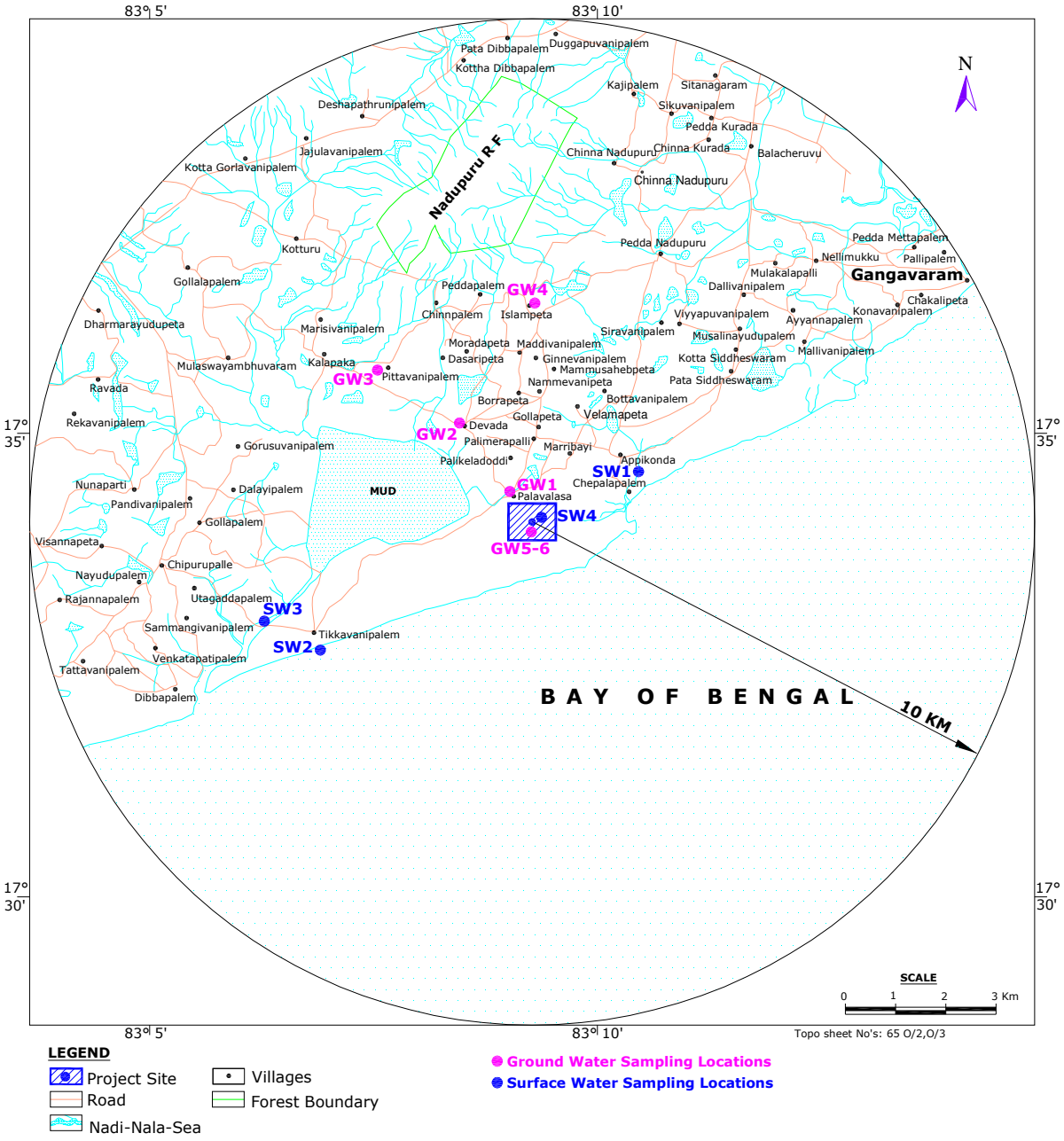


FIGURE-3.4
WATER SAMPLING LOCATIONS

TABLE-3.11
GROUND WATER QUALITY

Sr.No.	Parameters	Unit	GW1 - Devada village						Limits as per IS:10500
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.5	7.6	7.5	7.8	7.5	7.3	6.5 – 8.5 (NR)
2	Colour	Hazen	3	2	1	1	1	2	5(15)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Conductivity	µS/cm	1618	1682	1478	1242	1034	1125	$
6	Turbidity	NTU	3	3	2	2	1	2	1(5)
7	TDS	mg/l	1036	1111	932	796	653	721	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	375	435.7	371.0	285.6	233.3	267.3	200(600)
9	Total Alkalinity	mg/l	346.5	357.8	324.6	262.3	205.3	223.3	200(600)
10	Calcium as Ca	mg/l	63.5	71.4	61.5	49.7	38.5	45.2	75(200)
11	Magnesium as Mg	mg/l	53.5	62.5	52.8	39.2	33.3	37.5	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	0.05	0.03	0.05	0.03	0.01	0.03	0.5(1)
14	Chlorides as Cl	mg/l	213.2	221.7	189.2	174.5	152.3	165.3	250(1000)
15	Sulphates as SO_4	mg/l	147.8	154.6	132.5	98.3	87.6	92.0	200(400)
16	Fluorides as F	mg/l	0.5	0.7	0.5	0.3	0.1	0.4	1.0(1.5)
17	Nitrates as NO_3	mg/l	6.7	7.5	6.5	6.1	5.5	7.0	45(NR)
18	Sodium as Na	mg/l	192.0	179.6	161.5	147.8	125.6	131.8	$
19	Potassium as K	mg/l	9.5	10.5	12.4	9.5	7.9	6.2	$
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	0.12	0.16	0.22	0.17	0.15	0.12	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	0.27	0.32	0.41	0.27	0.31	0.23	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
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.7	7.4	7.6	7.7	7.8	7.6	6.5 – 8.5 (NR)
2	Colour	Hazen	2	2	2	2	2	2	5(15)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Conductivity	µS/cm	1465	1501	1611	1503	1318	1208	$
6	Turbidity	NTU	3	2	3	2	2	2	1(5)
7	TDS	mg/l	911	961	1064	992	845	786	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	575	612.9	422.0	350.8	313.2	275.3	200(600)
9	Total Alkalinity	mg/l	283.4	291.5	303.2	287.3	255.3	240.3	200(600)
10	Calcium as Ca	mg/l	106.7	109.7	76.3	65.1	60.1	55.3	75(200)
11	Magnesium as Mg	mg/l	75.1	82.3	56.2	45.7	39.6	33.3	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	0.06	0.07	0.04	0.05	0.02	0.01	0.5(1)
14	Chlorides as Cl	mg/l	188.4	193.2	209.7	197.4	175.2	170.5	250(1000)
15	Sulphates as SO_4	mg/l	165.4	171.2	185.2	167.5	142.2	111.2	200(400)
16	Fluorides as F	mg/l	0.8	0.4	0.2	0.5	0.3	0.2	1.0(1.5)
17	Nitrates as NO_3	mg/l	7.5	5.7	7.4	7.2	6.6	5.6	45(NR)
18	Sodium as Na	mg/l	65.3	57.4	62.8	178.3	155.2	147.6	$
19	Potassium as K	mg/l	10.3	9.5	10.5	7.3	6.6	5.2	$
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	0.06	0.09	0.11	0.07	0.11	0.08	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	0.22	0.17	0.23	0.33	0.27	0.36	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
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.4	7.6	7.8	7.6	7.4	7.7	6.5 – 8.5 (NR)
2	Colour	Hazen	2	2	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	1674	1702	1540	1363	1192	1008	$
6	Turbidity	NTU	2	3	2	2	2	1	1(5)
7	TDS	mg/l	1022	1107	986	873	775	656	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	482	474.4	421.9	363.9	321.3	274.8	200(600)
9	Total Alkalinity	mg/l	390.2	407.8	354.3	262.3	290.3	251.3	200(600)
10	Calcium as Ca	mg/l	96.7	79.3	72.3	64.4	55.6	51.3	75(200)
11	Magnesium as Mg	mg/l	58.4	67.1	58.6	49.3	44.3	35.6	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	0.02	0.04	0.03	0.01	<0.01	0.01	0.5(1)
14	Chlorides as Cl	mg/l	216.3	225.6	212.3	187.6	158.6	130.3	250(1000)
15	Sulphates as SO_4	mg/l	126.6	110.3	102.3	76.4	69.5	60.5	200(400)
16	Fluorides as F	mg/l	0.7	0.4	0.2	0.4	0.2	0.1	1.0(1.5)
17	Nitrates as NO_3	mg/l	7.5	6.1	8.2	6.5	7.2	6.0	45(NR)
18	Sodium as Na	mg/l	158.2	166.8	153.6	139.5	121.3	102.3	$
19	Potassium as K	mg/l	7.3	8.7	10.5	9.3	7.8	5.8	$
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	0.04	0.07	0.13	0.08	0.04	0.06	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	0.31	0.37	0.41	0.34	0.28	0.31	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
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.8	7.5	7.6	7.9	7.6	7.5	6.5 – 8.5 (NR)
2	Colour	Hazen	2	1	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	1578	1450	1231	1046	916	856	$
6	Turbidity	NTU	3	2	1	2	1	1	1(5)
7	TDS	mg/l	99.5	914	764	649	568	531	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	556	474.7	398.7	330.2	294.0	272.0	200(600)
9	Total Alkalinity	mg/l	313.5	293.5	257.6	287.3	189.6	175.3	200(600)
10	Calcium as Ca	mg/l	118.7	105.6	81.3	70.2	60.8	58.6	75(200)
11	Magnesium as Mg	mg/l	63.2	51.2	47.5	37.6	34.5	30.5	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	0.06	0.08	0.06	0.03	0.05	0.03	0.5(1)
14	Chlorides as Cl	mg/l	242.3	227.1	175.6	132.3	120.3	112.3	250(1000)
15	Sulphates as SO_4	mg/l	119.6	101.4	96.3	91.3	87.6	82.3	200(400)
16	Fluorides as F	mg/l	0.6	0.2	0.3	0.2	0.4	0.2	1.0(1.5)
17	Nitrates as NO_3	mg/l	6.5	4.6	6.3	5.8	6.2	5.5	45(NR)
18	Sodium as Na	mg/l	100.2	107.8	92.9	81.6	71.4	68.6	$
19	Potassium as K	mg/l	10.7	12.4	11.1	8.5	6.4	4.3	$
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	0.08	0.11	0.06	0.12	0.17	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	0.18	0.25	0.33	0.27	0.37	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-3.15
GROUND WATER QUALITY

Sr.No.	Parameters	Unit	GW5 – Palavalasa village						Limits as per IS:10500
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.8	7.4	7.7	7.5	7.7	7.8	6.5 – 8.5 (NR)
2	Colour	Hazen	2	2	2	2	2	2	5(15)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Conductivity	µS/cm	1637	1574	1602	1434	1274	1332	$
6	Turbidity	NTU	2	2	1	2	2	2	1(5)
7	TDS	mg/l	1065	1039	1058	919	803	840	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	596	541.2	533.8	477.7	418.4	436.9	200(600)
9	Total Alkalinity	mg/l	335.4	327.4	295.6	274.8	244.8	256.3	200(600)
10	Calcium as Ca	mg/l	128.8	118.2	105.2	97.6	85.4	88.5	75(200)
11	Magnesium as Mg	mg/l	60.8	59.7	65.8	56.8	49.8	52.4	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	0.04	0.02	0.04	0.02	0.03	0.01	0.5(1)
14	Chlorides as Cl	mg/l	233.9	223.5	244.6	215.8	197.6	202.3	250(1000)
15	Sulphates as SO_4	mg/l	135.5	129.6	144.6	119.3	102.3	113.3	200(400)
16	Fluorides as F	mg/l	0.8	0.3	0.1	0.3	0.5	0.3	1.0(1.5)
17	Nitrates as NO_3	mg/l	9.3	7.6	8.2	8.2	5.9	4.8	45(NR)
18	Sodium as Na	mg/l	98.1	108.4	118.1	105.4	96.3	101.2	$
19	Potassium as K	mg/l	6.5	7.8	6.3	5.7	7.1	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	0.15	0.12	0.07	0.04	0.13	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	0.23	0.18	0.07	0.10	0.23	0.31	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 – Appikonda village						Limits as per IS:10500
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.5	7.6	7.5	7.7	7.9	7.6	6.5 – 8.5 (NR)
2	Colour	Hazen	1	2	2	3	2	2	5(15)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Conductivity	µS/cm	1748	1787	1673	1511	1402	1521	$
6	Turbidity	NTU	1	2	2	2	2	3	1(5)
7	TDS	mg/l	1154	1144	1026	983	912	974	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	659	715.9	629.7	567.6	519.5	563.1	200(600)
9	Total Alkalinity	mg/l	343.2	354.6	338.7	318.5	292.3	326.3	200(600)
10	Calcium as Ca	mg/l	120.1	130.8	117.4	106.2	99.8	112.3	75(200)
11	Magnesium as Mg	mg/l	87.2	94.5	81.7	73.4	65.6	68.6	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	0.03	0.01	0.04	0.02	0.03	0.5(1)
14	Chlorides as Cl	mg/l	230.1	252.7	232.2	201.3	188.6	199.3	250(1000)
15	Sulphates as SO_4	mg/l	141.2	162.4	153.6	133.2	127.5	139.9	200(400)
16	Fluorides as F	mg/l	0.5	0.7	0.5	0.2	0.1	0.2	1.0(1.5)
17	Nitrates as NO_3	mg/l	7.6	8.7	7.4	7.1	8.2	7.4	45(NR)
18	Sodium as Na	mg/l	71.4	76.3	88.9	81.5	79.5	86.6	$
19	Potassium as K	mg/l	7.1	8.3	9.6	7.6	6.8	7.1	$
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	0.10	0.14	0.17	0.09	0.05	0.07	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	0.30	0.14	0.07	0.11	0.20	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
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	
1	pH	-	7.4	7.7	7.4	7.8	7.6	7.4	6.5 – 8.5 (NR)
2	Colour	Hazen	2	3	1	1	2	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	1604	1556	1456	1246	1073	1178	$
6	Turbidity	NTU	2	1	1	1	2	1	1(5)
7	TDS	mg/l	1012	965	903	774	698	766	500(2000)
8	Total Hardness as $CaCO_3$	mg/l	486	509.4	424.0	349.9	308.6	336.5	200(600)
9	Total Alkalinity	mg/l	326.4	318.7	302.2	261.4	220.8	226.3	200(600)
10	Calcium as Ca	mg/l	108.5	99.4	81.2	71.5	62.2	68.6	75(200)
11	Magnesium as Mg	mg/l	52.3	63.4	53.7	41.6	37.2	40.1	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	0.02	0.01	0.02	0.01	<0.01	0.02	0.5(1)
14	Chlorides as Cl	mg/l	279.8	271.4	255.7	175.3	152.3	171.2	250(1000)
15	Sulphates as SO_4	mg/l	68.1	61.2	51.2	96.3	88.6	106.8	200(400)
16	Fluorides as F	mg/l	0.4	0.5	0.3	0.5	0.3	0.4	1.0(1.5)
17	Nitrates as NO_3	mg/l	6.3	10.4	8.7	9.2	7.6	6.6	45(NR)
18	Sodium as Na	mg/l	141.1	120.3	134.2	119.8	100.2	112.2	$
19	Potassium as K	mg/l	6.2	5.4	8.7	6.7	7.5	6.3	$
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	0.07	0.12	0.08	0.12	0.07	0.11	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	0.34	0.27	0.20	0.18	0.15	0.10	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 APRIL TO SEPTEMBER 2019

S. No.	Parameter	Units	APR-2019		MAY-2019		JUN-2019		JUL-2019		AUG-2019		SEP-2019	
			SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2	SW1	SW2
1	pH	-	8.0	7.8	7.8	7.9	8.0	7.8	7.8	7.9	7.6	7.8	7.8	7.9
2	Color	Hazen	2	3	3	3	4	3	4	4	5	4	6	4
3	Conductivity	µS/cm	49100	48300	50700	49300	48300	50100	47100	49300	48300	47300	50300	49100
4	Total Dissolved Solids	mg/l	36400	35300	36600	36500	35300	37100	34400	36500	35300	34100	36300	35800
5	DO	mg/l	5.7	5.4	5.6	5.4	5.7	5.6	5.5	5.7	5.4	5.6	5.3	5.5
6	BOD	mg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
7	COD	mg/l	63	54	85	95	93	89	81	78	89	86	78	93
8	Total Hardness as $CaCO_3$	mg/l	4844	3155	5311.6	4555.3	4773.2	4854.2	4670.0	4766.3	4830.5	4311.4	5163	4739
9	Total Alkalinity as $CaCO_3$	mg/l	263.4	302.3	312.2	364.2	287.3	378.5	266.5	362.4	245.3	296.3	305.3	356.3
10	Calcium as Ca^{+2}	mg/l	271.5	212.3	361.2	248.5	327.4	341.2	315.4	328.4	336.3	251.3	425.3	293.0
11	Magnesium as Mg^{+2}	mg/l	1012.3	637.8	1071.3	923.3	961	972.3	943.2	958.7	969.5	895.0	996.3	973.6
12	Chlorides as Cl	mg/l	15955	16052	16623.0	15963.3	15968.7	16386	15636.0	16195.3	15856.3	15426.3	16520	16158
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	2.0	1.4	1.8	2.5	2.1	1.3	1.8	2.3	1.1	1.5	0.8	1.2
15	Sulphates as SO_4	mg/l	1092.3	1012.0	1115.6	1097.3	1024.6	1158.7	985.5	1135.4	1005.3	965.3	1232.3	986.3
16	Fluorides as F	mg/l	0.3	0.5	0.6	0.4	0.8	0.5	0.6	0.7	0.4	0.9	0.7	0.6
17	Nitrates as NO_3	mg/l	15.3	12.3	18.5	15.8	15.3	18.4	12.4	16.7	14.2	13.6	12.5	11.3
18	Sodium as Na^+	mg/l	8835.2	9440.0	8974.3	9011.2	8679.1	9025.3	8457.3	8902.4	8672.3	8712.3	8963.3	8896.3
19	Potassium as K	mg/l	381.4	362.1	406.3	386.7	391.2	401.6	348.7	396.3	358.6	305.3	385.3	361.2
20	Total Boron as B	mg/l	0.08	0.05	0.05	0.07	0.06	0.04	0.04	0.03	0.06	0.04	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	0.13	0.19	0.16	0.13	0.13	0.18	0.17	0.10	0.15	0.08	0.21	0.16
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

SW1- Appikonda beach(marine); SW2-Tikkavanipalem beach(marine);

TABLE-3.19
SURFACE WATER QUALITY (CREEK WATER SAMPLES)
FROM APRIL TO SEPTEMBER 2019

S. No.	Parameters	Units	April 2019	May 2019	June 2019	July 2019	August 2019	September 2019
1	pH	-	7.8	7.9	8.0	7.8	7.9	8.0
2	Suspended solids	mg/l	10	15	21	27	33	29
3	Conductivity	µS/cm	40800	43200	44700	43200	41900	39550
4	TDS	mg/l	28600	30300	30900	29900	28922	27300
5	DO	mg/l	5.8	5.4	5.8	5.6	5.4	5.6
6	BOD	mg/l	<3	<3	<3	<3	<3	<3
7	Turbidity	NTU	5	7	6	8	6	9
8	Salinity	ppt	25	26	27	26	25	24
9	Total Alkalinity as $CaCO_3$	mg/l	284.5	303.5	336.4	313.2	303.3	286.3
10	Calcium as Ca	mg/l	165.4	220.8	262.8	247.3	235.3	206.3
11	Magnesium as Mg	mg/l	464.1	523.4	591.7	574.1	561.2	475.2
12	Chlorides as Cl	mg/l	13852.3	14623.3	15126.4	14601.3	14056.3	13362.3
13	Phosphates as PO_4	mg/l	2.3	3.1	2.3	3.7	2.5	1.7
14	Sulphates as SO_4	mg/l	405.6	432.6	458.7	428.7	412.3	385.3
15	Fluorides as F	mg/l	0.6	0.8	1.1	0.8	0.6	0.5
16	Nitrates as NO_3	mg/l	3.5	4.5	5.4	4.3	6.1	7.6
17	Sodium as Na	mg/l	8205.4	8574.6	8726.4	8436.5	8183.6	7852.6
18	Potassium as K	mg/l	183.2	191.4	215.8	206.8	198.6	175.3
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	0.09	0.13	0.18	0.08	0.13	0.15
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					
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	sep 19
1	Texture	--	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay
a	Sand	%	53	48	51	49	47	45
b	Silt	%	20	22	21	25	25	24
c	Clay	%	27	30	28	26	28	31
2	Bulk Density	g/cc	1.0	1.4	1.4	1.3	1.2	1.1
3	pH (1:5 Aq.Extraction)		7.6	7.3	7.5	7.3	7.4	7.21
4	Conductivity (1:5 Aq.Extraction)	µS/cm	542	623	702	658	702	641
5	Cation Exchange Capacity	(meq/100gm)	21.8	23.2	22.6	37.11	35.9	29.6
6	Exchangeable Calcium	(meq/100gm)	14.8	15.1	13.7	23.80	22.6	18.7
7	Exchangeable Magnesium	(meq/100gm)	6.1	7.1	7.6	12.40	12.31	10.41
8	Exchangeable Potassium	(meq/100gm)	0.45	0.52	0.63	0.57	0.61	0.53
9	Exchangeable Sodium	(meq/100gm)	0.42	0.56	0.60	0.34	0.38	0.26
10	Sodium Absorption Ratio (SAR)	----	0.18	0.24	0.26	0.28	0.26	0.19
11	Available Nitrogen as N	Kg/ha	53.8	69.7	85.6	112.5	121.6	98.7
12	Available Phosphorous as P	Kg/ha	28.2	27.8	29.9	30.2	31.6	29.6
13	Available Potassium as K	Kg/ha	271.9	407.6	532.3	568.8	512.8	0.64
14	Organic Carbon	%	0.32	0.32	0.37	0.41	0.48	0.37
15	Organic Matter	%	0.54	0.55	0.63	0.71	0.76	0.64
16	Water Soluble Chlorides as Cl	mg/kg	163.1	132.9	148.9	153	164	149.7
17	Water Soluble Sulphates as SO4	mg/kg	45.9	48.2	53.7	62.4	66.8	54.9
18	Aluminium	%	1.34	0.93	0.72	0.64	0.58	0.79
19	Total Iron	%	1.69	2.16	1.52	1.64	1.71	1.12
20	Manganese	mg/kg	494	376	404	392	412	379
21	Boron	mg/kg	31.2	27.3	32.4	28.6	32.1	28.7
22	Zinc	mg/kg	40.4	35.6	23.4	21.2	22.8	19.4

TABLE-3.21
SOIL QUALITY RESULTS

S. No	Parameters	Unit	S2 –Appikonda Village					
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	sep 19
1	Texture	--	Clay	Clay	Clay	Clay	Clay	Clay
a	Sand	%	33	34	33	36	38	28
b	Silt	%	13	10	8	10	12	14
c	Clay	%	54	56	59	54	56	58
2	Bulk Density	g/cc	1.3	1.2	1.1	1.2	1.3	1.2
3	pH (1:5 Aq.Extraction)		7.4	7.6	7.8	8.1	8.0	7.78
4	Conductivity (1:5 Aq.Extraction)	µS/cm	702	762	812	825	784	815
5	Cation Exchange Capacity	(meq/100gm)	24.6	22.5	24.1	43.20	41.92	36.7
6	Exchangeable Calcium	(meq/100gm)	15.3	13.7	15.2	25.60	24.8	29.8
7	Exchangeable Magnesium	(meq/100gm)	8.3	7.5	7.8	16.40	15.94	18.5
8	Exchangeable Potassium	(meq/100gm)	0.50	0.67	0.55	0.62	0.64	0.78
9	Exchangeable Sodium	(meq/100gm)	0.53	0.59	0.53	0.58	0.54	0.63
10	Sodium Absorption Ratio (SAR)	----	0.22	0.26	0.22	0.24	0.28	0.31
11	Available Nitrogen as N	Kg/ha	13.9	115.3	103.5	124.6	116.8	126.4
12	Available Phosphorous as P	Kg/ha	31.1	35.4	32.5	33.8	34.9	43.7
13	Available Potassium as K	Kg/ha	392.1	489.6	363.7	396.5	411.3	0.93
14	Organic Carbon	%	0.26	0.58	0.56	0.58	0.61	0.54
15	Organic Matter	%	0.44	0.99	0.97	1.00	1.02	0.87
16	Water Soluble Chlorides as Cl	mg/kg	150.7	175.5	164.8	168	174	167.2
17	Water Soluble Sulphates as SO4	mg/kg	50.0	51.1	46.9	49.5	58.6	73.9
18	Aluminium	%	1.50	1.23	0.96	1.08	1.11	1.13
19	Total Iron	%	2.10	1.53	1.22	1.32	1.46	1.57
20	Manganese	mg/kg	531	484	487	458	466	518
21	Boron	mg/kg	47.6	42.3	38.6	42.6	48.8	37.5
22	Zinc	mg/kg	62.4	37.4	19.4	18.6	21.8	24.6

TABLE-3.22
SOIL QUALITY RESULTS

S. No	Parameters	Unit	S3 –Devada Village					
			Apr 19	May 19	Jun 19	Jul 19	Aug 19	sep 19
1	Texture	--	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay
a	Sand	%	51	53	50	52	50	48
b	Silt	%	19	9	14	22	23	16
c	Clay	%	30	38	36	26	27	36
2	Bulk Density	g/cc	1.1	1.4	1.3	1.4	1.3	1.1
3	pH (1:5 Aq.Extraction)		7.8	7.7	7.5	7.9	8.2	7.65
4	Conductivity (1:5 Aq.Extraction)	µS/cm	742	811	765	734	813	594
5	Cation Exchange Capacity	(meq/100gm)	21.0	23.8	24.2	39.06	39.95	21.7
6	Exchangeable Calcium	(meq/100gm)	13.2	14.8	15.8	22.80	23.8	20.6
7	Exchangeable Magnesium	(meq/100gm)	7.0	8.1	7.4	15.10	14.99	11.21
8	Exchangeable Potassium	(meq/100gm)	0.36	0.45	0.50	0.55	0.52	0.47
9	Exchangeable Sodium	(meq/100gm)	0.38	0.42	0.59	0.61	0.64	0.31
10	Sodium Absorption Ratio (SAR)	----	0.17	0.18	0.25	0.27	0.24	0.22
11	Available Nitrogen as N	Kg/ha	23.7	124.9	153.8	142.8	136.8	110.5
12	Available Phosphorous as P	Kg/ha	34.2	29.4	29.8	34.6	31.3	36.7
13	Available Potassium as K	Kg/ha	242.6	351.6	392.9	412.8	426.4	0.70
14	Organic Carbon	%	0.39	0.90	0.71	0.74	0.72	0.41
15	Organic Matter	%	0.66	1.55	1.22	1.28	1.31	0.71
16	Water Soluble Chlorides as Cl	mg/kg	132.7	150.6	145.3	156	159	131.5
17	Water Soluble Sulphates as SO4	mg/kg	43.6	45.9	50.9	52.8	64.4	49.7
18	Aluminium	%	1.27	1.06	0.81	1.48	1.32	0.94
19	Total Iron	%	1.23	1.71	1.63	1.72	1.66	1.46
20	Manganese	mg/kg	456	412	422	436	572	427
21	Boron	mg/kg	33.7	25.6	21.7	28.9	29.8	21.8
22	Zinc	mg/kg	47.0	52.0	27.3	31.2	32.6	16.7

TABLE-3.23
SOIL QUALITY RESULTS (QUARTERLY)

S. No	Parameters	Unit	S4		S5		S6	
			Apr 19	Jul 19	Apr 19	Jul 19	Apr 19	Jul 19
1	Texture	--	Sandy	Sandy	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay
a	Sand	%	55	57	49	47	56	54
b	Silt	%	18	11	15	21	12	17
c	Clay	%	27	32	36	32	32	29
2	Bulk Density	g/cc	1.4	1.2	1.3	1.4	1.2	1.3
3	pH (1:5 Aq.Extraction)		7.3	7.6	7.6	7.4	7.5	7.2
4	Conductivity (1:5 Aq.Extraction)	µS/cm	302	346	411	458	346	396
5	Cation Exchange Capacity	(meq/100gm)	20.3	37.6	19.9	41.2	32.4	60.5
6	Exchangeable Calcium	(meq/100gm)	15.4	21.6	14.4	24.6	26.3	31.6
7	Exchangeable Magnesium	(meq/100gm)	3.8	14.8	4.5	15.6	5.2	27.8
8	Exchangeable Potassium	(meq/100gm)	0.53	0.58	0.40	0.49	0.32	0.42
9	Exchangeable Sodium	(meq/100gm)	0.63	0.66	0.58	0.54	0.61	0.64
10	Sodium Absorption Ratio (SAR)	----	0.26	0.31	0.32	0.33	0.32	0.29
11	Available Nitrogen as N	Kg/ha	61.0	82.6	95.6	91.2	32.9	48.6
12	Available Phosphorous as P	Kg/ha	187.1	212.6	149.3	152.6	147.9	155.8
13	Available Potassium as K	Kg/ha	342.9	322.8	382.1	376.8	274.1	312.8
14	Organic Carbon	%	0.26	0.32	0.44	0.48	0.16	0.21
15	Organic Matter	%	0.45	0.55	0.76	0.83	0.28	0.36
16	Water Soluble Chlorides as Cl	mg/kg	194.9	217	175.4	183	182.6	195
17	Water Soluble Sulphates as SO4	mg/kg	69.5	72.4	135.9	156.8	172.3	134.6
18	Aluminium	%	2.11	2.24	1.63	1.82	2.31	2.11
19	Total Iron	%	3.42	3.86	2.07	2.17	2.11	2.01
20	Manganese	mg/kg	373	368	483	502	512	538
21	Boron	mg/kg	32.6	36.8	38.0	41.6	47.1	50.8
22	Zinc	mg/kg	52.3	48.6	43.6	44.7	68.4	71.6

Soil Sampling Locations
S4- Islampeta village
S5- Namidoddi village
S6- Palikiladoddi village

TABLE-3.24
SOIL QUALITY RESULTS (QUARTERLY)

S. No	Parameters	Unit	S7		S8	
			Apr 19	Jul 19	Apr 19	Jul 19
1	Texture	--	Sandy Clay	Sandy Clay	Sandy	Sandy
a	Sand	%	59	54	51	53
b	Silt	%	12	14	11	7
c	Clay	%	29	32	38	40
2	Bulk Density	g/cc	1.3	1.4	1.4	1.4
3	pH (1:5 Aq.Extraction)		8.0	8.2	7.8	7.6
4	Conductivity (1:5 Aq.Extraction)	µS/cm	673	764	528	598
5	Cation Exchange Capacity	(meq/100gm)	24.1	45.5	26.4	51.4
6	Exchangeable Calcium	(meq/100gm)	16.3	26.4	21.1	27.8
7	Exchangeable Magnesium	(meq/100gm)	6.5	17.6	4.2	22.4
8	Exchangeable Potassium	(meq/100gm)	0.51	0.61	0.37	0.42
9	Exchangeable Sodium	(meq/100gm)	0.78	0.88	0.73	0.78
10	Sodium Absorption Ratio (SAR)	----	0.31	0.34	0.30	0.28
11	Available Nitrogen as N	Kg/ha	82.8	78.6	65.4	68.8
12	Available Phosphorous as P	Kg/ha	142.2	138.6	137.4	148.6
13	Available Potassium as K	Kg/ha	377.6	386.8	287.5	368.9
14	Organic Carbon	%	0.38	0.42	0.28	0.32
15	Organic Matter	%	0.66	0.72	0.48	0.55
16	Water Soluble Chlorides as Cl	mg/kg	157.7	169	164.8	173
17	Water Soluble Sulphates as SO4	mg/kg	154.1	118.8	119.1	128.6
18	Aluminium	%	1.83	1.68	2.06	2.11
19	Total Iron	%	2.41	2.32	3.66	3.38
20	Manganese	mg/kg	397	426	284	312
21	Boron	mg/kg	36.3	32.8	45.0	46.5
22	Zinc	mg/kg	43.2	62.4	65.2	59.5

Soil Sampling Locations
S7- Dasaripeta village
S8- 8th feet road (Near Islampet village)

TABLE-3.25
SOIL QUALITY OF INTER-TIDAL REGION

Sr. No	Parameter	UOM	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019
1	Texture	--	Sandy	Sandy	Sandy	Sandy	Sandy	Sandy
2	Phosphorous	mg/kg	16.1	13.6	15.2	9.8	7.6	5.8
3	Chromium (as Cr)	mg/kg	0.52	0.71	0.56	0.30	0.28	0.34
4	Nickel (as Ni)	mg/kg	1.2	0.82	0.74	0.43	0.32	0.42
5	Cadmium (as Cd)	mg/kg	0.41	0.66	0.34	0.25	0.18	0.12
6	Lead (as Pb)	mg/kg	2.1	1.8	1.2	0.8	0.64	0.51
7	Mercury (as Hg)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
8	Total Petroleum hydrocarbons(PHC)	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

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-3.26 and 3.27.**

TABLE-3.26
ETP OUTLET ANALYSIS RESULT AT PLANT SITE

Sr.no	Parameters	Unit	Apr 2019	May 2019	Jun 2019	Jul 2019	Aug 2019	Sep 2019	standards
1	pH	-	7.8	7.5	7.6	7.8	7.5	7.8	6.50—8.50
2	Total Suspended Solids (at 103—105° C)	mg/l	49	63	57	63	53	63	100 mg/l
3	Oil and Grease	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	20 mg/l
4	Free chlorine	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.5 mg/l
5	Phosphate as PO4	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	20 mg/l
6	Chromium (Total)	mg/l	0.07	0.05	0.03	0.06	0.12	0.08	0.2 mg/l
7	Copper (Total)	mg/l	0.62	0.74	0.55	0.41	0.51	0.63	1 mg/l
8	Iron	mg/l	0.51	0.35	0.43	0.38	0.43	0.35	1 mg/l
9	Zinc	mg/l	0.64	0.52	0.69	0.50	0.56	0.44	1 mg/l

TABLE-3.27
OUTFALL WATER QUALITY AT DIFFUSION POINT

Sr.no	Parameters	Unit	Apr 2019		May 2019		Jun 2019	
			Surface area	Bottom area	Surface area	Bottom area	Surface area	Bottom area
1	pH	-	7.9	7.8	7.8	8.0	7.6	7.9
2	Temperature	°C	29.5	31.5	30.5	32.0	30.0	31.5
3	Salinity	mg/l	28	29	27	28	26	27
4	DO	mg/l	5.6	5.4	5.4	5.5	5.6	5.4
5	BOD	mg/l	<3	<3	<3	<3	<3	<3
6	Dissolved Phosphate	mg/l	0.5	1.1	1.1	1.7	0.96	1.4
7	Ammonia	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
8	Total Petroleum hydrocarbons	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

TABLE-3.27(A)
OUTFALL WATER QUALITY AT DIFFUSION POINT

Sr.no	Parameters	Unit	Jul 2019		Aug 2019		Sep 2019	
			Surface area	Bottom area	Surface area	Bottom area	Surface area	Bottom area
1	pH	-	7.9	8.0	7.8	7.9	7.9	8.0
2	Temperature	°C	29.5	31.0	29.0	31.5	29.0	31.0
3	Salinity	mg/l	27	28	26	27	27	28
4	DO	mg/l	5.2	5.5	5.5	5.6	5.3	5.5
5	BOD	mg/l	<3	<3	<3	<3	<3	<3
6	Dissolved Phosphate	mg/l	1.1	0.86	0.92	0.75	0.78	0.82
7	Ammonia	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
8	Total Petroleum hydrocarbons	%	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

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-3.28 & Table-3.29**

TABLE-3.28
STACK EMISSION MONITORING

Sr. No.	Parameters	UOM	Unit-II	Unit-II	Unit-II	Methods of Testing
			Apr 2019	May 2019	Jun 2019	
	Sampling date		30/04/19	31/05/2019	19/06/2019	
1	Capacity	MW	520	520	520	-
2	Stack Height	m	275	275	275	-
3	Stack diameter	m	6.8	6.8	6.8	-
4	Cross sectional area of the duct	m^2	36.33	36.33	36.33	-
5	Flue gas Temperature	^oC	124	120	124	-
6	Velocity of the flue gas	m/s	23.81	22.79	22.57	IS: 11255(P-3) 2008
7	Gas volumetric flow rate	Nm^3/s	672.85	657.17	635.10	IS: 11255(P-3) 2008
8	Particulate Matter	mg/Nm^3	24.3	21.8	23.5	IS: 11255(P-1) 2009
9	Sulphur dioxide	mg/Nm^3	518	596	610	IS: 11255(P-7) 2012
10	Oxides of Nitrogen	mg/Nm^3	372	401	432	IS: 11255(P-2) 1985

TABLE-3.28(A)
STACK EMISSION MONITORING

Sr. No.	Parameters	UOM	Unit-I	Unit-I	Unit-I	Methods of Testing
			Jul 2019	Aug 2019	Sep 2019	
	Sampling date		20/07/2019	07/08/2019	12/09/2019	
1	Capacity	MW	520	520	520	-
2	Stack Height	m	275	275	275	-
3	Stack diameter	m	6.8	6.8	6.8	-
4	Cross sectional area of the duct	m^2	36.33	36.33	36.33	-
5	Flue gas Temperature	^oC	130.3	126	122	-
6	Velocity of the flue gas	m/s	22.51	22.11	22.3	IS: 11255(P-3) 2008
7	Gas volumetric flow rate	Nm^3/s	619.37	614.96	627.08	IS: 11255(P-3) 2008
8	Particulate Matter	mg/Nm^3	22.0	23.3	24.1	IS: 11255(P-1) 2009
9	Sulphur dioxide	mg/Nm^3	674	492	512	IS: 11255(P-7) 2012
10	Oxides of Nitrogen	mg/Nm^3	503	286	293	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-3.29.**

TABLE-3.29
PIZEO WELLS MONITORING FOR GROUND WATER

Sr.No.	Location Name	Depth of Water levels (m)	
		April 2019	July 2019
1	Appikonda village	6.6	6.2
2	Palavalasa village	3.2	3.6
3	Velama Appikonda village	6.5	6.1
4	Gouruvanipalem village	7.3	7.0
5	Islampet village	7.2	6.8
6	Dasaripeta village	4.7	5.0

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-3.30.**

TABLE-3.30
SEWAGE OUTLET WATER QUALITY (APRIL TO SEPTEMBER 2019)

Sr. No	Parameter	UOM	Apr 2019		May 2019		Jun 2019		Jul 2019		Aug 2019		Sep 2019	
			Plant Site	Colony	Plant Site	Colony	Plant Site	Colony	Plant Site	Colony	Plant Site	Colony	Plant Site	Colony
1	pH	-	7.5	7.3	7.3	7.6	7.6	7.8	7.5	7.6	7.8	7.5	7.5	7.9
2	Total Dissolved Solids	mg/l	412	465	485	503	511	567	603	538	574	502	602	562
3	Total Suspended Solids	mg/l	53	45	62	56	45	52	50	42	55	47	61	53
4	Bio Chemical Oxygen Demand for 3 day $27^{O}C$	mg/l	14	16	17	18	15	19	18	16	16	14	17	16

3.11 Shoreline and Beach Profile Studies

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.

3.11.1 Shoreline

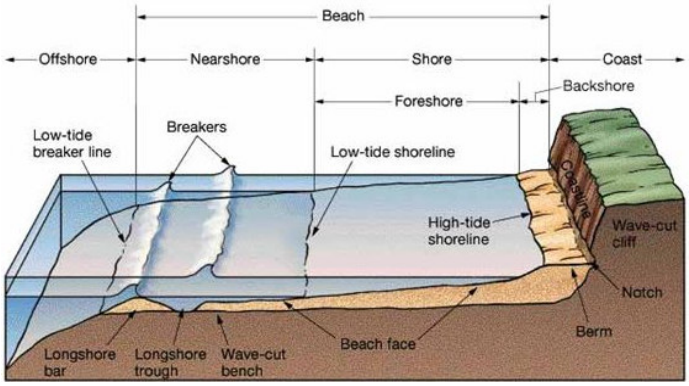
The coastal areas are always physically and ecologically changing that depends to natural and human factors. Monitoring of coastal areas is an important fact in steady development and environment maintenance. To monitor a coastal area, shoreline extraction in various times is an essential task. Shoreline 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 January 2019 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., 21-Apr-2019 is not available, Resourcesat 2A L4FMX multispectral satellite data of 5 m resolution on 21-Apr-2019 has been procured to draw shore lines during April 2019. The Resourcesat 2A L4FMX satellite data of 5 m resolution of 21-Apr-2019 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 21-Apr-2019 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 21-Apr-2019. From the shoreline map, it is observed that there is no major change in SL except around HNPCL Intake-Outfall Jetty transition point and up to 150 m east of Jetty due to Jetty activity. 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.



SHORE LINE PROFILES

East of HNPCL Jetty

West of HNPCL Jetty

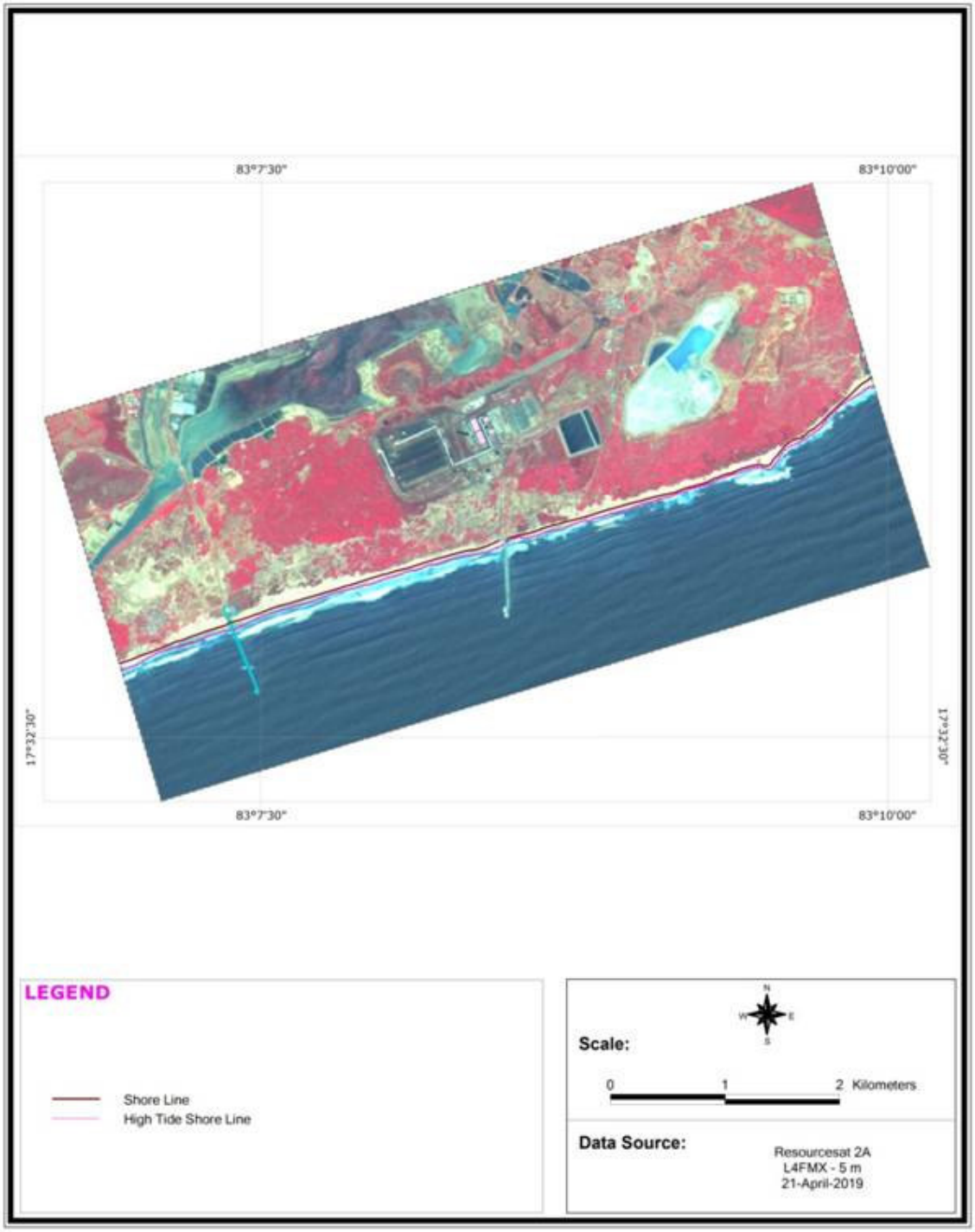


FIGURE-3.5

SHORELINE SATELLITE IMAGERY OF HTL, LTD FOR CARTOSAT1 PAN-2.5 M (21 APRIL 2019)

3.11.2 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 3.6**. Beach profile measurements are run from the installed reference marks at right angles across the beach on 21.04.2019. 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-3.6
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 3.31** and individual profiles are presented in **Figure 3.7**.

Total length of profiles ranges from 28.56 m to 64.81 m from the reference mark in to the offshore with vertical drop w.r.t reference mark ranging from 2.509 m to 6.525 m and sectional profile area ranging from 37.12 sq m to 214.53 sq m.

TABLE-3.31
DETAILS OF PROFILES ON 21.04.2019

S.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	35.02	6.525	154.06
2	E100	17 ^{0} 33' 18.6"N	83 ^{0} 08' 29.2"E	3.31	28.56	2.509	37.12
3	E250	17 ^{0} 33' 20.2"N	83 ^{0} 08' 34.0"E	5.32	47.00	5.169	158.36
4	E500	17 ^{0} 33' 22.2"N	83 ^{0} 08' 42.4"E	3.31	64.81	4.874	214.53
5	W8.1	17 ^{0} 33' 17.6"N	83 ^{0} 08' 24.9"E	4.54	54.53	4.914	183.87
6	W100	17 ^{0} 33' 16.5"N	83 ^{0} 08' 21.9"E	4.40	64.13	4.085	176.24
7	W250	17 ^{0} 33' 15.2"N	83 ^{0} 08' 16.9"E	3.60	69.04	4.719	213.12
8	W500	17 ^{0} 33' 13.0"N	83 ^{0} 08' 08.6"E	3.50	52.60	4.488	156.64

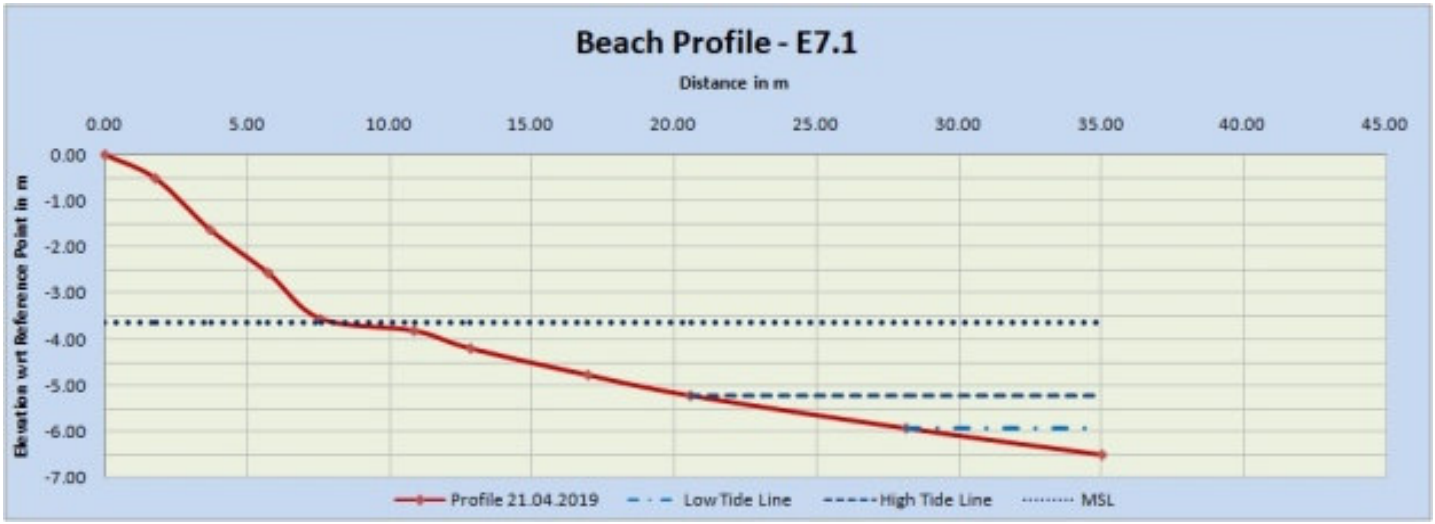
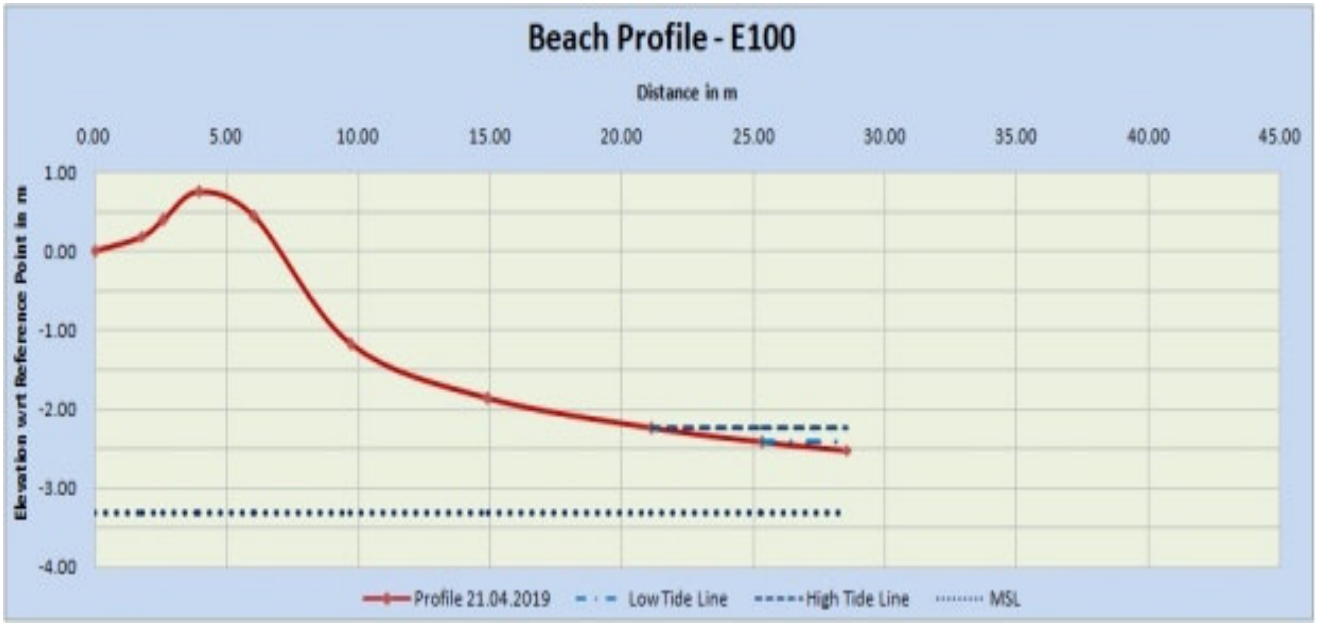


FIGURE-3.4
BEACH PROFILE – EAST 7.1 METERS FROM JETTY 21.04.2019



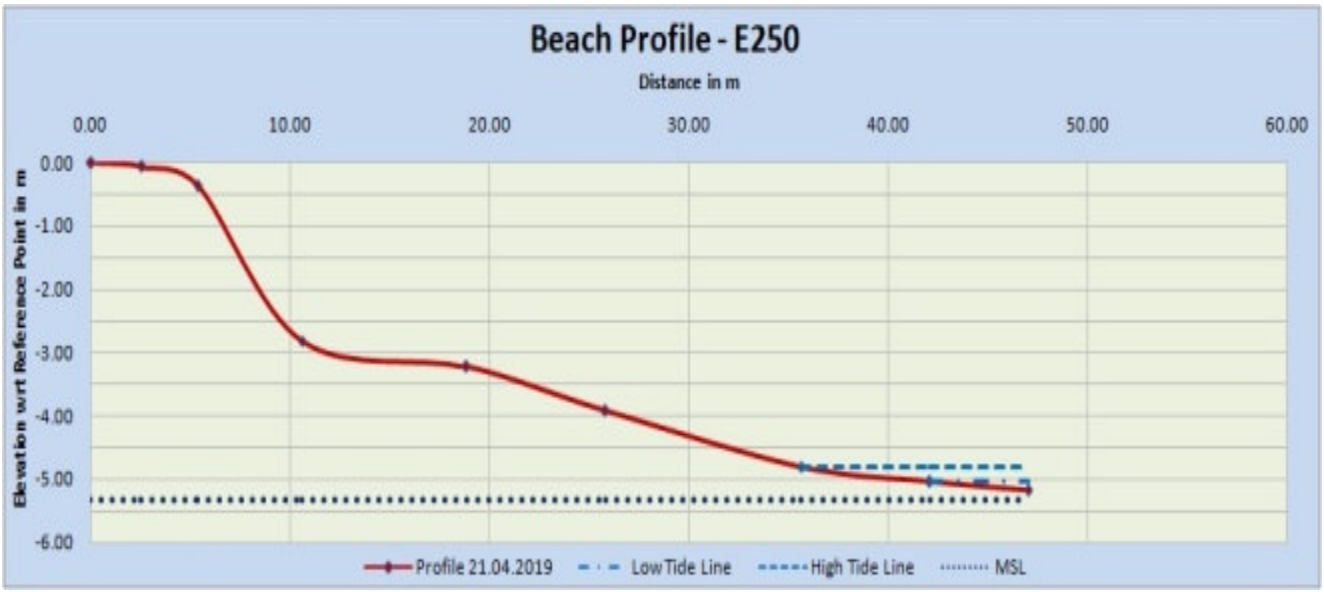
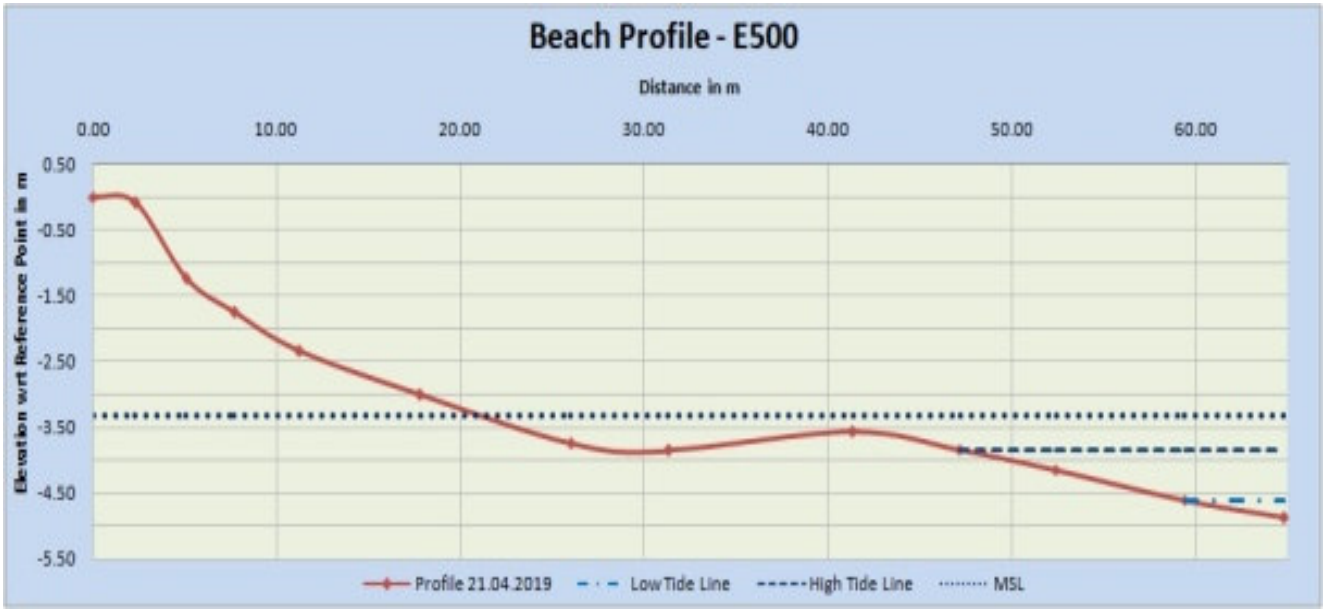


FIGURE-3.5
BEACH PROFILE – EAST 100 & EAST 250 METERS FROM JETTY 21.04.2019



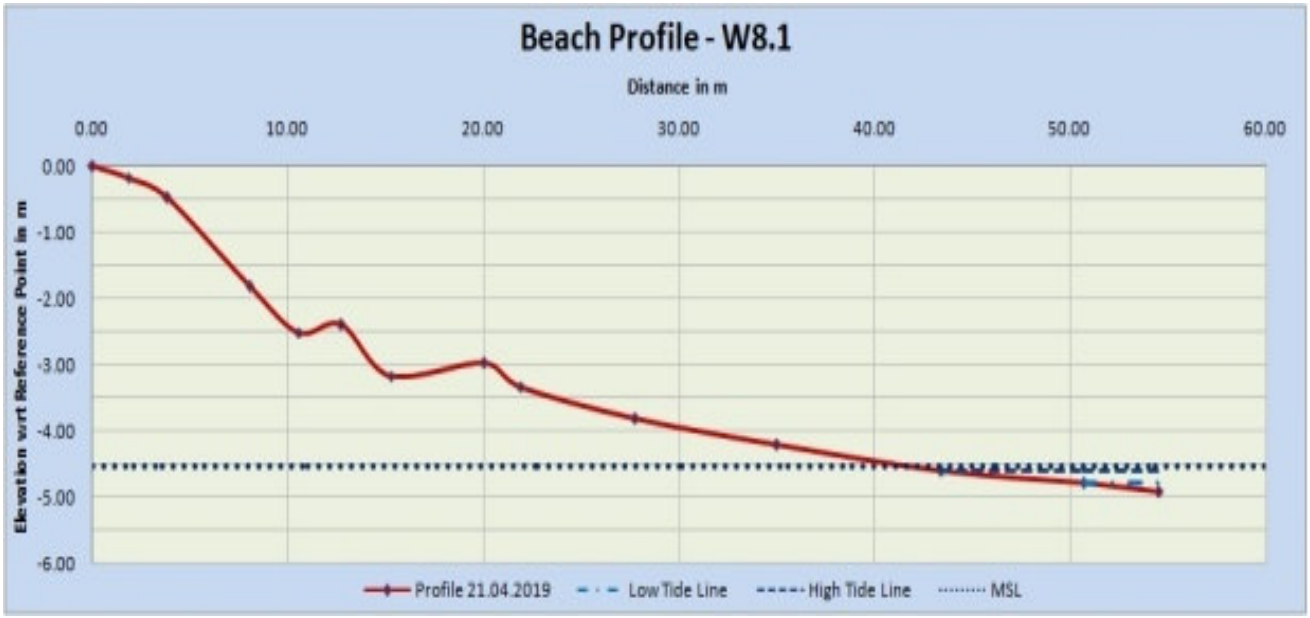
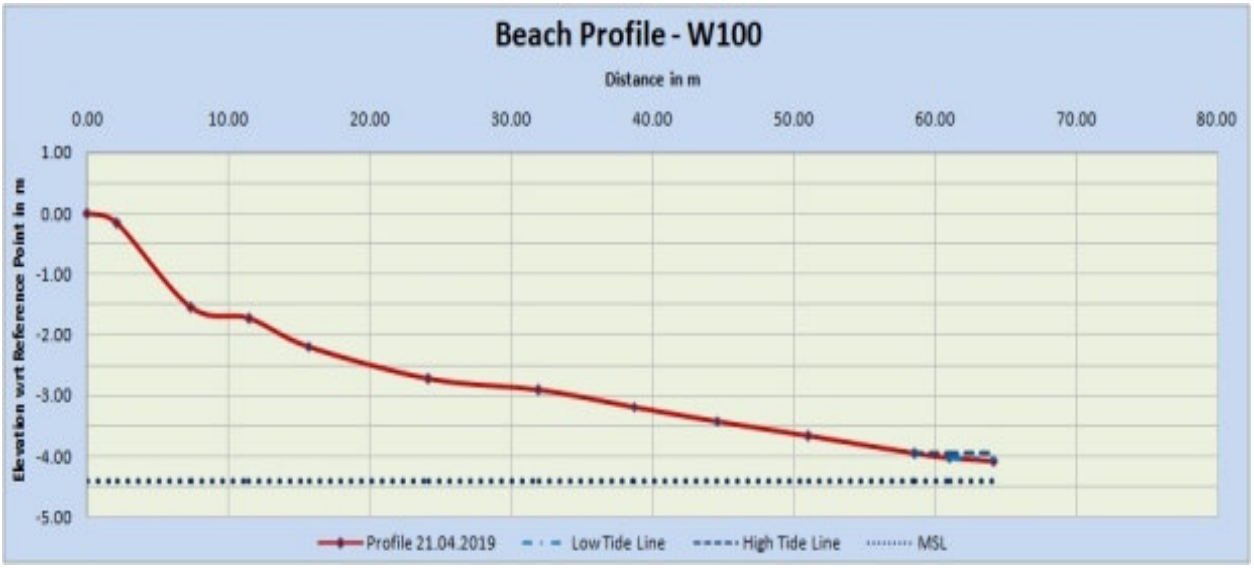


FIGURE-3.6
BEACH PROFILE – EAST 500 & WEST 8.1 METERS FROM JETTY 21.04.2019



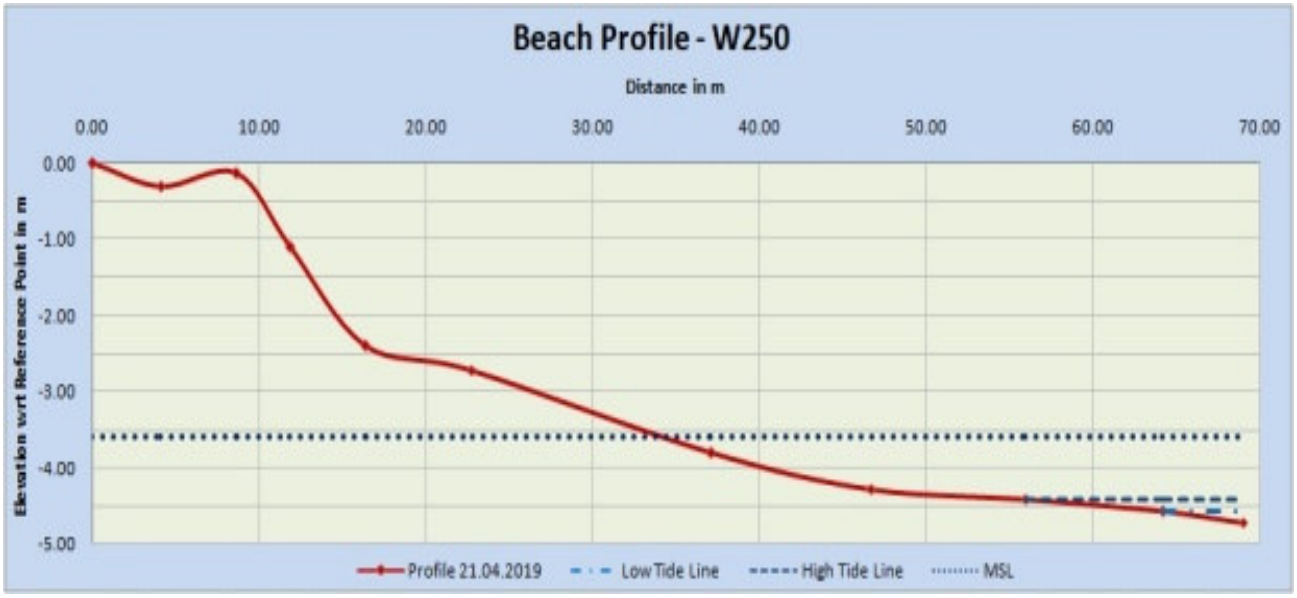


FIGURE-3.7
BEACH PROFILE – WEST 100 & WEST 250 METERS FROM JETTY 21.04.2019

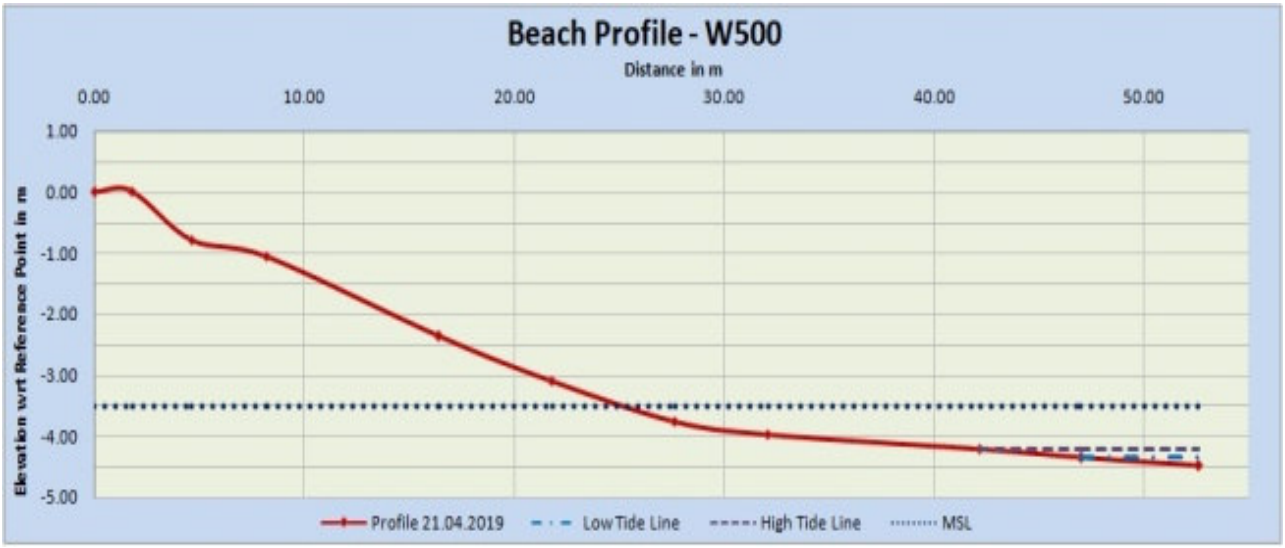


FIGURE-3.8
BEACH PROFILE – WEST 500 METERS FROM JETTY 21.04.2019

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**	**C6H6**
1	04/04/2019	26.3	59.8	12.3	14.8	241	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	05/04/2019	29.1	58.2	11.4	14.1	221	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	08/04/2019	27.4	61.7	14.2	16.3	237	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	09/04/2019	28.6	60.2	12.6	15.7	244	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	18/04/2019	29.3	62.3	13.8	16.5	233	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	19/04/2019	28.4	60.1	11.9	14.4	226	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	22/04/2019	27.5	64.5	14.0	16.2	235	13.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	23/04/2019	28.2	60.7	12.5	14.8	254	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	02/05/2019	28.8	63.2	13.2	15.6	233	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	03/05/2019	31.5	67.1	11.2	13.2	218	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	06/05/2019	32.1	65.3	12.7	14.8	229	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	07/05/2019	31.0	68.5	11.2	13.8	237	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	16/05/2019	32.6	65.8	12.3	14.5	225	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	17/05/2019	30.8	63.4	13.6	15.3	238	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	20/05/2019	28.4	67.4	12.4	14.6	227	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	21/05/2019	32.6	62.3	11.1	13.5	247	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	30/05/2019	28.7	65.1	12.7	15.0	238	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	31/05/2019	30.4	65.4	11.1	13.7	223	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	03/06/2019	26.3	62.4	11.7	14.3	224	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	04/06/2019	29.4	65.2	13.2	16.0	231	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	13/06/2019	30.2	63.4	11.2	13.8	218	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	14/06/2019	33.1	65.3	12.5	14.6	230	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	17/06/2019	30.2	66.4	10.8	13.8	215	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	18/06/2019	32.9	63.2	12.3	14.1	231	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	27/06/2019	26.1	61.3	10.9	13.5	217	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	28/06/2019	29.4	65.1	12.8	14.4	240	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	01/07/2019	24.5	60.3	12.4	15.2	230	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	02/07/2019	27.7	62.8	11.8	14.3	241	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	10/07/2019	28.4	61.2	12.6	15.8	224	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	11/07/2019	31.4	63.1	13.1	15.0	235	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	15/07/2019	28.8	64.4	14.2	16.6	221	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	16/07/2019	31.2	60.7	12.9	14.9	236	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	24/07/2019	24.1	59.3	11.4	13.5	219	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	27/07/2019	27.5	62.9	13.4	15.4	245	12.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	29/07/2019	29.6	58.2	14.1	16.2	227	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	30/07/2019	27.3	60.5	12.5	15.7	241	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	09/08/2019	26.3	62.6	11.5	14.4	236	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	10/08/2019	29.5	65.1	12.2	15.3	247	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	12/08/2019	30.2	63.5	13.7	15.0	230	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	13/08/2019	33.2	65.4	12.2	14.2	241	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	22/08/2019	30.6	66.2	13.3	15.8	257	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	23/08/2019	33.0	63.0	12.0	14.1	242	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	26/08/2019	25.9	61.6	11.0	13.1	225	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	27/08/2019	29.3	65.2	12.5	14.6	251	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	06/09/2019	24.4	57.6	10.2	13.1	225	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	07/09/2019	25.3	59.6	11.5	13.5	236	9.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	09/09/2019	28.3	61.7	12.6	14.6	245	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	11/09/2019	32.1	63.5	13.0	15.1	247	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	19/09/2019	28.7	64.4	14.1	16.3	264	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	21/09/2019	31.2	61.5	12.8	14.5	248	8.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	23/09/2019	24.2	64.2	11.8	13.6	234	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	24/09/2019	27.4	63.4	13.3	15.5	257	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**24.1**	**57.6**	**10.2**	**13.1**	**215**	**8.2**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**33.2**	**68.5**	**14.2**	**16.6**	**264**	**13.0**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**29.0**	**63.0**	**12.4**	**14.7**	**235**	**10.9**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**33.1**	**67.4**	**14.2**	**16.5**	**257**	**12.6**	**<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**	**C6H6**
1	01/04/2019	27.5	56.7	11.5	14.2	238	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	02/04/2019	29.1	52.1	12.6	15.9	225	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	11/04/2019	27.5	60.3	11.3	13.6	231	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	12/04/2019	25.1	57.0	12.1	15.1	211	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	15/04/2019	30.6	59.3	13.2	16.0	235	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	16/04/2019	27.4	61.9	12.6	15.2	243	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	25/04/2019	24.3	57.6	11.6	14.0	236	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	26/04/2019	31.6	62.5	13.2	15.2	234	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	29/04/2019	29.2	61.8	11.8	13.6	226	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	30/04/2019	31.0	58.6	12.9	15.6	242	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	09/05/2019	30.1	60.1	12.8	15.1	226	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	10/05/2019	27.6	55.4	11.2	13.4	218	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	13/05/2019	29.8	63.7	10.8	13.0	223	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	14/05/2019	27.5	60.3	12.4	14.9	204	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	23/05/2019	33.2	57.6	11.7	13.4	227	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	24/05/2019	29.8	64.2	12.0	15.2	236	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	27/05/2019	26.8	59.4	10.6	12.7	225	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	28/05/2019	32.6	65.8	11.8	13.9	227	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	06/06/2019	32.3	63.1	11.8	14.2	217	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	07/06/2019	29.7	58.2	10.5	13.1	211	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	10/06/2019	32.5	64.1	13.0	15.6	214	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	11/06/2019	29.6	63.1	11.1	13.7	197	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	20/06/2019	30.4	60.5	13.2	16.1	218	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	21/06/2019	25.1	54.3	10.7	13.5	229	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	24/06/2019	31.5	60.5	11.4	14.0	221	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	25/06/2019	35.2	63.5	13.0	16.3	220	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	03/07/2019	30.4	59.3	12.1	15.1	223	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	04/07/2019	28.0	56.0	11.1	13.9	232	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	08/07/2019	30.7	62.3	12.5	15.2	220	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	09/07/2019	27.9	60.9	11.7	14.5	202	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	17/07/2019	28.5	58.2	13.9	15.3	225	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	18/07/2019	23.4	52.1	11.3	13.8	234	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	22/07/2019	29.6	58.5	12.2	14.9	228	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	23/07/2019	33.5	61.3	13.6	15.6	224	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	01/08/2019	29.2	57.7	11.0	14.2	218	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	02/08/2019	26.8	54.4	10.3	13.0	227	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	05/08/2019	30.1	60.3	11.4	14.3	215	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	07/08/2019	26.7	59.3	10.6	13.6	197	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	16/08/2019	27.3	56.6	12.8	14.4	243	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	17/08/2019	23.0	50.5	10.2	12.9	229	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	19/08/2019	28.4	56.9	11.1	13.2	223	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	20/08/2019	31.7	59.7	12.5	14.9	219	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	29/08/2019	25.6	55.6	10.2	13.0	236	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	30/08/2019	27.8	58.4	12.0	14.2	228	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	02/09/2019	24.6	55.8	12.1	14.0	224	8.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	03/09/2019	25.7	52.5	11.2	14.1	215	9.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	12/09/2019	27.6	56.3	12.3	15.7	221	8.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	14/09/2019	25.6	57.4	11.5	14.7	203	9.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	16/09/2019	26.2	54.7	13.2	15.8	249	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	17/09/2019	22.3	48.6	11.1	14.0	235	8.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	27/09/2019	27.3	55.0	12.0	14.3	229	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	01/04/2019	27.5	56.7	11.5	14.2	238	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**22.3**	**48.6**	**10.2**	**12.7**	**197**	**8.2**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**35.2**	**65.8**	**13.9**	**16.3**	**249**	**12.2**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**28.5**	**58.4**	**11.8**	**14.4**	**224**	**10.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**33.5**	**64.2**	**13.6**	**16.1**	**243**	**12.1**	**<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**	**C6H6**
1	01/04/2019	27.2	61.2	10.7	14.3	237	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	02/04/2019	28.7	54.5	12.7	15.1	225	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	11/04/2019	26.5	56.4	12.2	16.1	232	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	12/04/2019	27.4	57.0	10.8	15.3	223	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	15/04/2019	28.7	58.9	11.6	15.5	232	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	16/04/2019	29.4	59.4	11.2	14.4	235	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	25/04/2019	30.9	56.8	13.1	17.5	247	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	26/04/2019	28.5	57.7	12.0	16.4	256	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	29/04/2019	27.3	61.3	13.5	17.3	241	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	30/04/2019	29.9	61.9	12.9	17.0	265	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	09/05/2019	29.7	59.4	11.2	13.2	229	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	10/05/2019	31.1	62.1	12.2	16.1	218	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	13/05/2019	29.2	57.4	10.7	13.5	223	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	14/05/2019	27.6	60.3	11.4	14.0	216	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	23/05/2019	31.3	62.3	10.1	13.8	221	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	24/05/2019	28.4	58.3	12.0	15.9	228	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	27/05/2019	27.5	60.2	11.5	15.8	237	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	28/05/2019	29.4	61.0	10.6	14.9	249	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	06/06/2019	26.2	60.2	9.8	12.5	221	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	07/06/2019	28.1	57.6	10.9	13.6	211	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	10/06/2019	27.1	60.4	12.1	14.4	214	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	11/06/2019	29.7	58.2	10.1	12.8	212	9.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	20/06/2019	27.3	60.1	9.3	12.0	212	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	21/06/2019	25.4	56.4	10.7	14.7	240	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	24/06/2019	29.8	59.4	10.5	13.4	227	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	25/06/2019	30.2	56.4	12.1	15.2	231	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	03/07/2019	24.3	57.8	10.5	13.4	231	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	04/07/2019	26.4	55.4	11.5	14.4	216	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	08/07/2019	25.4	58.3	12.3	15.3	221	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	09/07/2019	28.0	56.0	11.1	14.2	217	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	17/07/2019	25.7	57.8	10.5	13.2	219	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	18/07/2019	23.7	54.2	11.3	16.2	245	10.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	22/07/2019	27.8	57.1	11.2	14.3	233	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	23/07/2019	28.5	53.9	12.7	16.0	236	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	01/08/2019	23.3	55.2	11.3	14.0	241	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	02/08/2019	26.0	51.9	12.1	15.1	227	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	05/08/2019	24.4	56.9	10.5	13.8	231	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	07/08/2019	25.3	52.5	11.9	13.4	228	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	16/08/2019	24.7	56.9	11.3	14.2	225	9.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	17/08/2019	21.0	53.1	12.4	15.9	251	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	19/08/2019	26.9	55.8	9.9	13.0	239	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	20/08/2019	23.6	52.6	11.6	15.2	242	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	29/08/2019	24.6	54.6	10.1	13.6	237	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	30/08/2019	26.1	55.1	11.1	14.4	227	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	02/09/2019	24.5	53.6	11.5	13.6	229	8.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	03/09/2019	26.2	50.3	10.3	13.5	233	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	12/09/2019	25.6	52.3	11.3	14.2	237	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	14/09/2019	26.5	50.9	12.7	14.5	228	8.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	16/09/2019	25.9	55.3	12.1	15.3	231	9.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	17/09/2019	27.5	51.5	11.5	13.6	257	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	27/09/2019	23.5	54.2	10.7	14.1	245	8.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	28/09/2019	24.8	50.4	12.4	16.3	236	9.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**21.0**	**50.3**	**9.3**	**12.0**	**211**	**8.0**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**31.3**	**62.3**	**13.5**	**17.5**	**265**	**12.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**27.0**	**56.7**	**11.4**	**14.6**	**232**	**10.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**31.1**	**62.1**	**13.1**	**17.3**	**257**	**12.2**	**<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-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**	**C6H6**
1	01/04/2019	28.1	58.7	12.3	16.7	258	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	02/04/2019	30.6	56.4	13.9	18.2	241	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	11/04/2019	28.5	60.3	11.7	15.6	253	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	12/04/2019	30.8	57.9	13.4	18.4	247	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	15/04/2019	29.3	62.4	12.3	15.4	255	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	16/04/2019	31.2	58.7	14.3	17.6	247	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	25/04/2019	30.3	69.5	15.3	18.7	271	12.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	26/04/2019	28.7	68.0	16.4	19.9	267	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	29/04/2019	30.4	65.4	13.6	18.1	273	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	30/04/2019	31.5	68.8	13.2	17.4	250	12.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	09/05/2019	30.6	62.1	11.2	15.3	249	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	10/05/2019	33.0	59.7	12.5	16.9	234	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	13/05/2019	31.3	63.8	13.2	14.2	245	13.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	14/05/2019	29.4	61.2	11.7	17.1	240	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	23/05/2019	30.5	58.9	12.4	14.2	247	12.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	24/05/2019	34.5	62.0	12.9	14.5	237	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	27/05/2019	29.1	72.7	13.6	16.5	262	13.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	28/05/2019	31.1	71.3	14.7	17.2	259	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	06/06/2019	32.8	65.2	12.1	14.3	238	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	07/06/2019	29.5	62.5	11.2	15.7	227	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	10/06/2019	27.6	57.6	13.2	16.0	255	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	11/06/2019	31.5	64.0	12.0	15.9	233	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	20/06/2019	28.4	61.7	10.8	13.8	250	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	21/06/2019	32.2	64.8	11.6	14.2	230	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	24/06/2019	26.8	68.6	12.1	15.2	246	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	25/06/2019	32.2	63.4	13.4	16.0	256	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	03/07/2019	29.5	62.8	10.8	15.2	244	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	04/07/2019	27.8	60.3	11.8	16.5	232	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	08/07/2019	25.7	55.4	13.7	16.9	261	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	09/07/2019	29.8	61.8	12.6	16.7	238	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	17/07/2019	26.6	59.2	11.5	14.8	256	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	18/07/2019	30.5	62.6	12.2	15.0	235	10.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	22/07/2019	25.2	66.3	14.0	16.1	252	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	23/07/2019	30.3	61.2	11.4	16.8	260	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	01/08/2019	28.6	60.4	13.1	16.0	234	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	02/08/2019	25.6	58.5	11.1	15.6	224	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	05/08/2019	24.8	54.2	12.8	14.6	212	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	07/08/2019	28.9	58.4	11.9	13.9	236	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	16/08/2019	25.7	55.4	13.6	16.5	218	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	17/08/2019	29.2	60.8	11.5	14.1	227	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	19/08/2019	24.3	64.2	13.3	15.2	213	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	20/08/2019	29.2	59.4	10.7	14.3	230	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	29/08/2019	26.1	60.4	11.4	13.8	225	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	30/08/2019	28.1	63.1	12.4	14.6	216	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	02/09/2019	26.5	58.6	13.9	15.3	212	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	03/09/2019	24.9	61.5	11.9	14.2	230	8.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	12/09/2019	25.4	63.1	13.6	15.5	220	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	14/09/2019	27.7	66.3	12.7	14.8	242	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	16/09/2019	30.2	58.4	14.4	17.4	224	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	17/09/2019	27.6	62.4	12.3	15.0	233	8.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	27/09/2019	25.3	62.4	14.1	16.1	219	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	28/09/2019	28.0	57.6	11.5	15.2	236	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**24.3**	**54.2**	**10.7**	**13.8**	**212**	**8.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**34.5**	**72.7**	**16.4**	**19.9**	**273**	**13.2**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**28.9**	**61.9**	**12.7**	**15.8**	**240**	**11.0**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**33.0**	**71.3**	**15.3**	**18.7**	**271**	**13.0**	**<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	04/04/2019	29.3	60.6	10.5	14.2	225	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	05/04/2019	27.3	63.2	11.0	15.2	231	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	08/04/2019	30.8	67.8	12.2	16.1	243	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	09/04/2019	29.6	70.1	11.3	14.8	228	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	18/04/2019	26.1	65.1	11.3	13.9	209	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	19/04/2019	27.6	62.5	10.1	12.1	221	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	22/04/2019	27.7	63.5	11.5	13.5	252	12.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	23/04/2019	25.8	68.4	10.4	13.2	242	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	02/05/2019	31.8	64.1	11.4	13.6	217	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	03/05/2019	28.2	66.5	9.6	12.5	224	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	06/05/2019	32.1	71.2	10.7	14.7	235	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	07/05/2019	27.4	73.4	9.9	13.5	221	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	16/05/2019	29.4	68.5	11.6	14.1	201	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	17/05/2019	30.6	65.8	11.2	13.5	214	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	20/05/2019	28.1	67.2	12.1	15.2	244	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	21/05/2019	28.3	71.7	10.8	12.8	235	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	30/05/2019	31.5	69.8	12.6	14.6	205	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	31/05/2019	29.7	71.5	10.5	12.8	211	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	03/06/2019	29.4	67.2	12.3	14.4	208	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	04/06/2019	26.1	64.2	10.4	13.6	234	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	13/06/2019	30.2	66.1	11.5	13.3	225	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	14/06/2019	29.4	63.2	12.0	15.0	214	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	17/06/2019	30.3	71.5	10.2	13.1	250	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	18/06/2019	26.4	68.6	12.5	14.3	226	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	27/06/2019	28.4	71.2	11.6	13.7	234	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	28/06/2019	26.3	69.4	12.1	14.0	241	9.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	01/07/2019	27.5	64.8	12.8	15.3	215	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	02/07/2019	24.4	62.0	11.0	14.4	227	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	10/07/2019	28.4	63.7	12.2	15.1	231	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	11/07/2019	27.7	61.0	12.6	14.1	219	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	15/07/2019	28.2	69.2	10.9	13.6	224	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	16/07/2019	24.7	66.4	13.1	15.1	231	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	24/07/2019	26.5	68.8	12.5	14.9	244	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	27/07/2019	24.6	67.2	12.7	14.8	229	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	29/07/2019	26.3	65.2	13.3	16.1	241	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	30/07/2019	27.2	63.8	12.1	14.8	236	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	09/08/2019	25.7	62.7	11.5	14.4	223	9.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	10/08/2019	22.6	59.9	12.1	15.2	235	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	12/08/2019	26.6	61.6	11.4	14.2	239	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	13/08/2019	25.9	60.2	12.9	15.7	227	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	22/08/2019	26.4	67.6	11.3	14.2	241	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	23/08/2019	22.9	64.3	12.3	15.1	239	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	26/08/2019	24.7	66.7	11.7	14.0	256	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	27/08/2019	22.9	65.1	11.9	13.2	237	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	06/09/2019	23.6	60.8	12.3	14.3	231	8.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	07/09/2019	21.8	57.6	11.8	13.4	241	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	09/09/2019	25.5	59.7	12.2	14.1	245	8.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	11/09/2019	24.8	58.3	11.5	13.9	233	9.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	19/09/2019	25.3	65.7	12.1	14.5	247	8.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	21/09/2019	21.8	62.4	13.1	15.2	245	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	23/09/2019	25.1	64.8	11.8	13.6	262	8.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	24/09/2019	24.6	63.2	12.7	14.1	243	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**21.8**	**57.6**	**9.6**	**12.1**	**201**	**8.2**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**32.1**	**73.4**	**13.3**	**16.1**	**262**	**12.6**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**27.0**	**65.5**	**11.7**	**14.2**	**231**	**10.8**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**31.8**	**71.7**	**13.1**	**16.1**	**256**	**12.5**	**<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

AAQ-6 Islampeta village													
Sr.No	**Monitoring Date**	**PM2.5**	**PM10**	**SO_2**	**NO_2**	**CO**	**O_3**	**NH_3**	**Pb**	**As**	**Ni**	**Bap**	**C6H6**
1	04/04/2019	28.7	59.2	11.3	14.1	221	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	05/04/2019	26.4	54.5	11.9	15.1	219	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	08/04/2019	27.8	56.8	10.7	14.5	227	12.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	09/04/2019	29.4	55.4	11.4	14.5	223	13.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	18/04/2019	28.3	57.4	10.5	12.5	218	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	19/04/2019	30.2	58.1	11.0	12.8	239	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	22/04/2019	27.1	60.3	10.2	13.1	243	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	23/04/2019	27.5	58.5	10.8	12.6	258	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	02/05/2019	27.5	62.7	11.1	13.6	213	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	03/05/2019	32.0	57.8	10.5	12.4	242	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	06/05/2019	30.4	60.2	11.6	14.0	219	11.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	07/05/2019	31.8	58.7	10.0	13.2	223	12.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	16/05/2019	30.6	60.8	11.2	12.8	209	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	17/05/2019	32.6	61.4	10.0	12.6	232	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	20/05/2019	29.8	64.2	10.6	13.2	248	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	21/05/2019	31.4	61.8	11.2	13.6	251	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	30/05/2019	29.5	63.2	10.3	14.0	217	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	31/05/2019	31.2	61.7	11.4	13.6	241	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	03/06/2019	29.8	58.4	10.6	12.2	204	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	04/06/2019	30.2	60.6	11.0	13.2	235	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	13/06/2019	26.1	59.4	10.2	13.8	211	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	14/06/2019	28.4	61.5	9.3	12.0	216	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	17/06/2019	31.2	62.4	10.5	12.6	201	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	18/06/2019	30.2	60.1	9.2	13.2	225	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	27/06/2019	27.4	62.4	11.2	13.8	238	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	28/06/2019	29.4	59.5	9.9	12.4	243	9.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	01/07/2019	27.8	56.1	11.3	13.1	210	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	02/07/2019	28.5	58.4	9.5	12.7	240	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	10/07/2019	24.3	57.3	10.9	14.7	217	9.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	11/07/2019	26.7	59.3	11.5	13.2	221	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	15/07/2019	29.4	60.4	11.1	13.5	251	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	16/07/2019	28.7	57.9	9.8	12.8	230	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	24/07/2019	25.5	60.2	12.1	14.5	225	10.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	27/07/2019	27.7	57.3	10.5	13.2	248	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	29/07/2019	30.2	59.4	12.3	14.4	221	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	30/07/2019	28.3	57.5	10.6	13.9	235	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	09/08/2019	25.6	54.1	12.1	14.0	223	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	10/08/2019	27.3	56.4	10.3	13.6	235	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	12/08/2019	23.6	55.3	11.7	14.2	212	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	13/08/2019	25.5	57.3	13.1	15.1	216	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	22/08/2019	28.7	58.2	11.9	14.4	246	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	23/08/2019	27.5	55.9	10.6	13.7	225	10.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	26/08/2019	24.3	58.2	12.9	15.2	243	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	27/08/2019	26.5	55.3	11.3	14.1	234	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	06/09/2019	23.3	52.3	13.0	15.1	230	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	07/09/2019	24.6	54.6	11.2	14.7	242	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	09/09/2019	22.4	53.6	12.6	15.3	219	8.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	11/09/2019	24.3	55.5	11.6	13.9	223	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	19/09/2019	27.5	56.8	12.8	15.5	253	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	21/09/2019	26.3	54.1	11.5	14.8	232	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	23/09/2019	23.1	56.4	13.8	16.0	250	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	24/09/2019	25.3	54.3	12.2	15.2	241	9.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**22.4**	**52.3**	**9.2**	**12.0**	**201**	**8.4**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**32.6**	**64.2**	**13.8**	**16.0**	**258**	**13.3**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**27.8**	**58.3**	**11.2**	**13.8**	**230**	**10.8**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**32.0**	**63.2**	**13.1**	**15.5**	**253**	**12.6**	**<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**	**C6H6**
1	01/04/2019	31.2	67.2	12.1	15.6	245	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	02/04/2019	28.4	72.3	11.1	14.7	241	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	11/04/2019	30.5	65.2	12.5	15.1	229	13.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	12/04/2019	28.2	66.6	14.1	16.8	238	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	15/04/2019	27.8	67.4	11.3	14.3	223	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	16/04/2019	28.7	73.1	10.0	11.6	234	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	25/04/2019	28.5	68.2	12.5	15.2	251	13.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	26/04/2019	29.8	70.6	10.5	13.2	250	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	29/04/2019	30.7	65.4	11.6	14.6	235	13.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	30/04/2019	29.6	68.7	12.3	14.6	219	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	09/05/2019	33.8	70.6	10.6	14.2	237	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	10/05/2019	35.6	75.6	10.5	15.1	239	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	13/05/2019	29.5	68.8	11.3	13.5	221	12.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	14/05/2019	35.4	73.6	13.5	17.2	236	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	23/05/2019	30.5	72.1	10.1	13.6	214	13.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	24/05/2019	33.3	69.4	12.6	14.2	220	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	27/05/2019	29.4	71.6	11.2	13.6	243	12.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	28/05/2019	34.4	73.9	12.7	14.0	236	13.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	06/06/2019	30.2	73.6	11.6	13.8	218	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	07/06/2019	34.2	70.3	12.0	14.6	225	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	10/06/2019	31.9	73.9	12.5	15.0	213	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	11/06/2019	30.4	69.4	11.6	13.5	229	11.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	20/06/2019	33.1	73.2	10.5	12.8	236	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	21/06/2019	35.4	70.2	11.3	13.0	213	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	24/06/2019	31.5	73.6	10.2	12.6	240	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	25/06/2019	36.5	71.6	11.4	14.0	229	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	03/07/2019	28.4	71.3	12.3	14.7	224	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	04/07/2019	32.5	68.1	11.6	15.4	230	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	08/07/2019	30.1	71.6	13.2	15.6	219	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	09/07/2019	28.7	67.2	12.2	14.3	234	12.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	17/07/2019	31.3	70.8	11.5	13.8	242	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	18/07/2019	33.7	68.0	11.9	14.1	218	10.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	22/07/2019	29.7	71.2	10.9	13.0	246	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	23/07/2019	34.8	69.4	12.0	14.8	234	12.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	01/08/2019	26.8	68.0	12.9	14.2	218	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	02/08/2019	30.9	65.9	12.2	15.0	224	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	05/08/2019	28.5	67.5	13.8	15.4	213	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	07/08/2019	27.1	65.0	12.8	14.2	228	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	16/08/2019	29.7	68.1	11.1	13.3	237	7.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	17/08/2019	33.7	65.8	12.5	14.5	212	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	19/08/2019	28.1	67.4	11.5	13.2	215	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	20/08/2019	33.2	65.3	12.6	14.3	228	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	29/08/2019	29.5	67.1	11.8	13.8	236	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	30/08/2019	32.4	68.0	12.4	14.0	221	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	02/09/2019	24.6	63.6	11.6	13.8	225	7.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	03/09/2019	28.1	64.0	12.3	14.3	231	8.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	12/09/2019	27.0	65.6	12.6	14.8	220	9.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	14/09/2019	25.6	63.1	13.2	15.1	235	7.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	16/09/2019	28.2	66.2	12.0	14.2	244	8.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	17/09/2019	30.5	63.9	13.4	15.0	219	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	27/09/2019	26.6	65.5	12.4	14.1	222	8.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	28/09/2019	31.7	63.4	13.5	15.2	235	8.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**24.6**	**63.1**	**10.0**	**11.6**	**212**	**7.6**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**36.5**	**75.6**	**14.1**	**17.2**	**251**	**13.7**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**30.6**	**68.8**	**12.0**	**14.3**	**229**	**10.8**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**35.6**	**73.9**	**13.8**	**16.8**	**250**	**13.5**	**<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

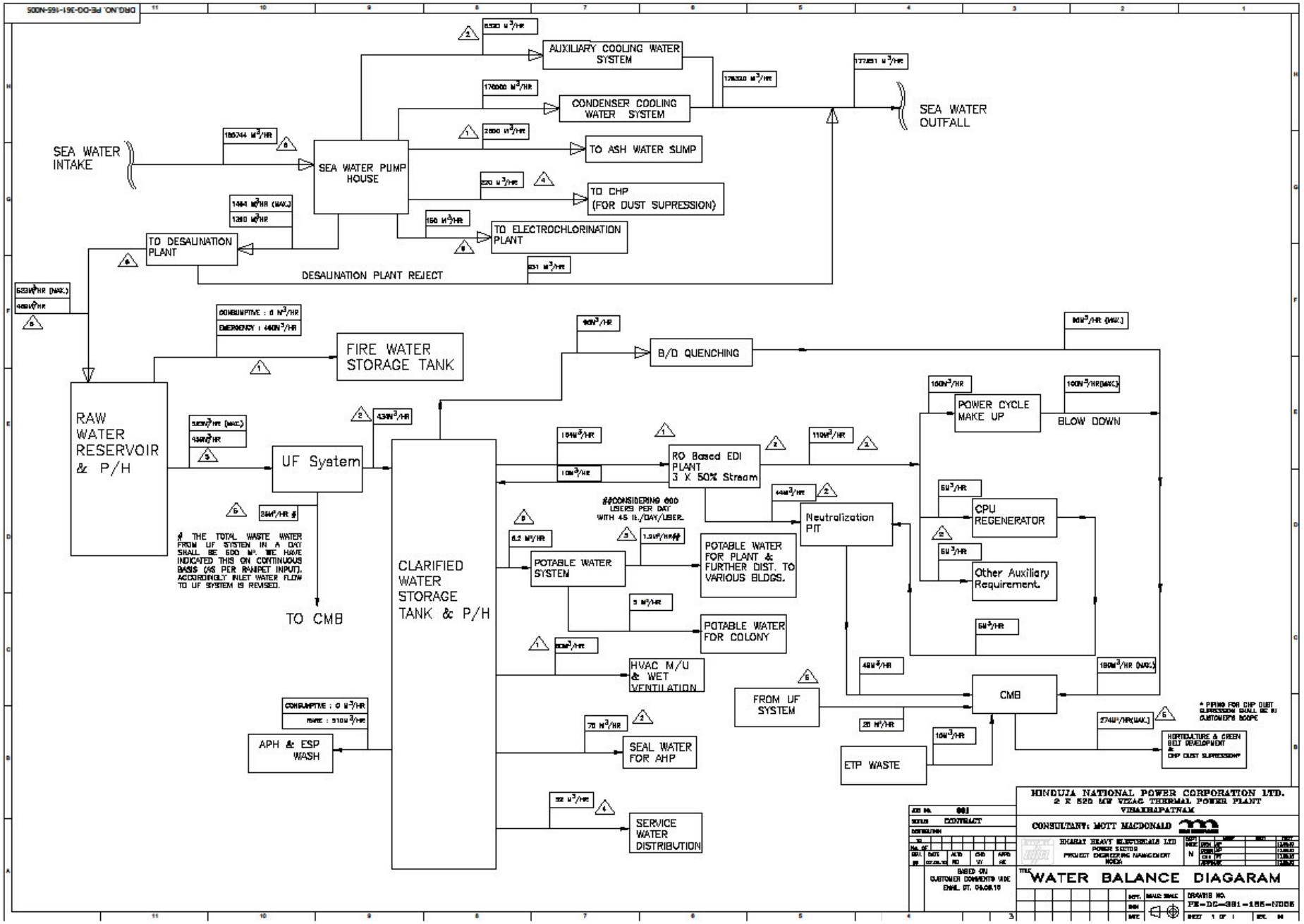
AAQ-8 Kalapaka village													
Sr.No	**Monitoring Date**	**PM2.5**	**PM10**	**SO_2**	**NO_2**	**CO**	**O_3**	**NH_3**	**Pb**	**As**	**Ni**	**Bap**	**C6H6**
1	04/04/2019	30.7	66.6	12.2	15.7	235	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
2	05/04/2019	27.4	69.4	11.5	14.9	236	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
3	08/04/2019	29.8	65.1	10.7	14.6	249	12.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
4	09/04/2019	27.2	62.3	12.3	15.3	237	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
5	18/04/2019	26.5	68.4	12.5	14.5	239	12.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
6	19/04/2019	25.8	59.4	9.3	12.1	249	11.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
7	22/04/2019	27.9	62.8	11.3	13.5	229	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
8	23/04/2019	26.8	66.4	11.8	14.2	243	12.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
9	02/05/2019	32.6	70.2	11.7	14.3	227	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
10	03/05/2019	28.4	71.6	10.1	13.6	245	9.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
11	06/05/2019	30.3	68.5	11.8	13.2	229	11.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
12	07/05/2019	29.6	65.6	12.3	14.0	230	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
13	16/05/2019	27.6	71.8	11.2	13.1	231	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
14	17/05/2019	28.2	62.7	10.2	14.2	244	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
15	20/05/2019	30.5	66.3	9.8	12.4	221	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
16	21/05/2019	29.2	69.7	10.4	13.6	236	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
17	30/05/2019	32.6	70.6	12.1	14.5	248	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
18	31/05/2019	30.4	65.3	11.5	13.7	217	10.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
19	03/06/2019	25.1	61.2	10.2	12.9	218	9.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
20	04/06/2019	29.4	68.6	11.5	14.0	238	11.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
21	13/06/2019	33.6	65.3	10.4	12.6	221	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
22	14/06/2019	31.7	68.4	11.0	13.6	223	11.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
23	17/06/2019	29.8	69.4	10.6	12.6	226	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
24	18/06/2019	30.3	65.5	10.2	14.1	237	10.9	<20	<1.0	<1.0	<1.0	<0.01	<0.01
25	27/06/2019	26.1	69.4	11.6	13.9	211	9.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
26	28/06/2019	33.2	66.4	9.5	12.8	229	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
27	01/07/2019	23.3	58.8	10.9	13.8	224	10.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
28	02/07/2019	27.7	66.4	12.1	14.8	240	11.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
29	10/07/2019	31.6	62.9	11.2	13.5	227	11.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
30	11/07/2019	30.0	66.2	11.6	14.4	228	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
31	15/07/2019	28.2	67.1	11.5	13.7	232	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
32	16/07/2019	28.6	63.3	10.8	13.2	240	11.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
33	24/07/2019	24.3	67.3	12.3	14.5	218	10.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
34	27/07/2019	31.5	64.2	10.1	13.6	234	10.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
35	29/07/2019	29.4	63.7	12.5	15.3	224	11.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
36	30/07/2019	27.5	60.5	11.7	14.1	237	10.2	<20	<1.0	<1.0	<1.0	<0.01	<0.01
37	09/08/2019	25.1	56.6	10.8	12.9	215	9.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
38	10/08/2019	23.5	64.2	12.5	14.0	224	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
39	12/08/2019	26.4	60.7	11.4	13.5	218	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
40	13/08/2019	28.8	64.0	10.9	13.6	219	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
41	22/08/2019	30.3	64.9	12.3	14.6	223	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
42	23/08/2019	26.1	61.1	12.4	14.1	227	10.3	<20	<1.0	<1.0	<1.0	<0.01	<0.01
43	26/08/2019	23.1	65.5	11.5	13.7	209	9.7	<20	<1.0	<1.0	<1.0	<0.01	<0.01
44	27/08/2019	29.4	62.0	10.9	12.8	225	10.0	<20	<1.0	<1.0	<1.0	<0.01	<0.01
45	06/09/2019	23.5	54.7	11.7	13.6	221	8.5	<20	<1.0	<1.0	<1.0	<0.01	<0.01
46	07/09/2019	24.6	56.3	10.9	12.5	216	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
47	09/09/2019	22.7	58.8	11.2	13.0	224	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
48	11/09/2019	25.6	62.1	11.8	13.3	225	10.6	<20	<1.0	<1.0	<1.0	<0.01	<0.01
49	19/09/2019	27.6	63.0	10.6	12.9	235	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
50	21/09/2019	25.0	59.2	11.5	13.7	224	9.4	<20	<1.0	<1.0	<1.0	<0.01	<0.01
51	23/09/2019	22.0	63.6	12.4	14.8	215	8.8	<20	<1.0	<1.0	<1.0	<0.01	<0.01
52	24/09/2019	28.3	60.1	11.8	13.9	231	9.1	<20	<1.0	<1.0	<1.0	<0.01	<0.01
Minimum value		**22.0**	**54.7**	**9.3**	**12.1**	**209**	**8.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Maximum value		**33.6**	**71.8**	**12.5**	**15.7**	**249**	**12.3**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
Average value		**28.0**	**64.5**	**11.3**	**13.8**	**229**	**10.5**	**<20**	**<1.0**	**<1.0**	**<1.0**	**<0.01**	**<0.01**
98th Percentile		**33.2**	**71.6**	**12.5**	**15.3**	**249**	**12.2**	**<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



Annexure-III

Beach Profile StudyData

ANNEXURE-III
BEACH PROFILE DATA SHEET

BEACH PROFILE DATA SHEET FOR WEST 8.1 METERS FROM JETTY (4.54 mt AMSL)

Project Name : HNPCL		**Date : 21/04/2019**	
Profile ID : W 8.1		**Location : HNPCL Jetty W to 8.1 meters**	
Ref.Mark Latitude : N $17^0$33'17.6''		**Ref.Marl Longitude : E $83^0$08'24.9''**	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observer : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty embankment West side 8.1 meters and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore;	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	1.85	+ 05°20'	Reference point- ground cover vegetation
B-C	2.00	+ 08°50'	
C-D	4.20	+ 18°40'	Backshore with ground cover vegetation up to swash limit
D-E	2.55	+ 15°50'	Beach starting embankment platform
E-F	2.12	- 03°30'	Beach Sand
F-G	2.56	+ 17°50'	Beach Sand
G-H	4.72	- 02°20'	Beach Sand
H-I	1.90	+ 10°40'	Beach Sand
I-J	5.86	+ 04°40'	
J-K	7.23	+ 03°10'	Beach Sand
K-L	8.41	+ 02°40'	High tide
L-M	7.27	+ 01°30'	Low tide
M-N	3.86	+ 01°50'	Sea-Bay of Bengal

BEACH PROFILE DATA SHEET FOR WEST 100 METERS FROM JETTY (4.40 mt AMSL)

Project Name : HNPCL		**Date : 24/04/2019**	
Profile ID : W 100		**Location : HNPCL Jetty W to 100 meters**	
Ref.Mark Latitude : N $17^0$33'16.5''		**Ref.Marl Longitude : E** $83^0$08'21.9''	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observer : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty embankment W 8.1 to 100 meters west and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	2.10	+ 04 ^{0}30'	Reference point- ground cover vegetation around
B-C	5.23	+ 14 ^{0}10'	Backshore with ground cover vegetation up to swash limit
C-D	4.10	+ $02^0$30'	Beach starting
D-E	4.25	+ $05^0$40'	Beach sand
E-F	8.44	+ 03°20'	Beach sand
F-G	7.80	+ $01^0$40'	Beach sand
G-H	6.74	+ 01°50'	Beach sand
H-I	5.90	+ 02 ^{0}30'	Beach sand
I-J	6.46	+ $02^0$20'	Beach sand
J-K	7.51	+ $01^0$50'	High tide
K-L	2.50	+ $01^0$30'	Low tide
L-M	3.10	+ $01^0$50'	Sea-Bay of Bengal

ANNEXURE-III
BEACH PROFILE DATA SHEET

BEACH PROFILE DATA SHEET FOR WEST 250 METERS FROM JETTY (3.6 mt AMSL)

Project Name : HNPCL		**Date : 21/04/2019**	
Profile ID : W 250		**Location : HNPCL Jetty W to 250 meters**	
Ref.Mark Latitude : N $17^0$33'15.2''		**Ref.Marl Longitude : E** $83^0$08'16.9''	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observer : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty W 100 to 250 meters west and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	4.10	+04°20'	Reference point- ground cover vegetation around
B-C	4.55	- 02°10'	Beach sand clean
C-D	3.20	+17°30'	Beach sand
D-E	4.54	+ $16^0$40'	Beach sand
E-F	6.40	+ 02°50'	Beach sand
F-G	14.32	+ 04°20'	Beach sand
G-H	9.64	+ 02°50'	
H-I	9.24	+ $0^0$50'	High tide
I-J	8.20	+ $1^0$10'	Low tide
J-K	4.85	+ $1^0$40'	Sea-Bay of Bengal

BEACH PROFILE DATA SHEET FOR WEST 500 METERS FROM JETTY (3.5 mt AMSL)

Project Name : HNPCL		**Date : 21/04/2019**	
Profile ID : W 500		**Location : HNPCL Jetty W to 500 meters**	
Ref.Mark Latitude : N $17^0$33'13.0''		**Ref.Marl Longitude : E** $83^0$08'08.6''	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observer : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty W 250 to 500 meters west and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	1.82	- $00^0$40'	Reference point- ground cover vegetation around
B-C	2.80	+ $16^0$30'	
C-D	3.60	+ $04^0$20'	Beach Starting
D-E	8.20	+ 09°10'	Beach sand
E-F	5.40	+ 07°50'	Beach sand
F-G	5.85	+ 06°30'	Beach sand
G-H	4.43	+ 02°50'	Beach sand
H-I	10.10	+ $02^0$10'	High tide
I-J	4.80	+ $01^0$20'	Low tide
J-K	5.60	+ $01^0$50'	Sea-Bay of Bengal

ANNEXURE-III
BEACH PROFILE DATA SHEET

BEACH PROFILE DATA SHEET FOR EAST 7.1 METERS FROM JETTY (3.62 mt AMSL)

Project Name : HNPCL		**Date : 21/04/2019**	
Profile ID : E 7.1		**Location : HNPCL Jetty E to 7.1 meters**	
Ref.Mark Latitude : N $17^0$33'17.7"		**Ref.Marl Longitude : E** $83^0$08'26.3"	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observer : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty embankment No ground cover vegetation up to swash limit and clean beach sand in the shore; disturbed ground and construction/removed stone left around reference mark	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	1.82	+ 16 $^{0.}$ 30'	Reference Point - construction/removed stone left around Vegitation starts
B-C	1.93	+ 34 $^{0.}$ 50'	Beach sand (Vegitation ends)
C-D	2.01	+ 28 $^{0.}$ 20'	Beach sand
D-E	1.85	+ 31 $^{0.}$ 50'	Beach sand
E-F	3.29	+ 04 $^{0.}$ 40'	Beach sand
F-G	1.95	+ 11 $^{0.}$ 30'	Beach sand
G-H	4.12	+ 08 $^{0.}$ 10'	Beach sand
H-I	3.64	+ 06 $^{0.}$ 50'	High tide
I-J	7.53	+ 05 $^{0.}$ 30'	Low tide
J-K	6.88	+ 04 $^{0.}$ 50'	Sea-Bay of Bengal

BEACH PROFILE DATA SHEET FOR EAST 100 METERS FROM JETTY (3.31 mt AMSL)

Project Name : HNPCL		**Date : 21/04/2019**	
Profile ID : E 100		**Location : HNPCL Jetty E to 100 meters**	
Ref.Mark Latitude : N $17^0$33'18.6"		**Ref.Marl Longitude : E** $83^0$08'29.2"	
Ref.Mark Height (m) : 0 (Ground level)		**Eye Level from top of Ref.Mark (m) : 1.585**	
Observe : Mr. D.Tarakeswara rao (Env-Scientist)		**Observations :** Profile runs along jetty embankment E 7.1 to 100 meters East side and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore	
Beach Segment	**Length of Segment (m)**	**Slope Angle (Deg & Min)**	**Remarks**
A-B	1.79	- 06 ^{0}10'	Reference Point (Vegitation observed)
B-C	0.82	- 15°10'	Backshore with ground cover vegetation up to swash limit
C-D	1.34	- 15°30'	Beach sand (Vegitation ending)
D-E	2.10	+ 08°40'	Beach starting
E-F	3.65	+ 26°20'	Beach sand
F-G	5.23	+ 07°30'	Beach sand
G-H	6.19	+ 03^{0}30'	High tide
H-I	4.20	+ 02^{0}30'	Low tide
I-J	3.24	+ 01^{0}40'	Sea-Bay of Bengal

ANNEXURE-III
BEACH PROFILE DATA SHEET

BEACH PROFILE DATA SHEET FOR EAST 250 METERS FROM JETTY (5.32 mt AMSL)

Project Name : HNPCL	**Date : 21/04/2019**
Profile ID : E 250	**Location : HNPCL Jetty E to 250 meters**
Ref.Mark Latitude : N $17^0$33'20.2''	**Ref.Marl Longitude : E $83^0$08'34.0''**
Ref.Mark Height (m) : 0 (Ground level)	**Eye Level from top of Ref.Mark (m) : 1.585**
Observer : Mr. D.Tarakeswara rao (Env-Scientist)	**Observations :** Profile runs along jetty embankment E 100 to 250 meters East side and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore

Beach Segment	Length of Segment (m)	Slope Angle (Deg & Min)	Remarks
A-B	2.55	+ 01°30'	Reference Point - ground cover vegetation around
B-C	2.82	+ $06^0$10'	Backshore with ground cover vegetation up to swash limit
C-D	5.24	+ $27^0$50'	Beach sand (Vegitation ending)
D-E	8.23	+ 02°50'	Beach starting
E-F	6.98	+ 05°40'	Beach sand
F-G	9.83	+ 05°10'	High tide
G-H	6.43	+ 02°10'	Low tide
H-I	4.92	+ 01°30'	Sea-Bay of Bengal

BEACH PROFILE DATA SHEET FOR EAST 500 METERS FROM JETTY (3.31 mt AMSL)

Project Name : HNPCL	**Date : 21/04/2019**
Profile ID : E 500	**Location : HNPCL Jetty E to 500 meters**
Ref.Mark Latitude : N $17^0$33'22.2''	**Ref.Marl Longitude : E $83^0$08'42.4''**
Ref.Mark Height (m) : 0 (Ground level)	**Eye Level from top of Ref.Mark (m) : 1.585**
Observer : Mr. D.Tarakeswara rao (Env-Scientist)	**Observations :** Profile runs along jetty embankment E 250 to 500 meters to East side and Goat's Foot Creeper & Chicken Weed as ground cover vegetation up to swash limit and clean beach sand in the shore

Beach Segment	Length of Segment (m)	Slope Angle (Deg & Min)	Remarks
A-B	2.30	+ $02^{0.}$ 20'	Reference Point - ground cover vegetation around
B-C	2.75	+ $24^{0.}$ 30'	Backshore with ground cover vegetation up to swash limit
C-D	2.63	+ $11^{0.}$ 30'	Beach starting
D-E	3.54	+ $09^{0.}$ 30'	Beach sand
E-F	6.56	+ $05^{0.}$ 50'	Beach sand
F-G	8.20	+ $05^{0.}$ 10'	
G-H	5.31	+ $01^{0.}$ 10'	
H-I	10.05	- $01^{0.}$ 40'	
I-J	5.82	+ $02^{0.}$ 40'	High tide
J-K	5.24	+ $03^{0.}$ 20'	
K-L	6.98	+ $03^{0.}$ 50'	Low tide
L-M	5.43	+ $02^{0.}$ 50'	Sea-Bay of Bengal