BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE BENCH AT CHENNAI

OA No.130 of 2024

IN THE MATTER OF:

BODDAPALLI APPA RAO & OTHERS ..... APPLICANT

VERSUS

UNION OF INDIA AND OTHERS

..... RESPONDENTS

REPORT FILED BY THE APPCB 3rd RESPONDENT

DATE- 06.07.2024

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ADVOCATE

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BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL SOUTHERN ZONE BENCH AT CHENNAI

Original Application No. 130 of 2024 (SZ)

IN THE MATTER OF:

Boddapalli Apparao & Others.

.....APPLCANT

VERSUS

Union of India and others

...RESPONDENTS

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It is certified that all the documents contained in the above annexure are true copies.

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Environmental Engineer,
A.P. Pollution Control Board,
Regional Office,
Visakhapatnam

Environmental Engineer
A.P Pollution Control Board
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Report on Original Application No.130 of 2024(SZ) before the Hon'ble National Green Tribunal Southern Bench, Chennai filed by Sri. Boddapalli Apparao & Others, Thadi Colony, Thadi, Anakapalli District, Andhra Pradesh against M/s. Visakha Pharmacity Limited (Formerly M/s. Ramky Pharmacity (India) Pvt. Ltd.,), JNPC, Parawada, Anakapalli District

It is to submit that Sri. Boddapalli Apparao & Others, Thadi Colony, Thadi, Anakapalli District has filed a case before the National Green Tribunal Southern Bench, Chennai in O.A.No. 130 of 2024(SZ).

The petitioner alleged the following:

i. Thadi village is adjacent to Jawaharlal Nehru Pharma City, Parawada, Lankelapalem which houses to major pharmaceutical companies.

ii. All these companies release gases into environment everyday which polluted the entire area.

iii. Deterioration Environment quality of surrounding villages of Thadi.

iv. Ground water is also fully polluted because of these industries, cannot find water now. There is no drinking water available.

v. Thadi village has become inhabitable because of pollution.

vi. Thadi villagers were promised to give rehabilitation to a new area by the government long ago. But nothing has been done till today.

vii. Objections for expansion of TSDF.

viii. No company has turned up to provide us with basic drinking water, hospitality even under their CSR activities,

ix. None of the departments work towards the betterment of their lives.

In this regard, the following is submitted for kind perusal:

1. M/s. Visakha Pharmacity Limited (Formerly M/s. Ramky Pharmacity (India) Pvt. Ltd.,), JNPC, Parawada, Anakapalli District was established in the year 2005, to setup a Pharma Park involving common infrastructure facilities viz., Power Plant – 100 MW, Multi Fuel – Gas/Coal/Oil, Power distribution (Substations /Transformers), Hazardous Waste Management (TSDF) – 2,00,000 TPA, Water Treatment Plant, Storage System, Water Distribution System Effluent / Sewerage network, CETP – 50 MLD, Storm Water Drainage, Common Boiler – 230 TPH, Common DG Set – 15 MW, incinerator – 1.5 TPH etc.

2. The APIIC allocated an area of 2143.0 Acres to establish pharma city in Parawada village, Anakapalli District. Out of 2143.0 Acres, 1429.31 acres have been allotted for development of industrial plots and the remaining 713.69 Acres is allotted for the common infrastructure facilities like Roads, Common utilities and green buffer area etc. So far, 104 industries are established and 94 Bulk drug & intermediates,

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Pharmaceuticals and Chemical units are in operation. The Source of water for pharmacity is Yeleru canal, supplied by Andhra Pradesh Industrial Infrastructure Corporation (APIIC).

3. The facility is having the following common facilities for treatment of the effluent generated by the member industries.

   i. Common Effluent Treatment Plan (CETP)
   ii. Treatment, Storage and Disposal Facility (TSDF)
   iii. Incinerator
   iv. Alternative Fuel & Raw material pre-processing facility (AFRF)

4. **Air pollution and control measures taken up by M/s. Visakha Pharmacity Limited and member industries located in M/s. Visakha Pharmacity Limited:**

M/s. Visakha Pharmacity Limited:

The main source of air pollution is boilers & fugitive emissions. M/s. Visakha Pharmacity Limited is having 3 x 10 TPH coal fired boilers (one boiler is standby.) All boilers stacks are provided with mechanical dust collectors followed by bag filters to control dust emissions. The facility provided online stack analyzers for continuously monitoring PM (Particulate Matter) parameter and connected to APPCB/CPCB website. While storing, handling and treating of effluents, the facility provided the following to control fugitive odor causing emissions:

a. All the effluent receiving storage tanks are covered with HDPE hoods followed by double stage scrubber.
b. As per the directions of APPCB, air stripper of MEE is replaced with Steam stripper.
c. Wet scrubbers are provided for the stacks attached to spray drier of MEE system and incinerator.

Member Industries:

All the pharma industries located in M/s. Visakha Pharmacity Limited have installed and operating mechanical dust collectors followed by bag filters as air pollution control equipment to control flue gas emissions from the boilers. The APPCB has stipulated stringent standard (100 mg/Nm^3) against standard of 115 mg/Nm^3.

Process emissions are controlled by installing multistage scrubbers and fugitive emissions controlled by pumping transfer of solvents through pipelines, centrifuge vents connected to the scrubbers and by installing vent condensers to bulk solvent storage tanks.

The industries have provided hood on the top of the effluent storage tanks and vent connected to the scrubbers to control odour nuisance in the surroundings.

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Monitoring of Ambient Air Quality by M/s. Visakha Pharmacity Limited through Continuous Ambient Air Quality Monitoring Stations:

The facility is having 3 online Continuous Ambient Air Quality Monitoring (CAAQM) stations for continuous monitoring the parameters VOC, NH3 & SO2(odour causing compounds) located at Tadi(V), Thanam(V) & SEZ Parawada. The online monitoring systems were connected to the web site of APPCB. If there are any exceedances recorded, the auto alerts will be generated and communicated to the facility for rectification. As per reports, the AAQ parameters viz., PM10, PM2.5, SO2, NOx, NH3 are within the NAAQ standards. Copy of the CAAQ Analysis Reports for the last one year is enclosed as **Annexure-I.**

5. Marine outfall Monitoring by APPCB:

The member industries located in Pharmacity are sending their effluents (High TDS & Low TDS effluents) to CETP through closed conveyance pipelines with digital flow meters to the CETP to treat the effluents in CETP. After treatment, the treated wastewater is stored in guard ponds and after confirming to the marine discharge standards, the treated wastewater is discharged into sea through marine outfall in presence of APPCB officials with lock & key system.

The consolidated Analysis Report of marine disposals into sea for the last two years is enclosed as **Annexure-II**. Out of 358 samples, 24 samples were rejected from Apr-2023 to Mar-2024, the rejection percentage is 6.7% only for the last one year. In case of the treated wastewater standards are not meeting the marine discharge standards, it will not be allowed for discharge into sea and sent back to CETP for re-treatment till comply with the marine discharge standards. No effluent discharges were observed from the industries in JN Pharmacity, Parawada.

6. NIO Studies on marine outfall:

APPCB conducted studies through National Institute of Oceanography (NIO), Visakhapatnam to assess the marine outfalls of different industries established in the areas between Pydibheemavaram and Nakkapalli of North Andhra Coast in the year 2011. The NIO submitted report in the year 2014 and it is reported that "it is concluded from the present results that the coastal waters studied are not affected by the discharge of industrial effluents through marine outfalls and the small changes noticed may be due to the seasonal variations of chemical constituents caused through run off and other local activities".

APPCB again conducted the study through NIO to carry out an assessment of the marine environment at and around the marine outfall points (MOP) of industries between Pydibhimavaram (Srikakulam district) and Kesavaram (Visakhapatam district) of north Andhra coast to ascertain cumulative effects, if any, on the ecology, water and sediment quality due to the discharge of treated effluents in to the coastal waters. Accordingly, CSIR-NIO has carried out field campaigns during pre-monsoon (February -March, 2018)

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and post monsoon (December, 2018) seasons in the coastal waters of north Andhra coast between Pydibhimavarm and Kesavaram for in-situ observations. The NIO submitted report to APPCB in 2020. Copy of the NIO report is herewith enclosed as **Annexure-III.**

Based on the recommendations of the NIO report, APPCB has issued instructions to the industry on 27.05.2022 to conduct monthly eco-toxicology tests on treated effluent, trace metals and major organic compounds present in the treated effluent by CSIR-National Institute of Oceanography (NIO), Visakhapatnam.

The facility approached NIO to conduct monthly reports and NIO conducted analysis of marine outfall disposal samples and Sea water samples at marine outfall in Sea. Reports are awaited.

7. Ground water quality monitoring in Tanam and Tadi Villages:

APPCB is monitoring ground water quality in Tanam & Tadi Villages. As per the analysis results, all the parameters are within the permissible limits for drinking water specifications except TDS, Total Alkalinity and Calcium concentrations in some samples occasionally. Copy of the Analysis Reports on ground water quality in Tanam & Tadi Villages are herewith enclosed as **Annexure-IV**.

The Andhra University conducted study on impact of ground water quality due to operations of CETP during the period from November 2020 to April,2021 within 10 km radius from the CETP. As per the study, it was concluded that "Water quality of groundwater is within the permissible limits of drinking water standards. At few places along the coast groundwater quality influenced by salt water intrusion." Copy of the AU report on Hydrology (Ground Water Assessment Studies) - 2021 is herewith enclosed as **Annexure-V.**

8. Treatment, Storage and Disposal Facility (TSDF):

M/s. Re Sustainability Limited is operating Common Hazardous Waste Management Facility at Sy.No. 183, 117, 161 and 54/P, JN Pharmacity, Parawada, Anakapalli District for safe and scientific disposal of hazardous waste. The total quantity of hazardous waste disposed in existing TSDF is 15,75,581 MT. As the existing TSDF is about to exhaust, the facility proposed for expansion of TSDF at Sy.No. 116 part of Thadi Village, Parawada Mandal duly conducting Environmental Impact Assessment study and approached SEIAA, MoEF&CC to obtain Environmental Clearance. The SEIAA issued standard Terms of Reference (TOR) with public hearing for Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only). Copy of the TOR is herewith enclosed as **Annexure-VI**. Public Hearing was conducted for the proposed project on 30.01.2024 and the facility has obtained Environmental Clearance from SEIAA, AP, MoEF&CC. Copy of the EC is herewith enclosed as **Annexure-VII**. The facility has adopted CPCB approved methodology for construction of secured landfill wherein the bottom of the landfill site is specially designed with different liners to avoid ground water contamination. The APPCB issued CTE to M/s. Coastal Waste Management Project, (A division of Re Sustainability

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Limited) in JN Pharmacity, Sy.No.116/P, JN Pharmacity, Parawada, Anakapalli District vide order dated 15.05.2024 for establishment of a common hazardous waste treatment, storage and disposal facility of 9,88,561.02 MT or 3,00,000 TPA (Direct Landfill – 1,50,000 TPA & Landfill after treatment - 1,50,000 TPA). Copy of the CTE Order is herewith enclosed as **Annexure-VIII.**

9. CSR activities: --

10. Rehabilitation works of the project (Pharma City, Parawada): --

11. Action Taken by APPCB:

1. The Board is regularly monitoring the common facilities and member industries in the pharmacity once in 6 months by officials of APPCB to verify the compliance status of the APPCB consent conditions / directions issued to the facility and the industries. Any violations found during the inspection, APPCB is reviewing the facility and industries before external advisory (Task Force) Committee Meeting and issuing directions to the industries time to time for strict compliance with Board conditions.
2. The Board issued directions to all the industries in the Pharmacity vide circular memo dated 26.08.2020 to avoid contaminated storm water discharges into the drains to avoid contamination of nearby water bodies. Copy of the directions dated 26.08.2020 is herewith enclosed as **Annexure-IX.**
3. The Board has constituted a monitoring committee with members from pharma industries, APIIC and APPCB to monitor the industries to curb the illegal discharges of effluents into storm water drains and to control air pollution in JN Pharmacity. Copy of the proceedings dated 08.09.2020 is herewith enclosed as **Annexure-X.**
4. The APPCB issued showcause notices / directions to the industries for not complying the Board directions and imposed an amount of Rs. 6,90,000/-towards Environmental Compensation during the period from Apr-2023 to Mar-2024. Accordingly, the industries have paid Environmental Compensation. Copy of the consolidated statement showing the directions/Showcause issued to the industries are herewith enclosed as **Annexure-XI.**

The Hon'ble NGT issued orders on 29.05.2024 stating that "the District Collector, Anakapalli(Respondent No.5) to ensure that the drinking water being supplied to the Villagers is safe and incase the water is found to be polluted, make alternative arrangements to provide safe drinking water till such time the issue of pollution is addressed".

The District Revenue Officer & Addl. District Magistrate, Collector's Office, Anakapalli vide letter dated:21.06.2024 directed the Zonal Commissioner, GVMC, Anakapalli Zone, the Environmental Engineer, Pollution Control Board, Regional Office, Visakhapatnam and the Superintending Engineer, Rural Water Supply, Anakapalli to conduct joint inspection to find out the sources of drinking water to be provided to the people of Tadi Village and to submit the action taken report, so as to submit the compliance report to the Hon'ble National Green Tribunal, Southern Zone, Chennai.

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Regional Office, Visakhapatnam

The Zonal Commissioner, GVMC, Anakapalli Zone along with the EE, APPCB, Visakhapatnam has inspected Tadi Village on 25.06.2024 and submitted the joint committee report on 02.07.2024. Copy of the Joint Committee report is herewith enclosed as **Annexure-XII**.

This report is submitted for kind consideration.

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A.P. Pollution Control Board,
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ANNEXURE-I

Real Time Data Acquisition And Monitoring

Site Name: Visakha Pharmacity Limited (Earlier Known As .Ramky Pharmacity (India) Ltd., (CETP))

Report: Custom Report

From Date: 2023/04/01 00:00:00 To Date : 2024/03/31 23:59:17

Description	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
Prescribed Standards	0 - 80	0 - 80	0 - 400	0 - 100	0 - 60	0 -
Maximum Data	62.0	34.0	6.32	96.36	53.0	0.6
Minimum Data	1.19	0.65	0.12	4.99	3.45	0.21
Geometric Mean	6.94	5.13	0.63	39.24	23.22	0.5
Median	5.92	3.34	0.55	34.42	22.84	0.5
Standard Deviation	5.24	4.89	0.5	23.63	12.58	0.02
Maximum Value At Time	2024-01-10	2024-01-10	2024-01-10	2023-12-07	2023-12-07	2023-11-11
Minimum Value At Time	2023-07-26	2023-07-26	2023-07-26	2023-07-26	2023-07-26	2023-09-26
Valid Data Points	316	316	316	316	316	316
Total Data Points	366	366	366	366	366	366
Data Availability %	86.34%	86.34%	86.34%	86.34%	86.34%	86.34%

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
1	2023-04-01	2.43	1.69	0.31	13.36	8.91	0.49
2	2023-04-02	1.80	1.25	0.23	9.94	6.61	0.49
3	2023-04-03	2.41	1.67	0.31	13.28	8.83	0.49
4	2023-04-04	2.78	1.93	0.36	15.34	10.22	0.50
5	2023-04-05	2.04	1.41	0.26	11.23	7.47	0.49
6	2023-04-06	2.33	1.61	0.30	12.84	8.55	0.50
7	2023-04-07	3.28	2.27	0.42	18.05	12.03	0.51
8	2023-04-08	3.87	2.68	0.50	21.29	14.22	0.49

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
9	2023-04-09	5.11	3.55	0.66	28.23	18.79	0.50
10	2023-04-10	5.09	3.53	0.66	28.02	18.72	0.49
11	2023-04-11	6.59	4.57	0.85	36.22	24.19	0.51
12	2023-04-12	5.89	4.08	0.76	32.42	21.64	0.50
13	2023-04-13	6.27	4.35	0.81	34.44	23.00	0.51
14	2023-04-14	5.44	3.78	0.70	29.97	19.96	0.50
15	2023-04-15	5.93	4.11	0.76	32.72	21.77	0.51
16	2023-04-16	6.76	4.68	0.87	37.24	24.83	0.48
17	2023-04-17	6.36	4.42	0.82	35.03	23.39	0.50
18	2023-04-18	5.82	4.04	0.74	32.07	21.38	0.48
19	2023-04-19	NA	NA	NA	NA	NA	NA
20	2023-04-20	NA	NA	NA	NA	NA	NA
21	2023-04-21	NA	NA	NA	NA	NA	NA
22	2023-04-22	2.72	1.88	0.35	14.99	9.96	0.52
23	2023-04-23	3.54	2.46	0.46	19.53	13.00	0.51
24	2023-04-24	7.51	5.21	0.97	41.10	27.42	0.48
25	2023-04-25	6.81	4.73	0.89	37.59	25.12	0.53
26	2023-04-26	11.28	7.83	1.47	62.11	41.39	0.50
27	2023-04-27	9.09	6.29	1.20	50.04	33.38	0.51
28	2023-04-28	14.36	8.65	1.61	34.19	21.79	0.50
29	2023-04-29	30.08	16.50	3.07	51.64	28.86	0.49
30	2023-04-30	3.64	1.99	0.37	15.25	10.56	0.50
31	2023-05-01	2.75	1.47	0.28	11.60	8.02	0.50
32	2023-05-02	3.21	1.76	0.33	13.44	9.31	0.52
33	2023-05-03	1.99	1.09	0.20	8.33	5.77	0.50

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
34	2023-05-04	2.65	1.45	0.27	11.09	7.68	0.52
35	2023-05-05	2.27	1.24	0.23	9.86	6.59	0.47
36	2023-05-06	2.38	1.30	0.24	9.98	6.90	0.50
37	2023-05-07	3.41	1.87	0.35	14.33	9.92	0.51
38	2023-05-08	3.73	2.04	0.38	15.61	10.81	0.50
39	2023-05-09	3.33	1.82	0.34	13.94	9.66	0.50
40	2023-05-10	5.62	3.08	0.57	23.59	16.32	0.48
41	2023-05-11	4.77	2.62	0.49	20.00	13.85	0.50
42	2023-05-12	4.10	2.25	0.42	17.19	11.90	0.52
43	2023-05-13	4.94	2.71	0.50	20.76	14.37	0.51
44	2023-05-14	8.61	4.72	0.88	36.13	25.02	0.49
45	2023-05-15	9.13	5.01	0.93	38.28	26.50	0.49
46	2023-05-16	15.73	8.63	1.62	42.90	27.72	0.51
47	2023-05-17	6.26	3.43	0.64	26.26	18.18	0.50
48	2023-05-18	4.95	2.72	0.50	20.76	14.37	0.49
49	2023-05-19	5.09	2.79	0.52	21.37	14.80	0.49
50	2023-05-20	6.07	3.33	0.62	25.47	17.61	0.49
51	2023-05-21	4.22	2.32	0.43	17.70	12.25	0.50
52	2023-05-22	4.63	2.54	0.47	19.43	13.47	0.49
53	2023-05-23	5.04	2.76	0.51	21.11	14.63	0.49
54	2023-05-24	5.31	2.91	0.54	22.25	15.43	0.49
55	2023-05-25	5.40	2.96	0.55	22.64	15.67	0.49
56	2023-05-26	8.11	4.45	0.81	27.22	18.30	0.49
57	2023-05-27	7.00	3.84	0.71	29.31	20.29	0.50
58	2023-05-28	6.64	3.64	0.68	27.76	19.25	0.51
59	2023-05-29	5.22	2.87	0.54	22.05	15.25	0.51

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
60	2023-05-30	3.56	1.95	0.36	14.92	10.31	0.48
61	2023-05-31	5.21	2.86	0.53	21.82	15.11	0.48
62	2023-06-01	6.85	3.75	0.70	28.71	19.88	0.51
63	2023-06-02	7.13	3.91	0.73	29.89	20.70	0.50
64	2023-06-03	6.83	3.74	0.70	28.62	19.81	0.50
65	2023-06-04	6.08	3.34	0.62	25.44	17.67	0.51
66	2023-06-05	7.38	4.05	0.76	24.15	16.15	0.50
67	2023-06-06	5.53	3.03	0.56	23.19	16.07	0.51
68	2023-06-07	5.47	3.00	0.56	22.93	15.87	0.49
69	2023-06-08	6.17	3.38	0.63	25.88	17.94	0.49
70	2023-06-09	6.13	3.36	0.63	25.73	17.79	0.49
71	2023-06-10	4.54	2.49	0.46	19.04	13.18	0.51
72	2023-06-11	5.45	2.99	0.56	22.85	15.80	0.50
73	2023-06-12	5.59	3.06	0.57	23.44	16.23	0.50
74	2023-06-13	7.85	4.31	0.80	33.16	22.81	0.46
75	2023-06-14	5.87	3.22	0.60	24.61	17.04	0.49
76	2023-06-15	5.61	3.08	0.57	23.53	16.29	0.50
77	2023-06-16	8.64	4.74	0.88	36.27	25.07	0.52
78	2023-06-17	7.42	4.07	0.76	31.12	21.43	0.49
79	2023-06-18	15.78	8.65	1.61	51.66	32.30	0.49
80	2023-06-19	14.33	7.86	1.45	40.29	24.65	0.51
81	2023-06-20	7.69	4.21	0.78	32.24	22.32	0.50
82	2023-06-21	10.68	5.86	1.09	40.26	25.26	0.51
83	2023-06-22	6.45	3.53	0.66	26.88	18.47	0.51
84	2023-06-23	9.42	5.17	0.96	39.50	27.31	0.50

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
85	2023-06-24	5.25	2.88	0.54	22.03	15.26	0.49
86	2023-06-25	13.64	7.48	1.39	41.28	25.68	0.51
87	2023-06-26	3.26	1.79	0.33	13.70	9.48	0.50
88	2023-06-27	8.43	4.62	0.86	35.25	23.98	0.50
89	2023-06-28	13.03	7.14	1.33	45.41	28.84	0.50
90	2023-06-29	10.18	5.58	1.04	41.20	27.50	0.51
91	2023-06-30	8.56	4.70	0.87	34.44	22.86	0.50
92	2023-07-01	20.15	11.04	2.05	58.86	35.69	0.50
93	2023-07-02	5.33	2.92	0.54	22.13	15.23	0.52
94	2023-07-03	7.00	3.84	0.71	27.18	18.52	0.51
95	2023-07-04	13.53	7.42	1.39	43.41	28.35	0.51
96	2023-07-05	27.37	15.01	2.80	61.81	35.98	0.49
97	2023-07-06	26.66	14.62	2.72	74.70	43.18	0.52
98	2023-07-07	5.57	3.05	0.57	23.70	16.29	0.53
99	2023-07-08	7.30	4.00	0.74	30.68	21.21	0.50
100	2023-07-09	9.09	4.99	0.93	36.69	23.67	0.50
101	2023-07-10	13.10	7.19	1.34	42.35	25.61	0.50
102	2023-07-11	3.03	1.66	0.31	12.66	8.78	0.51
103	2023-07-12	2.54	1.39	0.26	10.64	7.37	0.51
104	2023-07-13	3.18	1.74	0.32	13.34	9.23	0.50
105	2023-07-14	7.19	3.94	0.73	27.36	18.21	0.50
106	2023-07-15	5.54	3.04	0.57	23.22	16.03	0.50
107	2023-07-16	3.33	1.83	0.34	13.97	9.68	0.50
108	2023-07-17	4.51	2.48	0.46	18.89	12.98	0.52
109	2023-07-18	3.77	2.07	0.38	15.80	10.92	0.51

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
110	2023-07-19	2.72	1.49	0.28	11.33	7.84	0.53
111	2023-07-20	1.93	1.06	0.20	8.09	5.61	0.49
112	2023-07-21	1.99	1.09	0.20	8.34	5.78	0.48
113	2023-07-22	2.14	1.17	0.22	8.99	6.22	0.50
114	2023-07-23	2.90	1.59	0.30	12.23	8.47	0.49
115	2023-07-24	1.49	0.82	0.15	6.24	4.32	0.49
116	2023-07-25	1.57	0.86	0.16	6.55	4.54	0.50
117	2023-07-26	1.19	0.65	0.12	4.99	3.45	0.51
118	2023-07-27	2.40	1.32	0.24	10.08	7.01	0.51
119	2023-07-28	3.63	1.99	0.37	15.23	10.55	0.50
120	2023-07-29	3.13	1.72	0.32	13.18	9.14	0.50
121	2023-07-30	4.32	2.37	0.44	18.14	12.54	0.51
122	2023-07-31	4.57	2.51	0.47	19.13	13.24	0.50
123	2023-08-01	3.78	2.07	0.38	15.82	10.96	0.49
124	2023-08-02	4.63	2.54	0.47	19.41	13.44	0.48
125	2023-08-03	4.49	2.45	0.46	18.79	13.07	0.49
126	2023-08-04	5.45	2.99	0.55	22.69	15.73	0.47
127	2023-08-05	11.51	6.31	1.17	48.02	33.32	0.52
128	2023-08-06	9.72	5.33	0.99	40.34	26.94	0.52
129	2023-08-07	6.69	3.67	0.68	28.03	19.38	0.50
130	2023-08-08	5.90	3.24	0.60	24.73	17.09	0.51
131	2023-08-09	6.04	3.31	0.61	25.22	17.51	0.48
132	2023-08-10	3.69	2.02	0.38	15.61	10.76	0.50
133	2023-08-11	7.45	4.10	0.75	31.42	21.61	0.50
134	2023-08-12	8.13	4.46	0.82	34.13	23.65	0.50
135	2023-08-13	3.33	1.83	0.34	14.00	9.68	0.52

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
136	2023-08-14	8.11	4.45	0.82	33.95	23.52	0.49
137	2023-08-15	NA	NA	NA	NA	NA	NA
138	2023-08-16	5.64	3.09	0.57	23.71	16.42	0.52
139	2023-08-17	3.60	1.96	0.36	14.98	10.48	0.51
140	2023-08-18	3.34	1.83	0.34	14.01	9.69	0.51
141	2023-08-19	3.32	1.82	0.34	13.67	9.66	0.52
142	2023-08-20	3.11	1.70	0.32	13.13	9.08	0.51
143	2023-08-21	4.56	2.50	0.46	19.09	13.21	0.50
144	2023-08-22	3.48	1.91	0.35	14.39	10.12	0.51
145	2023-08-23	5.54	3.04	0.57	23.27	16.09	0.50
146	2023-08-24	3.49	1.91	0.35	14.73	10.13	0.51
147	2023-08-25	3.92	2.15	0.40	16.45	11.38	0.50
148	2023-08-26	2.38	1.31	0.24	10.02	6.93	0.50
149	2023-08-27	3.00	1.65	0.31	12.55	8.71	0.50
150	2023-08-28	4.50	2.47	0.46	18.87	13.09	0.50
151	2023-08-29	6.98	3.83	0.71	29.25	20.26	0.49
152	2023-08-30	8.43	4.62	0.86	35.35	24.49	0.51
153	2023-08-31	8.19	4.49	0.83	34.29	23.75	0.50
154	2023-09-01	6.00	3.29	0.61	25.20	17.39	0.51
155	2023-09-02	4.41	2.42	0.45	18.51	12.79	0.53
156	2023-09-03	3.90	2.14	0.40	16.20	11.21	0.50
157	2023-09-04	3.72	2.04	0.38	15.62	10.80	0.48
158	2023-09-05	3.19	1.75	0.33	13.29	9.20	0.54
159	2023-09-06	1.97	1.08	0.20	8.21	5.71	0.50
160	2023-09-07	3.27	1.79	0.33	13.73	9.49	0.51
161	2023-09-08	3.88	2.12	0.40	16.19	11.25	0.51

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
162	2023-09-09	4.06	2.23	0.41	17.00	11.77	0.50
163	2023-09-10	2.26	1.24	0.23	9.47	6.55	0.52
164	2023-09-11	2.65	1.46	0.27	11.10	7.66	0.50
165	2023-09-12	2.07	1.13	0.20	8.60	5.94	0.52
166	2023-09-13	2.55	1.41	0.25	10.61	7.40	0.50
167	2023-09-14	1.96	1.08	0.20	8.25	5.69	0.50
168	2023-09-15	4.35	2.39	0.44	18.25	12.62	0.51
169	2023-09-16	3.21	1.76	0.33	13.49	9.29	0.51
170	2023-09-17	2.40	1.32	0.24	10.07	6.98	0.48
171	2023-09-18	3.13	1.71	0.32	13.19	9.10	0.51
172	2023-09-19	5.58	3.06	0.57	23.40	16.20	0.52
173	2023-09-20	2.34	1.29	0.24	9.74	6.79	0.54
174	2023-09-21	2.67	1.50	0.28	11.14	7.76	0.47
175	2023-09-22	3.17	1.74	0.33	13.41	9.29	0.51
176	2023-09-23	2.23	1.22	0.22	9.40	6.39	0.50
177	2023-09-24	2.76	1.51	0.28	11.55	8.02	0.51
178	2023-09-25	NA	NA	NA	NA	NA	NA
179	2023-09-26	1.49	0.82	0.15	6.24	4.32	0.21
180	2023-09-27	4.55	2.50	0.46	19.05	13.21	0.50
181	2023-09-28	2.98	1.63	0.30	12.51	8.67	0.51
182	2023-09-29	1.53	0.84	0.16	10.19	6.97	0.51
183	2023-09-30	2.51	1.37	0.25	30.81	19.55	0.52
184	2023-10-01	NA	NA	NA	NA	NA	NA
185	2023-10-02	NA	NA	NA	NA	NA	NA
186	2023-10-03	4.10	2.25	0.42	43.50	24.82	0.52

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
187	2023-10-04	5.06	2.78	0.51	53.59	30.91	0.50
188	2023-10-05	6.72	3.69	0.69	66.80	38.28	0.50
189	2023-10-06	6.52	3.58	0.67	69.13	39.60	0.50
190	2023-10-07	6.72	3.68	0.68	69.95	40.10	0.50
191	2023-10-08	6.83	3.74	0.70	69.51	39.56	0.50
192	2023-10-09	5.35	2.94	0.55	56.95	32.80	0.49
193	2023-10-10	6.13	3.36	0.63	61.89	35.20	0.50
194	2023-10-11	7.16	3.93	0.73	75.03	42.66	0.50
195	2023-10-12	6.87	3.77	0.70	71.47	40.83	0.50
196	2023-10-13	7.52	4.12	0.77	79.33	45.59	0.50
197	2023-10-14	6.09	3.35	0.62	64.96	37.26	0.51
198	2023-10-15	7.16	3.92	0.73	72.91	41.55	0.50
199	2023-10-16	6.54	3.59	0.67	68.96	39.58	0.48
200	2023-10-17	7.25	3.98	0.74	74.73	42.46	0.51
201	2023-10-18	7.22	3.95	0.73	75.92	43.51	0.48
202	2023-10-19	7.79	4.28	0.80	83.00	47.76	0.51
203	2023-10-20	5.73	3.14	0.58	60.88	35.11	0.51
204	2023-10-21	5.21	2.86	0.53	55.49	31.94	0.49
205	2023-10-22	5.56	3.05	0.57	59.13	34.08	0.51
206	2023-10-23	4.47	2.45	0.45	47.33	27.31	0.50
207	2023-10-24	5.32	2.92	0.54	56.60	32.57	0.49
208	2023-10-25	5.80	3.18	0.60	61.71	35.56	0.49
209	2023-10-26	5.83	3.20	0.59	62.08	35.69	0.51
210	2023-10-27	5.29	2.90	0.54	56.23	32.32	0.50
211	2023-10-28	9.32	5.09	0.95	73.10	41.79	0.49
212	2023-10-29	6.95	3.81	0.71	73.75	42.50	0.50

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
213	2023-10-30	5.35	2.93	0.54	56.95	32.75	0.51
214	2023-10-31	5.05	2.77	0.51	53.84	30.96	0.50
215	2023-11-01	4.01	2.20	0.41	42.88	24.63	0.49
216	2023-11-02	2.10	1.16	0.21	22.28	12.90	0.54
217	2023-11-03	1.68	0.92	0.17	17.85	10.24	0.48
218	2023-11-04	2.03	1.11	0.21	21.59	12.43	0.49
219	2023-11-05	1.82	1.00	0.19	19.35	11.14	0.51
220	2023-11-06	1.67	0.90	0.17	17.56	10.18	0.49
221	2023-11-07	4.73	2.59	0.48	50.35	28.95	0.48
222	2023-11-08	5.53	3.02	0.56	58.89	33.86	0.49
223	2023-11-09	6.05	3.33	0.62	64.70	37.24	0.50
224	2023-11-10	NA	NA	NA	NA	NA	NA
225	2023-11-11	8.31	4.55	0.84	87.99	50.64	0.60
226	2023-11-12	6.79	3.72	0.69	72.24	41.59	0.50
227	2023-11-13	9.32	5.11	0.95	94.32	52.66	0.52
228	2023-11-14	8.35	4.58	0.85	86.05	48.22	0.52
229	2023-11-15	7.17	3.94	0.73	76.38	43.95	0.50
230	2023-11-16	3.08	1.69	0.31	32.85	18.89	0.49
231	2023-11-17	4.15	2.27	0.42	44.26	25.43	0.52
232	2023-11-18	3.11	1.71	0.31	33.12	19.10	0.50
233	2023-11-19	3.34	1.84	0.34	35.77	20.62	0.47
234	2023-11-20	2.67	1.44	0.27	28.63	16.49	0.51
235	2023-11-21	3.02	1.65	0.31	32.06	18.49	0.49
236	2023-11-22	3.45	1.89	0.35	36.87	21.20	0.51
237	2023-11-23	6.28	3.45	0.64	66.99	38.53	0.50

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
238	2023-11-24	7.51	4.12	0.75	79.35	45.68	0.55
239	2023-11-25	6.93	3.80	0.71	73.91	42.54	0.51
240	2023-11-26	7.36	4.04	0.75	78.36	45.12	0.50
241	2023-11-27	6.63	3.64	0.67	70.23	40.37	0.50
242	2023-11-28	5.31	2.91	0.54	56.39	32.62	0.51
243	2023-11-29	5.90	3.25	0.60	63.07	36.30	0.53
244	2023-11-30	5.45	3.00	0.56	58.21	33.43	0.54
245	2023-12-01	6.42	3.52	0.66	68.41	39.39	0.49
246	2023-12-02	4.05	2.22	0.41	43.17	24.85	0.51
247	2023-12-03	3.87	2.14	0.39	41.23	23.80	0.53
248	2023-12-04	4.17	2.29	0.43	44.31	25.53	0.51
249	2023-12-05	1.44	0.79	0.14	15.31	8.75	0.48
250	2023-12-06	NA	NA	NA	NA	NA	NA
251	2023-12-07	9.05	4.96	0.92	96.36	53.00	0.38
252	2023-12-08	4.75	2.60	0.49	50.53	29.10	0.53
253	2023-12-09	3.23	1.76	0.33	34.40	19.76	0.50
254	2023-12-10	3.32	1.83	0.34	35.56	20.48	0.49
255	2023-12-11	NA	NA	NA	NA	NA	NA
256	2023-12-12	NA	NA	NA	NA	NA	NA
257	2023-12-13	NA	NA	NA	NA	NA	NA
258	2023-12-14	NA	NA	NA	NA	NA	NA
259	2023-12-15	NA	NA	NA	NA	NA	NA
260	2023-12-16	6.98	3.81	0.71	74.29	42.56	0.51
261	2023-12-17	6.66	3.65	0.68	70.49	40.33	0.52
262	2023-12-18	7.75	4.25	0.79	80.77	46.26	0.51

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
263	2023-12-19	8.82	4.82	0.90	88.60	50.16	0.49
264	2023-12-20	9.05	4.96	0.93	92.88	51.98	0.49
265	2023-12-21	8.72	4.78	0.89	85.92	48.96	0.50
266	2023-12-22	7.99	4.38	0.81	85.08	48.96	0.52
267	2023-12-23	8.12	4.45	0.83	84.55	48.14	0.50
268	2023-12-24	8.37	4.59	0.85	85.23	48.55	0.53
269	2023-12-25	8.24	4.52	0.84	84.90	48.38	0.52
270	2023-12-26	7.44	4.08	0.76	78.67	45.09	0.54
271	2023-12-27	6.90	3.78	0.71	71.70	41.15	0.49
272	2023-12-28	5.84	3.20	0.60	62.06	35.68	0.50
273	2023-12-29	7.04	3.87	0.72	74.57	42.73	0.51
274	2023-12-30	8.50	4.67	0.86	85.59	48.01	0.50
275	2023-12-31	8.16	4.48	0.83	85.91	49.16	0.52
276	2024-01-01	8.18	4.49	0.83	85.07	48.54	0.50
277	2024-01-02	8.91	4.89	0.91	91.89	51.87	0.48
278	2024-01-03	11.70	6.42	1.20	95.46	52.99	0.49
279	2024-01-04	8.75	4.80	0.89	89.34	50.82	0.53
280	2024-01-05	6.09	3.34	0.62	64.56	37.14	0.52
281	2024-01-06	7.26	3.92	0.74	75.72	43.08	0.54
282	2024-01-07	5.69	3.13	0.58	60.92	35.07	0.56
283	2024-01-08	NA	NA	NA	NA	NA	NA
284	2024-01-09	32.86	18.02	3.25	94.02	52.62	0.44
285	2024-01-10	62.00	34.00	6.32	96.00	53.00	0.49
286	2024-01-11	NA	NA	NA	NA	NA	NA
287	2024-01-12	NA	NA	NA	NA	NA	NA
288	2024-01-13	NA	NA	NA	NA	NA	NA

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
289	2024-01-14	NA	NA	NA	NA	NA	NA
290	2024-01-15	NA	NA	NA	NA	NA	NA
291	2024-01-16	NA	NA	NA	NA	NA	NA
292	2024-01-17	NA	NA	NA	NA	NA	NA
293	2024-01-18	NA	NA	NA	NA	NA	NA
294	2024-01-19	NA	NA	NA	NA	NA	NA
295	2024-01-20	NA	NA	NA	NA	NA	NA
296	2024-01-21	NA	NA	NA	NA	NA	NA
297	2024-01-22	NA	NA	NA	NA	NA	NA
298	2024-01-23	NA	NA	NA	NA	NA	NA
299	2024-01-24	NA	NA	NA	NA	NA	NA
300	2024-01-25	NA	NA	NA	NA	NA	NA
301	2024-01-26	NA	NA	NA	NA	NA	NA
302	2024-01-27	NA	NA	NA	NA	NA	NA
303	2024-01-28	NA	NA	NA	NA	NA	NA
304	2024-01-29	NA	NA	NA	NA	NA	NA
305	2024-01-30	NA	NA	NA	NA	NA	NA
306	2024-01-31	NA	NA	NA	NA	NA	NA
307	2024-02-01	NA	NA	NA	NA	NA	NA
308	2024-02-02	NA	NA	NA	NA	NA	NA
309	2024-02-03	NA	NA	NA	NA	NA	NA
310	2024-02-04	NA	NA	NA	NA	NA	NA
311	2024-02-05	NA	NA	NA	NA	NA	NA
312	2024-02-06	NA	NA	NA	NA	NA	NA
313	2024-02-07	NA	NA	NA	NA	NA	NA
314	2024-02-08	NA	NA	NA	NA	NA	NA

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
315	2024-02-09	NA	NA	NA	NA	NA	NA
316	2024-02-10	NA	NA	NA	NA	NA	NA
317	2024-02-11	NA	NA	NA	NA	NA	NA
318	2024-02-12	NA	NA	NA	NA	NA	NA
319	2024-02-13	NA	NA	NA	NA	NA	NA
320	2024-02-14	NA	NA	NA	NA	NA	NA
321	2024-02-15	11.76	15.04	0.58	52.79	25.68	0.44
322	2024-02-16	11.71	15.05	0.55	52.40	26.77	0.49
323	2024-02-17	11.63	15.22	0.54	52.68	26.24	0.51
324	2024-02-18	11.54	15.05	0.56	52.30	26.58	0.50
325	2024-02-19	11.52	15.08	0.54	52.66	26.75	0.49
326	2024-02-20	11.46	14.91	0.54	52.37	26.52	0.50
327	2024-02-21	11.50	15.03	0.55	52.50	26.45	0.49
328	2024-02-22	11.42	15.10	0.56	52.52	26.24	0.52
329	2024-02-23	11.56	14.89	0.56	52.49	26.31	0.51
330	2024-02-24	11.57	15.05	0.55	52.59	26.69	0.50
331	2024-02-25	11.42	15.00	0.55	52.22	26.37	0.49
332	2024-02-26	11.50	15.00	0.54	52.74	26.43	0.50
333	2024-02-27	11.59	14.79	0.55	52.34	26.29	0.49
334	2024-02-28	11.57	15.06	0.56	52.27	26.56	0.49
335	2024-02-29	11.54	14.86	0.56	52.69	26.44	0.50
336	2024-03-01	11.48	14.93	0.54	52.26	26.52	0.50
337	2024-03-02	11.49	14.97	0.55	52.68	26.76	0.51
338	2024-03-03	11.36	15.06	0.54	52.32	26.49	0.50
339	2024-03-04	11.59	14.95	0.54	52.65	26.45	0.50
340	2024-03-05	11.43	15.09	0.54	52.63	26.24	0.49

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
341	2024-03-06	11.49	15.00	0.54	52.40	26.84	0.49
342	2024-03-07	11.54	14.95	0.55	52.48	26.32	0.49
343	2024-03-08	11.47	14.96	0.53	52.40	26.29	0.50
344	2024-03-09	11.56	15.12	0.55	52.59	26.18	0.49
345	2024-03-10	11.65	14.96	0.55	52.54	26.27	0.50
346	2024-03-11	11.57	15.16	0.54	52.55	26.70	0.51
347	2024-03-12	11.60	15.25	0.54	52.90	26.37	0.49
348	2024-03-13	11.21	14.94	0.53	52.29	25.84	0.50
349	2024-03-14	11.57	15.05	0.55	52.70	26.28	0.51
350	2024-03-15	11.62	15.08	0.55	52.48	26.36	0.50
351	2024-03-16	11.57	15.00	0.55	52.66	26.90	0.50
352	2024-03-17	11.66	15.09	0.55	52.44	26.01	0.48
353	2024-03-18	11.51	15.01	0.55	52.50	26.73	0.51
354	2024-03-19	11.63	14.85	0.55	52.59	26.60	0.53
355	2024-03-20	11.47	15.08	0.55	52.41	26.41	0.49
356	2024-03-21	11.66	14.91	0.55	52.65	26.20	0.50
357	2024-03-22	11.60	15.02	0.56	52.34	26.44	0.51
358	2024-03-23	11.50	15.05	0.55	52.56	26.77	0.49
359	2024-03-24	11.46	14.97	0.56	52.27	26.47	0.50
360	2024-03-25	11.55	15.03	0.55	52.65	26.66	0.50
361	2024-03-26	11.59	15.03	0.55	52.66	26.37	0.51
362	2024-03-27	11.57	15.12	0.55	52.71	26.78	0.49
363	2024-03-28	11.59	14.94	0.54	52.69	26.40	0.51
364	2024-03-29	11.40	15.02	0.54	52.66	26.01	0.51
365	2024-03-30	11.61	15.04	0.54	52.58	26.50	0.50

Sl No	Time	Station_2_Thadi-SO2 - (ug/m3) Raw	Station_2_Thadi-NOx - (ug/m3) Raw	Station_2_Thadi-NH3 - (ug/m3) Raw	Station_2_Thadi-PM10 - (ug/m3) Raw	Station_2_Thadi-PM2.5 - (ug/m3) Raw	Station_2_Thadi-VOC - (ug/m3) Raw
366	2024-03-31	11.45	14.99	0.54	52.48	26.32	0.49

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ANNEXURE-II

A.P. POLLUTION CONTROL BOARD
ZONAL LABORATORY: VISAKHAPATNAM

Consolidated report on marine outfall discharges by M/s **Visakhapatnam Pharma City Limited (Formerly M/s Ramky Pharma City (I) Ltd.,) JNPC, Parawada, Anakapalli District** for the period from **April 2023 to March 2024**

S.No.	April 2023 to March 2024		Parameters exceeded
	No. of Guard Pond Samples Collected	No. of Guard Pond Samples Rejected	TSS, COD & NH_3-N
1.	358	24	

Note:

1. Out of 358 samples, 24 samples were rejected from April 2023 to March 2024, the rejection percentage is 6.7 % for the last year.
2. In case, if the treated wastewater does not meet the marine discharge standards, it will not be allowed for discharge into sea, and will be sent back to CETP for re-treatment .

23/05/24

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Chapter 7

Off Tikkavanipalem (Zone 5)

Coastal waters off Tikkavanipalem (Zone 5) contain marine outfall points (MOP) of pharmaceutical industry, i.e., M/s. JN Pharama City Ltd. and National Thermal Power Corporation (NTPC) Ltd. (Fig. 2.5). Tikkavanipalem is a coastal village situated towards south of Visakhapatnam. National Institute of Oceanography has carried out Rapid Marine Environmental Assessment studies to identify the marine out fall points for discharge of treated effluents from JN Pharma City Ltd. The NTPC project involves intake pipeline for drawl of seawater for cooling purpose and outfall pipeline for discharge of seawater into the sea. There is an existing corridor for intake of seawater for cooling purpose and discharge of water into the sea through a jetty at land fall point. The estimated discharge through Central Monitoring Basin (CMB) is 5870 cum/hr for Stage – I. The treated wastewater of Stage - I is being discharged into the sea at 400 m from the High Tide Line at a depth of 4 m. The discharge point selected by NTPC was not as suggested by NIO, but as recommended by some other Organization.

The location of the M/s. JN Pharma City is at about 30 km west of Visakhapatnam city. As the Pharma City comprises of several bulk drugs, pharmaceuticals and chemical sectors, the waste discharges are associated with high organic pollutant load. This industry is considered as one of the major 17 groups of industries for priority action for the control of pollution by Central Pollution Control Board. In order to maintain cleaner environment and achieve sustainability of the concerned industrial sector, the Pharma City decided to discharge the treated effluents into the sea through a pipeline as per the new guidelines of Ministry of Environment and Forests (MoEF) and Andhra Pradesh Pollution Control Board (APPCB). The discharge point suggested

by NIO for JN Pharma City is at a depth of 18 m and at a distance of 1.44 km from the coast. Results of studies conducted in the coastal waters off Tikkavanipalem during pre- and post-monsoon seasons were discussed in this chapter

7.1 Physico-chemical parameters

Results of physico-chemical parameters studied in the coastal waters off Tikkavanipalem (zone 5) during pre monsoon and post monsoon seasons were given Tables 7.1a to 7.1c and 7.2a to 7.2c, respectively. Water column temperature of this zone varied from 26.6 to 27.3^{o}C in the surface and 25.8 to 27.1^{o}C in the bottom, with mean temperature of 27.0^{o}C and 26.4^{o}C, respectively, during pre monsoon (Table 7.1a). Relatively lower ranges of mean temperature were observed during post monsoon in both surface (mean: 24.2^{o}C; range: 23.2 to 24.4^{o}C) and bottom waters (mean: 24.4^{o}C; range: 23.7 to 25.3^{o}C) (Table 7.2a). Salinity ranged from 33.3 to 33.7 PSU, with a mean salinity of 33.5 PSU in the surface, and from 33.5 to 34.0 PSU (mean: 33.7 PSU) in bottom waters of this region during pre monsoon season (Table 7.1a). Compared to the pre monsoon, relatively lower salinities were found during post monsoon, with mean salinities of 29.2 PSU in the surface (range: 28.9 to 29.6 PSU) and 29.5 PSU in the bottom (range: 29.0 to 30.4 PSU) waters of this region (Table 7.2a). Total suspended matter (TSM) varied from 14.5 to 33.8 mg/L (mean: 18.6 mg/L) in the surface and from 15.8 to 23.0 mg/L (mean (18.7 mg/L) in the bottom waters during pre monsoon (Table 7.1a). Slightly lower range of TSM concentrations were found during the post monsoon season both in the surface (range: 8.0 to 21.7 mg/L; mean: 11.9 mg/L) and bottom waters as well (9.1 to 16.2 mg/L and 11.5 mg/L, respectively (Table 7.2a). TSM concentrations found in this study are very close to those reported in the previous study conducted in this region during 2011 (Table 7.3). pH values of surface and bottom waters in the region varied from 7.3 to 8.1 (mean: 7.6) and from 7.4 to 7.9

(mean: 7.6), respectively, during pre monsoon season (Table 7.1a). During post monsoon season, the ranges of pH values in the surface and bottom waters are relatively higher where it ranged from 8.3 to 9.0 in the surface and from 8.1 to 8.6 in the bottom waters.

Dissolved oxygen (DO) concentrations ranged from 6.1 to 6.7 mg/L (mean 6.3 mg/L) in the surface and from 3.9 to 6.4 mg/L (mean 4.8 mg/L) in the bottom waters during pre monsoon season (Table 7.1b). These DO concentrations are relatively lower when compared to those obtained during pre monsoon season of the year 2011 in this region (6.5 to 8.3 mg/L) (Fig. 7.1) (Table 7.3). Relatively higher DO concentrations were found during post monsoon season in both surface (range: 6.4 to 7.8 mg/L; mean: 7.1 mg/L) and bottom waters (6.6 to 7.7 mg/L and 7.1 mg/L, respectively (Table 7.2b) compared to the pre monsoon season (Table 7.1b). DO concentrations found during the post monsoon season are consistent with those obtained in this region during 2011 study (6.2 to 8.9 mg/L) (Fig. 7.1) (Table 7.3). Relatively lower dissolved oxygen concentrations during pre monsoon season may be due to the increased input of organic matter contamination through the release of treated effluents from JN Pharma City Ltd. and/or from NTPC Ltd. and Hindhuja Ltd. Biochemical oxygen demand for five days (BOD_5) values varied from 3.9 to 4.4 and from 2.5 to 4.1 mg/L, with mean BOD_5 values of 4.0 mg/L and 3.1 mg/L in the surface and bottom waters, respectively, during pre monsoon season (Table 7.1b). Relatively lower ranges of BOD_5 values were found during post monsoon season in both surface (range: 0.2 to 1.4 mg/L; mean: 0.7 mg/L) and bottom (range: 0.3 to 1.7 mg/L; mean: 0.84 mg/L) waters (Table 7.2b). BOD_5 values found in this study are relatively lower during post monsoon season and higher during pre monsoon season when compared to those found in previous monitoring study conducted in this region in 2011 (Table 7.3). Ammonium concentrations ranged from 0.3 to 3.1 μM (mean: 1.2 μM) in the surface and from 0.1 to 3.1 μM (mean: 1.4

μM) in the bottom waters during pre monsoon (Table 7.1b). Relatively lower concentrations of

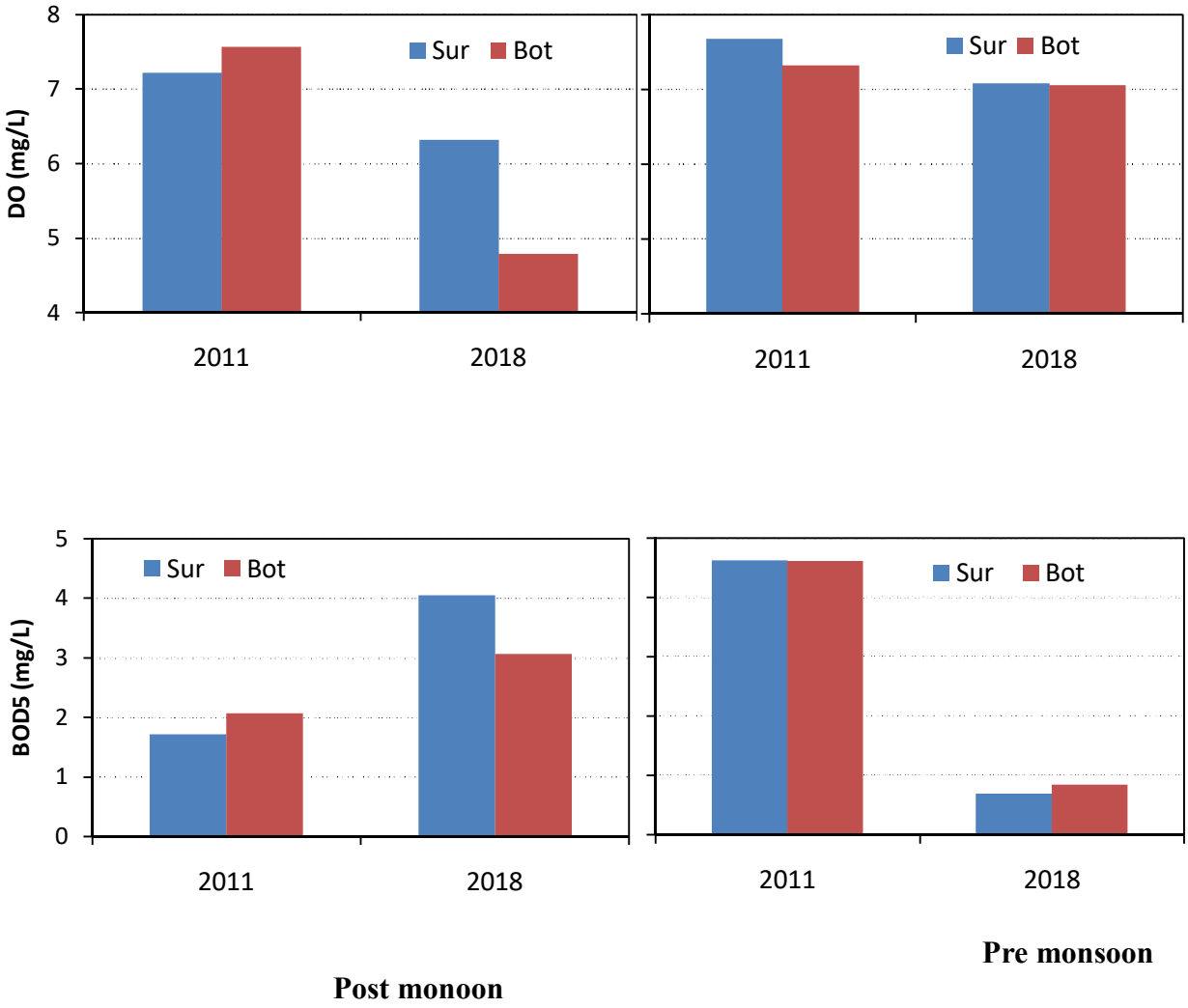

Fig. 7.1: Comparison of mean dissolved oxygen (DO; mg/L) and biochemical oxygen demand (BOD; mg/L) concentrations in coastal waters off Tikkavanipalem during pre monsoon and post monsoon seasons of the present study with that of the study conducted in 2011 in this region

ammonium were found in this region during post monsoon season, with similar mean values of 0.3 μM (range: 0.1 to 0.5 μM) in the surface and 0.4 μM (range: 0.3 to 0.6 μM) in the bottom

waters (Table 7.2b). Relatively higher ammonium concentrations were found at the MOP of JN Pharma City Ltd. in both surface and bottom waters. Phosphate concentrations ranged from 0.4 μM to 2.2 μM (mean: 1.3 μM) in the surface and from 0.7 μM to 2.6 μM (mean: 1.6 μM) in the bottom waters during pre monsoon season (Table 7.1b). Considerably lower concentrations of phosphate were found in the surface (mean: 0.4 μM; range: 0.1 to 0.9 μM) and bottom (0.6 μM; range: 0.1 to 1.5 μM) waters during post monsoon season (Table 7.2c). Dissolved inorganic silicate concentrations ranged from as low as 0.6 μM to as high as 6.4 μM (mean: 4.4 μM) in the surface and from 3.9 to 26.9 μM (mean: 7.6 μM) in the bottom waters during pre monsoon (Table 7.1c). Relatively higher silicate concentrations were found during post monsoon season, with mean silicate concentrations of 6.4 μM (range: 0.3 to 16.3 μM) in the surface and 9.6 μM (range: 4.3 to 20.9 μM) in the bottom waters (Table 7.2c). Higher silicate concentrations during the post monsoon season are mainly due to the influence of freshwater input to the study region through river discharge during the monsoon and equator ward flow of freshwaters from the northern Bay of Bengal by the southward flowing EICC during post monsoon season. Nitrite concentrations ranged from 0.1 to 0.3 μM (mean: 0.2 μM) in the surface and 0.1 to 0.5 μM (mean: 0.2 μM) in the bottom waters during the pre monsoon season (Table 7.1c). Relatively higher concentrations of nitrite were found during post monsoon in the surface (0.1 to 2.7 μM) and bottom (0.1 to 3.4 μM) waters, with mean nitrite concentrations of 0.5 μM and 1.0 μM in the surface and bottom waters, respectively. Dissolved inorganic nitrate concentrations varied from 0.6 to 1.9 μM (mean: 1.0 μM) and from 0.8 to 2.3 μM (mean: 1.3 μM) in the surface and bottom waters, respectively, during pre monsoon (Table. 7.1c). Similar range of nitrate concentrations were found during post monsoon, with man nitrate concentrations of 0.8 μM (range: 0.1 to 3.6 μM) in the surface and 0.8 μM (range: 0.1 to 2.3 μM) in the bottom waters (Table 7.2c). Mean

total phosphorus (TP) concentrations were found to be 0.9 µM (range: 0.2 to 2.2 µM) in the surface and 1.7 µM (range: 0.7 to 3.0 µM) in the bottom waters of this region during post monsoon season (Table 7.2b). Total petroleum hydrocarbon (TPHC) concentrations varied from as low as 1.5 to as high as 54.0 µg/L (mean: 13.6 µg/L) in the surface and from 2.4 to 38.8 µg/L (mean: 12.8 µg/L) in the bottom waters of this region during post monsoon. These PHC concentrations are higher compared to those obtained during 2011 study in this region (1.0 to 34.1 µg/L), indicating that increased input of PHC to this region in recent years.

Results of physico-chemical parameters studied in the coastal waters off Tikkavanipalem (zone 5) showed no significant deviation from ambient concentrations of the physico-chemical parameters in the coastal waters of east coast of India, except for dissolved oxygen. Mean dissolved oxygen concentrations in bottom waters of this zone during pre monsoon (mean: 4.8 mg/L) are slightly depleted than the threshold limit of dissolved oxygen for healthy coastal waters (5.0 mg/L), indicating that the coastal waters of this region are at the initial stage of deterioration in water quality. It could be due to the increased input of organic matter contamination through treated effluent release from JN Pharma City Ltd. and/or NTPC Ltd. and Hindhuja Ltd. However, coastal waters of this region are well oxygenated during post monsoon season. Comparison of physico-chemical data obtained in this study with that of the study conducted in this region during pre and post monsoon seasons of 2011 was given in Table 7.3. Seasonal variability between pre and post monsoon season were attributed to input of freshwater discharge from rivers during the southwest monsoon (June-September) and southward flow of freshwaters from the northern Bay of Bengal to the present study region by the equator ward flowing east Indian coastal current (EICC) during October-December. Although, PHC concentrations in this study were found to be higher compared to reported values from this

region in 2011, however, they are within the threshold limit, indicating no significant pollution of TPHC in this region.

Table 7.1a: Spatial variability in temperature (^{o}C), Salinity (PSU), total suspended matter (mg/L) and pH in surface and bottom waters off Tikkavanipalem coast during the pre monsoon season

Station	Temperature (^{o}C)		Salinity (PSU)		TSM (mg/l)		pH	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	26.8	26.8	33.7	33.5	17.6	18.0	7.3	7.6
TVM-2	26.9	26.7	33.6	33.5	17.0	20.2	7.6	-
TVM-3	26.9	26.8	33.5	33.6	15.0	16.5	7.7	7.8
TVM-4	-	-	-	-	-	-	7.9	7.6
TVM-5	26.8	26.7	33.5	33.6	33.8	22.1	7.3	7.7
TVM-6	27.2	26.6	33.5	33.9	-	17.3	7.6	7.4
TVM-7	27.1	27.1	33.5	33.5	16.3	17.9	7.3	7.4
TVM-8	27.2	26.0	33.4	33.8	23.0	21.9	7.7	7.7
TVM-9	27.3	26.0	33.3	33.8	-	15.8	-	7.7
TVM-10	27.3	26.5	33.4	33.7	15.9	19.9	7.5	7.5
TVM-11	27.0	25.9	33.3	33.9	14.5	23.0	7.3	7.5
TVM-12	27.1	25.9	33.4	33.9	18.7	18.5	7.4	7.5
TVM-13	27.0	25.8	33.3	34.0	20.4	17.8	8.1	7.6
TVM-14	27.2	26.0	33.4	33.8	17.2	19.0	7.4	7.7
TVM-15	27.0	26.2	33.4	33.8	14.6	18.2	7.8	7.8
TVM-16	27.1	26.1	33.4	33.9	17.6	19.8	7.8	7.9
NTP-MOP	26.8	26.9	33.7	33.7	19.6	15.8	7.6	7.5
JNP-MOP	26.6	26.0	33.6	33.8	18.0	15.8	-	-

Table 7.1b: Spatial variability in dissolved oxygen (mg/L), biochemical oxygen demand (BOD_5; mg/L), ammonium (µM) and phosphate (µM) concentrations in surface and bottom waters off Tikkavanipalem coast during pre monsoon season

Station	DO (mg/l)		BOD_5 (mg/l)		Ammonium (µM)		Phosphate (µM)	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	-	6.1	4.2	4.0	0.6	0.6	0.5	0.7
TVM-2	6.7	5.9	4.4	3.9	0.3	-	1.3	1.3
TVM-3	6.1	6.2	4.1	4.1	0.6	1.3	1.3	1.2
TVM-4	6.2	3.9	4.0	2.5	1.3	0.3	1.6	1.7
TVM-5	6.1	6.4	4.1	4.0	1.3	0.1	1.8	1.9
TVM-6	6.4	6.1	4.1	3.6	0.7	0.6	1.7	1.7
TVM-7	6.5	6.4	4.3	4.1	0.4	2.0	2.0	2.6
TVM-8	6.4	4.4	3.9	2.8	0.7	0.6	1.8	2.0
TVM-9	6.4	4.2	4.0	2.9	1.1	0.6	0.9	0.9
TVM-10	6.4	4.0	3.9	2.6	0.4	1.3	1.3	1.7
TVM-11	6.7	3.9	3.9	2.5	0.4	2.0	1.8	2.3
TVM-12	6.4	4.1	3.9	2.5	1.8	2.7	0.9	1.4
TVM-13	6.2	3.9	4.2	2.5	2.1	1.4	0.8	1.7
TVM-14	6.2	4.0	3.9	2.6	2.6	2.8	0.9	1.9
TVM-15	6.1	3.9	4.0	2.6	1.3	1.7	0.4	0.7
TVM-16	6.2	3.9	4.3	2.6	1.6	1.4	0.5	2.2
NTP-MOP	6.2	4.1	4.1	2.6	0.9	0.9	1.7	0.8
JNP-MOP	-	-	-	-	3.1	3.1	2.2	1.7

Table 7.1c: Spatial variability in silicate (µM) nitrite (µM) and nitrate (µM) concentrations in surface and bottom waters off Tikkavanipalem coast during pre monsoon season

Station	Silicate (µM)		Nitrite (µM)		Nitrate (µM)	
	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	5.1	26.9	0.1	0.2	1.0	1.2
TVM-2	-	-	0.2	0.2	0.9	1.0
TVM-3	5.4	4.8	0.1	0.2	0.9	1.6
TVM-4	6.4	4.5	0.1	0.2	1.2	0.8
TVM-5	5.9	9.0	0.1	0.2	0.9	0.8
TVM-6	5.7	7.5	0.2	0.1	0.9	1.2
TVM-7	4.6	5.2	0.2	0.1	1.2	1.4
TVM-8	3.1	8.1	0.2	0.2	1.0	1.4
TVM-9	3.1	7.3	0.3	0.1	1.1	1.0
TVM-10	0.9	5.9	0.2	0.2	0.8	1.3
TVM-11	3.9	7.3	0.2	0.3	0.8	0.9
TVM-12	4.1	7.4	0.3	0.4	0.9	1.2
TVM-13	3.9	5.4	0.2	0.5	1.2	1.2
TVM-14	4.5	5.0	0.2	0.3	0.6	1.0
TVM-15	3.2	9.0	0.1	0.2	0.9	1.9
TVM-16	3.9	7.8	0.1	0.2	1.9	2.3
NTP-MOP	5.4	4.1	0.1	0.1	0.7	1.1
JNP-MOP	0.6	3.9	0.1	0.2	1.2	1.0

Table 7.2a: Spatial variability in temperature (^{o}C), Salinity (PSU), total suspended matter (mg/L) and pH in surface and bottom waters off Tikkavanipalem coast during the post monsoon season

Station	Temperature (^{o}C)		Salinity (PSU)		pH		TSM (mg/l)	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	24.1	24.0	29.3	29.3	8.4	8.5	8.9	-
TVM-2	24.3	24.3	29.3	29.2	8.6	8.6	11.1	10.7
TVM-3	24.3	24.4	29.3	29.0	8.6	8.4	10.1	9.8
TVM-4	24.3	24.5	29.2	29.7	8.3	8.4	9.8	14.2
TVM-5	24.3	24.3	29.0	29.4	8.4	8.4	9.5	14.4
TVM-6	24.4	24.2	29.2	29.3	8.4	8.6	17.9	12.2
TVM-7	24.3	23.9	29.2	29.3	8.5	8.5	10.7	10.4
TVM-8	24.2	24.3	29.3	29.3	9.0	8.5	21.7	16.2
TVM-9	24.1	24.4	29.3	29.5	8.6	8.6	9.9	10.6
TVM-10	24.0	24.7	29.4	29.3	8.6	8.1	10.7	9.1
TVM-11	24.2	25.3	29.3	30.3	8.5	8.5	16.7	10.1
TVM-12	24.2	24.3	29.3	30.2	8.5	8.4	8.0	9.3
TVM-13	24.1	25.2	29.4	30.4	8.6	8.5	10.5	15.5
TVM-14	23.2	24.9	29.6	29.9	8.5	8.5	15.0	11.7
TVM-15	24.0	24.5	29.3	29.3	8.4	8.4	10.9	10.6
TVM-16	24.3	24.2	28.9	29.3	8.5	8.4	10.5	10.5
JNP-MOP	24.3	24.4	29.2	29.3	8.4	8.3	10.5	9.7
NTPC-MOP	24.2	23.7	29.0	29.2	8.6	8.4	11.5	10.4

Table 7.2b: Spatial variability in dissolved oxygen (mg/L), biochemical oxygen demand (BOD_5; mg/L), total phosphorous (µM) and ammonium (µM) concentrations in surface and bottom waters off Tikkavanipalem coast during post monsoon season

Station	DO (mg/l)		BOD_5 (mg/l)		TP (µM)		Ammonium (µM)	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	6.7	6.7	1.0	1.2	0.5	0.8	0.3	0.4
TVM-2	7.2	7.1	1.4	1.7	0.8	0.7	0.5	0.6
TVM-3	7.0	6.9	1.0	1.4	0.7	1.1	0.5	0.6
TVM-4	7.6	7.3	0.6	0.9	1.3	2.3	0.4	0.4
TVM-5	7.3	7.4	0.2	0.8	0.2	1.4	-	0.3
TVM-6	6.7	6.8	0.8	1.0	2.2	2.8	0.4	0.5
TVM-7	6.4	6.6	1.2	1.5	1.0	2.5	0.1	0.3
TVM-8	6.8	6.8	0.3	0.7	1.0	2.9	0.3	0.4
TVM-9	7.8	7.7	0.4	0.6	1.0	1.4	0.3	0.4
TVM-10	7.1	7.1	0.2	0.5	0.7	1.1	-	-
TVM-11	7.5	7.4	0.6	0.4	0.6	1.7	0.3	0.4
TVM-12	6.6	6.8	0.7	0.6	0.8	3.0	0.5	0.5
TVM-13	7.0	7.0	0.5	0.3	0.4	0.9	0.3	0.5
TVM-14	7.5	7.3	0.3	0.5	1.2	1.9	0.1	0.3
TVM-15	6.6	6.6	1.3	1.1	0.7	1.2	0.4	0.5
TVM-16	7.6	7.5	1.0	0.8	0.8	1.0	0.1	0.3
JNP-MOP	7.2	7.2	0.3	0.5	1.7	1.2	0.5	0.5
NTPC-MOP	6.6	6.7	0.7	0.6	1.1	2.0	-	0.4

Table 7.2c: Spatial variability in nitrite (µM), nitrate (µM), phosphate (µM) and silicate (µM) concentrations in surface and bottom waters off Tikkavanipalem coast during post monsoon season

Station	Nitrite (µM)		Nitrate (µM)		Phosphate (µM)		Silicate (µM)	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
TVM-1	0.6	0.2	0.5	0.1	0.4	0.7	0.7	11.2
TVM-2	1.1	0.7	0.6	0.6	0.2	0.2	4.6	7.3
TVM-3	0.3	0.2	0.4	0.6	0.5	0.1	6.9	8.4
TVM-4	2.7	3.4	1.9	2.3	0.2	0.9	6.4	7.6
TVM-5	0.2	0.2	0.6	1.0	-	0.3	7.9	8.7
TVM-6	0.2	2.7	0.4	1.9	0.2	1.5	8.8	4.3
TVM-7	0.2	0.4	0.9	0.4	0.8	0.7	0.3	6.8
TVM-8	0.2	0.1	0.5	0.4	0.1	0.7	7.9	11.6
TVM-9	0.2	2.5	0.1	2.2	0.7	0.7	8.3	11.2
TVM-10	0.2	1.0	0.6	0.2	0.2	0.2	8.7	17.5
TVM-11	0.1	0.2	0.4	0.4	0.5	0.7	5.8	4.8
TVM-12	0.3	0.5	0.3	0.6	0.5	0.7	6.0	7.3
TVM-13	0.2	7.7	1.5	0.1	0.2	0.2	2.1	7.0
TVM-14	0.6	0.2	3.6	0.4	0.9	0.9	6.4	6.8
TVM-15	0.3	2.4	0.4	1.7	0.2	0.9	5.2	15.2
TVM-16	0.3	0.8	0.4	0.6	0.3	0.7	1.2	7.1
JNP-MOP	0.4	0.2	0.4	0.9	0.7	0.2	16.3	8.7
NTPC-MOP	0.5	0.4	0.4	0.5	0.7	1.0	11.4	20.9

Table 7.2d: Spatial variability in total petroleum hydrocarbon concentrations (TPHC; µg/L) in surface and bottom waters off Tikkavanipalem coast during post monsoon season

Station	PHC (µg/L)	
Name	Surface	Bottom
JNP-MOP	54.0	4.3
NTPCMOP	4.0	19.9
TVM-1	8.7	-
TVM2	18.1	12.8
TVM3	6.4	2.4
TVM4	5.7	3.0
TVM5	18.4	7.0
TVM6	-	3.0
TVM7	15.2	3.7
TVM8	1.5	10.1
TVM9	9.8	5.9
TVM10	-	-
TVM11	**4.2**	**10.3**
TVM12	-	**37.5**
TVM13	**9.9**	**38.8**
TVM14	**27.6**	**5.1**
TVM15	**7.1**	**28.6**
TVM16	-	-

Table 7.3: Comparison of data obtained for various physico-chemical parameters during pre monsoon and post monsoon seasons of 2011 and 2018 (present study) in the coastal waters off Tikkavanipalem.

Parameter	Pre monsoon		Post monsoon	
	2011	Present study	2011	Present study
Temperature	26.9 – 27.9	25.8 – 27.3	29.3 – 30.1	23.2 – 25.3
Salinity	30.9 – 33.7	33.3 – 34.0	17.9 – 22.5	28.9 – 30.4
TSM	8.8 – 14.2	14.5 – 33.8	8.9 – 22.3	8.0 – 21.7
pH	7.9– 8.3	7.3 – 8.1	8.0 – 8.3	8.1 – 8.6
DO	6.5 – 8.3	3.9 – 6.7	6.2 – 8.9	6.4 – 7.8
BOD	1.0 – 3.3	2.5 – 4.4	2.6 – 4.4	0.2 – 1.4
Ammonium	0.03 – 0.54	0.1 – 3.1	0.9 – 2.5	0.1 – 0.6
Nitrite	0.04 – 0.54	0.1 – 0.5	0.04 -0.54	0.1 – 3.4
Nitrate	1.5 – 13.6	0.6 – 2.3	2.9 – 15.0	0.1 – 3.6
Phosphate	0.3 – 1.1	0.4 – 2.6	0.8 – 2.5	0.1 – 1.5
Silicate	3.2 – 10.6	0.26– 26.9	10.9 – 28.1	0.3 – 20.9
PHC	4.9 – 34.1	-	1.0 – 11.5	1.5 – 54.0

7.2 Biological parameters

7.2.1. Chlorophyll *a*

During the pre monsoon period, Chl-*a* concentration varied from 2.17 to 7.54 mg/m^3 in surface and from 1.38 to 10.16 mg/m^3 in bottom waters of this region. Whereas, Chl-*a* concentration ranged from 0.49 to 4.14 mg/m^3 in surface and from 0.38 to 3.96 mg/m^3 in bottom waters during post monsoon season. Relatively higher Chl-*a* concentration was found during the pre monsoon season compared to the post monsoon season. This observation is concurrent with those reported previously in coastal waters of this region and along east coast of India. Elevated concentrations of Chl-*a* was reported in coastal waters of the central east coast of India during pre monsoon season (February – April) due to the occurrence of mild coastal upwelling during

this period. Coastal upwelling brings nutrient-rich sub surface waters into the surface and enhances primary production in euphotic zone of the region. It is a seasonal phenomenon and it does not occur during the post monsoon season.

Altogether, 44 phytoplankton species/forms are reported from this region in the present study. The number of species varied from 14 to 29 during pre monsoon and from 20 to 21 during post monsoon. These ranges are comparable during pre monsoon and slightly lower during post monsoon when compared to those obtained in 2011 study in this region (Table 7.6). Diatoms were dominant over dinoflagellates in this region during both pre and post monsoon seasons. The dominance of diatoms was seen at every station. Some of the major species found in this region are: *Nitzschia, Navicula, Skeletonema, Thalassiosira, Rhizosolenia, Coscinodiscus, Chaetoceros, Gyrosigma, Pleurosigma, Cerastium, Prorocentrum, Trichdesmium* and *Leptocylindrus*

Phytoplankton abundance ranged from 4200 to 10450 No./L in the surface and from 2300 to 14000 No./L in bottom waters during the pre monsoon season (Table 7.4). Phytoplankton abundance during post monsoon period varied from 4400 No./L to 8600 No./L in the surface and from 4600 to 8740 No./L in bottom waters (Table 7.5). MOP of NTPC recorded considerably lower phytoplankton abundance in both surface (5800 No./L) and bottom (5600 No./L) compared to the surrounding stations in this region (mean: 7103 No./L and 7158 No./L, respectively) during pre monsoon season (Fig. 7.2a). However, station at MOP of JN Pharma City Ltd recorded higher phytoplankton abundance in the surface (8650 No./L) and lower abundance in the bottom waters (6450 No./L) during pre monsoon than the surrounding stations in this region (7103 No./L and 7158 No./L, respectively) (Fig. 7.2a). Similarly, during post monsoon season also MOP of NTPC Ltd. recorded considerably lower phytoplankton biomass both in surface (4400 No./L) and bottom (4600 No./L) compared to the surrounding stations in

this region (5730 No./L and 7199 No./L, respectively) (Fig. 7.2b). Consistent with pre monsoon season, MOP of JNP recorded higher phytoplankton abundance in the surface (7400 No./L) and lower abundance in the bottom waters (5200 No./L) than the surrounding stations in this region (5730 No./L and 7199 No./L, respectively) (Fig. 7.2b). Contrasting to surface waters, bottom waters at MOP of JN Pharma City Ltd. recorded lower phytoplankton biomass during pre monsoon (6450 No./L) and post monsoon (5200 No./L) than the surrounding stations in this region (7158 No./L and 7199 No./L, respectively). Compared to 2011 study conducted in this region, phytoplankton abundance was significantly higher in this study than those found in 2011 study during both pre monsoon and post monsoon seasons (Fig. 7.4a) (Table 7.6).

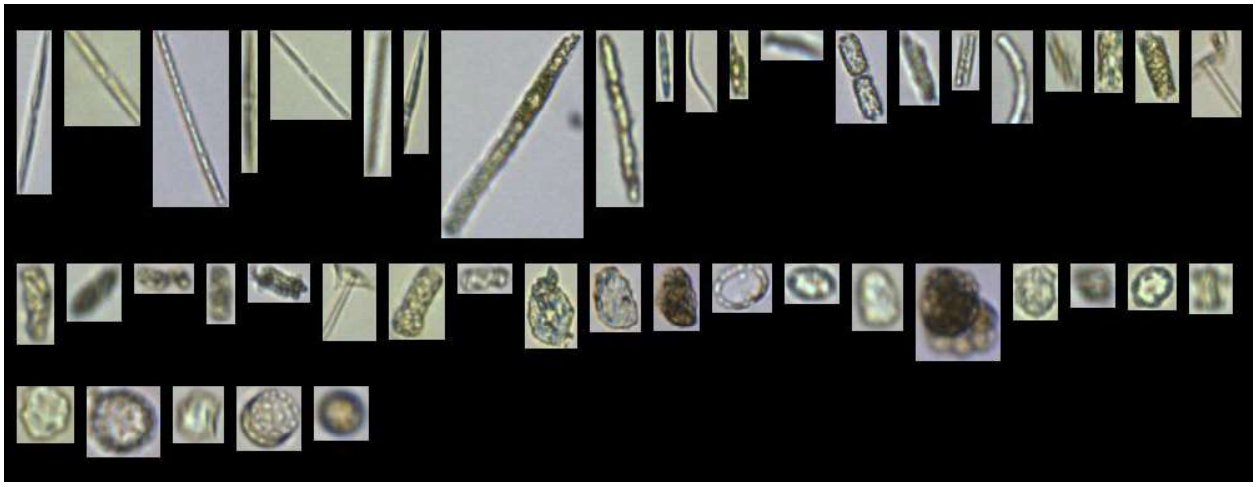

Plate 7.1: Microscopic images of some phytoplankton

Zooplankton, which feed on phytoplankton, is the secondary producer in the marine food chain. Zooplankton abundance in the sampling stations of this zone was presented in Table 7.4 and 7.5 for pre monsoon and post monsoon seasons, respectively. Copepods are the most dominant species in the zooplankton abundance. The other groups reported during the study

period were Hydromedusae, siphanophores, chaetognatha, decapods larvae, polycheate larvae, gastropod larvae, lucifers, cladocerans, and fish eggs and larvae. Zooplankton abundance ranged from 600 to 2600 No./m^3 during pre monsoon season (Table 7.4), and significantly lower abundance was recorded at the MOP of NTPC Ltd. (600 No./m^3) and JN Pharma City Ltd. (960 No./m^3) compared to the mean zooplankton abundance in this zone (1795 No./m^3) (Fig. 7.3a). During the post monsoon season, numerical abundance of zooplankton varied from 625 No./m^3 to 1324 No./m^3. MOPs of NTPC Ltd and JN Pharma City Ltd have recorded slightly lower abundance of zooplankton (789 No./m^3 and 860 No./m^3, respectively) compared to the adjacent stations in this region (938 No./m^3) during post monsoon season (Fig. 7.3b). However, during both pre monsoon and post monsoon seasons, MOPs of NTP Ltd. and JN Pharma City Ltd. recorded relatively lower values of zooplankton abundance compared to the mean abundance in this zone.

Seasonal variations of the zooplankton abundance show that the zooplankton abundance was high during pre monsoon season compared to post monsoon season. Zooplankton abundance is mainly regulated by the phytoplankton abundance, which was found to be relatively low during the post monsoon period compared to pre monsoon. The same pattern of the distribution of zooplankton abundance was also found in the previous monitoring study conducted in this region in 2011. The results of the zooplankton abundance suggest that zooplankton abundance were in line with the phytoplankton abundance. Relatively low zooplankton abundance MOP locations than the surrounding locations, suggest that the impact of industrial effluent on zooplankton is considerable but it is localized as the impact of effluent decreases rapidly with increasing distance from MOP (<2 km from MOP). Compared to 2011 observations in this region, zooplankton abundance found in this study was considerably higher during post monsoon

(Fig. 7.4b) (Table 7.6). Data is not available during pre monsoon season of 2011 to compare our results during pre monsoon season.

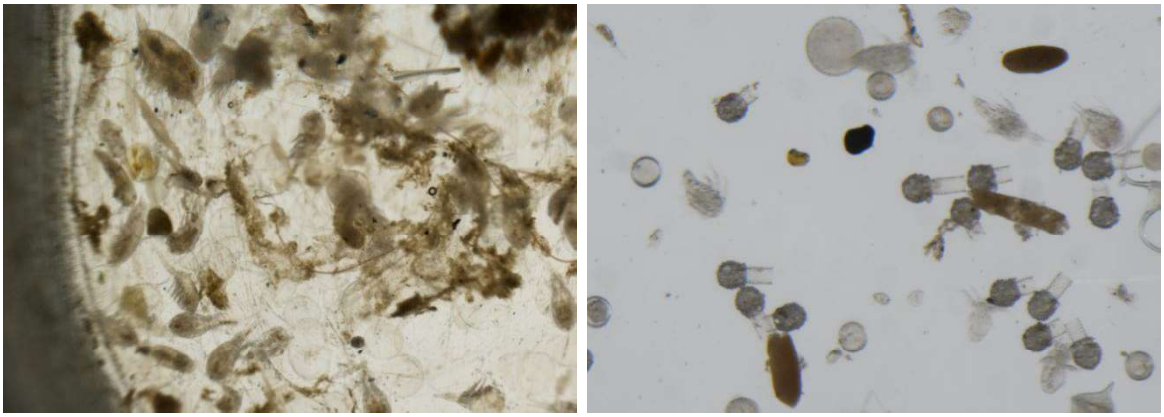

Plate 7.2: Microscopic images of some zooplankton

Benthos play a significant role in transitional ecosystems, by filtering phytoplankton and then offer a food source for fish, thereby linking primary producers with higher trophic levels. Benthic monitoring is a comparatively effective and reliable technique that can serve as early indicators of environmental changes. Benthic organisms are generally divided into two categories, namely, macro benthos and meio benthos, based on their size structure. The distribution and abundance of macro fauna in different locations of this zone during the pre and post monsoon seasons are given in Table 7.4 and Table 7.5, respectively. A total of 38 macro benthic groups/genus/ species are reported in the present study that all are belongs to 8 major groups. Polychaets are the most dominant form of macro benthos. Members of families commonly found in the study region are Megalonidae, Cirratulidae, glyceridae, Spionidae and Capitellidae. Glycera sp., Prionospiopinnata, Lumbrinereis sp., Eunice sp. and Magelona sp. Among crustaceans, amphipods and cumaceans were dominant. The mollusca were represented

by bivalves and gastropods. No endangered species or invasive species was found during the present study.

Macro benthos abundance ranged from 600 No./m^2 to 2900 No./m^2 during pre monsoon (Table 7.4) and from 800 No./m^2 to 1600 No./m^2 during the post monsoon (Table 7.5) seasons. Seasonally, macro benthos abundance was higher during the pre monsoon period (mean: 2512 No./m^2) compared to post monsoon period (1300 No./m^2). The macro faunal abundance was significantly less at marine outfall point of JN Pharma City Ltd. (600 No./m^2 and 900 No./m^2 during pre and post monsoon seasons, respectively) and NTPC Ltd. (650 No./m^2 and 800 No./m^2 during pre and post monsoon seasons, respectively) compared to surrounding stations in this region (2512 No./m^2 and 1300 No./m^2 during pre and post monsoon seasons, respectively) (Fig. 7.3a and b). Relatively less macro faunal density at the MOP locations and the high abundance in the adjacent locations within the zone indicate that the effect of industrial effluent on macro faunal density was considerable but localized. Dilution of industrial effluent with increasing distance from the MOP might have decreased its influence on macro benthic density in the surrounding locations of MOP than at MOP.

Numerical counts of the meio-fauna were in the range of 220 to 780 No./10cm^2 during pre monsoon (Table 7.4) and 400 to 940 No./10cm^2 during post monsoon season (Table 7.5). Nematodes were found to be the most dominant species. Total meio faunal abundance was significantly low at the MOPs of JN Pharma City Ltd. and NTPC Ltd. during both pre monsoon (238 No./10cm^2 and 220 No./10cm^2, respectively) and post monsoon seasons (500 No./10cm^2 and 400 No./10cm^2, respectively), compared to the mean abundance of the adjacent locations in this zone (650 No./10cm^2 and 765 No./10cm^2, respectively) (Fig. 7.3a and b). Total meio-faunal abundance was less at the MOP locations compared to the surrounding locations within the

zones, indicating that considerable impact of the industrial effluents on meio faunal abundance in the study region. However, relatively higher meio faunal abundance at locations within the 2 km from MOP locations suggest that the impact of industrial effluent on meio faunal abundance was localized and limits up to less than 2 km from MOP.

Compared to 2011 observations from this region, both macro and meio faunal abundance found during post monsoon season of the present study were considerably higher compared to those found during the post monsoon season of 2011 study (Fig. 7.4b) (Table 7.6). However, macro and meio faunal abundance data is not available for the pre monsoon season of 2011 to compare our results of pre monsoon season (Fig. 7.4b) (Table 7.6). Significant increase in abundance of phytoplankton, zooplankton, macro benthos and meio benthos in our study compare to 2011 data indicate that the impact of treated effluent release from M/s JN Pharma City Ltd. and NTPC Ltd. is not significant on the abundance of phytoplankton, zooplankton, macro benthos and meio benthos in this region.

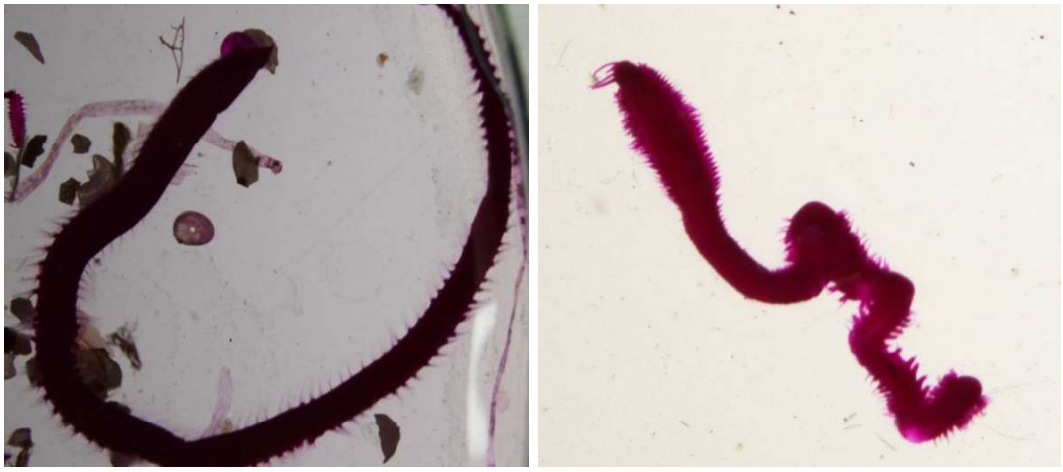

Plate 7.3: Microscopic images of some benthic organisms

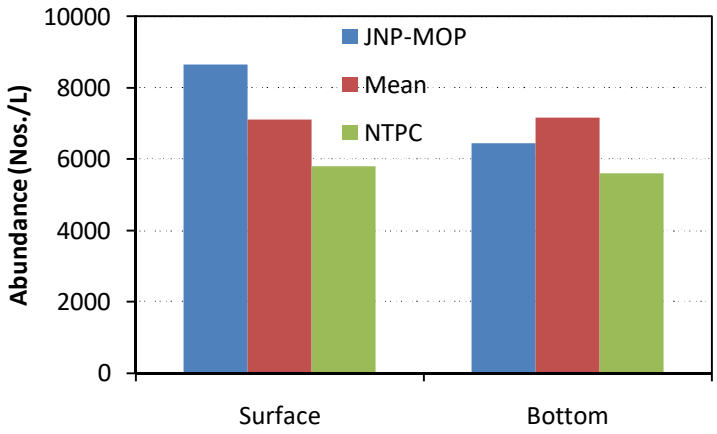

Fig. 7.2a: Comparison of phytoplankton abundance (No./L) at marine outfall points of JN Pharmacity Ltd. (JNP-MOP) and NTPC Ltd. with that of the mean phytoplankton abundance in surrounding stations of this zone during pre monsoon season

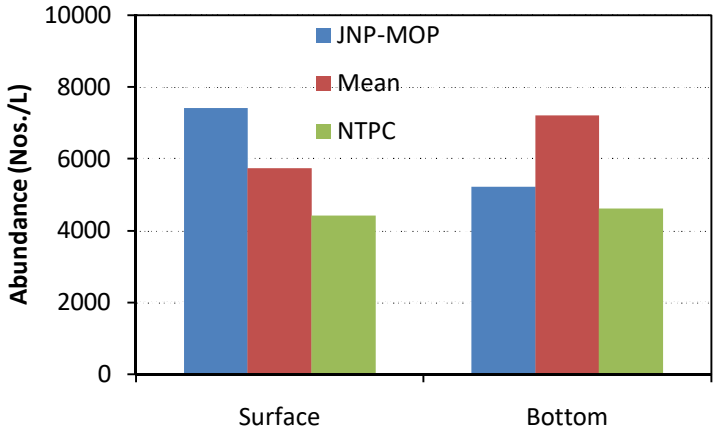

Fig. 7.2b: Comparison of phytoplankton abundance (No./L) at marine outfall points of JN Pharmacity Ltd. (JNP-MOP) and NTPC Ltd. with that of the mean phytoplankton abundance in surrounding stations of this zone during post monsoon season

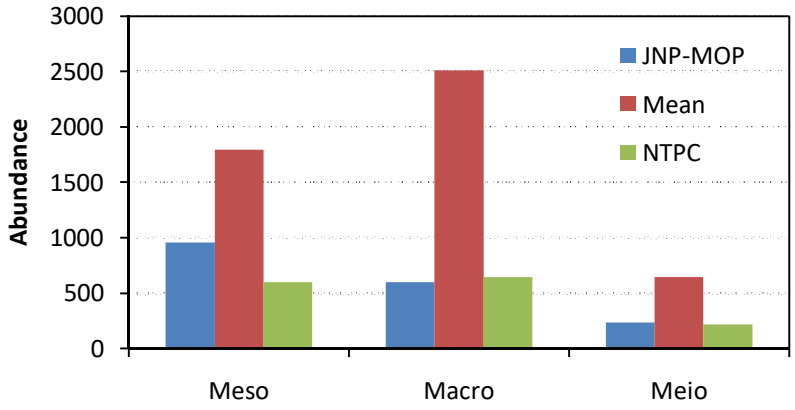

Fig. 7.3a: Comparison of abundance of Meso zooplankont (Meso; No./m^3), macro benthos (Macro; No./m^2) and meio benthos (Meio; No./10cm^2) at marine outfall points of JN Pharma City Ltd. (JNP-MOP) and NTPC Ltd. with that of the mean phytoplankton abundance in surrounding stations of this zone during pre monsoon season

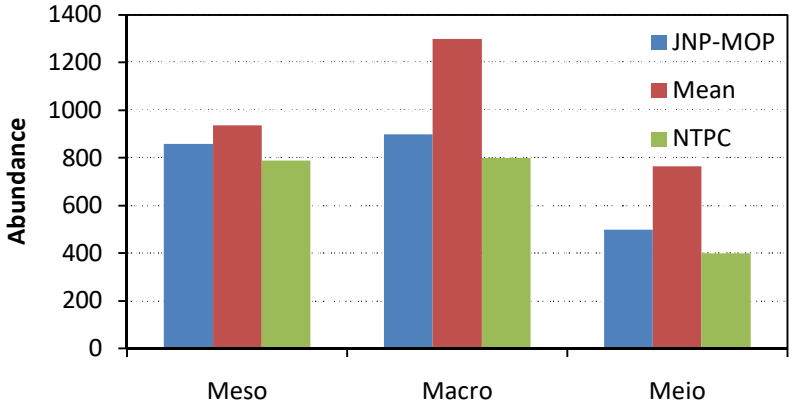

Fig. 7.3b: Comparison of abundance of Meso zooplankont (Meso; No./m^3), macro benthos (Macro; No./m^2) and meio benthos (Meio; No./10cm^2) at marine outfall points of JN Pharma City Ltd. (JNP-MOP) and NTPC Ltd. with that of the mean phytoplankton abundance in surrounding stations of this zone during post monsoon season

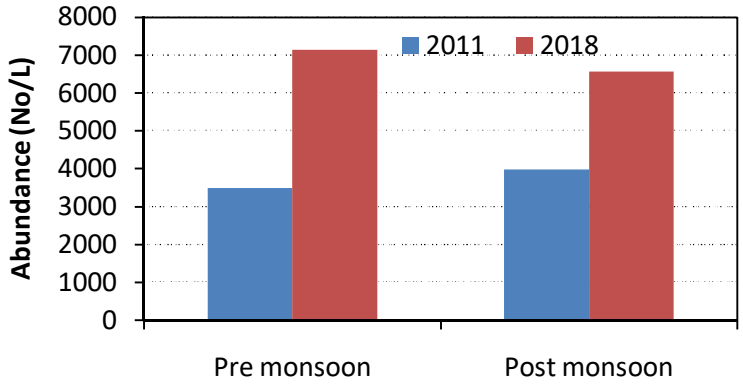

Fig. 7.4a: Comparison of mean phytoplankton abundance (No./L) found in coastal waters off Tikkavanipalem during pre monsoon and post monsoon seasons of the present study with that of the study conducted in 2011 in this region

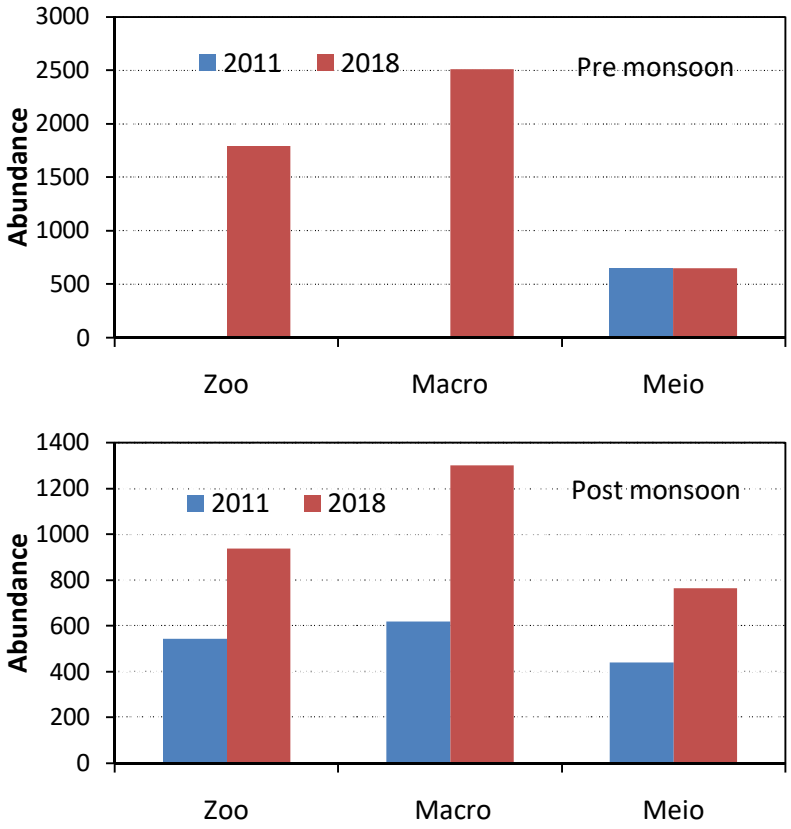

Fig. 7.4b: Comparison of mean abundance of zooplankton (No./m^3), macro benthos (No./m^2) and meio benthos (No./10cm^2) found in coastal waters off Tikkavanipalem during pre monsoon and post monsoon seasons of the present study with that of the study conducted in 2011 in this region

Table 7.4: Details of the biological parameters in coastal waters off Tikkavanipalem during pre monsoon season

Stations	Chlorophyll *a* (mg/m^3)		Phytoplankton (No./L)		Meso zooplankton abundance ($No./m^3$)	Macro benthos abundance ($No./m^2$)	Meio benthos abundance $No./10cm^2$
	Sur	Bot	Sur	Bot			
TVM1	4.08	4.89	10450	8450	1100	-	-
TVM2	5.14	5.37	8650	6400	2140	-	-
TVM3	7.2	7.92	9600	3450	2160	-	-
TVM4	6.2	5.4	8400	10750	1080	2250	740
TVM5	7.54	10.16	7500	10560	-	-	-
TVM6	6.25	4.9	6800	8400	2450	-	-
TVM7	-	5.83	-	6450	-	-	-
TVM8	3.58	4.58	4200	10580	1900	-	-
TVM9	-	6.03	-	11450	2200	-	-
TVM10	3.01	2.87	5640	5400	2100	2250	600
TVM11	4.45	2.6	4800	6800	2600	2650	480
TVM12	4.71	1.92	5600	2600	1400	-	-
TVM13	2.17	1.38	4800	2300	1600	-	-
TVM14	6.19	9.17	9400	14000	1400	2900	780
TVM15	4.9	2.88	6400	2600	1600	-	-
TVM16	5.45	4.69	7200	4350	1400	-	-
NTPC - MOP	5.05	5.05	5800	5600	600	650	220
JNP-MOP	6.3	4.36	8650	6450	960	600	238

Table 7.5: Details of the biological parameters in coastal waters off Tikkavanipalem during post monsoon season

Station Name	Chlorophyll *a* (mg/m^3)		Phytoplankton (No./L)		Meso zooplankton abundance $No./m^3$	Macro benthos abundance ($No./m^2$)	Meio benthos abundance $No./10cm^2$
	Surface	Bottom	Surface	Bottom			
TVM 1	-	1.15	4600	6800	920	-	-
TVM 2	0.49	1.32	5200	7200	1140	-	-
TVM 3	3.72	2.9	4600	6400	1060	-	-
TVM 4	2.49	2.44	5400	8000	1040	1600	760
TVM 5	1.25	2.14	6400	8200	860	-	-
TVM 6	0.78	1.55	7600	8400	1324	-	-
TVM 7	4.14	1.13	4600	5400	625	-	-
TVM 8	3.84	3.96	5200	8460	860	-	-
TVM 9	1.25	1.82	5640	6400	1014	-	-
TVM 10	0.58	0.96	4600	5600	945	1400	940
TVM 11	1.71	1.09	5100	8740	780	1200	600
TVM 12	4.11	0.38	8600	5600	820	-	-
TVM 13	-	1.55	6450	8100	890	-	-
TVM 14	-	0.57	4600	7100	920	1000	760
TVM 15	2.79	2.55	5040	6140	840	-	-
TVM 16	1.9	2.61	8060	8640	965	-	-
NTPC MOP	2.22	2.14	4400	4600	789	800	400
JNP- MOP	1.94	1.44	7400	5200	860	900	500

Comparison of biological characteristics observed in this study with that of the study conducted in this region during 2011 was given in Table 7.6

Table 7.6: Comparison of biological characteristics found in present study with earlier studies conducted in the coastal waters off Tikkavanipalem

Parameter	2009-2010	2011		Present study	
		Pre monsoon	Post monsoon	Pre monsoon	Post monsoon
Phytoplankton abundance ($x10^4$ cells/ L)	0.42-1.80	0.25-1.47	0.19-1.26	0.42-1.40	0.44-0.87
Species richness	11-18	13-28	12-25	14-29	20-21
Zooplankton abundance ($No./m^3$)	73-146	-	317-683	600-2600	625-1324
Macro benthos abundance ($No./m^3$)	450-2100	-	125-1650	600-2900	800-1600
Meio faunal abundance ($No./m^3$)	440-1344	-	267-825	220-780	400-940

7.3 Microbiological parameters

Both surface and bottom water samples collected from the study area were analyzed for the following microbiological parameters:

1. Total viable count (TVC) – R2A Agar seawater medium,
2. Total Coliform (TC) – Mac Conkey's Agar,
3. *Escherichia coli* like organisms (ECLO) – Mac Conkey's Agar,
4. *Enterococcus feacalis* like organisms (EFLO) – Mac Conkey's Agar,
5. *Pseudomonas aeruginosa* like organisms (PALO) – Cetrimide Agar,
6. *Vibro* like organisms (VLO) – TCBS Agar,
7. *Vibro cholerae* like organisms (VCLO) – TCBS Agar,
8. *Vibro parahaemolyticus* like organisms (VPLO) – TCBS Agar

Certain aquatic microbes serve as excellent indicator of pollution. Microbes, in particular bacteria react quickly to changes in the environmental conditions. An assessment of the microbial activity is possible by the determination of the microbial biomass (total viable count). Therefore the total viable counts implies an indirect measure of *in situ* activity in contrast to number of specific indicator microbes, and this has been used as one of the principal criteria of pollution in natural water. Besides the pollution indicator bacteria such as total coliforms (TC), *Escherichia coli* like organisms (ECLO) and *Enterococcus feacalis* like organisms (EFLO) occurring the coastal waters have also been included. These indicator bacteria will presumably shows that sewage discharge with human faecal matter is present, which also indicates that possible presence of pathogenic bacteria in the water samples. Apart from that some pathogenic bacteria such as *Pseudomonas aeruginosa* like organisms (PALO), *Vibro cholerae* like organisms (VLO) and *Vibro parahaemolyticus* like organisms (VPLO) abundance was also studied.

Bacterial counts of the water samples collected during pre and post monsoon seasons in the coastal waters off Tikkavanipalem are given in Tables 7.7 and 7.8. The values of TVC in the surface and bottom water were in the range of 0.3 to 4.0 and 1.3 to 5.6 CFUx10^3/ml during pre monsoon season (Table 7.7a). The values during post monsoon season were 0.8 to 18.7 and 0.8 to 24.0 CFUx10^3/ml, in the surface and bottom water respectively (Table 7.8a). Total Coliform counts in the surface and bottom water were in the range of 0.4 to 3.9 and 1.4 to 6.3 CFUx10^2/ml during pre monsoon season (Table 7.7a). The values during post monsoon season were 0.1 to 25 and 0.1 to 39.2 CFUx10^2/ml, in the surface and bottom water respectively (Table 7.8a). Similarly the *Escherichia coli* like organism counts in the surface and bottom water were in the range of 0.1 to 0.9 and 0.2 to 1.1 CFUx10^1/ml during pre monsoon season (Table 7.7a). The values during

post monsoon season were 1.0 to 126.0 and 1.0 to 392 CFUx10^1/ml, in the surface and bottom water respectively (Table 7.8a). *Enterococcus faecalis* like organism counts in the surface and bottom water were in the range of 0.1 to 2.6 and 0.5 to 2.0 CFUx10^1/ml during pre monsoon season (Table 7.7a). The values during post monsoon season were 1.0 to 10 and 1.0 to 50 CFUx10^1/ml, in the surface and bottom water respectively (Table 7.8a). *Pseudomonas aeruginosa* like organism counts in the surface and bottom water were in the range of 0.2 to 4.3 and 2.1 to 9.4 CFUx10^3/ml during pre monsoon season (Table 7.7b). The values during post monsoon season were 0.2 to 9.2 and 0.6 to 65 CFUx10^3/ml, in the surface and bottom water respectively (Table 7.8b). *Vibrio* like organism counts in the surface and bottom water were in the range of 0.1 to 2.0 and 0.2 to 0.9 CFUx10^1/ml during pre monsoon season (Table 7.7b). The values during post monsoon season were 1.0 to 2.0 and 1.0 to 11.0 CFUx10^1/ml, in the surface and bottom water respectively (Table 7.8b). *Vibrio cholerae* like organism counts in the surface and bottom water were in the range of 1.5 to 9.0 and 0.1 to 0.2 CFUx10^1/ml during pre monsoon season (Table 7.7b). The VCLO count during post monsoon season were 2.0 and 3.0 CFUx10^1/ml, in the surface and bottom water respectively (Table 7.8b). *Vibrio parahaemolyticus* like organism counts in the surface and bottom water were in the range of 0.1 to 0.3 and 0.1 to 0.2 CFUx10^1/ml during pre monsoon season (Table 7.7b). The VPLO counts during post monsoon season were 1.0 and 1.0 to 8.0 CFUx10^1/ml, in the surface and bottom water respectively (Table 7.8b).

Table 7.7a. Spatial variability in total viable count (TVC; CFU/ml), total coli forms (TC, CFU/ml), *Escherichia coli* like organism (ECLO, CFU/ml) and *Enterococcus faecalis* like organism (EFLO, CFU/ml) in surface and bottom waters off Tikkavanipalem coast during pre monsoon season

Station	TVC ($CFU*10^3$/ml)		TC ($CFU*10^2$/ml)		ECLO ($CFU*10^1$/ml)		EFLO ($CFU*10^1$/ml)	
	SUR	BOT	SUR	BOT	SUR	BOT	SUR	BOT
TVM1	2.6	2.2	2.9	2.5	0.6	0.4	0.8	0.8
TVM2	1.5	-	1.6	-	0.4	-	0.4	-
TVM3	2.3	2.6	2.5	2.9	0.5	0.5	0.7	0.9
TVM4	1.9	3.1	1.8	3.7	0.9	0.6	1.1	1.2
TVM5	1.1	1.6	1.0	1.9	0.5	0.3	0.6	0.6
TVM6	0.3	1.8	0.4	2.0	0.1	0.3	0.1	0.7
TVM7	2.4	3.4	2.6	3.8	0.6	0.6	0.7	1.2
TVM8	2.2	2.0	2.4	2.2	0.5	0.4	0.6	0.7
TVM9	1.5	-	1.7	-	0.4	-	0.4	-
TVM10	3.3	1.7	3.6	2.0	0.8	0.3	1.0	0.6
TVM11	1.7	5.6	1.9	6.3	0.4	1.1	0.5	2.0
TVM12	2.0	2.7	2.2	3.0	0.5	0.5	0.6	1.0
TVM13	1.0	4.2	1.1	4.7	0.3	0.8	0.3	1.5
TVM14	2.3	5.3	2.5	6.0	0.6	1.0	0.7	1.9
TVM15	1.9	1.9	2.0	2.2	0.5	0.4	0.5	0.7
TVM16	1.7	3.2	1.8	3.6	0.4	0.6	0.5	1.1
NTPC-MOP	0.8	1.3	0.9	1.4	0.2	0.2	0.2	0.5
JNP-MOP	4.0	2.1	3.9	2.3	2.2	0.6	2.6	1.1

Table 7.7b. Spatial variability in *Pseudomonas aeruginosa* like organism (PALO, CFU/ml), *Vibrio* like organism (VLO, CFU/ml), *Vibrio cholerae* like organism (VCLO, CFU/ml) and *Vibrio parahaemolyticus* like organism (VPLO, CFU/ml) in surface and bottom waters off Tikkavanipalem coast during pre monsoon season

Station	PALO ($CFU*10^3$/ml)		VLO ($CFU*10^1$/ml)		VCLO ($CFU*10^1$/ml)		VPLO ($CFU*10^1$/ml)	
	SUR	BOT	SUR	BOT	SUR	BOT	SUR	BOT
TVM1	1.6	3.7	0.6	0.3	0.1	0.1	0.1	0.1
TVM2	0.9	-	0.3	-	0.1	-	0.1	-
TVM3	1.3	4.4	0.5	0.4	0.1	0.1	0.1	0.1
TVM4	1.6	4.9	0.8	0.5	0.2	0.1	0.2	0.1
TVM5	0.9	2.5	0.4	0.3	0.1	0.1	0.1	0.1
TVM6	0.2	3.1	0.1	0.3	-	0.1	-	0.1
TVM7	1.4	5.6	0.5	0.5	0.1	0.1	0.1	0.1
TVM8	1.3	3.3	0.5	0.3	0.1	0.1	0.1	0.1
TVM9	0.9	-	0.3	-	0.1	-	0.1	0.-
TVM10	1.9	2.9	0.7	0.3	0.2	0.1	0.1	0.1
TVM11	1.0	9.4	0.4	0.9	0.1	0.2	0.1	0.2
TVM12	1.2	4.5	0.4	0.4	0.1	0.1	0.1	0.1
TVM13	0.6	7.0	0.2	0.6	0.1	0.2	-	0.1
TVM14	1.4	8.9	0.5	0.8	0.1	0.2	0.1	0.2
TVM15	1.1	3.2	0.4	0.3	0.1	0.1	0.1	0.1
TVM16	1.0	5.3	0.4	0.5	0.1	0.1	0.1	0.1
NTPC-MOP	0.5	2.1	0.2	0.2	-	-	-	-
JNP-MOP	4.3	3.5	2.0	0.3	0.5	0.1	0.2	0.1

Table 7.8a. Spatial variability in total viable count (TVC; CFU/ml), total coli forms (TC, CFU/ml), *Escherichia coli* like organism (ECLO, CFU/ml) and *Enterococcus faecalis* like organism (EFLO, CFU/ml) in surface and bottom waters off Tikkavanipalem coast during post monsoon season

Station	TVC ($CFU*10^3$/ml)		TC ($CFU*10^2$/ml)		ECLO ($CFU*10^1$/ml)		EFLO ($CFU*10^1$/ml)	
	SUR	BOT	SUR	BOT	SUR	BOT	SUR	BOT
TVM1	0.9	3.9	-	-	-	-	-	-
TVM2	0.8	2.0	-	0.4	-	4	-	-
TVM3	5.2	0.9	4.0	39	0	392	-	-
TVM4	11.4	13.2	2.9	-	105	-	-	-
TVM5	3.1	10.6	2.4	-	-	-	-	-
TVM6	15.3	8.8	0.4	-	1.0	-	1	-
TVM7	1.5	9.6	0.1	0.9	-	9	-	12
TVM8	1.3	0.8	-	2.8	10	28	10	1
TVM9	-	-	-	-	-	-	-	-
TVM10	18.7	4.5	0.8	0.1	32	1	-	-
TVM11	0.9	3.7	21.4	-	-	-	-	-
TVM12	16.8	24	9	1.2	4	12	-	-
TVM13	11.7	13.5	6.6	0.4	15	4	-	-
TVM14	13.4	10.1	5.1	-	11	-	-	-
TVM15	-	11.3	-	-	-	-	-	-
TVM16	15.0	5.3	25	-	-	-	-	-
NTPC-MOP	1.1	7.8	19	1.4	126	14	-	50
JNP-MOP	-	-	-	-	-	-	-	-

Table 7.8b: Spatial variability in *Pseudomonas aeruginosa* like organism (PALO, CFU/ml), *Vibrio* like organism (VLO, CFU/ml), *Vibrio cholerae* like organism (VCLO, CFU/ml) and *Vibrio parahaemolyticus* like organism (VPLO, CFU/ml) in surface and bottom waters off Tikkavanipalem coast during post monsoon season

Station	PALO ($CFU*10^3$/ml)		VLO ($CFU*10^1$/ml)		VCLO ($CFU*10^1$/ml)		VPLO ($CFU*10^1$/ml)	
	SUR	BOT	SUR	BOT	SUR	BOT	SUR	BOT
TVM1	1.2	-	-	-	-	-	-	-
TVM2	1.2	0.6	-	-	-	-	-	-
TVM3	2.5	8.5	1	11	-	3	1	8
TVM4	7.7	-	2	1	2	-	-	1
TVM5	0.6	1.2	-	2	-	-	-	2
TVM6	5.3	3.4	-	-	-	-	-	-
TVM7	0.6	5.6	-	-	-	-	-	-
TVM8	0.2	6.2	-	-	-	-	-	-
TVM9	-	-	-	-	-	-	-	-
TVM10	3.7	1.5	-	-	-	-	-	-
TVM11	9.2	1.7	-	-	-	-	-	-
TVM12	1.3	2.6	-	-	-	-	-	-
TVM13	6.6	5.3	-	5	-	-	-	5
TVM14	3.8	3.4	-	7	-	-	-	7
TVM15	-	2.9	-	-	-	-	-	-
TVM16	5.3	-	-	-	-	-	-	-
NTPC-MOP	1.6	65	-	-	-	-	-	-
JNP-MOP	-	-	-	-	-	-	-	-

Table 7.9: Comparison of microbial populations found during the pre monsoon and post monsoon seasons of this study (2018) with those obtained during the previous monitoring study conducted in this region in 2011.

Region	Type of bacteria	This study (2018)		Previous study (2011)	
		Pre monsoon	Post monsoon	Pre monsoon	Post monsoon
Tikkavanipalem (zone 5)	TVC (CFUx10^3/ml)	0.3-5.6	0.8-24	2.9-19	3.1-9
	TCC (CFUx10^2/ml)	0.4-6.3	0.1-39	0.6-5	0.1-1.5
	ECLO (CFUx10^1/ml)	0.1-1.1	1.0-392	0.1-15	0.8-5
	VLO (CFUx10^1/ml)	0.1-2.0	1.0-11	0.9-214	0.7-82

TVC counts are more during post monsoon season compared to pre monsoon season. When compared to 2011 data, TVC counts found in this study are lower during pre monsoon season and higher during post monsoon season. TC counts are more during post monsoon season. These counts are more or less similar during pre monsoon season and higher during post monsoon season compared 2011 data. ECLO counts are more during post monsoon season and these counts are lower during pre monsoon season and higher during post monsoon season compared to 2011 data. EFLO, PALO and VLO counts are more during post monsoon than pre monsoon season. VCLO and VPLO counts are very low and no considerable seasonal variability was found.

Microbiological quality of the seawater in this region is not good as the presence of indicator bacteria and some pathogenic bacteria in higher concentrations than the standard levels. The presence of indicator bacteria and some pathogenic bacteria in concentrations higher than the standard levels in coastal waters in this region indicated that coastal waters of this region is considerably contaminated with untreated domestic sewage.

Chapter 13

RECOMMENDATIONS

Present study region, the coastal waters of north Andhra coast extending from off Pydibhimavaram to off Kesavaram was investigated during pre and post monsoon seasons for physico-chemical, biological, micro biological and sedimentolgical parameters in order to assess the impact of industrial effluent release through the marine outfall points (MOPs) on the seawater quality and ecosystem of the region, if any. The *in-situ* observations and sample collection was carried from 17th February to 08th March 2018 during the pre monsoon season and from 08th December 2018 to 1st January 2019 during the post monsoon season. Results of our investigations in the study region during both the seasons (pre and post monsoon) were described in detail in chapters 3 to 12. Based on findings of this study the following recommendations have been made to maintain the seawater quality and the health of the ecosystem in the coastal waters of north Andhra coast.

- ✓ Since the dissolved oxygen concentrations are depleted and ecosystem at MOPs is impacted, continuous yearly monitoring of the north Andhra coast is very much required, at least for the next two years, to monitor the DO levels and to understand the expansion/compression of impacted area around the MOP location, and to take necessary timely precautions to protect the seawater quality and the health of the ecosystem in the region
- ✓ Time series experiments (continuous daily measurements at MOP and surrounding locations for one week; before, during and after effluent release) should be conducted at

least for two industries (one in the south and the other in the north of Visakhapatnam) to understand the impact of effluent release on the ecosystem in the region.

- ✓ Since the seasonal variability in all the parameters is very high in the study region, monitoring should be conducted with high temporal resolution, at least 4 times in a year, for example, February, May, September and December.
- ✓ In order to assess the impacted area around the MOP location, it should be covered at least 5km (instead of 2km in the present study) from the MOP in both the directions along the coast.
- ✓ Further treatment for industrial effluents is required to reduce their toxicity before discharging into the sea because the treated effluents from all the industries are mildly acute toxic.
- ✓ Bio assay tests for industrial effluents must be conducted on monthly time scale at least for one year to understand the variability in the quality of effluent because the composition of the treated effluent is highly variable with time for any industry.
- ✓ Trace metals (chromium, manganese, cobalt, nickel, copper, cadmium, zinc etc) concentrations should be determined in the treated effluents of industries before discharging in to the sea, coastal waters, and benthic organisms along with surface sediments in order to assess the trace metal contamination in the food chain.
- ✓ Sludge remained in the guard ponds should be removed on regular time intervals to avoid its transport into the sea along with effluent.
- ✓ Since, fish is more susceptible to contamination of organic compounds the major organic compounds present in the treated effluent should be understood before discharging into the sea.

- ✓ Antibiotic resistivity of the indicator and pathogenic bacteria present in the waters of the study region should be investigated
- ✓ As microbiological studies indicated significant input of untreated domestic sewage to the present study region, it is strongly recommended to take necessary steps to prevent the transport of untreated domestic sewage into the sea.

ANNEXURE-IV

consolidated analysis reports of Borewells in Tadi by month (February 2022 to December 2023)

Bore well sample collected at MPP School, Tadi (V)

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.70	2033	1268	249.39	172	460	0.02	82.6	0.72	0.05	14.58	BDL	148.8	49.16	136.28	4.58	0.008	0.006	0.072	0.001	0.002	0.009	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.50	1626	1060	109.6	260	440	BDL	77.12	1.36	0.22	21.47	BDL	41.6	38.00	170.3	5.55	<0.001	0.012	0.029	<0.001	<0.001	0.02	<0.001	<0.001	<0.001	<0.001
07.06.2023	6.17	1018	662	53.8	180	252	BDL	1.63	0.28	BDL	0.44	BDL	49.6	13.6	65.07	0.12	<0.001	0.002	0.03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.43	1546	1010	117.36	292	560	BDL	62.38	0.85	0.03	5.28	0.01	116.8	35.96	175.1	1.49	<0.001	0.002	0.01	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.37	568	344	24.99	124	167	0.04	7.10	0.65	0.02	1.23	BDL	64	60	23.68	26.71	<0.001	0.023	0.034	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.64	2382	1550	254.28	391	540	0.05	116.32	1.26	0.02	24.52	BDL	210	181	304.2	2.56	<0.001	0.006	0.024	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001

Bore well sample collected at Tadi (V)

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.38	2083	1792	410.76	536	623	0.04	98.4	1.86	0.08	20.28	BDL	214.4	76.78	184.66	6.16	0.006	0.005	0.064	0.003	0.003	0.012	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.90	2210	1436	214.9	164	280	BDL	16	2	0.01	27.93	BDL	17.6	29.20	334.7	10.32	<0.001	0.001	0.021	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
07.06.2023	6.92	766	496	88	292	260	BDL	16.57	0.36	0.01	14.7	BDL	86.4	18.4	56.68	1.78	<0.001	<0.001	0.036	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.37	3110	2026	482.79	600	652	0.02	113.00	0.77	BDL	16.1	0.01	240	66.09	277.1	2.23	<0.001	0.02	0.038	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.52	844	516	94.97	228	155	0.05	14.62	0.86	0.18	16.91	BDL	108	120	36.3	2.74	<0.001	0.006	0.068	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.72	2956	1928	396.09	218	487	0.04	126.51	0.74	0.06	48.14	BDL	280	312	286.6	2.74	<0.001	0.02	0.02	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001

Bore well sample collected at BC Colony, Tadi (V)

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.57	1710	1276	197.36	288	517	0.03	75.6	0.84	0.07	18.36	BDL	115.2	44.71	172.2	3.92	0.005	0.004	0.052	0.002	0.004	0.01	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.65	2860	1858	334.2	516	284	BDL	59.4	0.77	0.11	43.65	0.05	68.8	83.5	171.2	2.2	<0.001	0.024	0.047	0.001	<0.001	0.032	<0.001	<0.001	<0.001	<0.001
07.06.2023	6.55	576	374	132	356	284	BDL	20.1	1.26	0.01	22	BDL	99.2	26.2	58.08	4.18	<0.001	<0.001	0.061	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.74	2270	1480	259.17	172	615	0.01	90.30	2.5	0.01	6.42	0.01	68.8	20.41	387	1.95	<0.001	0.001	0.021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.15	1017	618	119.96	224	130	0.08	19.02	0.51	0.03	21.78	BDL	112	112	46.51	2.61	<0.001	0.004	0.08	<0.001	<0.001	0.018	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.56	1714	1116	122.25	291	212	0.06	82.22	0.82	0.1	25.38	BDL	135	156	84.01	2.04	<0.001	0.004	0.026	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Bore well sample collected at Tanam (V)

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.42	1076	882	188.24	320	288	0.02	56.3	0.76	0.05	16.56	BDL	98	35.96	104.86	4.18	0.008	0.008	0.04	0.003	0.005	0.008	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.65	821	536	60.1	304	272	0.02	15.98	1.16	0.01	14.52	0.01	76.8	27.30	35	2.32	<0.001	<0.001	0.046	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
07.06.2023	7.68	2260	1468	249.2	124	588	0.01	110	0.89	0.16	29.74	BDL	36.8	7.7	414.8	3.19	<0.001	0.001	0.016	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.36	868	568	122.25	332	370	BDL	13.46	1.06	0.07	4.08	0.02	132.8	39.85	34.56	2.85	<0.001	0.007	0.072	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.81	2220	1338	238.91	104	522	0.04	103.16	1.35	0.01	23.15	BDL	52	60	387.4	1.17	<0.001	0.004	0.014	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.46	972	634	117.38	318	216	0.04	13.50	0.74	0.14	14.26	BDL	170	148	42.14	2.56	<0.001	0.008	0.052	<0.001	<0.001	0.008	<0.001	<0.001	<0.001	<0.001

Bore well sample collected at ZP High School, Tanam (V)`

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.16	974	846	182.79	224	267	0.01	52.8	0.58	0.04	14.18	BDL	89.6	24.30	120.36	14.26	0.007	0.004	0.038	0.001	0.003	0.006	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.07	1014	654	124.9	368	284	0.03	22.24	0.63	0.02	21.47	0.03	105.6	25.30	52.97	2.37	<0.001	0.001	0.063	<0.001	<0.001	0.021	<0.001	<0.001	<0.001	<0.001

07.06.2023	7.77	1702	1108	132	268	604	BDL	10.95	1.11	0.06	29.8	0.01	48	35.9	250.55	6.44	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.35	594	390	54.9	176	260	BDL	3.04	0.68	BDL	0.03	0.02	70.4	20.41	23.43	24.92	<0.001	0.021	0.037	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.69	1603	970	104.96	164	436	0.04	73.80	0.89	0.12	22.53	BDL	88	76	226.62	1.71	<0.001	0.002	0.024	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.24	656	428	34.23	203	232	0.03	6.28	0.56	BDL	6.38	BDL	105	98	22.36	26.52	<0.001	0.024	0.042	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Bore well sample collected at NTR Statue Main Road, Tanam (V)

Date	pH	EC	TDS	Cl	TH	TA	P	SO4	F	NO2-N	NO3	NH3-N	Ca	Mg	Na	K	Cr	Mn	Fe	Ni	Cu	Zn	As	Cd	Pb	Hg
03.02.2023	7.01	1130	972	198.72	360	315	0.03	68.9	0.8	0.06	16.5	BDL	104	29.16	142.72	5.32	0.012	0.009	0.048	0.004	0.006	0.012	<0.001	<0.001	<0.001	<0.001
17.04.2023	7.54	828	538	94.9	316	264	0.01	16.23	1.13	0.01	14.65	BDL	80	28.20	45.17	2.15	<0.001	<0.001	0.045	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
07.06.2023	7.33	2920	1896	498.9	488	680	0.01	61.1	0.49	0.19	49.9	BDL	88	65.1	349.35	2.78	<0.001	<0.001	0.003	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
21.08.2023	7.03	962	630	171.15	360	351	BDL	7.86	0.83	0.06	1.07	0.04	144	41.79	37.63	1.37	<0.001	0.007	0.072	<0.001	<0.001	0.015	<0.001	<0.001	<0.001	<0.001
28.10.2023	7.33	2930	1764	384.84	324	428	0.05	120.72	0.87	0.04	46.83	BDL	192	132	368.1	1.63	<0.001	0.022	0.026	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
30.12.2023	7.32	1134	740	132.03	120	203	0.05	20.16	0.48	0.02	20.52	BDL	180	140	49.28	2.74	<0.001	0.006	0.074	<0.001	<0.001	0.014	<0.001	<0.001	<0.001	<0.001
Standards	NR	-	2000	1000	600	600	-	400.00	1.5	-	-	-	200	100	-	-	NR	0.3	NR	NR	1.5	15	0.05	NR	NR	

NR- No Relax

ANNEXURE-V

A REPORT ON THE HYDROGEOLOGICAL AND HYDROLOGICAL INVESTIGATION AT COMMON EFFLUENT TREATMENT PLANT (CETP) AREA OF M/S. RAMKY PHARMACITY(INDIA) LTD, JAWAHARLAL NEHRU PHARMA CITY (JNPC), PARAWADA, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

SUBMITTED TO

RAMKY PHARMA CITY (INDIA) LIMITED

JNPC, Commercial hub, Road No.13/RNB, Visakhapatnam

2021 **TECHNICAL REPORT**

Prepared By

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A REPORT ON THE HYDROGEOLOGICAL AND HYDROLOGICAL INVESTIGATION AT COMMON EFFLUENT TREATMENT PLANT (CETP) AREA OF M/S. RAMKY PHARMACITY(INDIA) LTD, JAWAHARLAL NEHRU PHARMA CITY (JNPC), PARAWADA, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

Name of the Client	:	M/s RAMKY PHARMA CITY (INDIA) LIMITED JNPC, Commercial hub, Road No.13/RNB Visakhapatnam
Site of Investigation	:	CETP Area Ramky Pharmacity, Parawada Visakhapatnam
Reference	:	WO NO: 0400058852, dated 05-11-2020 PR No.: 3000060065
Investigation period	:	November, 2020 to April, 2021

1. INTRODUCTION (Very Brief Activity about the Industry):

In response to a communication received from M/s Ramky Pharma City (India) Pvt. Ltd., JNPC, Parawada, Visakhapatnam Dt. to conduct Hydrogeological and Hydrological investigation around its Common Effluent Treatment Plant (CETP), investigation has been taken up on behalf of Centre for Scientific and Industrial Consultancy, Andhra University. Common Effluent Treatment Plant (CETP) is one of the Environmental monitoring unit in M/s Ramky Pharma City (India) Limited Industrial unit located in JNPC, at Parawada village, Parawada mandal in Visakhapatnam district. CETP receives effluents from User Industries of Pharma City for treatment and disposal. The following treatment systems are provided:

1. Low TDS treatment system
2. High TDS treatment system
3. Treatment for cyanided bearing effluents
4. Treatment for Heavy metal (Chromium) bearing effluents.

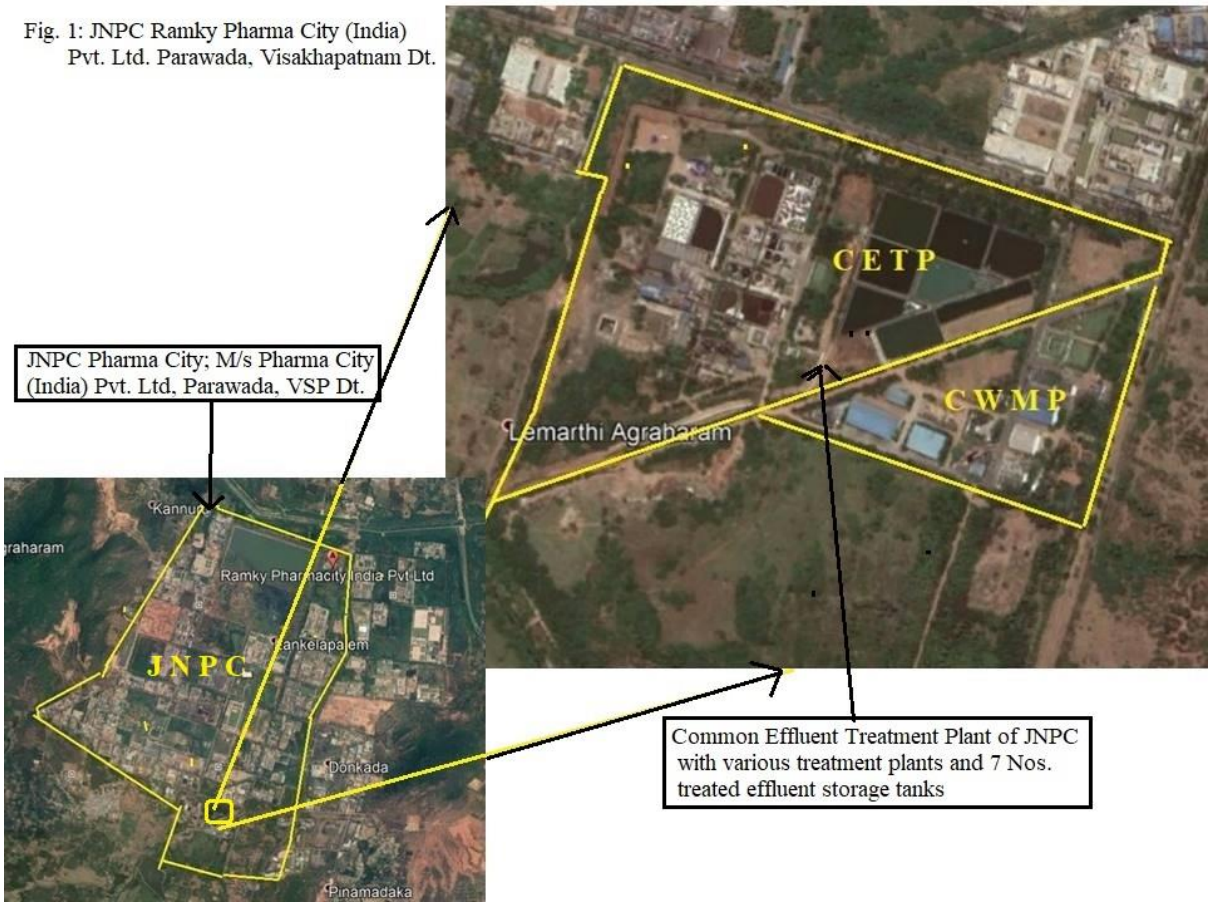
Effluent Conveyance network with HDPE pipelines is provided in JNPC for conveyance of effluents from industries to CETP. This conveyance system is designed to carry Low TDS and High TDS effluents separately through two conveyance lines. Cyanide and Heavy Metal bearing wastes which will be relatively very low in volume are conveyed through road tankers to CETP. Limits of various parameters for discharge into the above conveyance systems are as per PCB guide lines.33.

Low TDS effluent Treatment system is designed to treat 3.5 MLD (3500 M^3 / day) of effluents. High TDS effluent Treatment system is designed to treat 1.5 MLD (1500 M^3 / day) of effluents. Wastes containing traces of Cyanide and heavy metals like chromium effluents are taken to high TDS stream for further treatment.

Guard Ponds

Nine Guard Ponds are provided with total 47200m^3 capacities to hold treated effluents. Effluent collected in ponds will tested by PCB for outlet parameters for discharge to marine coastal areas (sea). During this period effluent will be collected in next Guard Pond. After conformity of the parameters for discharge standards, effluents will be pumped to Marine Out Fall through a conduit after getting clearance from PCB in the presence of PCB officials. If the treated effluents from Guard Ponds are rejected by PCB, the treated water will be taken back for further treatment. Satellite image of the JNPC and CETP areas are shown in fig. 1.1 JNPC Ramky

Fig. 1: JNPC Ramky Pharma City (India) Pvt. Ltd. Parawada, Visakhapatnam Dt.



Pharma City (India) Pvt. Ltd. Spread in an area of about 693 Hectares as per the boundary marked in fig. 1.1 Common Effluent Treatment Plant (CETP) is part of JNPC and its area is about 16.6 Hec. as marked above that consists of 9 guard ponds and effluent treatment units.

The treated effluent will be delivered into marine fall (Sea) after getting permission from APPCB.

1.1 Proposed Studies: Purpose of the Hydrgeological investigation is to establish base line data on groundwater parameters like water table fluctuations, broadly present status of groundwater potential and exploration at regional and local level, quality of groundwater, identification of aquifer zones, geological and geomorphological features. The other related themes like drainage, catchment divisions, water bodies and present land use/ land cover also required. Rainfall of the region and rainwater harvesting for improvement of groundwater potential also dealt. Number of thematic maps will be prepared at small scale maps taking the study area CETP as centre and data will be collected and consolidated to 10km radius corridor from the centre point. Similarly large scale thematic maps will be prepared considering the drainage catchment of CETP area. Base maps of small scale and large scale are shown in the following image mosaics of topo sheet updated up to 1978 and satellite image of 2020. All the themes prepared further on the proposed objectives are both on the 10km radius as well study

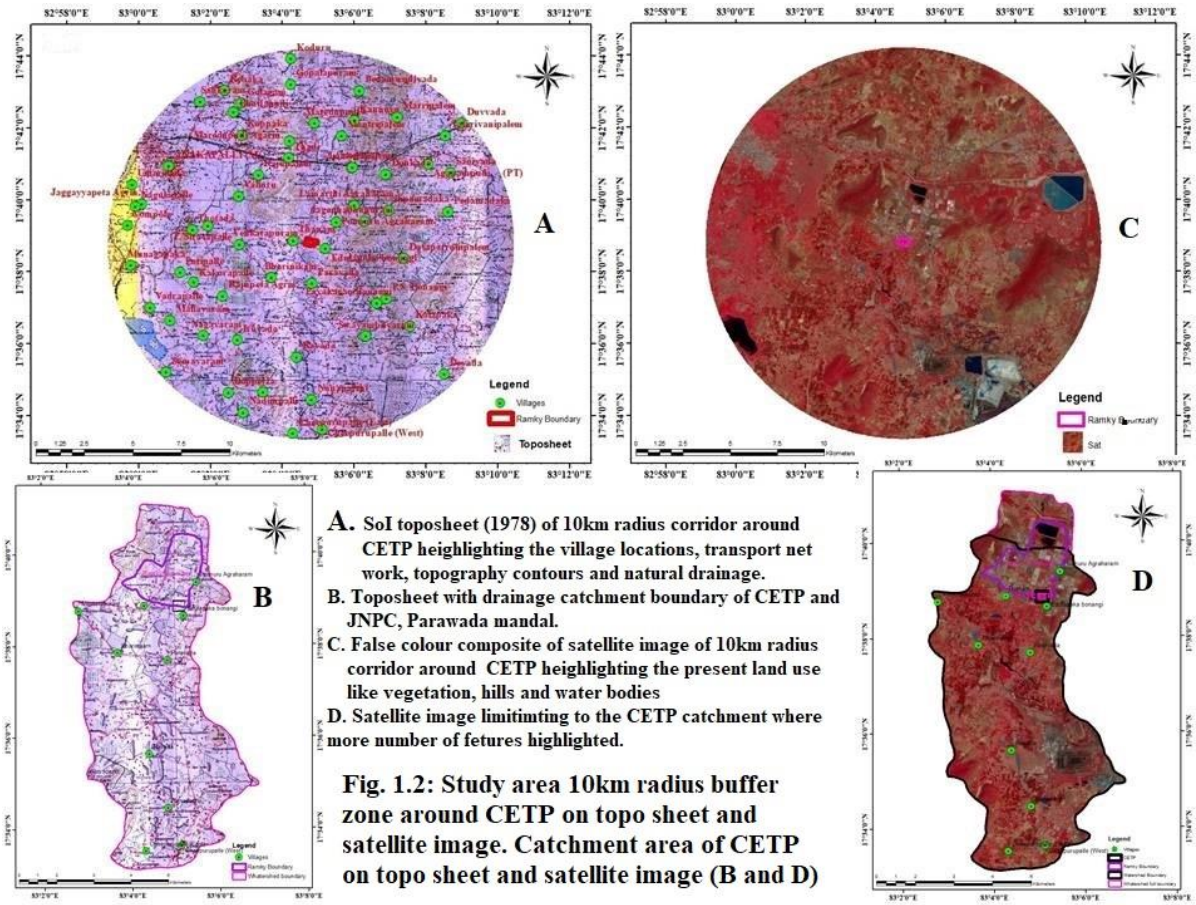


Fig. 1.2: Study area 10km radius buffer zone around CETP on topo sheet and satellite image. Catchment area of CETP on topo sheet and satellite image (B and D)

area catchment is shown in fig. 1.2. Ten kilometres corridor area is about 314 sq.km and the selected catchment area is about 65 sq.km. Influence of the effluents on hydro mostly limited to the watershed catchment of the CETP as shown B and D.

1.1.1 Objectives:

- To study the land forms and drainage pattern with special reference to ground water regime.
- To study ground water conditions and fluctuations with respect to seasons.
- To study the impact of CETP activity on ground water regime.
- To study the characteristics of environmental hydrology and their vulnerability to Effluent treatment activity.
- Suggestions to improve the quality and quantity of groundwater through Rainwater harvesting.

1.1.2 Scope of Study:

- To map and characterize the drainage network from the SOI topo sheets up to 10km buffer zone for regional analysis and catchment area on large scale where CETP located.
- To observe the hydrogeomorphological features from the available recent remote sensing data from Google Earth. Land use/ land cover mapping from the remote sensing data.
- Collection, collation and compilation of hydro-geological information with special reference to ground water storage, sub-surface geology, hydrochemical behavior, climate characteristics. The data need to be processed for presentation and prediction of future behavior activity in the region.
- Detailed investigation parameters will be limited to 1.0km radius- identification of more number of observation wells/ bore wells, groundwater levels, groundwater quality analysis.
- To study hydrological aspects of existing streams, tanks etc. with respect to effluent treatment plant surroundings.
- Implementation of Rainwater harvesting in the CETP as per the site condition. Ultimately suggest designs of rainwater harvesting for total rainwater conservation within the site.

1.2. Methodology:

The magnitude of impact shall depend upon size of the ETP, collection, treatment processes, storage and disposal from end to end and contact with the natural drains, water bodies, soil etc. intervention of the disciplines is necessary in impact assessment. While establishing the data base, primary as well secondary data is essential for which data has been collected from the various government published records, maps of last few decades and also digital data being gathered and updated from time to time through remote sensing technology. Primary data is collected around the study area regarding surface hydrology and subsurface hydrogeology.

- Survey of India topo sheets have the very accurate information regarding topography, elevation contours, natural drainage network, transportation network, villages, land use etc. The above said information has been extracted from the 1:25,000 scale maps and produced as thematic maps. Remote sensing data is also to be extracted after geocoding the images with topo sheets. Geological survey has prepared geology maps with to the district level and the geology information has been obtained by geocoding the GSI maps and extracted to the required scale. Mandal wise groundwater potential estimations and exploitation levels were prepared and updated up to 2015 by the state and Central Ground water Boards and published data has been utilised in this report. Climatic data such as rainfall and temperature has been collected from secondary sources.
- Present land use/ land cover, hydrogeomorphology, changes in water bodies and slope thematic maps have been prepared from the remote sensing data. Depth to water table, chemical analysis of groundwater and some chemical parameters themes are prepared from the primary data collected during the investigation. Resistivity soundings have been conducted within CETP area and subsurface geology, aquifer zones have been identified through field investigation during investigation. Groundwater recharge due to rainfall has been estimated based on the Andhra Pradesh state hydrograph network stations and field observations.
- Groundwater resource and its utilization has been worked out as per norms prescribed by the Ground Water Estimation Committee (GEC-2015), Government of India.

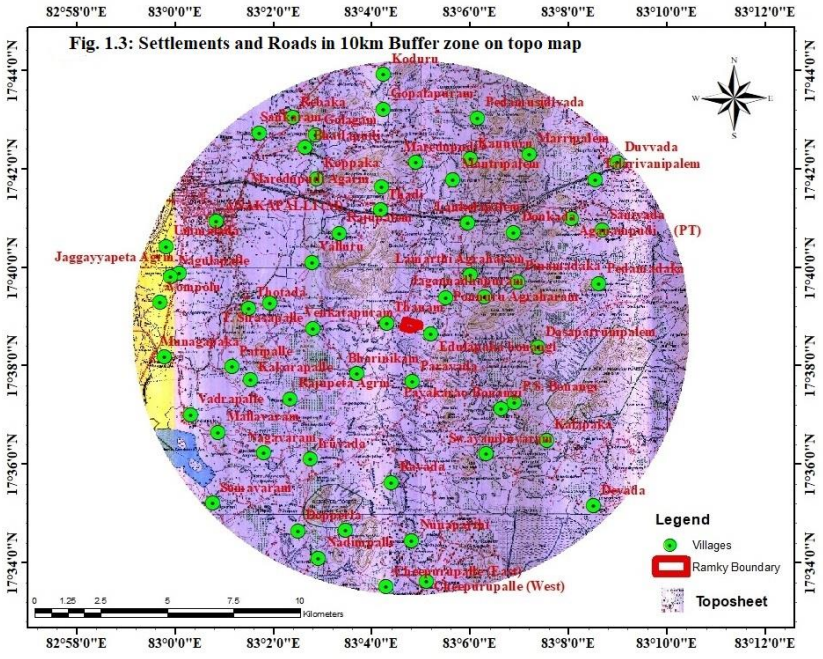
1.3 Location and Communication:

The study area Common Effluent Treatment Plant (CETP) is located in Jawaharlal Nehru Pharma City (JNPC) is located in Parawada mandal, abutting GVMC, Visakhapatnam district, Andhra Pradesh.

The CETP area falls under the topo sheet No. 65 O/2 and the geographical coordinates are: Latitude: 17°38'58.7”N to 17°38'48.40"N and Longitude: 83°04'39.80"E to 83°05'02.00"E

The CETP area is a part of the JNPC and concerned to almost all the units in the Pharma City from which liquid waste is collected, processed and suppose to dispose safely into the marine fall. Geographical coordinates of the JNPC are: Latitude: 17°40'27.3”N to 17°38'36.40"N and Longitude: 83°04'47.60"E to 83°05'38.40"E.

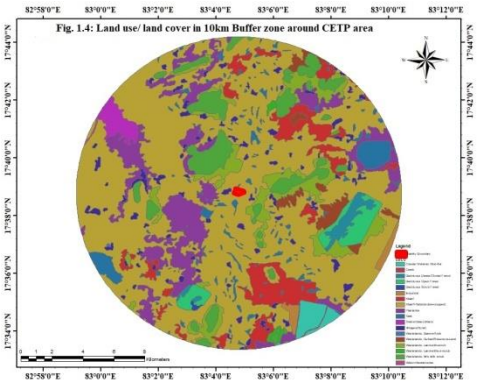
Regional analysis on certain parameters is required and as per ToR, the extension is 10km radius. Regional scaled map available is the topo sheet prepared by Survey of India. A 10km radius topo sheet along with mandal boundaries and village locations area marked on the fig. 1.3. The mandals that cover the CETP and its physiographic catchment where the impact of the industry may suppose to influence are partly Parawada and Pedagantyada. All the village locations in 10 km radius are marked in fig. 1.3. The villages that falls in the CETP catchment area are: Tanam, E.Bonangi, Venkatapuram, Bharanikam, Parawada, Dharmaraayudupalem Vennelapalem, Somunaidupalem, Mula swayambhuvaram etc. National High-way- 16 is just 4km from CETP and 2km from JNPC north boundary. Nearest is town Anakapalli through which NH-16 as well GT Railway track is connected. Nearest Air port is Visakhapatnam which is about 17km from the Pharma city.



1.4. Land Utilization:

Land use/ Land cover (LULC) pattern of any region is an outcome of various physical and cultural factors and their utilization by man in time and space.

The CETP area (16.6 Ha.) is meant for treating the common effluent from all the industries belong to JNPC. Land use/ land cover of the study area as well buffer zone of 10 km radius around the study area is to be studied to know the impact of CETP as per the ToR, MoEF. Present land use/ land cover of the buffer zone is mapped using the recent satellite image, i.e., march, 2020. Ten kilometer radius high resolution satellite image is shown in fig. 1.4.



1.4.1 Land Use Land Cover Statistics of CETP Buffer Zone:

The core and buffer area Land use classes of Buffer zone 10 km radius statistics of the CETP is listed in table 1.1. The area covered with Agricultural land (kharif, kharif+Rabi, plantation and fallow) is major area around 72.52 % of the total area, followed by waste land categories- uplands with or without scrub, gullied and ravenous land of about 14.42 % and built-up land include industrial, urban and rural area is about 4.76%. There is considerable area under coastal wet land and mudflats about 1.21% and area under forest is about 1.05%. Water bodies include irrigation tanks, channels and other drainage is about 3.86%. The area under different land use/ land cover is represented in a pie diagram shown below.

Table 1.1: Land use classes of Buffer zone 10 km around CETP

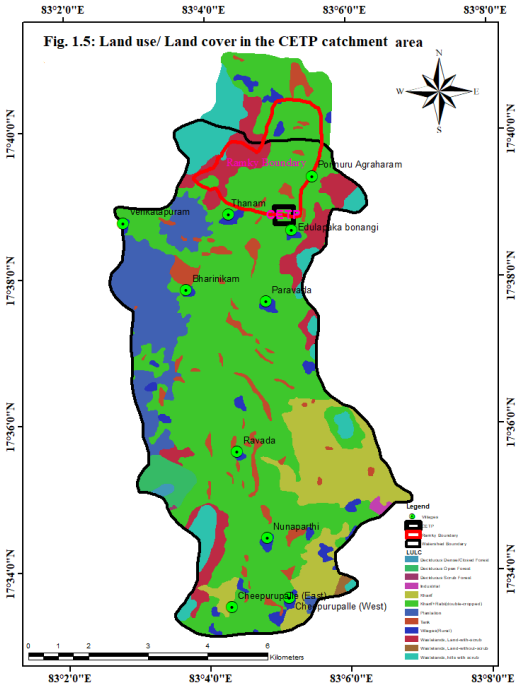
S.No	Name	Area Sq.km	Area in %
1	Coastal Wetland, Mud-flat	3.81	1.21
2	Creek	0.23	0.07
3	Deciduous Dense/Closed Forest	3.29	1.05
4	Deciduous Open Forest	6.53	2.08
5	Industrial	2.03	0.65
6	Kharif	22.08	7.04
7	Kharif+Rabi(double-cropped)	171.44	54.67
8	Plantation	33.91	10.81
9	Tank	11.98	3.82
10	Towns/cities(Urban)	3.76	1.20
11	Villages(Rural)	9.12	2.91
12	Wastelands, Barren-Rock	0.041	0.01
13	Wastelands, Gullied/Ravenous-Land	5.39	1.72
14	Wastelands, hills with scrub	19.72	6.29
15	Wastelands, Land-without-scrub	0.79	0.25
16	Wastelands, Land-with-scrub	19.31	6.16
17	Water-channel-area	0.17	0.05
	Total	313.601	100.00

1.4.1.1 Land area: The catchment area of the CETP include the natural drainage boundary around CETP and the main drain that joins with back water drain up to NTPC at Mula swayambhuvaram near the coast.

Five types of land use/ land cover categories have been identified in the catchment area and listed in table- 1.2. Land use/ land cover map of CETP catchment area is shown in fig. 1.5. Maximum coverage area is agricultural land that include khari, kharif&rabi and plantation is about 42.88 sq.km, built up land include industrial and rural is about 9.17 sq.km and is 14.14%. Waste land categories hills with and without scrub is about 8.87sq.km and is about 13.68%. Deciduous forest area is 1.24sq.km ans 1.91%. Water bodies include tanks, ponds and stream courses cover about 2.67 sq.km and is about 4.12%.

Table 1.2: Land use/ land cover in the CETP catchment area.

S.No	Name	Area (sq.km)	Area in %
1	Deciduous Dense/Closed Forest	0.13	0.20
2	Deciduous Open Forest	1.11	1.71
3	Industrial	7.14	11.01
4	Kharif	7.28	11.23
5	Kharif+Rabi(double-cropped)	29.48	45.47
6	Plantation	6.12	9.44
7	Tank	2.67	4.12
8	Villages(Rural)	2.03	3.13
9	Wastelands, hills with scrub	4.19	6.46
10	Wastelands, Land-without-scrub	4.68	7.22
	total	64.83	100.00

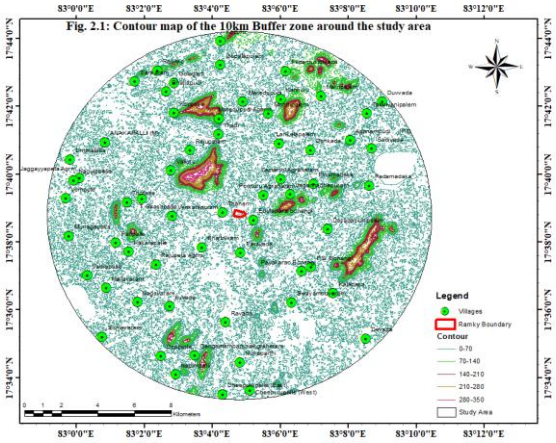


2.0 GEOMORPHOLOGY

It is the study on origin and evolution of land forms by physical, chemical and biological process by natural agents like air, rivers, oceans, glaciation and biological activities. Hydro-geomorphology is the study of groundwater occurrence, storage and movement in these land forms and depends on their presence in various climatological conditions.

2.1 Physiography

Physical geography also known as physiography is one of the two fields of geography. Here it is described the surface topography mapped and recorded in the topo sheets is presented in fig. 2.1. The map shows the present topography in the 10km corridor of the study area. After the weathering process has taken place on the earth, the present status of the topography is shown as contour map fig. nearest hill range is Tadi konda on the west and NW side of the CETP and JNPC areas and its strike/ alignment direction is NE-SW and its maximum elevation is 346m.

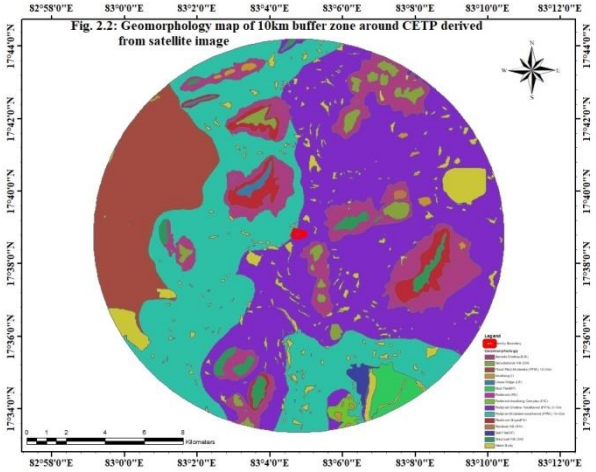


CETP area is in between 20m and 40m contour and is in the valley portion. Another hill (203m) range striking N-S direction is near Gorla Anakapalli on the west side of the CETP. Koppaka konda is on the north side of JNPC on the north side of railway track with max elevation of 306m. Kannuru konda with max elevation of 291m , Devikonda with strike of NE-SW direction and max elevation of 259m are on the east side. Dopper konda with max elevation of 184m with forest cover over it is on the south side of the CETP. Isolated hills near Parawada is 204m, Vennelapalem hills 170m and 158m on the south east side. Near to NTPC at Swayambhuvaram village max elevation of the hill is 130m. However within 4km to 5km radius there are number of hill ranges indicates the corridor area is highly undulating.

Within the CETP watershed, Tadikonda hill on the west, Devikonda hill on the east, Dopper konda on south and Vennelapalem hills and Swayambhuvaram hill on the east and SE side as shown in fig. Drainage originating from the east and west side hills formed as main drain near Bharanikam and there onwards it is well formed stream and its local name is Kharjurapugedda till it reaches the NTPC boundary and from there it is back water area.

2.2 Hydrogeomorphology:

Various geomorphological features have been identified and mapped from the high resolution satellite image in the 10km corridor are shown in fig. 2.2. Mainly, they are six categories of geomorphological features covering the corridor area and listed in table 2.1. Each geomorphic feature is explained with reference to groundwater occurrence and potential.



2.2.1 Denudational origin

Landform of denudational origin is formed where the denudation process dominates over the other process. Most of the landform resulting due to this process is the combined effect of mechanical and chemical weathering. Denudation is the process of removal of material by erosion and weathering. Land forms of such origin are:

Pediment zone: The pediment and related group consists of i) Pediment, ii) Pediment Inselberg Complex (PIC), iii) Pediplain Shallow Weathered (PPS), 0-10m, iv) Pediplan Moderate weathered (PPM), 10-20m, Total pediment zone is 224.30sq.km which about 71.21% with in corridor area. Sub classes pediment and pediment inselberg complex cover about 21042 sq.km which is 67.10%, with respect to groundwater occurrence and potential it is poor potential zone due to occurrence of semi-weathered rock and hard rock at surface level or at very shallow depth. These areas are the steep slopes of the hill ranges, elevated places with or without scrub. Pediplain shallow and pediplain moderate weathered zones have water bearing zones up

Table 2.1: Geomophological Feature areas in the 10km Radius corridor

S.No	Names	Area Sq.km	%
1	Bazada Shallow(BJS)	0.23	0.07
2	Denudational Hill (DH)	3.29	1.05
3	Flood Plain Moderate (FPM), 10-20m	6.53	2.08
4	Inselberg (I)	2.03	0.65
5	Linear Ridge (LR)	22.08	7.04
6	Mud Flat(MF)	2.28	0.73
7	Pediment (PD)	198.44	63.28
8	Pediment Inselberg Complex (PIC)	11.98	3.82
9	Pediplain Shallow Weathered (PPS), 0-10m	3.76	1.20
10	Pediplan Moderate weathered (PPM), 10-20m	9.12	2.91
11	Piedmont Slope(PS)	33.91	10.81
12	Residual Hill (RH)	5.39	1.72
13	Salt Flat(SF)	3.52	1.12
14	Structural Hill (SH)	8.26	2.63
15	Water Body	2.79	0.89
		313.61	100.00

to 10m to 20m depth and these two cover about 11.98 sq.km which is 3.82%. These zones are extended between middle slopes to near to flood plains. With respect to groundwater potential, these zones come under moderate to good water potential aquifer zones.

Piedmont slope cover about 33.91sq.km which is about 10.81% of the corridor. It is weathered and semi-weathered rock buried under soil and mostly occurs in the mid slopes to foot hill region. The zone may have poor to moderate groundwater potential.

Denudational and Structural Hills: It is a highly dissected hill which has obliterated the structures. Denudational hills occupy an area of 3.29 sq.km and is about 1.05%. Residual hill is a small remnant hill, which has witnessed all forms of denudation. These hills covered 5.39 sq.km and is about 1.72%. Groundwater potential point of view, there may be very little dependable source.

Landform of structural origin is related to structural aspect of the area. Most of the landforms under this class have genesis related to underlying structure. The structural control could be active structures whose form is directly impressed on the modern landscape or ancient structural features whose influence on a modern landscape is due primarily to differential erosion. Structural hills cover an area of 8.26 sq.km and are 2.63% of the corridor. Major fracture/ fault zones in these structural hills are potential zones of groundwater, but their areal extent may be limited few tens of meters and length may be in kilometers.

Land forms of fluvial origin:

The word fluvial is used in Earth science to refer to processes and landforms produced by running water. As with other surficial processes, running water can either erode material from the earth's landscape, or deposit layers of sediment. The resulting landforms can thus be classified as either erosional landforms or depositional landforms. The incredible power of running water in carving various erosional and depositional landforms is well known. The fluvial dissection of the landscape consists of valleys and their included channel ways organized into a system of connection known as a drainage network. Drainage networks display many types of quantitative regularity

Flood plain: The surface or strip of relatively smooth land adjacent to a river channel formed by the present river in its existing regimen and covered with water when the river overflows its banks at times of high water. It is built of alluvium carried by the stream/river during floods and deposited in the sluggish water beyond the influence of the swiftest current. Identified flood plain- Flood Plain Moderate (FPM), 10-20m along the well-developed streams in the corridor area is about 6.53sq.km which is about 2.08%. Flood plains are supposed to be good

groundwater potential area and shallow water table is expected. Aquifer gets recharged from stream flows as well from the applied irrigation.

Land forms of Marine Origin: As the site of investigation is abutting coast, there is marine action continuously. In the 10km corridor it is extended to the coast. Within this corridor area the coastal land form- mud flat exists and is about 2.28 sq.km that come to 0.73%. Because the land form is marine origin, groundwater may be saline.

2.3 Hydrogeomorphology of the CETP Catchment: The dominant land form in the CETP catchment is pediment occupies 59.77 sq.km which is 92.15% of the catchment and the remaining area is hilly terrain that consists of inselbergs, pediplain, residual hill and structural hills shown in fig. 2.3. Areal extent of each feature is is listed in table However, the pediment zone area may have poor to moderate groundwater potential.

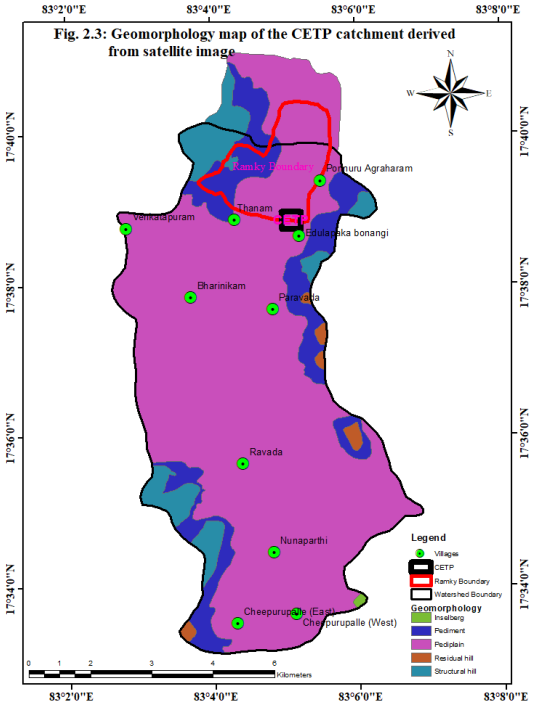
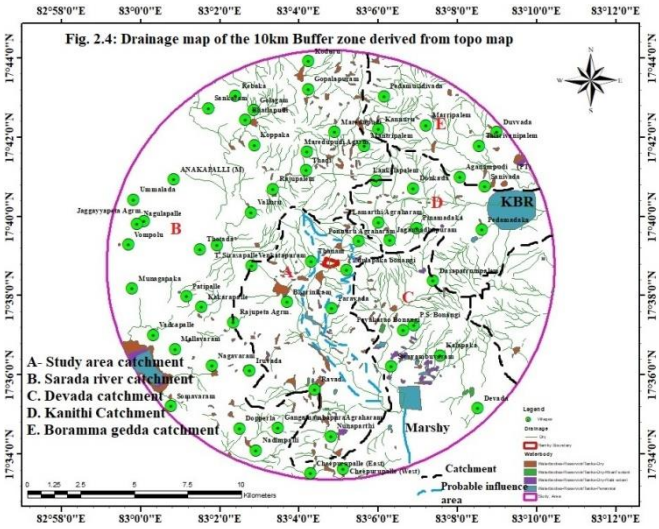


Table 2.2: Geomophological Feature areas in the CETP catchmentr

S.No	Name	Area Sq.km	Area in %
1	Inselberg	0.07	0.11
2	Pediment	59.77	92.15
3	Pediplain	0.05	0.08
4	Residual hill	2.66	4.10
5	Structural hill	2.31	3.56
		64.86	100.00

2.4 Drainage

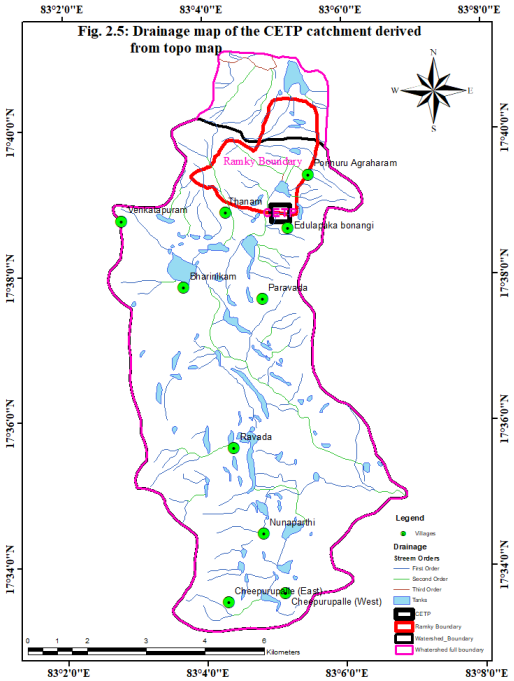
Drainage discussed here is the water ways formed naturally by removal of a surface's water from an area with excess of water. A drainage basin is any area of land where precipitation collects and drains off into a common outlet, such as into a stream/ river/ bay, or other body of water. The drainage basin includes all the surface water from rain runoff and nearby streams that run downslope towards the shared outlet, as well as the groundwater underneath the earth's surface. Drainage basins connect into other drainage basins at lower elevations in a hierarchical pattern, with smaller sub-drainage basins, which in turn drain into another common outlet.



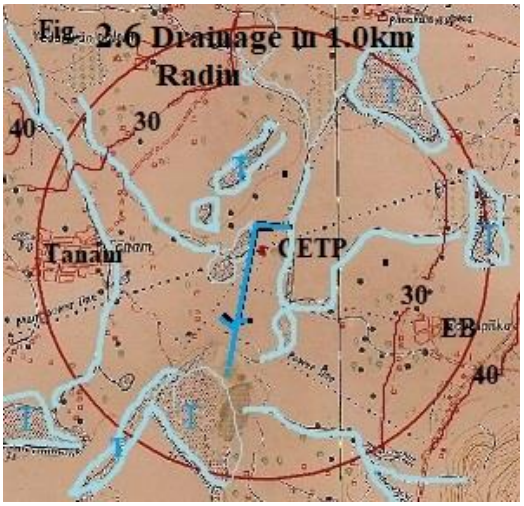
Drainage pattern and catchment areas of the 10 km corridor is shown in fig. 2.4. Broadly the corridor area is divided into 5 catchments. The watershed where CETP is located is marked as catchment- A, originating from the hills around JNPC, Parawada area and finally join with the mud flats/ marshy land at NTPC. Catchment- B comes under Sarada river basin and nearly 40% of the corridor area falls in this basin. Main stream from this catchment join with the Kondakarla lake located in the SW edge part of the corridor. Catchment- C originate from some part of Devi konda, pedda konda and hillocks around Vennelapalem. Main stream from all these hills join in the mud flats at Devada and Palavalasa where NTPC ash ponds exists. Stagnated water from this region join with the salt water creek and finally join with sea at Mutyalammapalem. Drainage for Catchment- D originates from northern parts of Devokonda and Peddakonda and southern part of Kannuru konda. The main drain is Pamu gedda that used to join Kanithi cheruvu but it is by passed the tank after converting it as Kanithi Balancing Reservoir (KBR). Borammagedda stream originates from Kannuru konda and drains along northern edge of the Steel Plant and joins into Pamu gedda down below the KBR near Peda Gantyada.

2.4.1. Drainage description of the Study area- Catchment - A:

The catchment where CETP located is about 65 sq.km that includes JNPC at the northern boundary, some industrial units around Parawada and NTPC at the southern end of the catchment is shown in fig.2.5. Catchment shape looks like a fern leaf extending from north to south for about 12.5 km up to NTPC and about 4.5km in the east-west. JNPC is at the northern boundary and is extending about 3.2km in N-S and 2.2km to 2.8km in E-W direction. CETP is at the southern boundary of JNPC. Blue lines are the streams of 1st, 2nd and 3rd streams and blue polygons are water bodies/ tanks extracted from topo sheet. Before the industrialisation of that area there are at least 40 to 50 tanks used for irrigation. Satellite image of the some area show that some missing due to land conversion. Main drain of this catchment join became the creek at NTPC boundary due to sea water intrudes along the creek up to the ash ponds of NTPC.



2.4.2: Drainage around CETP: Drainage pattern 1.0km around the CETP is extracted from the topo sheet is shown in fig. 2.6. First order streams originate from some part of the Tadi konda on the west side and some part of Devikonda on the east side shown with light blue colour lines and water bodies with blue polygons. Surface topography contours 30m and 40m are present on the east and west side of CETP. Topographic contours show that the CETP is located in the centre of the localised valley through which the main stream originating from JNPC traverse across. However, a drain is constructed along the north boundary of CETP to divert surface run off from the JNPC main stream catchment as well from the hill slopes of Edullapalli Bonangi from east side. All the runoff/ storm water is diverted through the newly constructed drain towards west direction and at the end point of the CETP site, the drain is along the west boarder of CETP till it reaches a tank which is about200m distance from southern border as shown in fig.



2.6. Natural drain which is abandoned within the CETP is used to transport the effluent from the other Ramky industries through a HDPE conduit to various effluent treatment units for processing. Treated effluent is stored in 9 lined ponds in CETP area for required time to release it into specified place in the sea. Another HDPE conduit run through subsurface along the drain to carry the treated water from the ponds further for about few kilometres towards sea till it reached the destination.

After establishing the various industrial units in the Ramky Pharma (JNPC), surface runoff/ storm water from various units join the lined drains made outside each industry along the roads. Runoff/ storm water may consists of rainwater mix with effluent spills from the individual units and finally join with the main natural drain that travers from north to south in JNPC which is diverted along the north and west border of CETP. Thus the storm water/ runoff from each unit in most part of the JNPC drain through the main drain that traversing through the north and west boarder of CETP and finally join a tank/ pond located at the southern tip of the JNPC.

3. HYDROMETEOROLOGY

3.1 Rainfall & Climate of District: Climatologically the district experiences tropical sub-humid type of climate with moderate summer and good seasonal rainfall. The southwest monsoon sets in the second week of June and lasts till September end. October and November receive rainfall from northeast monsoon. Winter season with cool and fine weather prevails from December to February followed by summer season upto early June. The average annual rainfall of the district is 1116 mm. and monthly rainfall ranges from nil rainfall in January to 207.5 mm in October. October is the wettest month of the year. The mean seasonal rainfall distribution is 673.5 mm. in southwest monsoon (June-September), 271.8 mm. in northeast monsoon (October-December), 10.9 mm. rainfall in Winter (Jan-Feb) and 159.6 mm in summer (March – May). The percentage distribution of rainfall, season-wise, is 60.36% in southwest monsoon, 24.36 % in northeast monsoon, 0.97 percentage in winter and 14.3 % in summer. The annual rainfall ranges from 708 mm in 2002 to 1703 mm in 2010. The annual rainfall departure ranges from -37 % in 2002 to +53% in 2010. The southwest monsoon rainfall contributes about 60 % of annual rainfall. It ranges from 459 mm in 2002 to 864 mm in 2006. The year 2002 and 2009 experienced drought conditions in the district as the annual rainfall recorded in these two years is 37 % and 34% less than the long period average (LPA) respectively. The cumulative departure of annual rainfall from LPA indicates that the rainfall departure as on 2011 is negative i.e. 40%, showing deficit rainfall. The annual rainfall during 2012 is 1218 mm.

3.2 Rainfall in the Parawada Mandal

The district has the benefit of receiving rainfall during both the South-West and North-East Monsoon periods. While the Normal Rainfall of the district for the South-West Monsoon period is 673.5 mm. and for the North-East Monsoon period is 271.8 mm. The Rainfall received during the Winter Period and Hot Weather Period is negligible, their respective normal being 10.9 mm. and 159.6 mm. The Annual Normal Rainfall of the district is 1116 mm. The nearest rain gauge to the study area is Parawada and rainfall data of neighbouring mandala is presented in table 3.1.

Table 3.1 Rainfall data for Parawada and surrounding Mandals that cover the study area

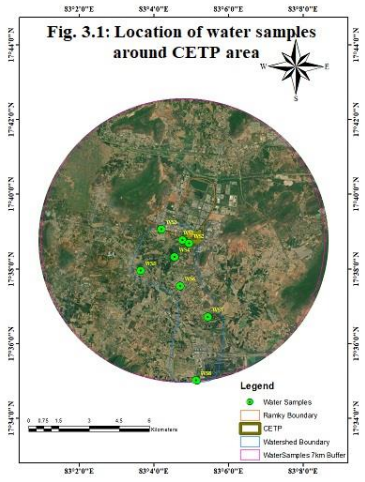
S.No	Mandal	Geographical coordinates		Normal rainfall(mm)
		Latitude	longitude	
1	Parawada	$N17^0 37'35"$	$E83^0 04'55"$	1130.5
2	Pedagantyada	$N17^0 39'46"$	$E83^0 12'29"$	1086.3
3	Munagapaka	$N17^0 38'05"$	$E82^0 59'47"$	1183.0
4	Anakapalli	$N17^0 40'48"$	$E82^0 01'04"$	1105.7
5	Avrage			1126.4

Source: Statistical Hand book of Visakhapatnam District

The above data showing that the average annual rainfall of the study area is 1126.4mm is near to the district average annual rainfall of 1116mm.

3.3 WATER QUALITY OF THE STUDY AREA

The water resources, both surface and groundwater play an important role in the development of the area. Likewise, the water resources of the area have been studied to establish the current status of water quality in the area. The parameters of prime importance were selected under physical, chemical inorganic, chemical organic groups. Groundwater samples are collected from 6 open wells, one bore well and surface water source from the downstream pond of CETP are collected. The water samples were collected in pre-treated sampling cans and transported to laboratory for analysis. Samples are collected during post monsoon of 2020 in the November month and pre monsoon of 2021 during the last week of March 2021. Due care was taken during sampling &transportation of these samples. Locations of the water samples are shown in fig. 3.1.



Sampling locations were selected on basis of:

a) Drainage pattern and catchment

b) Location of residential, irrigation and industrial areas representing different activities

c) Likely areas those can represent baseline conditions

Ground water samples were collected from 7 locations and surface water samples were collected from one location. The locations of the water samples collected in the study area are furnished in the table 3.2.

Table: 3.2 Water Sampling Stations

Code	Station	Latitude	Longitude	Source of collection
WS1	CETP	83.04’47.67	17.38’46’’.48	Ground water Bore well
WS2	CETP	83.04’58’’.26	17.38’40’’.82	Ground water Open well
WS3	Thanam	83.04’14’’.02	17.39’3’’.90	Ground water Open well
WS4	Bharanikam	83.03’40’’.47	17.37’57’’.04	Ground water Open well
WS5	Parawada	83.04’43’’.56	17.37’32’’.28	Ground water Open well
WS6	Vennelapalem	83.05’28’’.16	17.36’43’’.00	Ground water Borewell
WS7	NTPC	83.05’09’’.36	17.35’00’’.69	Ground water Open well
WS8	Thanam	83.04’34’’.79	17.38’19’’.04	Surface water Tank

The collected samples were analyzed in accordance with “Standard Methods for Examination of Water and Wastewater Analysis” published by APHA. Analysis results are listed in table 3.3

Table: 3.3 Ground water quality results of post monsoon- 2020 and pre-monsoon of 2021

Table 3.3 contd…

Sampling Site	pH		Conductivity (µ mhos)		TDS mg/l		HCO_3		Cl mg/l	
	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre
WS1	8.30	8.5	1951	1340	1101	884	353	250	371	55.3
WS2	8.40	8.5	2142	1360	1359	898	231	110	85	110
WS3	7.90	8.6	2340	1450	1544	957	73	50	96	147
WS4	7.90	8.0	1690	2280	1115	1504	268	60	443	60
WS5	8.10	7.5	1770	1820	1168	1201	73.2	150	31.9	100
WS6	8.20	8.0	1864	1780	1208	1175	140	70	130	154
WS7	8.00	8.1	1890	1640	1247	1082	250	1.4	220	43.4
WS8	8.10	8.4	1856	2340	1308	1544	345	50	167	30

WS1 (Bore well) and WS2 (Open well) are in the CETP site

Sampling Site	NO_3 mg/l		Na mg/l		K mg/l		Ca mg/l		Mg mg/l		TH mg/l	
	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre
WS1	0.074	0.01	139	138	51.7	0.8	38.40	48	102.65	127.9	384	644
WS2	0.078	-	63.94	74.0	1.17	1.2	41.60	89.6	103.46	66.4	326	496
WS3	0.080	-	736	31	1.95	3.2	44.80	30.4	104.43	59.5	292	320
WS4	0.051	-	287.5	6.9	5.46	0.39	54.40	118.4	70.31	77.1	288	612
WS5	0.070	0.06	12.19	73.3	2.73	1.56	33.60	57.6	109.31	171.8	276	848
WS6	0.062	0.02	87	87	63	35	34.20	48	95.60	104.4	292	548
WS7	0.060	-	158	135	20	1.2	32.00	38.4	200.08	52.7	492	312
WS8	0.068	0.02	80	14	20	0.78	34.20	75.2	110.62	154.2	248	820

3.3.1 Ground Water Quality of the Study Area

The above listed parameters aerial distribution thematic maps for selected parameters for post and pre monsoon are shown in fig. 3.2.

- The pH limit fixed for drinking water samples as per IS:10500 is 6.5 to 8.5. During the study period, the pH of the groundwater was found varying between 7.9 and 8.4 during post monsoon and the same variable between 7.5 and 8.6. The pH values for all the samples collected in the study area during study period were found to be within the acceptable limits.
- The desirable limit for total dissolved solids as per IS:10500 is 500 milligrams per litre (mg/l) whereas the permissible limits in absence of alternate source is 2000mg/l. In groundwater samples collected from the study area, the total dissolved solids (TDS) were found to be varying between 1101 mg/l and 1544 mg/l during post monsoon and varies between 884 mg/l and 1504 mg/l indicates

TDS values are beyond desirable limits. The TDS of all the samples were below the permissible limit of 2000 mg/l.

- The desirable limit for Chloride is 250 mg/l as per IS: 10500 whereas the permissible limit of the same is 1,000mg/l. The Chloride levels in the groundwater samples collected in the study area were ranging from 85-443 mg/l during post monsoon and during pre-monsoon it is between 30mg/l and 147mg/l. Five samples are within the desirable limits and 3 samples are within the permissible limits during post monsoon and all the samples are within desirable limits during pre-monsoon. All the samples are within permissible limits.
- The desirable limit as per IS:10500 for hardness is 300 mg/l, where as the

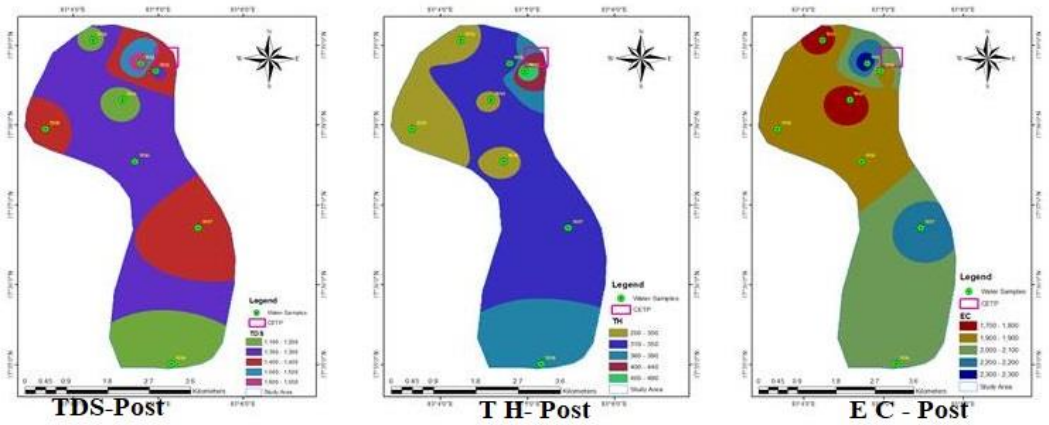
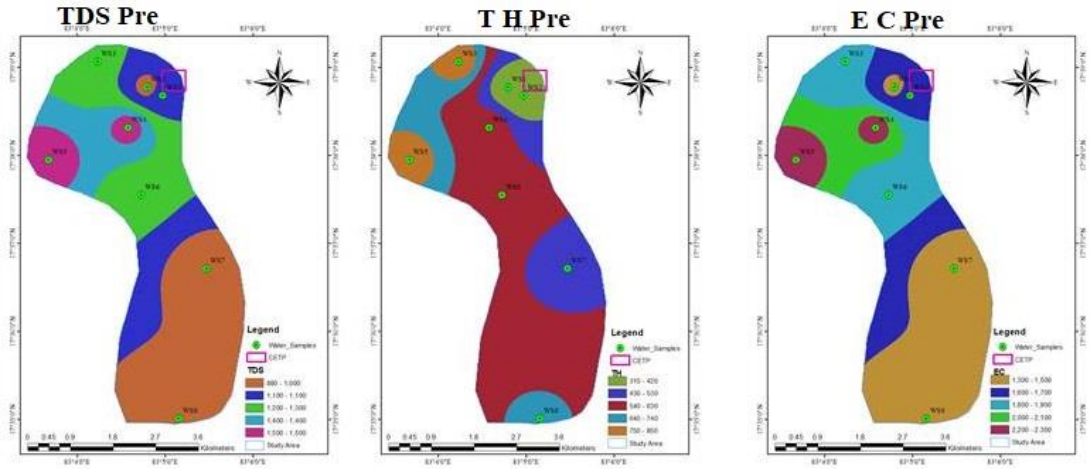


Fig. 3.2: Aerial distribution of some chemical parameters in CETP Catchment Area



permissible limit for the same is 600 mg/l. In the groundwater samples collected from the study area, the hardness was found to be varying from 248 mg/l to 492 mg/l in which 5 samples are within desirable limits during post monsoon and 3 samples are within the permissible limits. During pre-monsoon samples value range between 312mg/l to 848mg/l indicates all are above desirable limits but within the permissible limits.

- Nitrates (NO3) in both the seasons is less than 0.08mg/l indicates that the parameter is within the permissible limits.

An overview of the results obtained reveals that none of parameters were found beyond the permissible limits of IS: 10500 Drinking Water Standards during post monsoon of 2020 and pre-monsoon of 2021.

4. HYDROLOGY AND SURFACE WATER UTILIZATION

4.1 Irrigation Sources in the District: Visakhapatnam district is covered with 2 major basins Sarada, Varaha and Mehadrigedda, completely within the district and Gosthani and Thandava basins covered partially. All the above said rivers originate from the eastern part of the eastern ghats in Visakhapatnam Dt. Reservoirs are constructed across the above said rivers in the foot hill regions and water being used for irrigation and water supply to Visakhapatnam town from Thatipudi, Raiwada and Mehadrigedda reservoirs. Besides the above said reservoirs there are hundreds of irrigation tanks, canals from river diversions, tube wells and open wells and small lift irrigation sources. The area irrigated under various modes of source is given below:

Canals	:	53657 Hec.
Tanks	:	32587 Hec.
Tube wells	:	27,667 Hec.
Dug wells	:	11,921 Hec.
Lift	:	89 Hec.
Other sources	:	24,655 Hec.
Gross Irrigated area:		1,51,251 Hec.

Data source: Statistical hand book of Visakhapatnam Dt.

4.2 Water Sources from Outside the District: Surface water source from the reservoirs Thatipudi, Raiwada and Mehadrigedda that exists within the district not only irrigating thousands of acres in their ayacut but also became prime drinking water supply sources to Visakhapatnam city. Total water required for the Visakhapatnam Steel Plant is about 70 MGD being supplied from the Yeleru reservoir is around 150km distance through a open canal located in East Godavari. During summer when there is in sufficient reserves in the reservoir, required quantity of water being augmented from Godavari river bed which is about 50km further upstream from Yeleru canal through infiltration wells. This is the major source drawn from inter district. JNPC also drawing about 10 MLD from Yeleru canal.

4.3 Surface water Utilisation in Parawada mandal: Irrigation in Parawada mandal is through surface water bodies like tanks and ponds and groundwater source from tube wells and open wells. Area irrigated under various sources is listed below.

Canals	:	Nil
Tanks	:	171 Hec.
Tube wells	:	183 Hec.
Dug wells	:	39 Hec.
Lift	:	Nil
Other sources	:	Nil
Gross Irrigated area:		608 Hec.

Data source: Statistical hand book of Visakhapatnam Dt. (2016)

The above data shows that irrigation in the mandal being carried through tanks, tube wells and open wells. Water bodies present in the JNPC/ CETP catchment area is shown in fig. 4.1.Blue polygons are the tanks mostly concentrated in the central part of the watershed along the main stream course. There are more than 60 water bodies shown in the topo sheet, but at present these may be reduced to less than 20 due to industrialization/ urbanization as well the agricultural land also converted as settlement area. However, irrigation area is limited to change of land use and at present the gross irrigated area is only 608 Hec. Even though some water bodies are not disturbed, the ayacut area under these converted as urban land. These surface water bodies may be getting polluted by the liquid/ solid waste being generated in the urbanized lands. However, stored water in these water bodies may be useful for groundwater recharge.

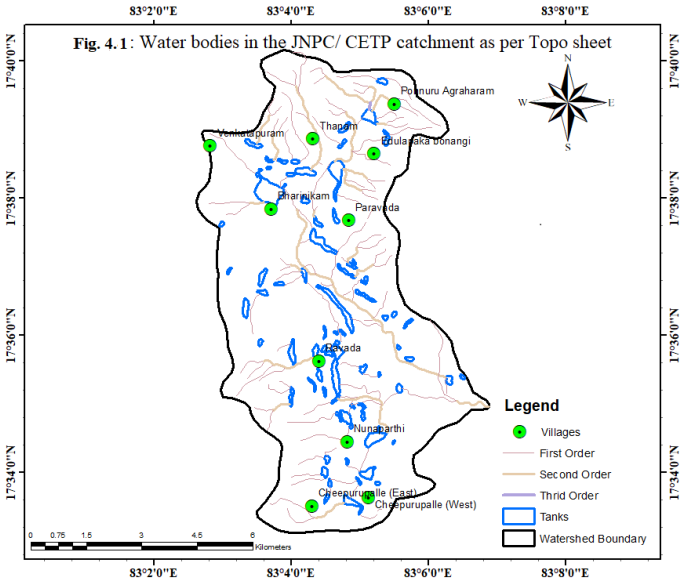
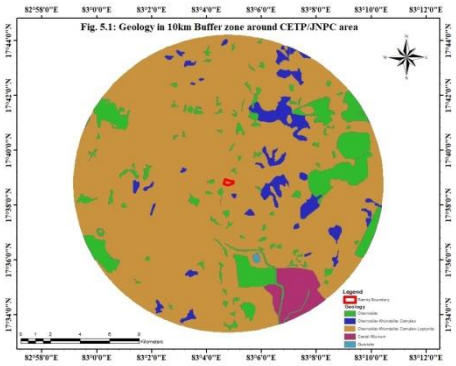


Fig. 4.1: Water bodies in the JNPC/ CETP catchment as per Topo sheet

5. GEOLOGY

5.1 Geology in the 10km Radius:

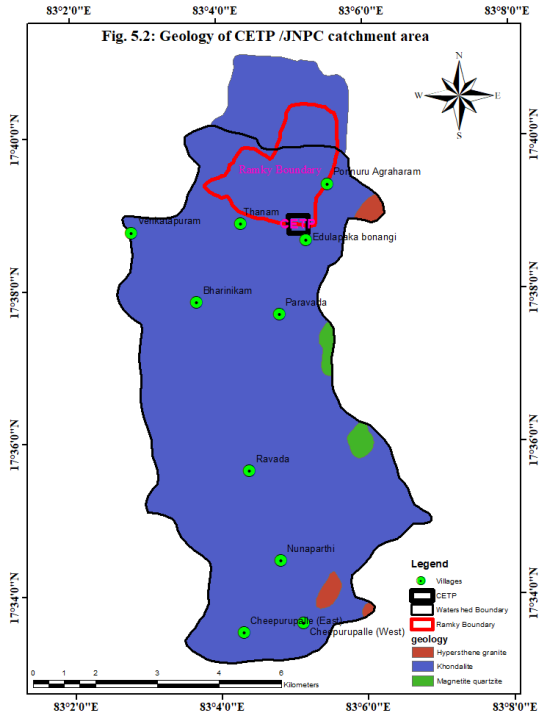
It is very essential to know the geology of the region where hydrogeological investigations being carried because groundwater occurrence, distribution and movement depend on the type of rock and its weathering nature. Secondary data on geology is acquired from GSI published maps. Besides the secondary data, primary data is also collected during our field visits for land use hydrogeomorphology and water table observations. A buffer zone map of 10km radius around the JNPC/ CETP area is presented in fig. 5.1. The area consists of Crystalline Basements complexes of Archaean age as well coastal environment. Crystalline rocks consists of khondalite, charnockite, quartzite and leptynite rocks is shown in fig. . Geomorphology of the area is buried pediment, inslebergs complex with isolated hills and hill ranges of khondalite rock with NE to SW and E to W strike direction with dip variable between 60^0 to 80^0 due south. Nearly 80% of the area consists of khondalite- charnockite-leptinite rock complex is shown in dark brown colour. In this rock complex zone top layer of the rock formations consists of khondalite and charnockite/ leptinite may present as intrusive rocks at shallow or deeper depth. As per the field observations, this rock is present in the north and NW part between 5km and 10km radius. Hill ranges present around Rabaka village are charnockite hills where black stone road metal being quarried. At Lankelapalem junction the hill range belong to khondalite rock between 290m and 40m altitude and below the 40m black rock (charnockite) being quarried below 20m altitude. Leptinite rock is present as inselberg complex (rock outcrops at ground level) between lankelapalem and Aganampudi.



Charnockite rock area is shown in green colour where the entire rock formation from top surface to deeper the same rock exists. Blue colour area is khondalite-charnockite complex area where top layers of geological formation consists of khondalite followed by charnockite rock as intrusion body at shallow or deeper depth. At Edullapalli Bonangi small hill mounds cross section shows that top 10m to 12m consists of khondalite rock followed by charnockite rock where black metal being quarried. Quartzite rock appears as intrusive veins in khondalite rock. These are observed in some parts of Thadikonda and Devi konda.

Coastal alluvium is shown in purple colour and is to the SE of the study area between 8km and 10km distance.

5.2 Geology in the JNPC/CETP Catchment: The study area surrounded by Thanam hill village on the west, bodi konda on the south, parawada hill and devikonda on the east side. Geology map of the CETP catchment is shown in fig.5.2, Nearly 95% of the catchment area covered by khondalite rock. Small patches of hypersthene granite and magnetite quartzite are observed along the eastern part of the catchment.

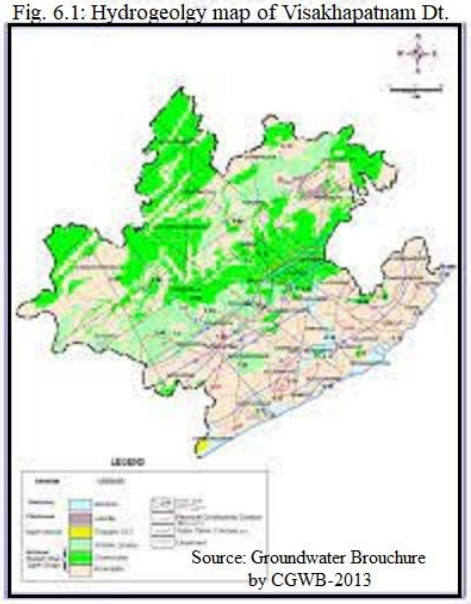


With respect to groundwater occurrence, khondalite rock will have good potential due to its high weathering and fracturing nature to deeper depth of rock mantle. Charnockite and leptinite rocks are hard and prone to low weathering and groundwater potential may be limited. Coastal alluvium consists of mud flats, salt pans and beach sands. Groundwater in this zone mostly saline and freshwater in the coastal sands may be very shallow and thin layer.

6 HYDRO-GEOLOGICAL ASPECTS

6.1 Hydrogeology at District level: The district is underlain by variety of geological formations from the oldest Archaeans to Recent Alluvium. The Archaean group of rocks includes Khondalites and Charnockites of Eastern Ghat super group and Granitic gneisses of Migmatite group. The Gondwana rocks which are represented by sandstones are in very limited aerial extent. The recent alluvium is prevalent along the rivers. Prominent lineaments are trending in NE-SW, NW-SE and ENE-WSW (Fig.6.1). Groundwater occurs in almost all geological formations. From the ground water point of view, the aquifers in the district can be broadly classified into hard formations (khondalites, charnockites, quartzites, granitic gneisses etc.) and soft formations (sand stones and alluvium). Ground water occurs under unconfined to semi-confined conditions in the hard formations, while it occurs under unconfined to confined conditions in soft formations. The yields in the weathered zones of hard formations range from

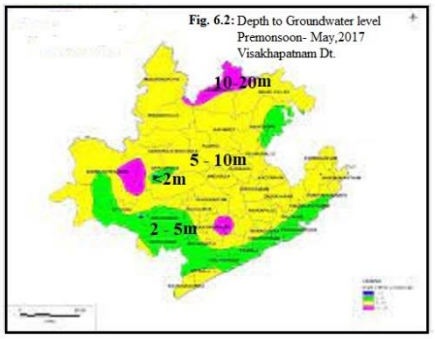
Fig. 6.1: Hydrogeolgy map of Visakhapatnam Dt.



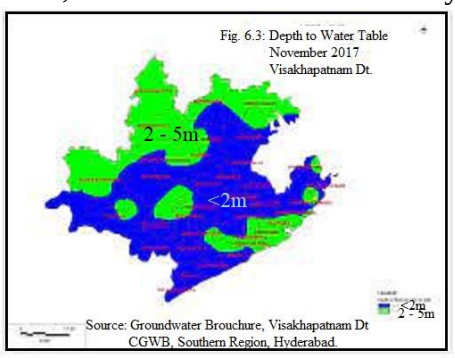
25 to 100 m^3/day. The bore wells drilled in the hard formations, generally tap the fractured and fissured zones. The yields of the bore wells in these formations range between 5 to 25 m^3/hr. Sand stones are exposed in the small isolated places around Nakkavanipalem and Elamanchili. In these formations, ground water occurs under both unconfined and confined conditions. The depth of dug wells in alluvium formations ranges from 2 to 10 mbgl and the yields generally ranges from 40 to 250 m^3/day. The depth of filter points/tubewells varies from 9 to 35 m with discharges ranging from 15 to 30 m^3/hour. The transmissivity values of the aquifers in the consolidated formations generally vary from 1 to 772 m^2/day, whereas specific capacity ranges from 1 to 290 lpm/mdd.

6.2 Water Level Fluctuation

Based on the water level data (year 2017) of ground water monitoring wells, pre monsoon depth to water levels map is prepared and presented in Fig.no.6.2. The depth to water level maps show varied water level zones due to underlying terrain and also different geological set up with complex type of hydrogeomorphical structures present in the district. Premonsoon (May, 2017) depth to water level map reveals, in general, the water levels are deep particularly in the hilly area of the district. Depth to water levels varies from 5 to 10 mbgl, except at Chintapalli, where water level recorded 15.78 mbgl. In the southern part of the district i.e., near to the coast, the water levels are comparatively shallow- 2m to 5m along the coast and adjacent to the river courses.



During the post monsoon period (November, 2017), in general, the water levels follow nearly same trend as shown fig. 6.3. Water levels in the most part of northern area show less than 5 m. except at Potinamallaya Palem (5.80 m). The Shallow water levels, <2m were observed in South-Western part of the district. The shallow water level was recorded at Addaroddu (0.30 m). The shallow water levels in the area might be due to location of wells close to surface water bodies/ in topographic low levels. From the trend of both pre and post monsoon levels it can be safely concluded that the area, in general, is not prone to water logging. The seasonal water level fluctuation varies from 0.03 m. (G.K.veedhi) to 14.22m. (Chintapallii). In general, the seasonal fluctuation is more in the hilly area compared to coastal plains.



6.3 Ground Water Resources:

As per the present ground water resource estimation (2008-2009) the total annual ground water recharge in the district is estimated to be 78,383 ha.m. (Command area = 11,794 ham and Non Command area = 66,689 ham) and the net annual ground water availability in the district after allowing the unavoidable natural discharges is 71689 ham (command area 10683 ham. and in Non command area 61,006 ham.). The gross ground water draft for all purposes is estimated as 23,100 ham out of which 6300 ham is in command area and 16,800 ham is in Non Command area. Thus the ground water available for future irrigation needs after allocating the ground water for future domestic and industrial needs is 38,264 ham in the entire district, which is 3,282 ham in command area and 34,982 ham in non command areas of the district. Groundwater potential in the surrounding mandals of the study area is given in Table- 6.1

Table 6.1: Mandal Wise Ground Water Resources in 10km Radius around study area (As on March 2009)

1	Administrative unit/ District	Sub unit	Net annual ground water availability (ham)	Existing gross ground water draft for all uses(ham)	Ground water balance (ham)	Stage of ground water development %	Category
1	Parawada	Command	0	0	0	0	
		Non Com	1459	486	973	33	Safe
		Total	1459	486	973	33	Safe
2	Munagapaka	Command	225	132	93	59	Safe
		Non Com	665	302	363	45	Safe
		Total	890	434	456	49	Safe
3	Pedagantyada	Command	0	0	0	0	
		Non Com	1212	81	1131	7	Safe
		Total	1212	81	1131	7	Safe
4	Anakapalli	Command	746	444	302	60	Safe
		Non Com	1076	495	581	46	Safe
		Total	1822	939	883	52	safe

Ground water utilization in the district is 32% of the total groundwater potential for all the purposes. Average groundwater utilization in 10km radius of the study area is around 35% in which Anakapalli and Munagapaka mandals utilization is about 50% due to heavy irrigation. However, district and mandals groundwater utilization is in safe zone and lot of groundwater potential available for future exploration.

6.4 Hydrogeological Condition in the JNPC/ CETP Catchment

Entire catchment of JNPC/CETP catchment comes under khondalite terrain. Nearly 20% of the catchment area consists of settlements and real estates and equal area under hills and forest. Still there is little area being used for agricultural activity. Earlier irrigation was carried through tank storage water and groundwater from open wells. In the recent years groundwater being

used through tube wells for irrigation as well for industrial and domestic needs in the residential area. However, JNPC drawing about 10 MLD from Yeleru canal for industrial needs. Groundwater also being explored by the individual industrial units for their domestic and industrial needs.

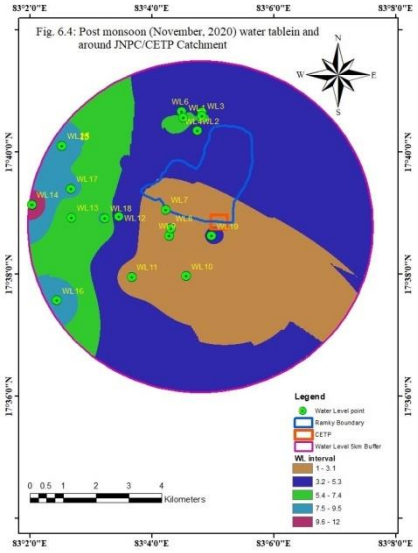
6.5 Water Level Fluctuation around JNPC/CETP area

Water table measurements have been carried in the observation wells established in and around the catchment area during the post monsoon of 2020 (November, 2020) and pre monsoon season of 2021 (April, 2021). Nineteen open wells are selected for water level observations and the data is presented in table 6.2.

Table 6.2: Post and Pre monsoon Groundwater levels in and around JNPC/CETP Catchment

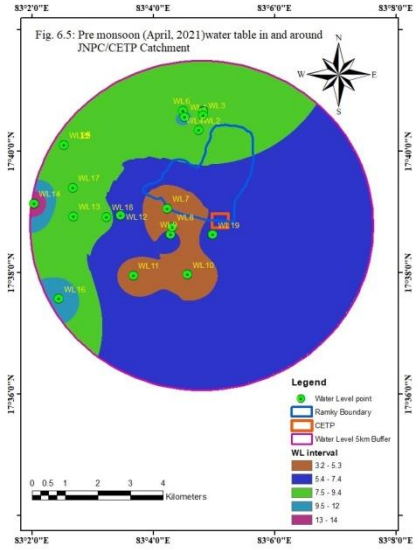
Well No.	Village	Type of well	Latitude	Longitude	Total Depth (m)	Water Level -Post (m)	Water Level -Pre (m)	WL diff. post& pre(m)
WL1	Kothapalem	OW	83^{0}04’42.8”	17040’18.9”	11.82	5.42	11.2	5.78
WL2	Thadi Colony	OW	83^{0}04’44.9”	17^{0}40 ’20.8”	11.48	8.95	11.02	2.07
WL3	ChinnaThadi	OW	83^{0}04’49.6”	17^{0}40’35.6”	10.64	3.5	8.60	5.10
WL4	ChinnaThadi	OW	83^{0}04’49.5”	17^{0}40’35.4”	9.00	6.8	8.70	1.90
WL5	ChinnaThadi	OW	83^{0}04’49.4”	17^{0}40’35.5”	7.25	5.85	6.21	0.36
WL6	PeddaThadi	OW	83^{0}04’29.8”	17^{0}40’39.8”	8.00	2.20	7.90	5.70
WL7	Thanam	OW	83^{0}04’14.1”	17^{0}39’03.25”	10.60	2.50	8.50	6.00
WL8	Thanam	OW	83^{0}04’18.9”	17^{0}38’44.9”	6.50	1.10	3.25	2.15
WL9	Thanam	OW	83^{0}04’17.4”	17^{0}38’37.4”	6.50	1.00	6.40	5.40
WL10	Paravada	OW	83^{0}04’34.1”	17^{0}37’58.1”	6.30	2.10	5.00	2.90
WL11	Bharnikam	OW	83^{0}03’40.9”	17^{0}37’57.1”	5.40	2.50	4.40	2.90
WL12	Venkantapuram	OW	83^{0}03’28.0”	17^{0}38’56.4”	6.40	3.25	5.40	2.15
WL13	Venkantapuram	OW	83^{0}02’41.36”	17^{0}38’41.55”	7.90	6.00	7.80	1.80
WL14	Sirasapalli	OW	83^{0}02’02.38	17^{0}39’08.36”	14.0	11.65	13.60	1.95
WL15	GorlaAnakapalli	OW	83^{0}01’25.67	17^{0}39’26.51”	7.75	2.85	4.00	1.25
WL16	Rajupet	OW	83^{0}02’16.86	17^{0}37’22.0”	13.45	8.90	10.90	2.00
WL17	Ramarayadupeta	OW	83^{0}02’40.86	17^{0}39’23.77”	10.00	7.75	9.90	2.15
WL18	Valluru	OW	83^{0}02’32.02	17^{0}40’06.00”	8.70	4.30	8.50	4.20
WL19	CETP	OW	83^{0}04’ 58.6”	17^{0}38 40.86”	7.62	3.30	5.45	2.15

Even though there are bore wells in the study area, it was not possible to take measurements in them. Most of the open wells were irrigation wells and because of change of land use most of them are idle. Some of them are in the low lying areas and some are in the foot hill region. During post monsoon season depth to water table varies between 1.0m at Tanam almost in the centre of the valley and 11.65m at Sirasapalli over the hill flank.



Based on the water level data (year 2020) of ground water monitoring wells, post monsoon depth to water levels map is prepared and presented in Fig.6.4. Area covered is about 2km radius from CETP. Brownish colour patch is the area where water table is between 1.0m and 3.1m that include CETP and Tanam villages and also follow the valley portion. Water table in the blue colour varies between 3.2m and 5.3m that cover entire JNPC area, Bharanikam and the area along the main stream course. More than 5m depth of water table is observed on the west side of the study area covering the villages Tadi, Sirasapalli, Rajupeta and Venkatapuram.

Water table in the pre monsoon varies between minimum depth of 3.25m and maximum depth of 13.60m is at the same locations of minimum and maximum recorded during post monsoon.



Pre monsoon period (April, 2021) water table variations are shown in fig. 6.5. depth to water table varies between 3.2m and 5.3m is recoded at the villages Tanam, Bharanikam and in the valley portion at Parawada. Blue colour represent the water table region between 5.4m and 7.5m depth that cover the south and east portion up to 2km radius of CETP. Northern part of JNPC and west side of the study area has water table more than 7.5m depth. At Sirasapalli village depth to water table is beyond 13.60m depth. Water level maps show varied water level zones due to underlying terrain and also different geological set up with complex type of hydrogeomorphical structures present. In general, the water levels are deep particularly in the hilly area of the region.

The shallow water levels near Tanam, Bharanikam and the wells adjacent to main stream course in the area might be due to location of wells close to surface water bodies/ in topographic low levels. As per the trend of the pre and post monsoon water levels it can be safely concluded that the area, in general, is not prone to water logging. The seasonal water level fluctuation

varies from 0.36 m. (China Thadi) to 6.00m. (Tanam). In general, the seasonal fluctuation is more in the hilly area compared to valley areas and coastal plains.

7. SUBSURFACE INVESTIGATION FOR LITHOLOGY AND AQUIFERS DELINEATION

In order to determine the subsurface lithology and identify the aquifer zones, surface geophysical method Vertical Electrical Soundings have been conducted. Detailed investigation is explained below.

7.1 Subsurface lithological profile in CETP Area: In the earlier chapters, land use, geology, geomorphology, climate and rainfall conditions, hydrogeological aspects- groundwater potential, water table fluctuations are dealt. This chapter mainly concentrated only in the CETP area to know the subsurface layers include aquifer zones. Geophysical surficial exploration method- Electrical resistivity soundings have been conducted at number of places and sub layers have been demarcated. In this method physical property of soil/ rock is measured that include resistivity of the material, fluid filled in the pore spaces of the material and quality of fluid. Because the industry is mainly dealing with treatment of liquid effluent discharged from all the industrial units in JNPC.

7. 2 Resistivity Method for delineation of subsurface layers: Vertical Electrical soundings (VES) have been conducted in the CETP area only covering the entire Plant, leaving the ponds, processing units and roads wherever concretisation is carried. VES are carried as per the IS code 3043:1987 electrode configuration to the subsurface layers up to 70m to 80m depth. VES locations are noted with GPS and are transferred on to the google image of CETP shown in fig. 7.1. It was possible to collect conduct the VES mainly in the open areas, greenbelt and along the margins of the roads where the soil is exposed. Broadly, different land use in CETP measured from google image are as follows:

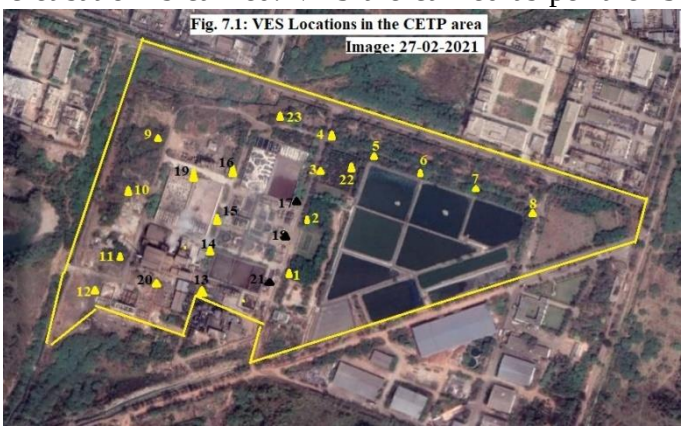


Fig. 7.1: VES Locations in the CETP area

Total CETP area: 16.6024 Hec.

Ponds area: 3.724 Hec.

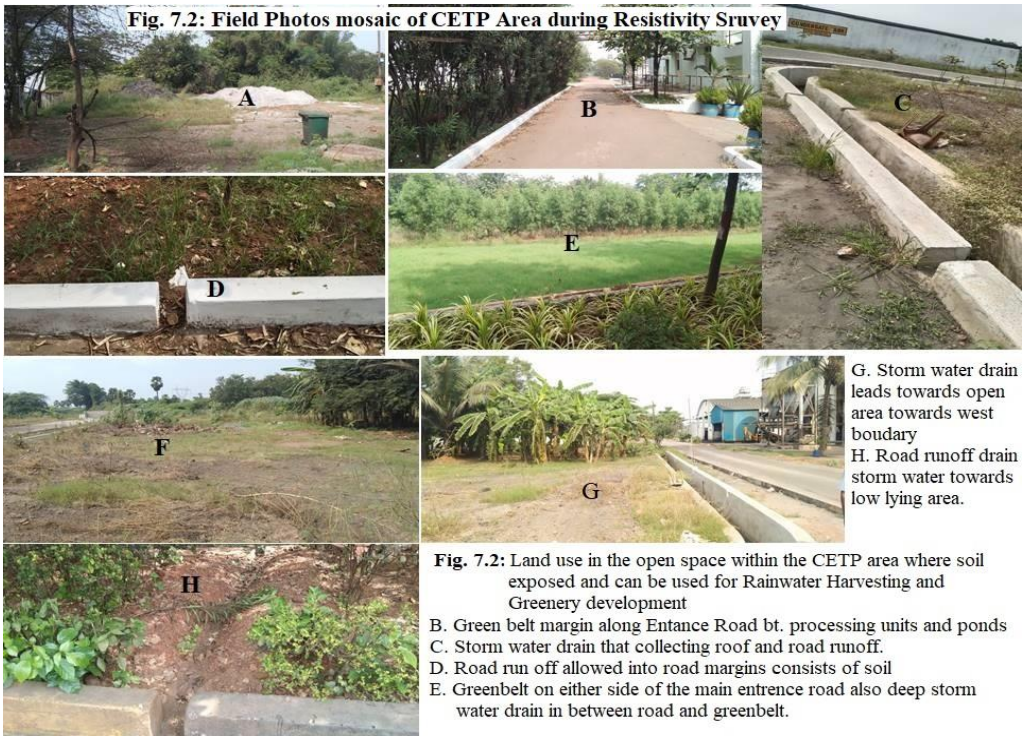
Processing Units: 4.166 Hec.

Green belt& open: 5.9094Hec.

Roads& others: 2.803 Hec.

VES are conducted at 23 locations. Each sounding is interpreted and layer thicknesses are arrived and designated synthesizing the geological hydrogeological field observations. Some of the field photos in the site of investigation is shown as mosaic in fig. 7.2. Resistivity

Fig. 7.2: Field Photos mosaic of CETP Area during Resistivity Sruvey



G. Storm water drain leads towards open area towards west boudary
H. Road runoff drain storm water towards low lying area.

Fig. 7.2: Land use in the open space within the CETP area where soil exposed and can be used for Rainwater Harvesting and Greenery development
B. Green belt margin along Entance Road bt. processing units and ponds
C. Storm water drain that collecting roof and road runoff.
D. Road run off allowed into road margins consists of soil
E. Greenbelt on either side of the main entrence road also deep storm water drain in between road and greenbelt.

soundings not only help in identifying the subsurface layers, but also indicate quality of groundwater that saturated the aquifer zones. Vertical cross sections are prepared grouping the soundings as traverses. Four vertical cross sections shown in traverses A.. to D in figs, 7.3a to 7.3c.

7.2.1 Vertical cross section along Traverses A&B: Six soundings have been conducted along traverse- A and the vertical cross section (Fig. 7.3a)shows that the top soil thickness varies between 3m and 5m followed by weathered rock which is the shallow unconfined aquifer zone extend up to 12m to 20m depth. Fractured rock zone which is the deep aquifer zone may be under semi confined condition noticed between 12m to 20m and 30m to 40 m depth. Beyond 40m depth hard rock is noticed.

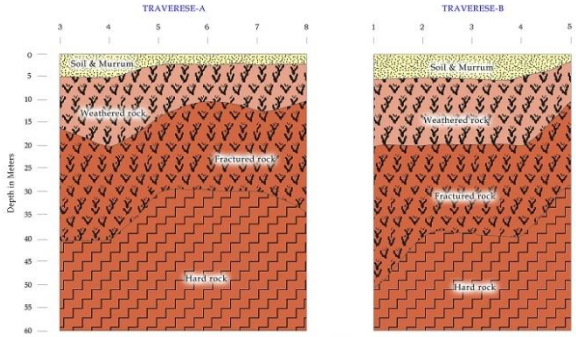


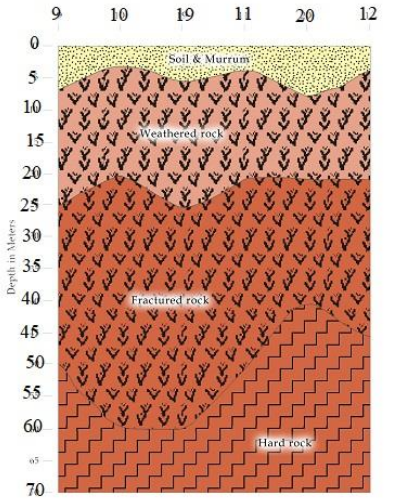
Fig. 7.3a: Vertical Lithological cross sections along Traverses- A and B

Vertical cross section of traverse- B: Five VES soundings have been conducted along this traverse. Vertical cross section (fig. 7.3a) shows that the top soil thickness varies between 2m

and 5m followed by weathered rock which is the shallow unconfined aquifer zone extend up to 15m to 20m depth. Fractured rock zone which is the deep aquifer zone may be under semi confined condition noticed between 15m to 20m and 30m to 50 m depth. Deep fracturing up to 50m depth is noticed at VES-1. Beyond 30m/50m depth hard rock is noticed.

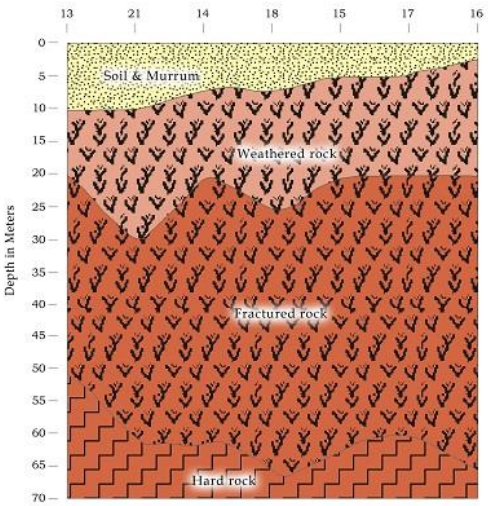
7.2.2 Vertical cross section along Traverses C: Six VES have been conducted along this traverse. Vertical cross section of traverse- C (fig. 7.3b) shows that the top soil thickness varies between 3m and 6m followed by weathered rock which is the shallow unconfined aquifer zone extend up to 20m to 25m depth. Fractured rock zone which is the deep aquifer zone may be under semi confined condition noticed between 20m to 25m and 45m to 60 m depth. Deep fracturing up to 60m depth is noticed between VES-9 and 19. Beyond 45m/60m depth hard rock is noticed.

Fig. 7.3b: Vertical cross section along Traverse-C



7.2.3 Vertical cross section of traverse- D: Seven VES have been conducted along this traverse. Vertical cross section of traverse- D (fig. 7.3c) shows that the top soil thickness varies between 2m and 10m followed by weathered rock which is the shallow unconfined aquifer zone extend up to 20m to 30m depth. Fractured rock zone which is the deep aquifer zone may be under semi confined condition noticed between 20m to 30m and 50m to 65 m depth. Deep fracturing up to 65m depth is noticed between VES-14 and 16. Beyond 50m/65m depth hard rock is noticed. In general depth to hard rock is deeper as we approach from east side to west side. Similarly thickness of fractured rock zone increase towards west boarder. Resistivity sounding data revealed the subsurface layers as i) top layer- brownish clayey loam- the layer thickness varies between 2m to maximum of 10m and is thin in the east side increases towards west side of the site. ii) second layer- weathered rock- yellow/ brownish disintegrated khondalite rock. Thickness this layer varies between 10m and 25m and is thin in the east side and increase towards west border. iii) third layer- fractured rock- Thickness of fractured khondalite rock varies between 25m and 40m.

Fig. 7.3c: Ver. Cross section- Traverse- D



Soil layer and weathered rock can be considered as unconfined aquifer and fractured zone can be considered as semi-confined aquifer.

8. IMPACT OF THE COMMON EFFLUENT TREATMENT PLANT (CETP) ON GROUNDWATER REGIME

Resistivity survey revealed subsurface lithology and is discussed with respect water bearing nature as unconfined and confined conditions. Piezometers are established at 5 places in bore wells constructed for that purpose within CETP around the treated water storage ponds and an open well as shown in fig. 8.1. Piezometric wells are constructed with 200mm diameter, cased

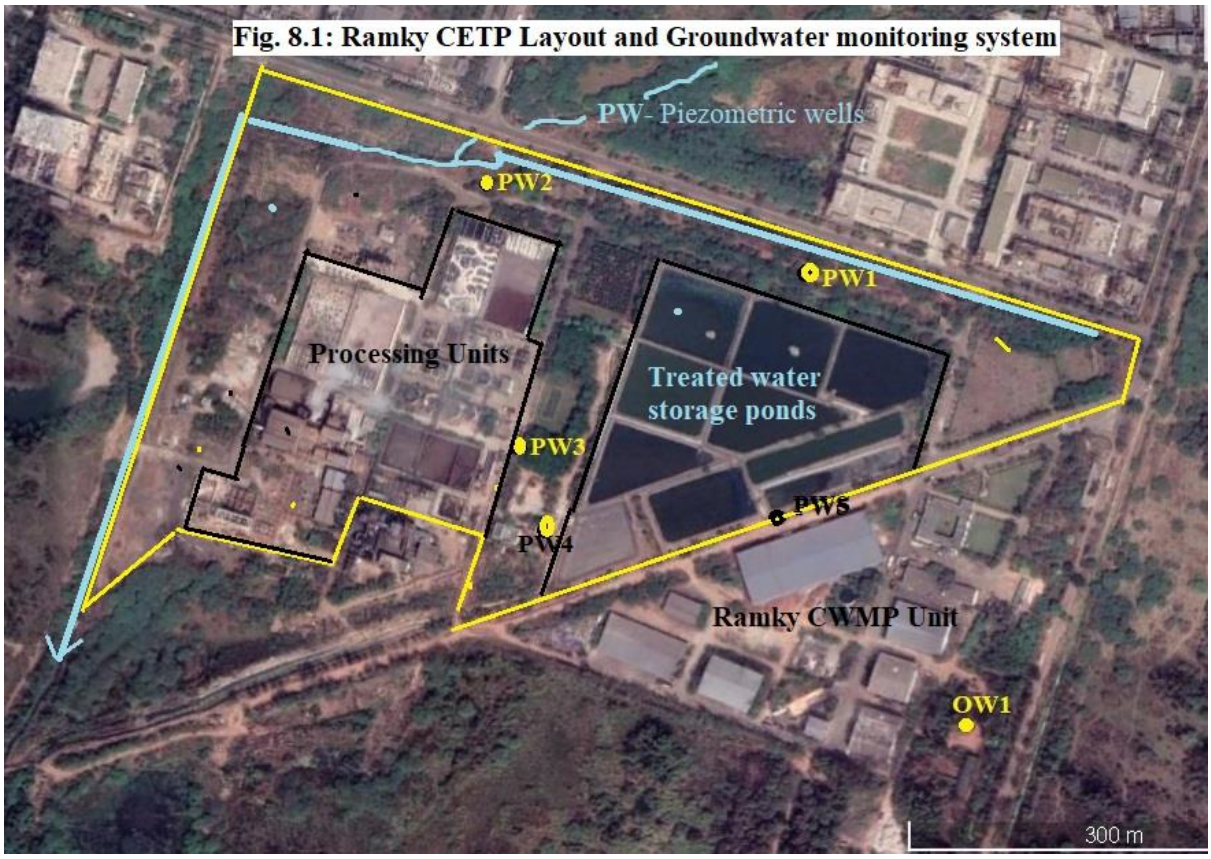


Fig. 8.1: Ramky CETP Layout and Groundwater monitoring system

with 150mm diameter slotted casing and drilled to 20m depth. Piezometer wells are marked as PW1…PW5 and existing open well OW1 with 6.5m diameter and total depth 7.63m located in CWMP is chosen as observation well shown in the above fig. 8.1. Broadly CETP area is marked as a) treated water storage ponds are, b) effluent treatment processing units area and c) greenbelt and open area for common facilities. Water table variations and quality being monitored for every 3 months by Ramky under third party- Andhra University supervision. Water levels observed by our team for the above said 6 wells during post monsoon of 2020 and pre monsoon of 2021 are presented in table – 8.1.

Table -8.1: Water table observation in CETP during Post and Pre monsoon seasons

		Longitude	Latitude	Total Depth (m)	Water Level-in (m)	WL diff.

Well No.	Type of well				Post	Pre	
OW1	OW	$83^0$04’58.4”	$17^0$38’40.7”	7.63	4.19	5.30	1.11
WL2	PW1	$83^0$04’54.26”	$17^0$38’51.13”	20.12	0.95	1.72	0.77
WL3	PW2	$83^0$04’46.8”	$17^0$38’53.38”	18.42	1.33	3.20	1.87
WL4	PW3	$83^0$04’47.07”	$17^0$38’46.9”	19.53	1.42	2.45	1.03
WL5	PW4	$83^0$04’49.4”	$17^0$40’35.5”	7.66	1.53	3.81	2.28
WL6	PW5	$83^0$04’29.8”	$17^0$40’39.8”	8.15	1.25	3.90	2.65

The above data shows that water table is very shallow and depth varies between 0.95m to 1.53m during post monsoon period and the same varies between 1.72m and 3.90m during pre monsoon. Water table fluctuation varies between 0.77m and 2.65m. Shallow water table in these piezometer wells may be due to large quantity of treated water storage in the ponds. In the observation open well water table is beyond 4m and is also located about 400m away from the ponds. Groundwater fluctuation in open well is only 1.11m.

There are bore wells in CETP yielding good quantity of water being used for domestic/ green belt in little quantities.

Water samples collected from the observation wells within CETP – samples collected in PW3 and open well OW1 are analysed for chemical analysis and presented in table 8.2.

Table 8.2: Chemical Analysis of groundwater samples in PW3 and OW1

S.No	Parameters	Water sample in PW- 3		Water sample in Open well	
		Latitude	Longitude	Latitude	Longitude
		Post monsoon	Pre monsoon	Post monsoon	Pre monsoon
1	pH	8.30	8.5	8.4	8.5
2	Conductivity µ mhos/cm	1951	1340	2142	1360
3	TDS mg/l	1101	884	1359	898
4	HCO3 mg/l	353	250	231	110
5	Chlorides mg/l	371	55.3	85	110
6	No3 mg/l	0.074	0.01	0.078	0.02
7	Sodium mg/l	139	138	63.94	73.96
8	Potassium mg/l	51.7	0.8	1.17	1.2
9	Calcium mg/l	38.4	48	41.6	89.6
10	Magnesium mg/l	102.65	127.9	103.46	66.4
11	Total Hardness mg/l	384	644	326	496

TDS values are higher (>500), but within the permissible limits (<1500). Total hardness is higher (>300), but within the permissible limits (<600). All the chemical parameters are within the permissible limits of drinking water standards. However, post monsoon period samples chemical parameters are high during post monsoon than the pre monsoon which is supposed to be vice-versa. Quality of groundwater is within the permissible limits of drinking water standard.

All the treated effluent storage ponds are lined with concrete and supposed not to seep into subsurface. The reasons for shallowness of the water table may be i) site of investigation is in the low lying area to that region and adjacent to main surface runoff drain, of course it is now

diverted about 200m west side and parallel, ii) there is tank measuring about 15.24 Hec. about 200m downstream of CETP always filled with water either from storm water or from industrial sullage that is drained from the JNPC area via diverted drain along CETP border. All the time, area between above said tank and CETP, top soil will be in wet condition and sometimes water logging condition. Shallow water table in the CETP all the time may be shallow, because of the above said reasons.

The industry has assured water supply from Yeleru canal and being stored in big surface storage reservoir constructed at the northern border of JNPC. However, groundwater utilisation is inevitable at least to the small quantities for gardening and for some domestic needs. Some rainwater harvesting measures to be taken up to improve the groundwater quality and quantity and is discussed in the following chapter.

9. SUMMARY AND CONCLUSIONS

Based on the field observations and secondary data collected from various sources, the following are the conclusions from various disciplines:

- Secondary data information has been collected to the extent of 10km radius buffer zone around JNPC/ CETP area. Total buffer zone is 314 sq.km and CETP catchment is about 65 sq.km.
- Field investigations like water table observations, water samples collection have been limited to 2km to 3km as well JNPC catchment. Subsurface geophysical investigation is limited to CETP area.
- Even though CETP is a part of JNPC, it is processing all the liquid waste generated in JNPC, and the processed material being disposed to the destination after getting a green signal from P C B.
- Buffer zone covered by Parawada, Pedagantyada, Munagapaka, Anakapalli mandals of Visakhapatnam Dt. JNPC catchment is totally in Parawada mandal.
- Land use/ land cover mapping shows that agricultural land occupies about 72% and hills and forest cover 15% of the buffer zone and in the CETP catchment it is 65 % and 15% respectively. Industrial area is about 10% in Parawada manadal.
- Physiography of the study area is very undulating land with number of hill ranges, isolated hills and upland with or without scrub.
- Drainage in the buffer zone can be divided into 5 catchments and the drainage density also high indicates moderate to high rainfall runoff. Average rainfall of the district is 1116mm and ave. rainfall of Parawada mandal is 1126mm.

- Water quality of groundwater is within the permissible limits of drinking water standards. At few places along the coast groundwater quality influenced by salt water intrusion.
- There are small reservoirs and number of tanks and few groins for surface water supply for irrigation. Since last decade groundwater for irrigation through open wells and tube wells increased enormously. However, groundwater utility of the district is about 32% and around the study area it is 35%. Still there scope for groundwater development.
- Visakhapatnam city getting lot amount of surface water for its domestic and industrial usage from various reservoirs at a distance ranging between 70km to 200km in and out the district. JNPC receiving 10 MLD from Yeleru canal.
- Geology of the entire district is dominated by crystalline rock- khondalite. In the Parawada mandal nearly 95% of the area covered by khondalite rock.
- Depth to water table varies between less than 2m to 16m in the district. In the area 2km around JNPC field observations shows that post monsoon water levels varies between 1.0m and 11.6m and in the same wells, water table varies between 3.25m and 13.60m in pre monsoon season.
- Subsurface investigations in the CETP indicate that i) the top soil thickness varies between 2m to maximum of 10m and is thin in the east side increases towards west side of the site. ii) second layer- weathered rock- yellow/ brownish disintegrated khondalite rock. Thickness this layer varies between 10m and 25m and is thin in the east side and increase towards west border, iii) third layer- fractured rock- Thickness of fractured khondalite rock varies between 25m and 40m.
- Piezometric observation wells around the treated water storage ponds indicate that water table varies between 0.95m to 1.53m during post monsoon period and the same varies between 1.72m and 3.90m during pre monsoon. Water table fluctuation varies between 0.77m and 2.65m. Shallow water table all the time in the CETP may be due to its location in the low lying area as well a big perennial water body is about 200m distance. Besides that water ponds spread in an area of about 4 Hec. in the CETP may also the reason for shallow water table. Even though the ponds are lined with concrete, there may be some cracks in it percolates storage water to subsurface.
- However, quality of groundwater in the piezometric wells is within the permissible limits of drinking water standards. Groundwater levels, quality of water of the 5

piezometer wells being monitored monthly by CETP and the analysis laboratory is Coastal Waste Management Project (CWMP), of Ramky Enviro Engineers Limited, JNPC, Visakhapatnam. Twenty three parameters being assessed from the water samples that include parameters- physical, chemical, biological and metals. Post and pre monsoon samples analysed are enclosed as Annexure- 1.

10. Recommendations

In the hydrogeological point of view, some measures are to be taken for improving the quality and quantity of groundwater.

10.1: Rainwater Harvesting: Nearly 2/3 area of the Plant covered with i) treated water storage ponds, ii) Various processing units of the treatment plant and roads& others infrastructure facilities. In the 1/3rd area, there is large area under green belt along the northern border, roads side tree rows and open land along the west border as shown in fig. 10.1. Yellow colour polygon is the vacant open area. Blue polygon is the green belt area. There is scope for rainwater harvesting in the green belt as well in the open area. Considering the land use and topographical conditions of the area suitable harvesting structures are: i) trenches across the slope of the ground, ii) small dykes along the border of the green belt and iii) recharge pits along the road berms.

Fig. 10.1: Proposed Rainwater Harvesting Structures in the CETP Area

10.1.1 Trench across slope: The open area along the west border is about 350m length and 60m width consists of some bushes and plants. The diverted stream on the north border flows along the west border of the site. Five trenches are proposed in the vacant land aligning across the slope. Each trench should be excavated for about 50m to 55m length, 0.5m width and 1.0m depth. Trench should be filled to ¾th level with permeable material like boulders at bottom, gravel at the centre and sand as top layer. Excavated soil should be placed on the downstream side of the trench as a bund. A trench constructed at one of the industry is shown in fig. 10.2 as photo mosaic. One of the sites selected for rainwater harvesting structure- Recharge trench near to the west border of the site is shown in fig. 10.3. In the above shown example, trench is

Fig. 10.

filled with sand to the top level. Instead of filling permeable material to the top level, top 25cm is to be left vacant to accommodate more water in the trench. Once in a year trench is to be maintained by removing the deposited silt and make it permeable.

10.1.2 Mini/Micro Dykes along the Outer Border of the Green belt: Main green belt exists along the northern border of CETP spread in an area of 350m E-W length and 40m width that include 8m road. Green belt consists of plantation of about 10m width along the border, about 15m width of grass land in between a drain and northern compound wall as shown in fig. 10.4. There is 8m width road and on its berms 2m to 3m width beautification plants are grown all along the road that leads to liquid waste processing Plant. There is a big drain between road margin and grass plantation shown above to drain the excess runoff from the road and its margin as well from the grass land area. It is suggested that the walls of the drain should be at least 15cm above the soil filled level for which 15cm height brick wall (mini/micro dyke) may be constructed to store the runoff for some time which comes from the road and grass land. Storm water gets stored within the grass area and road margins and percolates within a day or two. Thus mini dykes may be constructed along the road green belt between ponds and main processing units. The structure is small, but the impact on groundwater recharge will be high.

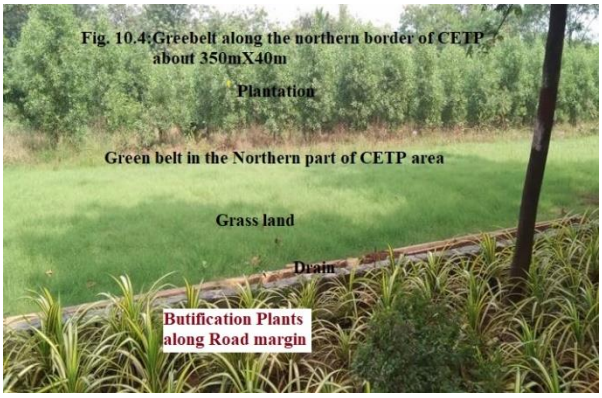


Fig. 10.4: Greebelt along the northern border of CETP about 350mX40m

10.1.3 Recharge pits along the Road Berms: There are number of roads in the processing units area with 5m width and more than a kilometre length. About 3m width of concrete/ bituminous surface and 2m berm consists of soil surface on either of the road. A six inches height dyke is constructed along the road in between bituminous and soil berm as shown in fig. 10.5. Road runoff is allowed over the berms at number of places leaving small gaps in the dyke. Road runoff will be 80% of the rainfall occur and is a good amount of water for the total length of the roads. Road runoff can be harvested by construction a rainwater harvesting structure-recharge well over the berm. Fig. 10.5 shows the location of the recharge well and adjustment of the ground slope towards the well. Top surface of the recharge well should be at the lowest level

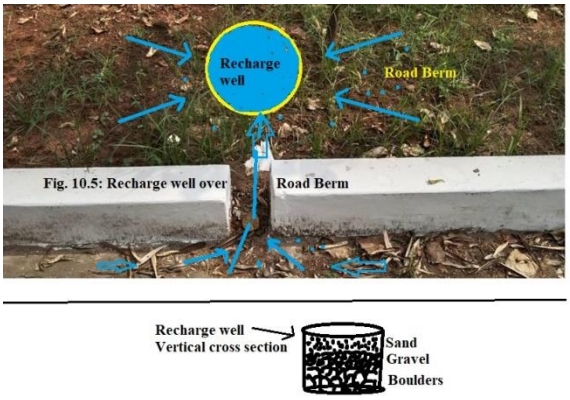


Fig. 10.5: Recharge well over

than surroundings to allow the road runoff as well runoff from surrounding berm area. Thus the road runoff also can be conserved.

As per the site conditions the above said three type of Rainwater harvesting structures are suitable.

a) Need for the Rainwater Harvesting:

- CETP is located in the lowest valley portion of the JNPC and a major stream traversing through the site but is diverted along the boundary. The industry is dealing with liquid waste treatment and management of the entire units in its upper catchment JNPC. Large quantities being stored in concrete lined ponds. Intake and outlets of the liquid waste is handled through impermeable conduits. Any spill overs in the upper catchment has to pass through the main drain which is abutting CETP.
- There is every possibility of leakage of liquid waste may be small quantities from the storage ponds and from the main stream that carries spillages or any other pollution from the upper catchment. Surface flow may directly join the 15 Hec. tank that located about 200m downstream of CETP. Piezometers observation indicates groundwater is very shallow all around storage tanks indicate that there may be some leakages from storage ponds. Mainly groundwater in the shallow aquifer zone gets influenced by the ponds and stream.
- Quality parameters of groundwater are mostly beyond desirable limits, but within the permissible limits. Instead of letting rainwater into the drains, it may be used for recharging aquifer that improves quality of groundwater, because rainwater is very good quality when it joins the aquifer which is a little inferior quality get improved by diluting with rainwater.
- It is suggested that storage tanks may be checked and treated to stop seepage cracks/ joints in the concrete when they are vacated.
- The place available for rainwater harvesting is the open area on the west part of CETP area and greenbelt. Harvesting structures cost is very little amount, but the benefit from improving the quality of groundwater will be enormous. Rainwater harvesting structures cost is only at the time of establishment, but the quantity is renewable every year.

Dr.V.Venkateswara Rao
Professor (Retd.), Geo-Engineering, A.U
QCI-NABET Accredited FAE in Hydrogeology & Geology,
Visakhapatnam- 530 003

ANNEXURE-VI

State Level Environment Impact Assessment Authority (SEIAA)
Andhra Pradesh
Ministry of Environment, Forests & Climate Change,
Government of India
D.No.33-26-14 D/2, Near Sunrise Hospital, Pushpa Hotel Centre,
Chalamavari Street, Kasturibaipet, Vijayawada-520010

By Speed Post

Lr No. SEIAA/AP/VSP/IND/1/2023/4914-287 **Dt**22.12.2023

To
Mr. Sivaramakrishnan Ganesh,
Deputy General Manager,
M/s. Re Sustainability Limited,
11th floor, Level 11 B,
Aurobindo Galaxy, Hyderabad Knowledge City,
Hitech City Road, Hyderabad, Telangana.

Sir,

Sub: SEIAA, A.P.– Proposal of M/s. Re Sustainability Limited for establishment of Common Hazardous Waste, Treatment, Storage and Disposal Facility (Landfill only) at Survey No 116 Part, Thadi Village, Parwada Mandal, Anakapalli District – **Terms of Reference (TOR) - Issued** - Reg.

Ref: 1. Your application received through online vide Proposal No. SIA/AP/INFRA2/410735/2022.
2. Minutes of the 231st SEIAA meeting received through email on 21.12.2023.

***

With reference to the above, it is to inform that your application for issue of TOR for establishment of Common Hazardous Waste, Treatment, Storage and Disposal Facility (Landfill only) at Survey No 116 Part, Thadi Village, Parwada Mandal, Anakapalli District was examined by the State Expert Appraisal Committee (SEAC), A.P in its 215th, 225th and 231st meetings. The project proponent and their consultant M/s. Re Sustainability Solutions Private Limited have attended the meeting and committee noted that:

a) The proposed project is for establishment of Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) by M/s. Re Sustainability Limited.,with design Capacity of 3,00,000 TPA at Survey No 116 Part, Thadi Village, Parwada Mandal, Anakapalli District.
b) As per the EIA Notification S.O. 1533 (E) dated 14-09-2006 and its amendments thereof, proposed project falls under the Activity - 7(d) - Common Hazardous Waste Treatment Storage and Disposal Facility, Category-B having Landfill only.
c) The proposed project is of 3,00,000 MTPA capacity includes direct land fill - 1,50,000 MTPA and Landfill after treatment is 1,50,000 MTPA using reagents like flyash, cement, lime based on the comprehensive analysis of the waste. The coverage area of the facility is to handle waste generated from Visakha Pharmacity and also from other industries within the State.
d) The project proponent informed that the operation of the facility will be 25 years and post closure monitoring will be 25 years.
e) The Proposed Land fill is adjacent the Visakha Pharma city and the APIIC, Atchuthapuram issued Alienation of Government land to M/s. Visakha Pharma City (erstwhile M/s. Ramky Pharmacity India Limited) measuring an extent of Ac. 50.00 cts in Sy.No. 116 part of Thadi Village, Parawada Madal for the purpose of "Secured Land Fill".
f) The APIIC vide Lr dated 17.06.2022 allotted an extent of AC 10.00 for TSDF facility and to reserve the balance land of Ac 40.00 subject to formation of the road at RPCIL cost.
g) M/s. Re Sustainable Limited entered into a Development agreement with M/s. Visakha Pharmacity to establish, operate and maintain the TSDF facility on behalf of Visakha Pharmacity for disposal of additional waste as the existing landfill of Pharmacity has exhausted.
h) The committee observed that the proposed site is located on Hill and also the elevation difference of top to bottom of the hill is 200m. The committee opined that proposal of land fill on hill is not suitable due to surface runoff.

i) The project proponent informed that will develop land fill on toe of the hill with 10 Ac of land. However, the committee verified the same through KML and observed the elevation difference of 25 to 30 m in proposed land of 10Ac. The committee opined that proposed site is not suitable for establishment of Secured Land Fill.

j) The committee also noted that the establishment of TSDF on Hills is not suitable (Construction of landfill on the hill shall be avoided) as per the CPCB guidelines.

k) This proposal was placed in 215th SEAC meeting recommended **to raise ADS** for submission of following:

- Detailed justification on the suitability of the proposed land for the establishment of secured landfill keeping in view of the location of the land which is on hill slope with an elevation difference 200m.
- Justification on the initial phase of establishment of Common Hazardous Waste Treatment Storage and Disposal Facility (Landfill only) in the proposed land of 10 Ac on the toe of the hill which is also having an elevation difference of 25 to 30 m.
- Furnishing / detailing of the proposed area for initial phase ie 10 Ac with the geo-coordinates out of the total 50 Ac of proposed area of the total project.
- Clarification on land whether the proposed land is in Industrial Estate or not with supporting documents.
- Detailing the technology proposed and the processing of the wastes in the project along with the details of the quantities of wastes to be treated.
- Details on the characteristics, quantities, collection, treatment and disposal of leachate.
- Details of experience in this field of work, if any.
- Justification for the technology to be used in the proposal.

l) Accordingly, the project proponent has submitted ADS reply and the proposal along with ADS reply was appraised in the 225th SEAC meeting.

m) The project proponent has informed that the proposed site qualifies the criteria for development of TSDF facility as per the CPCB Rejection or Knock-out criteria and also CPCB location criteria. The proposed site is located within 80 to 190 mtrs and having approximately 100-110 m of elevation difference.

n) The project proponent has informed that they will develop TSDF in four phases and initially 10.0 Acres of land have been allotted for immediate development and the remaining 40.0 Acres will be developed in subsequent phases.

o) The proposed land is outside industrial estate (M/s. Visakha Pharmacity) and wherein APIIC special project zone Atchutapuram allotted land for the development of Common Hazardous Waste TSDF (Landfill only) vide order dated 17.06.2022.

p) The project proponent informed that the leachate generated will be collected and treated in Leachate treatment plant of capacity 100 KLD. The part of treated Leachate will be used in sprinkling for stabilization of waste and the remaining is proposed to dispose through forced evaporation.

q) The Committee after examining the project proposals, presentations, EIA appraisal, ADS reply, MoEF&CC Notifications & OMs and detailed deliberations, **recommended to constitute** a **subcommittee** with the following members 1) Prof. M. Chandra Sekhar 2) Prof. K. Thyagaraju and 3) Dr. M. Sunandana Reddy **to visit** the proposed site for ascertaining the suitability of the land for setting up of Landfill facility as the proposed land is located on the hill slope with an elevation difference of about 200 mts and also to verify the compliance of the proposed site to the CPCB siting criteria for development of landfill facility.

r) Accordingly, the SEAC has constituted Subcommittee and the subcommittee inspected site on 09.09.2023 and the summary of the subcommittee report is as follows:

- The location is meeting the CPCB criteria for location of Secured Landfills.
- NGRI has given a favourable report for the existing site after Geotechnical & Geophysical investigations indicating suitability of the site for TSDF.
- The client has taken the criteria specified by CPHEEO manual for landfills in hilly regions in the design of TSDF.

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- APPCB, Reginal office also recommended the site in JN Pharma City, Parawada APIIC for allocation of 50 acres land for construction of Secured land fill for TSDF.
- Client should take all necessary precautions specified by CPCB in construction, operation and maintenance of proposed TSDF.
- As suggested by NGRI, a garland drain to collect the surface runoff generated at the site should be constructed.
- It is recommended to submit/upload NGRI report, APPCB-RO recommendations, and certified compliance report (MoEF).

The proposal along with the Sub Committee report was appraised in 231st SEAC meeting and Committee after examining the project proposals, presentations, EIA appraisal, ADS reply, Subcommittee report, MoEF&CC Notifications & OMs and detailed deliberations, recommended to **issue Standard TOR with public hearing** with following additional conditions:

1. Importance and benefits of the project.
2. The E.I.A. would address to the conformity of site to the stipulations as made in the Hazardous and other Wastes (Management, handling and transboundary movement) Rules, 2016 and will have a complete chapter indicating conformity to the said rules.
3. Project proponents would also submit a write up on how their project proposal conform to the stipulations made in the "Protocol for Performance evolution and monitoring of the Common Hazardous Waste Treatment Storage and Disposal facilities ", published by the CPCB on May 24, 2010.
4. Status of compliance to the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and Bio-Medical Waste Management Rules, 2016.
5. Details of various waste management units with capacities for the proposed project.
6. List of waste to be handled and their source along with mode of transportation.
7. Other chemicals and materials required with quantities and storage capacities.
8. Details of temporary storage facility for storage of hazardous waste at project site.
9. Details of pre-treatment facility of hazardous waste at TSDF.
10. Details of air emissions, effluents, hazardous/solid waste generation and their management.
11. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).
12. Process description along with major equipments and machineries, process flow sheet (quantitative) from waste material to disposal to be provided.
13. Hazard identification and details of proposed safety systems.
14. Details of Drainage of the project up to 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided.
15. Ground water quality monitoring in and around the project site The Air Quality Index shall be calculated for base level air quality.
16. Details of effluent treatment and recycling process.
17. Leachate study report and detailed leachate management plan to be incorporated.
18. Action plan for measures to be taken for excessive leachate generation during monsoon period.
19. Action plan for any pollution of ground water is noticed during operation period or post closure monitoring period.
20. Detailed Environmental Monitoring Plan as well as Post Closure Monitoring Plan.
21. A detailed Plan for green belt development.
22. A certificate from the local body supplying water, specifying the total annual water availability with the local authority, the quantity of water already committed, the quantity of water allotted to the project under consideration and

the balance water available. This should be specified separately for ground water and surface water sources, ensuring that there is no impact on other users

23. Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.
24. The project proponents shall satisfactorily address to all the complaints/suggestions that have been received against the project till the date of submission of proposals for Appraisal.
25. Plan for Corporate Environment Responsibility (CER) as specified under Ministry's Office Memorandum vide F.No. 22-65/2017-IA.III dated 1stMay 2018 shall be prepared and submitted along with EIA Report.
26. The unit shall submit NGRI report for the existing site after Geotechnical & Geophysical investigations indicating suitability of the site for TSDF.
27. The unit shall submit all necessary precautions specified by CPCB in construction, operation and maintenance of proposed TSDF.
28. The unit shall submit a garland drain to collect the surface runoff generated at the site should be constructed As suggested by NGRI.
29. The unit shall to submit/upload NGRI report, APPCB-RO recommendations, and certified compliance report (MoEF).

Annexure- I: 7(d): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR COMMON HAZARDOUS WASTE TREATMENT, STORAGE AND DISPOSAL FACILITIES (TSDFS) AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT.

1. Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.
2. Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures.
3. Submit the present land use and permission required for any conversion such as forest, agriculture etc.
4. Examine the details of transportation of Hazardous wastes, and its safety in handling.
5. Examine and submit the details of on line pollutant monitoring.
6. Examine and submit details of monitoring of water quality around the landfill site.
7. Examine and submit details of the odour control measures.
8. Examine and submit details of impact on water body and mitigative measures during rainy season.
9. Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment. Regular monitoring shall be carried out for odour control.
10. Water quality around the landfill site shall be monitored regularly to examine the impact on the ground water.
11. The storage and handling of hazardous wastes shall be as per the Hazardous Waste Management Rules.
12. Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.
13. Public hearing to be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the website.
14. A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.
15. Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.

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16. The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
17. Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website.

The issue was placed before the SEIAA, A.P., in its **231st SEIAA** meeting held on 20.12.2023 **and SEIAA** agreed with the recommendations of SEAC to issue Standard TOR with public hearing for Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) of M/s. Re Sustainability Limited.

In view of the above, you are requested to prepare EIA report accordingly based on the **Standard Terms of Reference with Public Hearing** with the above additional TORs and to submit to the SEAC, A.P., accordingly for appraisal. The Terms of the reference are valid for a period of Four years.

MEMBER SECRETARY,
SEAC, A.P

ANNEXURE-VII

सत्यमेव जयते

File No: AP/AK/INFRA2/O2/2024/EC/73

Government of India

Ministry of Environment, Forest and Climate Change

(Issued by the State Environment Impact Assessment Authority(SEIAA), ANDHRA PRADESH)

***

Date **28/06/2024**

To,

Mr. Sivaramakrishnan Ganesh
RE SUSTAINABILITY LIMITED
Re Sustainability Limited, 11th floor, Level 11 B, Aurobindo Galaxy, Hyderabad Knowledge City, Hitech City road, Hyderabad, Telangana , RANGA REDDY, TELANGANA, , 500081
ganesh.srk@resustainability.com

Subject: Grant of prior Environmental Clearance (EC) to the proposed project under the provision of the EIA Notification 2006 -regarding.

Sir/Madam,

This is in reference to your application submitted to SEIAA vide proposal number SIA/AP/INFRA2/458016/2024 dated 14/02/2024 for grant of prior Environmental Clearance (EC) to the proposed project under the provision of the EIA Notification 2006 and as amended thereof.

2. The particulars of the proposal are as below :

(i) EC Identification No.	EC24B3202AP5336172N
(ii) File No.	AP/AK/INFRA2/O2/2024/EC/73
(iii) Clearance Type	Fresh EC
(iv) Category	B1
(v) Project/Activity Included Schedule No.	7(d) Common hazardous waste treatment, storage and disposal facilities (TSDFs)
(vii) Name of Project	Common Hazardous Waste Treatment Storage Disposal Facility (Landfill only)
(viii) Name of Company/Organization	RE SUSTAINABILITY LIMITED
(ix) Location of Project (District, State)	ANAKAPALLI, ANDHRA PRADESH
(x) Issuing Authority	SEIAA
(xi) Applicability of General Conditions as per EIA Notification, 2006	No

N/A

सत्यमेव जयते	**State Level Environment Impact Assessment Authority (SEIAA)** **Andhra Pradesh** **Ministry of Environment, Forests & Climate Change** **Government of India** Dr.YSR Paryavaran Bhavan, APIIC Colony Road, Gurunanak Colony, Auto Nagar, Vijayawada-520007.

REGD.POST WITH ACK.DUE

Order No. SEIAA/AP/AK/INFRA2/02/2024/241.27/241.20

Sub : SEIAA, A.P. – M/s. Re Sustainability Limited proposal to establish a Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) at Survey No 116 Part of Thadi Village, Parwada Mandal, Anakapalli District, Andhra Pradesh - Environmental Clearance - Issued - Reg.

I. This has reference to your EC application submitted through online on 14.02.2024 (**SIA/AP/INFRA2/458016/2024**), seeking Environmental Clearance for proposed to establish a Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) at Survey No 116 Part of Thadi Village, Parwada Mandal, Anakapalli District, Andhra Pradesh in favour of M/s. Re Sustainability Limited**,.** The nearest human habitation viz., Thadi (V) exists at a distance of about 0.8 km from the premises. The total land area is 50 acers. The capital cost of the project is Rs.200.0Crores. The details of the production capacities of the project is as follows:

Common Hazardous Waste Treatment, Storage and Disposal Facility

(Landfill only) with design Capacity of 3,00,000 TPA

The proposal along with all the documents submitted by the proponent has been examined and processed in accordance with EIA Notification, 2006 and its amendments thereof. The State Level Expert Appraisal Committee (SEAC) examined the application in its meeting held on **22.02.2024.**

Minutes of SEAC Meeting:-

Category: B1

The proposed project is for establishment of Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) by M/s. Re Sustainability Limited, with design Capacity of Landfill -3,00,000 TPA at Survey No 116 Part, at Thadi Village, Parwada Mandal, Anakapalli District, Andhra Pradesh.

As per the EIA Notification S.O. 1533 (E) dated 14-09-2006 and its amendments thereof, proposed project falls under the Activity - 7(d) - Common Hazardous Waste

Treatment Storage and Disposal Facility (TSDF) having only Landfill facility is Category-B.

The project proponent and their consultant M/s. Re Sustainability Solutions Private Limited have attended the meeting. The committee noted that:

1. M/s. Re Sustainability Solutions Private Limited proposed for the establishment of Common Hazardous Waste Treatment Storage and Disposal Facility (landfill only) at Survey No 116 Part, at Thadi Village, Parwada Mandal, Anakapalli District with a project cost of Rs. 200 Crores.
2. The APIIC issued Alienation of Government land to M/s. Visakha Pharma City (erstwhile M/s. Ramky Pharmacity India Limited) measuring an extent of Ac. 50.00 cts in Sy.No. 116 part of Thadi Village, Parawada Mandal for the purpose of “Secured Landfill”.
3. The APIIC vide Lr dated 17.06.2022 allotted an extent of AC 10.00 for TSDF facility and to reserve the balance land of Ac 40.00 subject to formation of the road at RPCIL cost. M/s. Re Sustainability Limited entered into a Development agreement with M/s. Visakha Pharmacity to establish, operate and maintain the TSDF facility on behalf of Visakha Pharmacity for disposal of additional waste as the existing landfill of Pharmacity has exhausted.
4. The project proponent has informed that they will develop TSDF in four phases and initially 10.0 Acres of land have been allotted for immediate development and the remaining 40.0 Acres will be developed in subsequent phases. The coverage area of the facility is to handle waste generated from VisakhaPharmacity and also from other industries within the State.
5. The proposed TSDF project is of 3,00,000 TPA capacity includes Direct to Landfill - 1,50,000 TPA and Landfill after Treatment - 1,50,000 TPA using reagents like fly ash, cement, lime based on the comprehensive analysis of the waste. The proposed project will be developed in 4 cells and the operation of the facility will be 25 years and post closure monitoring will be 25 years.
6. The Proposed Landfill is adjacent to the existing landfill of VisakhaPharma city and the committee observed that the proposed site is located on hill and also the elevation difference of top to bottom of the hill is 116 m. The project proponent informed that will develop land fill on toe/foot of the hill with 10 Ac of land.
7. The committee noted that the proposed site qualifies the criteria for development of TSDF facility as per CPCB Rejection or Knock-out criteria and also CPCB location criteria. Also, the committee noted that, NGRI after conducting detailed Geotechnical and Geo hydrological investigation indicated the suitability of the site for TSDF.
8. Also, the committee noted that APPCB, Regional Office, Visakhapatnam vide letter dt. 12.2017submitted the report to the Collector & District Magistrate

stating that the proposed site is suitable for creation of TSDF facility.

9. The committee directed the project proponent that they shall construct garland drain as suggested by the NGRI to collect the surface runoff.
10. The committee directed the project proponent that they shall ensure that all necessary precautions prescribed by CPCB are adhered to in the construction, operation, and maintenance of the TSDF.
11. The total water requirement of 15 KLD for the proposed project will be met through APIIC supply / tankers. The effluents from process and vehicle wash are proposed to be sent to CETP for further treatment and disposal.
12. The leachate generated from the landfill operations will be treated and reused in the landfill stabilization, sprinkling and the remaining leachate will be disposed through MEE & ATFD and the resultant salts will be sent to landfill to ensure Zero Liquid Discharge.
13. The SEIAA, AP granted Terms of Reference vide order dated 22.12.2023 and public hearing was conducted on 30.01.2024. The major issues raised in the public hearing are relocation of Thadi village, pollution due to exiting industries, local employment, medical & health care facilities, drinking water & RO facilities.
14. The committee noted that the relocation of the Thadi village is pertaining to Government level issue and the project proponent informed that the Government of AP has already issued the GO in this regard for rehabilitation of Thadi Village and assured that they will pursue with the Govt. for rehabilitation of the village at the earliest.
15. The other issues raised in the public hearing and the action plan given by the project proponent is as follows:

Issue raised in the public hearing	**Reply / Action plan by the project proponent**
Pollution due to existing industries, issue related to relocation of the villages of Thadi Village	Proposed project at Thadi village and the land is allotted by APIIC after consideration of recommendation from NGRI and confirmation from APPCB. To minimize the pollution and EMP budget of Rs 12.12 Crores has been proposed as capital cost and Rs.1.12 Crores as recurring cost for control of Air pollution, Water pollution, Soil pollution, Noise pollution, odour control, development of Greenbelt, Energy conservation measures, etc.
Waste water discharge into water bodies from the existing industries, local employment, medical and health care	No wastewater discharge involved in the proposal. Process and vehicle wash effluent will be sent to CWMP CETP, the leachate will be treated and reused and any excess will be

facility issues were raised Pollution due to existing industries, effluent discharge into water bodies	disposed through MEE & ATFD to ensure ZLD. Total Rs. 250 Lakhs has been provided for CER activities which will be used for provision of medical and healthcare facility. Preference will be given for employment to locals
Demands for regular use of CER fund for health care facilities	For taking up CER activities and budget of Rs. 250 Lakhs has been provided. Medical assistance will also be provided by Ramky foundation as and when required.
Questions about site selection and pollution	The site is allotted by APIIC after consideration of recommendation of NGRI and confirmation from APPCB. Proposed project will be developed after obtaining EC from SEIAA, AP, & CFE from APPCB and other mandatory permissions from statutory bodies.
Local employment	Total 50 workers during construction phase and 50 workers during operation phase will be required. Preference in employment will be given to locals as per their skills. Technical training will provide to the workers before their actual involvement at work place.
Status of existing health care facilities and greenbelt plan proposed	Health care facilities are present available in Thanam, EdulapakaBonangi, Nakkavanipalemand Agnampudi villages. Duvada PHC, Parwada PHC, Munagapaka PHC, and Ankapalli District Hospital are all government facilities available within a 5 to 10 Km radius from the proposed project site. Total 16.50 Acre (6.68 Ha) area covering 33% of total plot area is identified for greenbelt development. Total 6680 trees (@ 1000 tree/ Ha) will be planted. Rs.17.88 Lakhs has been allotted for greenbelt development.

Drinking water and RO water facility	Total Rs. 250 Lakhs has been identified for CER activities in which provision of drinking water facilities including RO installations proposed.
Issue of Ground water pollution, depletion of water table	Leachate generated in the facility will be collected and stored in Leachate Collection Pond and reused for landfill stabilization. Excess leachate will be treated using MEE and ATFD to achieve ZLD. No GW will be extracted for the project activities.

16. The base line data was collected from September, 2023 to November, 2023 and the predominant wind direction is observed to be North West to South East.
17. The project proponent informed that there is no stream passing through the proposed project site and the rain water coming from the upper regions will be diverted by providing garlanded drain around the landfill as suggested by NGRI.
18. It was also informed that for each phase of development cell, garland drain will be constructed so as to ensure that any runoff of the catchment area land fill is diverted effectively and there is no contamination of the runoff water.
19. The committee directed the project proponent that they shall construct garland drain towards hilly/ terrain portion and also directed to construct retaining wall boundary of the Phase-I i.e., towards Northwestern side to avoid overflow of garland drain in rainy season/ during cyclones.
20. The surface runoff from the hill shall not enter the landfill facility under any circumstances and the stormwater drains shall be provided with adequate size.
21. The committee directed the project proponent that the depth of the land fill site shall be based on the ground water table at the site and as permitted by the Pollution Control Board.
22. The project proponent informed that they have allocated Rs. 12.02 Crs as capital cost and Rs. 1.11 Crs as a recurring cost budget for the EMP. Also, the project proponent earmarked funds of Rs. 2.50 Crs for social development and welfare measures under CER activities in the surrounding villages towards development of education, healthcare and infrastructure facilities. The committee recommended the project proponent that they shall allot 2% of the annual profit towards CSR activities during operations as mandated by Indian Companies Act.

The Committee after examining the project proposals, presentations, MoEF&CC Notifications & OMs EIA report, Public Hearing minutes and detailed deliberations, recommended **SEIAA for issue of** Environmental Clearance to this proposed Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) by M/s. Re Sustainability Limited., with

design Capacity of 3,00,000 TPA and with following conditions:

1. The project proponent shall comply with the proposals furnished in the Environmental management plan & EIA report.
2. The project proponent shall comply with the criteria for hazardous waste landfills issued by CPCB vide HAZWAMS/17/2001.
3. The project proponents shall adhere to all conditions as prescribed in the Protocol for 'Performance Evaluation and Monitoring of the Common Hazardous Waste Treatment, Storage and Disposal Facilities' published by the CPCB in May, 2010.
4. The project proponent shall ensure that all necessary precautions prescribed by CPCB are adhered in the construction, operation, and maintenance of the TSDF.
5. The Project proponent should ensure that the TSDF fulfils all the provisions of Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016 and amendments thereof.
6. The project proponent shall comply with the recommendations of the NGRI based on their Geotechnical & Geo hydrological investigations including the construction of garland drain to collect the surface runoff.
7. The project proponent should handle the waste generated from the member units only.
8. The project proponent shall keep Sufficient number of Piezometer wells shall be installed in and around the project site to monitor the ground water quality in consultation with the State Pollution Control Board / CPCB. Trend analysis of ground water quality shall be carried out each season and information shall be submitted to the SPCB and the Regional Office of MoEF&CC.
9. The project proponent shall construct garland drain towards hilly/ terrain portion and also shall construct retaining wall boundary of the Phase-I i.e., towards Northwestern side to avoid overflow of garland drain in rainy season/ during cyclones.
10. The surface runoff from the hill shall not enter the landfill facility under any circumstances and the stormwater drains shall be provided with adequate size
11. Ambient air quality monitoring shall be carried out in and around the landfill site at up wind and downwind locations.
12. The depth of the land fill site shall be decided based on the ground water table at the site and may be such as permitted by the Pollution Control Board.
13. Environmental Monitoring Programme shall be implemented as per EIA report and guidelines prescribed by CPCB for hazardous waste facilities. Periodical ground water/soil monitoring to check the contamination in and around the site shall be carried out.
14. The Company shall ensure proper handling of all spillages by introducing spill control procedures for various chemicals.
15. On line real time continuous monitoring facilities shall be provided as per the CPCB or State Board Directions.

16. No non-hazardous wastes, as defined under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, shall be handled in the premises.
17. Gas generated in the Land fill should be properly collected, monitored and flared.
18. The Project Proponent shall develop green belt with native plant species that are significant and used for the pollution abatement. At least 10 m thick greenbelt shall be developed in the periphery of hazardous waste facility.
19. It shall be ensured that all the trees and other plantation are of the non-edible varieties and do not in any way encourage the incorporation of toxic materials in the food chain.
20. Project should ensure that the site is properly cordoned off from general movement and no unauthorized person or goods permitted to enter the premises. Necessary security provision should be made as a condition in the Authorisation under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 to prevent unwanted access.
21. Pre-medical check-up to be carried out on workers at the time of employment and regular medical record to be maintained.
22. Emergency plan shall be drawn in consultation with SPCB/CPCB and implemented in order to minimize the hazards to human health or environment from fires, explosion or any unplanned sudden or non- sudden release of hazardous waste or hazardous waste constituents to air, soil or surface water.
23. Rain water runoff from the landfill area shall be collected and treated in the effluent treatment plant.
24. The project proponent shall not extract ground water.
25. The facility shall store the waste in lined containers solely for the purpose of the accumulation of quantities of hazardous waste as necessary to facilitate proper recovery, treatment or disposal for which economically viable treatment/disposal techniques are presently not available at or outside the facility.
26. Each container shall be clearly marked to identify its contents and the date(s) of accumulation at the facility and such information for each consignment is recorded and maintained in the operating records at the facility.
27. The facility shall comply with the guidelines issued by MoEF&CC for storage and handling of hazardous waste by the TSDFs.
28. The facility shall carryout finger print analysis for hazardous waste before sending the waste for disposal into the landfill according to the identified path by the facility.
29. The capping of the landfill should be as per CPCB guidelines comprise of i) 150-mm soil cover, ii) 150-mm Gas collection layer, iii) a clay cap – 600mm thick with permeability $<10^{-9}$m/s, iv) 1.5 mm HDPE with permeability $<10^{-14}$ m/s, v) a geo Textile, vi) 200-mm Drainage media, vii) 300-mm top soil, viii) 300-mm vegetative soil and ix) Vegetation with well-prepared skirting storm water drainage all around the landfill facility with retention pond.
30. The facility shall create Escrow Account as per CPCBs guidelines and shall deposit 5% of the annual turnover of land fillable waste towards the Escrow

Account to monitor the facility at least for a period of 30 years from the closure.

31. The facility shall prepare emergency preparedness plan covering identifying potential risk, establishing emergency response team, develop communication protocols, create emergency procedures, provide training & drills, coordinating external agencies, develop continuity plans , details of drainage pattern in 5km radius of the project etc, before operation of the facility.
32. The project proponent shall comply with the assurances / action plan given on the objections raised in the public hearing.
33. The project proponent shall ensure issue of notification by the Government declaring 500m around landfill boundary as non-development buffer zone as stipulated in the CPCB criteria for Hazardous waste land fill.

The committee in the appraisal report clearly stated that they have examined the Form-I/II, PFR/DPR and EMP & EIA for compliance by the proponent.

The State Level Environment Impact Assessment Authority (SEIAA), in its meeting held on **15.03.2024** examined the proposal and the recommendations of SEAC and decided to accept SEAC recommendations aforesaid for strict compliance by the proponent and to issue EC for Common Hazardous Waste Treatment, Storage and Disposal Facility (Landfill only) with design Capacity of 3,00,000 TPA. The SEIAA, A.P **hereby accords Environmental Clearance to the project** as mentioned at Para no. I under the provisions of the EIA Notification 2006 and its subsequent amendments issued under Environment (Protection) Act, 1986 subject to implementation of the following special, specific and general conditions:

Part A: Special Conditions:

1. The proposal shall not attract the following Acts & Rules:

a. Forest Conservation Act, 1980;
b. Wild Life (Protection) Act,1972;
c. CRZ Notification, 2011;
d. The Eco sensitive areas as notified under Environment (Protection) Act,1986;
e. Critically polluted areas as notified by CPCB and also shall not harm livestock and human beings and disturb their activities.

2. The project proponent volunteered to allocate Rs. 12.02 Crs as capital cost and Rs. 1.11 Crs as a recurring cost budget for the EMP. Also, the project proponent earmarked funds of Rs. 2.50 Crs for social development and welfare measures under CER activities in the surrounding villages towards development of education, healthcare and infrastructure facilities. The committee recommended the project proponent that they shall allot 2% of the annual profit towards CSR activities during operations as mandated by Indian Companies Act.
3. The project proponent shall comply with the proposals furnished in the Environmental management plan & EIA report.

4. The project proponent shall comply with the criteria for hazardous waste landfills issued by CPCB vide HAZWAMS/17/2001.
5. The project proponents shall adhere to all conditions as prescribed in the Protocol for 'Performance Evaluation and Monitoring of the Common Hazardous Waste Treatment, Storage and Disposal Facilities' published by the CPCB in May, 2010.
6. The project proponent shall ensure that all necessary precautions prescribed by CPCB are adhered in the construction, operation, and maintenance of the TSDF.
7. The Project proponent should ensure that the TSDF fulfils all the provisions of Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016 and amendments thereof.
8. The project proponent shall comply with the recommendations of the NGRI based on their Geotechnical & Geo hydrological investigations including the construction of garland drain to collect the surface runoff.
9. The project proponent should handle the waste generated from the member units only.
10. The project proponent shall keep Sufficient number of Piezometer wells shall be installed in and around the project site to monitor the ground water quality in consultation with the State Pollution Control Board / CPCB. Trend analysis of ground water quality shall be carried out each season and information shall be submitted to the SPCB and the Regional Office of MoEF&CC.
11. The project proponent shall construct garland drain towards hilly/ terrain portion and also shall construct retaining wall boundary of the Phase-I i.e., towards Northwestern side to avoid overflow of garland drain in rainy season/ during cyclones.
12. The surface runoff from the hill shall not enter the landfill facility under any circumstances and the stormwater drains shall be provided with adequate size
13. Ambient air quality monitoring shall be carried out in and around the landfill site at up wind and downwind locations.
14. The depth of the land fill site shall be decided based on the ground water table at the site and may be such as permitted by the Pollution Control Board.
15. Environmental Monitoring Programme shall be implemented as per EIA report and guidelines prescribed by CPCB for hazardous waste facilities. Periodical ground water/soil monitoring to check the contamination in and around the site shall be carried out.
16. The Company shall ensure proper handling of all spillages by introducing spill control procedures for various chemicals.
17. On line real time continuous monitoring facilities shall be provided as per the CPCB or State Board Directions.
18. No non-hazardous wastes, as defined under the Hazardous and Other Wastes

(Management and Transboundary Movement) Rules, 2016, shall be handled in the premises.

19. Gas generated in the Land fill should be properly collected, monitored and flared.
20. The Project Proponent shall develop green belt with native plant species that are significant and used for the pollution abatement. At least 10 m thick greenbelt shall be developed in the periphery of hazardous waste facility.
21. It shall be ensured that all the trees and other plantation are of the non-edible varieties and do not in any way encourage the incorporation of toxic materials in the food chain.
22. Project should ensure that the site is properly cordoned off from general movement and no unauthorized person or goods permitted to enter the premises. Necessary security provision should be made as a condition in the Authorisation under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 to prevent unwanted access.
23. Pre-medical check-up to be carried out on workers at the time of employment and regular medical record to be maintained.
24. Emergency plan shall be drawn in consultation with SPCB/CPCB and implemented in order to minimize the hazards to human health or environment from fires, explosion or any unplanned sudden or non- sudden release of hazardous waste or hazardous waste constituents to air, soil or surface water.
25. Rain water runoff from the landfill area and other hazardous waste management area shall be collected and treated in the effluent treatment plant.
26. The project proponent shall not extract ground water.
27. The facility shall store the waste in lined containers solely for the purpose of the accumulation of quantities of hazardous waste as necessary to facilitate proper recovery, treatment or disposal for which economically viable treatment/disposal techniques are presently not available at or outside the facility.
28. Each container shall be clearly marked to identify its contents and the date(s) of accumulation at the facility and such information for each consignment is recorded and maintained in the operating records at the facility.
29. The facility shall comply with the guidelines issued by MoEF&CC for storage and handling of hazardous waste by the TSDFs.
30. The facility shall carryout finger print analysis for hazardous waste before sending the waste for disposal into the landfill according to the identified path by the facility.
31. The capping of the landfill should be as per CPCB guidelines comprise of i) 150-mm soil cover, ii) 150-mm Gas collection layer, iii) a clay cap – 600mm thick with permeability <10-9m/s, iv) 1.5 mm HDPE with permeability <10-14

m/s, v) a geo Textile, vi) 200-mm Drainage media, vii) 300-mm top soil, viii) 300-mm vegetative soil and ix) Vegetation with well-prepared skirting storm water drainage all around the landfill facility with retention pond.

32. The facility shall create Escrow Account as per CPCBs guidelines and shall deposit 5% of the annual turnover of land fillable waste towards the Escrow Account to monitor the facility at least for a period of 30 years from the closure.
33. The facility shall prepare emergency preparedness plan covering identifying potential risk, establishing emergency response team, develop communication protocols, create emergency procedures, provide training & drills, coordinating external agencies, develop continuity plans , details of drainage pattern in 5km radius of the project etc, before operation of the facility.
34. The project proponent shall comply with the assurances / action plan given on the objections raised in the public hearing.
35. The project proponent shall ensure issue of notification by the Government declaring 500 m around landfill boundary as non-development buffer zone as stipulated in the CPCB criteria for Hazardous waste land fill.
36. The area of the greenbelt shall not be less than 33% of the total area of the site. Greenbelt with tall growing trees shall be developed along the boundary of the site. The green belt shall be developed in an area of 6.68 Ha i.e., total 6680 trees (@ 1000 tree/ Ha shall be planted. Rs.17.88 Lakhs shall be allotted for greenbelt development as committed by the proponent.
37. The Process and vehicle wash effluent shall be sent to CWMP CETP, the leachate shall be treated and reused and any excess shall be disposed through MEE & ATFD to ensure ZLD. No wastewater discharge involved in the proposal.
38. Technical training shall be provided to the workers before their actual involvement at work place.
39. The Leachate generated in the facility shall be collected and stored in Leachate Collection Pond and reused for landfill stabilization. Excess leachate shall be treated using MEE and ATFD to achieve ZLD. No Ground Water shall be extracted for the project activities.
40. For each phase of development cell, garland drain shall be constructed so as to ensure that any runoff of the catchment area land fill is diverted effectively and there is no contamination of the runoff water.
41. The project proponent shall construct garland drain towards hilly/ terrain portion and also shall construct retaining wall boundary of the Phase-I i.e., towards Northwestern side to avoid overflow of garland drain in rainy season/ during cyclones.
42. The proponent shall comply with the concerns raised by the public and commitments made by the proponent during the public hearing.

Part B: Specific Conditions:

1. The Boiler of 3 TPH capacity shall be installed for MEE operation and shall provide stack of 30 m height. Fuel for boiler is HSD - 35 Lit/hr. Power requirement for the project is 125 KVA sourced from Andhra Pradesh Eastern Power Distribution Company Limited (APEPDCL). DG set of 125 KVA capacity is for emergency power backup.
2. If the emissions containing the HBr, HCl, NH3, HF, H2S and Mercaptans shall be routed through two stages scrubber system. The packing media in the scrubber is 25 mm poly propylene rings. Scrubbed liquid shall be treated and reused or subjected to MEE.
3. Strict measures shall be taken to control odour with appropriate odour abatement methods. Fugitive emissions from storage tanks shall be avoided.
4. Analysis of Dioxins and Furans shall be done through CSIR National Laboratory or equivalent NABL accredited Laboratory.
5. The proponent shall establish adequate number of air monitoring stations, including one online station, in consultation with the APPCB and take appropriate measures to ensure that the Ground Level Concentration (GLC) shall comply with the NAAQ norms notified by MoEF&CC, GoI on 16.11.2009.
6. Measures shall be taken to comply with the provisions made under "Noise pollution (Regulation and control) amendment rules 2010 dated 11-01-2010 issued by MoEF&CC.
7. The Total water requirement for the project is 15 KLD and shall be sourced from APIIC water supply. The details of Water requirement & wastewater generation are as follows:

S.No	Process description	Water requirement & wastewater generation		Treatment and Disposal
		Consumption	Effluent	
1	Stabilization	1.5	0	Shall be sent to nearest CETP through tankers for final treatment and disposal.
2	Process & washing	3.0	1.0	
3	Truck & tyre washing	5.0	3.0	
4	Domestic consumption	2.5	2.0	Shall be sent to septic tank followed by soak pits.
5	Greenbelt	3.0	0	
	Total	**15.0**	**6.0**	

8. The proponent shall provide separate storm water drains and harvest the rainwater from the rooftops to recharge the ground water.
9. Regular monitoring of ground water level and quality should be carried-out by establishing a network of existing wells in and around project area in consultation with the competent Ground Water Department. Data thus collected should be sent at regular intervals to MoEF&CC, CGWA and CGWB, Southern Region, Hyderabad.
10. Suitable conservation measures to augment groundwater resources in the area shall be planned and implemented in consultation with GWB. Suitable measures should be taken for rainwater harvesting.
11. In case of Ground water usage, Permission from the competent Govt. authority should be obtained for drawl of ground water, if any, required for this project.
12. Hazardous waste generated from the industry such as organic residue, salts, spent solvents waste oils, used oils etc., shall be disposed as per the Hazardous and other Wastes (Management and Transboundary movement) Rules, 2016 and its amendments thereof.
13. The waste manifest system shall be developed in accordance with the CPCB/APPCB. The manifest system shall include details of the waste generator, waste transporter, quantity of waste, characteristics of waste, description, consistency of waste in terms of physical state and waste category number as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and subsequent amendments.
14. The proponent shall take appropriate measures to prevent percolation of spills, leaks etc. to the soil and ground water, the storage area should be provided with concrete floor or steel sheet depending on the characteristics of waste handled and the floor must be structurally sound and chemically compatible with wastes.
15. The drums containing wastes stored in the storage area should be labeled properly indicating type of waste, quantity, characteristics, source and date of storing, etc.,
16. The Hazardous & Non-Hazardous / Solid waste generation and disposal:

S. No.	Description	Quantity	Mode of Disposal
1.	Waste oil from DG sets	5 TPA	To authorized recyclers/ re-processors.
2.	Evaporation Salt	10.0 TPD	Shall be sent to CHWTSDF
3.	Domestic Solid Waste	12.5 Kg/day	To municipal disposal site.

17. The proponent should strictly comply with the E-Waste Management Rules, 2016, and report compliance.
18. The Project Proponent shall ensure that the transportation activity of the unit should not cause any inconvenience to the public and comply with the local norms, if any;

Part C: General Conditions:

1. **This order is valid for 7 years.**

2. No further expansion, increase in production; or change in activity or

technologies/land use shall be made without prior approval of the SEIAA.

3. The project proponent shall submit the copies of the Environmental Clearance to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

4. The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and SEIAA, A.P.

5. The Prior Environmental Clearance issued to this project along with the Approved Environmental Management Plan (EMP) and the Approved DPR should be uploaded in the project's web site and be made available in the public domain.

6. The PEC main contents be displayed on permanent boards at the main entry of the premises and at other prominent places.

7. The project proponent shall strictly adhere to its Environmental Policy approved by the SEIAA, and shall be made available in their web site.

8. A separate "Environmental Management Unit" (With a laboratory) shall be set up with all monitoring facilities.

9. A Separate Bank account need to be started for the budget allocated for the EMP and the amount committed should be deposited before the project obtains CTE/CTO as the case may be. The amounts allocated should not be diverted for any other purpose.

10. The funds earmarked for environmental protection measures (Capital cost Rs.12.02 Crs& Recurring cost of Rs.1.11 Crs) should be kept in separate account and should not be diverted for other purpose.

11. The proponent before starting the operations, shall obtain all other mandatory clearances from respective departments, including the CTE and CTO from the APPCB.

12. The project proponent shall meticulously follow the Form-1/2 of the application; and approved EMP & EIA, for the purpose of all compliances.

13. Four ambient air quality-monitoring stations should be established in the core

zone as well as in the buffer zone. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the State Pollution Control Board.

14. Data on ambient air quality should be regularly submitted to the Ministry including its Regional Office located at Vijayawada and the State Pollution Control Board/ Central Pollution Control Board once in six months.

15. Personnel working in the industry should be provided with protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.

16. Occupational health check up program for the workers should be undertaken periodically. A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.

17. The project proponent shall submit Half-yearly reports on the status of compliance of the stipulated Environmental Clearance Conditions including results of monitored data (both in hard copies as well as by e-mail) to the Ministry of Environment & Forests, its Regional Office, Vijayawada, SEIAA, A.P., Regional Directorate, Central Pollution Control Board, Bengaluru, and A.P. Pollution Control Board.

18. The proponent shall upload the status of compliance of the environmental clearance conditions including results of monitored data on their websites and shall update the same periodically.

19. Officials from the Regional Office of MoEF&CC, Vijayawada / The SEIAA, Andhra Pradesh through the Regional Offices of Andhra Pradesh Pollution Control Board, who would be monitoring the implementation of environmental safeguards, should be given full co-operation, facilities and documents/data by the project proponents during their inspection. A complete set of all the documents shall be submitted to the CCF, Regional Office to MoEF&CC, Vijayawada.

20. SEIAA also reserves the right to cancel the EC issued at any time, if EC has been obtained by the proponent through suppression of any information or furnishing false information upon which the project is appraised.

21. Concealing the factual data in the compliance reports, or failure to comply with any conditions mentioned above may result in withdrawal of the EC and attract action under the provisions of Environment (Protection) Act, 1986.

22. The SEIAA may revoke or suspend the order, if implementation of any of the above conditions is not satisfactory. The SEIAA reserves the right to add/alter/modify the above conditions or stipulate any further condition in the

interest of environment protection.

23. Any appeal against this Environmental Clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

24. The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules.

25. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned state PCB as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional office of MoEF&CC by e-mail.

Special Secretary To Govt

MEMBER SECRETARY, SEIAA, A.P.	MEMBER, SEIAA, A.P.	CHAIRMAN, SEIAA, A.P.

To

M/s. Re Sustainability Limited,
Mr. Sivaramakrishnan Ganesh,
Deputy General Manager,
11th Floor, Level 11 B,
Aurobindo Galaxy, Hyderabad Knowledge City,
Hitech City Road, Hyderabad, Telangana.

Copy to:

1. The Chairman, SEAC, A.P. for kind information.
2. The Member Secretary, APPCB for kind information.
3. The EE, RO: Visakhapatnam, APPCB for information.
4. The Regional Officer, MoEF&CC, GoI, Vijayawada for kind information.
5. The Secretary, MoEF&CC, GoI New Delhi for kind information.
6. Monitoring cell, MoEF&CC, GoI, New Delhi for kind information.
7. The District Collector, Anakapalli District, Andhra Pradesh for kind information.

Additional EC Conditions Landfill:

S.No.	EC Conditions
1.	The project proponent shall install 24x7 continuous emission monitoring system at process stacks to monitor stack emission with respect to standards prescribed in Environment (Protection) Rules 1986 and connected to SPCB and CPCB online servers and calibrate these systems from time to time according to equipment supplier specification through labs recognised under Environment (Protection) Act, 1986 or NABL accredited laboratories.
2.	A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 02 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 02 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./ competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.
3.	Gas generated in the Land fill should be properly collected, monitored and flared
4.	The periodical monitoring of Dioxins and Furans in the Stack emissions shall be carried out. Analysis of Dioxins and Furans shall be done through CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram or equivalent NABL Accredited laboratory
5.	Appropriate Air Pollution Control (As proposed, air pollution control device viz. gas quencher; treatment with mixture of hydrated lime and activated powder for adsorption of partial acidity and VOCs (if any); bag filter/ESP for removal of particulate matter; venturi scrubber followed by packed bed scrubber with caustic circulation to neutralize the acidic vapours in flue gas; and demister column for arresting water carry over will be provided to the incinerator) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources, so as to comply prescribed stack emission and fugitive emission standards.
6.	The project proponent shall submit monthly summary report of continuous stack emission and air quality monitoring and results of manual stack monitoring and manual monitoring of air quality /fugitive emissions to Regional Office of MoEF&CC, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report.
7.	Sampling facility at process stacks and at quenching towers shall be provided as per CPCB guidelines for manual monitoring of emissions.
8.	The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants

	released (e.g., PM10 and PM2.5 in reference to PM emission, and SO2 and NOx in reference to SO2 and NOx emissions) within and outside the plant area at least at four locations (one within and three outside the plant area at an angle of 120°each), covering upwind and downwind directions.
9.	The project proponent shall monitor fugitive emissions in the plant premises at least once in every quarter through labs recognised under Environment (Protection) Act, 1986.
II. Water Quality Monitoring And Preservation :	
10.	Rain water runoff from hazardous waste storage area shall be collected and treated in the effluent treatment plant.
11.	Total fresh water use shall not exceed the proposed requirement as provided in the project details. Prior permission from competent authority shall be obtained for use of fresh water.
12.	All leachates arising from premises should be collected and treated in the ETP followed by RO. RO rejects shall be evaporated in MEE. Toxicity Characteristic Leaching Procedure (TCLP) test to be performed on leachates.
13.	The depth of the land fill site shall be decided based on the ground water table at the site.
14.	No discharge in nearby river(s)/pond(s).
15.	The project proponent shall submit monthly summary report of continuous effluent monitoring and results of manual effluent testing and manual monitoring of ground water quality to Regional Office of MoEF&CC, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report.
16.	Sufficient number of Piezometer wells shall be installed in and around the project site to monitor the ground water quality in consultation with the State Pollution Control Board / CPCB. Trend analysis of ground water quality shall be carried out each season and information shall be submitted to the SPCB and the Regional Office of MoEF&CC.
17.	The project proponent shall install continuous effluent monitoring system with respect to standards prescribed in Environment (Protection) Rules 1986 and connected to SPCB and CPCB online servers and calibrate these systems from time to time according to equipment supplier specification through labs recognised under Environment (Protection) Act, 1986 or NABL accredited laboratories.
III. Waste Management	
18.	Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Rules, 2016.
19.	The solid wastes shall be segregated, managed and disposed as per the norms of the Solid Waste Management Rules, 2016.
20.	No non-hazardous wastes, as defined under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, shall be handled in

	the premises.
21.	Periodical soil monitoring to check the contamination in and around the site shall be carried out.
22	The TSDF should only handle the waste generated from the member units.
IV. Statutory Compliance	
22.	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as applicable by project proponents from the respective competent authorities
23.	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.
24.	The project proponents shall adhere to all conditions as prescribed in the Protocol for 'Performance Evaluation and Monitoring of the Common Hazardous waste treatment, storage and disposal facilities' published by the CPCB in May, 2010.
25.	The Project proponent should ensure that the TSDF fulfils all the provisions of Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016.
V. Specific Conditions	
26.	As per the Ministry's OM dated 30.09.2020 superseding the OM dated 01.05.2018 regarding the Corporate Environmental Responsibility, and as per the action plan proposed by the project proponent to address the socio-economic and environmental issues in the study area, the project proponent, as committed, shall provide education funds in technical training centers/ support in nearby village's schools, support in health care facilities, drinking water supply and funds for miscellaneous activities like solar street lights, battery, solar panel etc., in the nearby villages. The action plan shall to be completed within time as proposed.
VI. Public Hearing And Human Health Issues	
27.	Occupational health surveillance of the workers shall be done on a regular basis.
28.	Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.
29.	Traffic congestion near the entry and exit points from the roads adjoining the project site shall be avoided. Parking should be fully internalized and no public space should be utilized.
VII. Noise Monitoring And Prevention	
30.	Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel shall be implemented as mitigation measures for noise impact due to ground sources.
31.	The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.
VIII. Miscellaneous	
32.	Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the

	National Green Tribunal Act, 2010.
33.	The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts/NGT and any other Court of Law relating to the subject matter.
34.	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.
35.	The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.
36.	The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.
37.	Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.
38.	No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).
39.	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee.
40.	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.
41.	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, commencing the land development work and start of production operation by the project.
42.	The criteria pollutant levels namely; PM2.5, PM10, SO2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.
43.	The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.
44.	Self-environmental audit shall be conducted annually. Every three years third

	party environmental audit shall be carried out.
45.	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.
46.	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.
47.	The company shall have a well laid down environmental policy duly approve by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental/forest/wildlife norms/conditions. The company shall have defined system of reporting infringements/deviation/violation of the environmental/forest/wildlife norms /conditions and/or shareholder's/stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.
48.	The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.
49.	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.
50.	The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.
51.	The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.
IX. Green Belt	
52.	Top soil shall be separately stored and used in the development of green belt.
53.	Green belt shall be developed in an area as provided in project details, with native tree species in accordance with Forest Department. The greenbelt shall inter alia cover the entire periphery of the project site.
X. Energy Conservation Measures	

54.	Energy conservation measures like installation of LED/CFLs/TFLs for the lighting the areas outside the building should be integral part of the project design and should be in place before project commissioning.

Signature Not Verified

Digitally Signed by : S Sri Saravanan
Member Secretary, SEIAA

Date: 28/06/2024

ANNEXURE-VIII

File No.APPCB-11025/7/2024-TEC-HWM-APPCB

ANDHRA PRADESH POLLUTION CONTROL BOARD
Dr.Y.S.RParyavaran Bhavan, APIIC Colony Road,
Gurunanak Colony, Autonagar, Vijayawada- 520007
Phone. No.0866-2463200, Website :https://pcb.ap.gov.in/

CONSENT TO ESTABLISH ORDER

Lr No: APPCB-11025/7/2024-TEC-HWM-APPCB -70 Dt: 15/05/2024

Sub: - APPCB– HO – VJA – HWM – M/s. Coastal Waste Management Project, (A division of Re Sustainability Limited) at Sy.No.116/P, Thadi (V), Parawada (M), Anakapalli District–Consent To Establish (CTE) of the Board under Sec.25 of Water (Prevention & Control of Pollution) Act, 1974 and under Sec.21 of Air (Prevention & Control of Pollution) Act, 1981 –Issued –Reg.,

O/C

Ref:-
1. Proponent's CTE application received through AP OCMMS vide ID No.3240922, dated: 06.04.2024.
2. ZO, VSP report vide dt. 10.04.2024.
3. T.O. Sought clarification to ZO,VSP vide Lr. dt.26.04.2024.
4. ZO, VSP submitted information vide Lr. dt.30.04.2024.
5. CTE committee meeting held on 30.04.2024.
6. ZO, VSP submitted information vide Lr. dt.06.05.2024.

16.05.2024 DESPATCH VNO

*****

1. In the ref.1st cited, an application was submitted to the Board seeking Consent To Establish (CTE) for establishment of a Common Hazardous Waste Treatment Storage and Disposal Facility (TSDF) with the following activities with a project cost of Rs. 21.49 Cr.

S.No.	Activity	Quantity as per CTE application
1.	Common Hazardous Waste Treatment Storage and Disposal Facility (TSDF) having only secured Landfill facility	9,88,561.02 MT (or) 3,00,000 TPA (Direct Landfill - 1,50,000 TPA & Landfill After Treatment – 1,50,000 TPA)

2. As per the application, the above activity is to be located at Sy.No.116/P, Thadi (V), Parawada (M), Anakapalli District in an area of 10 acres.
3. The above site was inspected by the SEE, ZO -VSP and EE & AEE, RO, VSP on 08.04.2024 and observed that the site is surrounded by

North	Vacant land followed by M/s. Visakha Pharmacity water treatment plant
South	Land of M/s. Meterochem Limited
East	Existing Landfill
West	Hillock

4. The Board, after careful scrutiny of the application, verification reportof Zonal Officer and recommendations of the CTE Committee, hereby issues **CONSENT TO ESTABLISH** to your facility Under Section 25 of Water (Prevention & Control of Pollution) Act 1974 and Section 21 of Air (Prevention & Control of Pollution) Act, 1981 and the rules made there under. This order is issued to under take the activity as mentioned at para (1) only.
5. This Consent Order now issued is subject to the conditions mentioned in Schedule 'A' and Schedule 'B'.
6. This order is issued from pollution control point of view only. Zoning and other regulations

File No.APPCB-11025/7/2024-TEC-HWM-APPCB

are not considered.

7. This order is valid for a period of 7 years from the date of issue.

Encl: Schedule: A
Schedule :B

B SREEDHAR IAS, MS(BS), O/o MEMBER SECRETARY-APPCB

To
M/s. Coastal Waste Management Project
(A division of Re Sustainability Limited),
Sy.No.116/P, Thadi (V),
Parawada (M), Anakapalli District.

Copy to:

1. The Joint Chief Environmental Engineer, Zonal Office, Visakhapatnam for information and necessary action.
2. The Environmental Engineer, Regional Office, Visakhapatnam for information and necessary action.

SCHEDULE – A

1. Progress on implementation of the project shall be reported to the concerned Regional Office, A.P. Pollution Control Board once in six months.
2. Separate energy meters shall be provided for water consumption and air pollution control equipments to record energy consumed.
3. The proponent shall obtain Consents for Operation from APPCB, as required under sec. 25/26 of the Water (P&C of P) Act, 1974 and under sec.21/22 of the Air (P&C of P) Act, 1981 and its Amendments thereof before commencement of the activity, including trial production.
4. The Consent of the Board shall be exhibited in the factory premises at a conspicuous place for the information of the inspection officers of different departments.
5. Compensation is to be paid for any environmental damage caused by it, as fixed by the Collector and District Magistrate as civil liability.
6. The Rules and Regulations notified by Ministry of Law and Justice, Government of India, regarding the Public Liability Insurance Act, 1991 shall be followed.
7. 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 such authority (hereinafter referred to as the Appellate Authority) constituted under Section 28 of Water (Prevention and Control of Pollution)Act,1974 and Section 31 of the Air (Prevention and Control of Pollution) Act, 1981.

SCHEDULE – B

1. The project proponent shall carry out the site investigation criteria w.r.t Ground water, Hydro geological investigations, Geotechnical investigations by certified organizations/ Reputed Institutions and submit the same along with the CTO application.
2. The project proponent shall submit the EC order of the proposed project which was recommended in the SEAC committee meeting vide dt.23.02.2024.
3. The project proponent shall construct garland drain with retaining wall towards hilly/ terrain portion i.e., towards North – West direction to avoid overflow of garland drain during rainy season/ cyclones. Protection measures shall be taken to avoid any impact on landfill area due to rain water (or) storm water.
4. The project proponent shall propose the proposed landfill in such a way that the existing garland drain of the existing landfill/TSDF towards western direction will be relocated embedding with the proposed landfill towards western direction i.e., Hill side.

5. The project proponent shall comply with the Criteria for Hazardous Waste Landfills issued by CPCB.
6. The project proponent shall comply with the Liner criteria (7.1) and minimum specifications (7.1.1) as per the Criteria for Hazardous Waste Landfills issued by CPCB.
7. The project proponent shall comply with the Design requirements (7.1.2) as per the Criteria for Hazardous Waste Landfills issued by CPCB.
8. The project proponent shall comply with the Construction requirements (7.1.3) as per the Criteria for Hazardous Waste Landfills issued by CPCB.
9. The project proponent shall submit the technical drawings of proposed landfill cell construction for approval.

Water:

10. The source of water is Common Raw water treatment plant, JN Pharmacity, Parawada and the maximum permitted fresh water consumption is 15.0 KLD.

S. No.	Purpose	Quantity as per CTE application
1.	Stabilization	1.5 KLD
2.	Process (Laboratory)	3.0 KLD
3	Washings (Truck, Machinery, Floor)	5.0 KLD
4.	Domestic	2.5 KLD
5.	Gardening	3.0 KLD
	Total	15.0 KLD

11. The maximum waste water generation shall not exceed the following:

S. No.	Source	Quantity as per CTE application	Mode of Disposal
1.	Process High TDS	1.0 KLD	The proponent proposed to send the High TDS Effluents to MEE followed by CETP of JNPC.
2.	High TDS effluent from Leachates	30.0 KLD	
3.	Washings	3.0 KLD	The proponent proposed to send the effluents to CETP of JNPC.
4.	Domestic	2.0 KLD	
	Total	**36.0 KLD**	

12. Under any circumstances, the effluents shall not be discharged outside the premises.
13. Separate meters with necessary pipe-line shall be provided and maintained for assessing the quantity of water utilized & for waste water generation for each purpose mentioned in the order.
14. The facility shall provide & maintain separate storm water drains along the periphery of the site such that the inplant rain water is collected in collection sump and shall be connected to CETP, JN Pharmacity, Parwada. Under any circumstances, effluent /storm water shall not be discharged from the facility premises.
15. Adequate numbers of ground water quality monitoring stations shall be provided in consultation with ZO, VSP with Piezometers around the project area as per CPCB guidelines. Sampling and trend analysis monitoring must be made on quarterly basis and reports shall be submitted to Regional Office, Visakhapatnam.

Air:

16. The proponent shall not exceed the following Ambient Air Quality standards measured at the periphery of activity – SO2 – 80 µg/m3, NOx – 80 µg/m3, PM2.5 – 60 µg/m3, PM10 – 100µg/m3.

Noise levels: Day time (6 AM to 10 PM) - 75 dB (A), Night time (10 PM to 6 AM) - 70 dB (A).

17. The proponent shall comply with the following for controlling Fugitive emissions:

a. Raw material unloading areas shall be provided with dust suppression system / water sprinklers.
b. All material transfer points shall be provided with dust extraction system with bag filters.
c. All the conveyors shall be covered to prevent the fly off of fugitive dust.
d. All internal roads are shall be made pucca to prevent the fugitive dust to vehicular movement.

18. Ambient Air Quality monitoring stations shall be setup in the down wind direction as well as where maximum ground level concentration of PM2.5, PM10 SO2, NOx & HCL (methane & non-methane) are anticipated in consultation with concerned Regional Office.

19. The industry shall take appropriate measures to control odour nuisance in the surroundings and the measures taken shall be reported to Concerned Regional office of APPCB before applying for CTO.

20. The following rules and regulations notified by the MoE&F, GoI shall be implemented.

a. Hazardous waste and other wastes (Management and Transboundary Movement) Rules, 2016.
b. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
c. Fly Ash Notification, 2016.
d. Batteries (Management & Handling) Rules, 2010.
e. E-Waste (Management) Rules, 2016.
f. Construction and Demolition waste Management Rules, 2016.
g. Bio-Medical Waste Management Rules, 2016.
h. Solid Waste Management Rules, 2016.
i. Plastic Waste Management Rules, 2016.

Solid Waste:

21. The proponent shall comply with the following:

Sl. No	Solid / Hazardous waste	Stream	Hazardous waste quantity applied as per CTE Application	Mode of disposal
1	All landfillable Hazardous wastes received from the waste generators / industries as per the authorizations issued by the Andhra Pradesh Pollution Control Board.	As per the Hazardous and other Waste (Management &Transboundary Movement) Rules, 2016 and its amendments	9,88,561.02 MT	Secured land filling with/ without stabilization based on the finger print analysis reports.
2	Containers / container liners, empty drums and barrels internally generated waste	--	--	Proposed to dispose to authorized agencies after complete De-toxification.

Other Conditions:

22. The facility shall take all possible steps for designing the land fill storage facility in such a way that it should be open for monitoring (or) for repair (or) for intermediary intervention in case of any emergency arises at any stage of implementation of the project right from inception to the final storage of the land fill site.
23. The occupier shall establish a sophisticated laboratory for monitoring of effluent, hazardous waste etc.,
24. The facility shall comply with the CPCB & APPCB directions from time to time.
25. The facility shall maintain the ESCROW account as per the CPCB guidelines.
26. The operator shall comply with the guidelines (or) standard operating procedures issued by the Ministry of Environment, Forest and Climate Change (or) the Central Pollution Control Board for environmentally sound management of hazardous and other wastes from time to time.
27. The facility shall obtain necessary approvals from competent authorities as applicable.
28. The facility shall comply with all CPCB/ MoEF & CC guidelines for handling the wastes processed in the facility.
29. The facility shall comply with Protocols for performance evaluation and monitoring of the common hazardous waste treatment storage and disposal facilities evolved by CPCB.
30. The facility shall ensure that there shall not be any change in the process technology and scope of working without prior approval from the Board.
31. The facility shall comply with SOPs issued by CPCB issued from time to time.
32. The Board can stipulate and invoke the conditions at any point of time.
33. Concealing the factual data or submission of false information/ fabricated data and failure to comply with any of the conditions mentioned in this order and attract action under the provisions of relevant pollution control Acts.
34. Notwithstanding anything contained in this conditional letter or consent, the Board hereby reserves its right and power under Sec.27 (2) of Water (Prevention and Control of Pollution) Act, 1974 and under Sec.21(4) of Air (Prevention and Control of Pollution) Act, 1981 to revoke this order, review any (or) all the conditions imposed herein and to make such alternation as deemed fit and stipulate any additional conditions by the Board.

B SREEDHAR IAS, MS(BS), O/o MEMBER SECRETARY-APPCB

To:
M/s. Coastal Waste Management Project
(A division of Re Sustainability Limited),
Sy.No.116/P, Thadi (V), Parawada (M), Anakapalli District.

Digitally Signed by B Sreedhar Ias
Date: 15-05-2024 19:52:00
Reason: Approved

ANNEXURE-IX

ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL OFFICE:: VISAKHAPATNAM
D.No.39-33-20/4/1,Madhavadhara Vuda Colony, Visakhapatnam - 530018.
Ph : 0891-2719380

Circular Memo/APPCB/ZO-VSP/Tech./2020 **Date: 26.08.2020**

Sub: APPCB – ZO-VSP –Industries Operating in M/s. Ramky Pharma city –Directions Issued - Reg.

****

The Board officials, during inspection of M/s. Ramky Pharma city observed that the washings generated from the non process sources in the plant premises are being disposed directly into storm water drains outside the plant premises in violation of the CFO condition. Also the contaminated storm water during rains is not contained in the premises and is also being discharged into storm water drains, thereby causing water pollution of the nearby water bodies and also ground & soil contamination in the area. As per the CFO condition the industry shall provide proper drainage system so that the rain water shall not be allowed to mix with either trade effluents or domestic effluent and shall maintain dry condition of storm water drains in the non-rainy season. The floor washings also shall be admitted into effluent collection system only and shall not be allowed to find their way into storm water drains or open areas.

In view of the above, the following directions are hereby issued to all the industries in M/s. Ramky Pharmacity, Parawada:

1. The industry shall construct a dyke of height 1 foot in the storm water drain both upstream and downstream of their industry to demonstrate the non discharge of any type of effluents into the storm water drains on non rainy days.
2. The industry shall lift the water accumulated in the storm water drains between the dykes along the boundary of the industry into their effluent storage tanks and shall be sent to CETP for further treatment.
3. The industry shall maintain the storm water drain all along the premises in dry condition on all non rainy days.

You are hereby directed to take immediate action for compliance of the above directions and submit the compliance report along with photographic evidences within a week.

Rajendra Reddy Thuraka
Digitally signed by Rajendra Reddy Thuraka
Date: 2020.08.26 16:36:41 +05'30'

JOINT CHIEF ENVIRONMENTAL ENGINEER

To
All the industries.

ANNEXURE-X

ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL OFFICE:: VISAKHAPATNAM
D.No.39-33-20/4/1,Madhavadhara Vuda Colony, Visakhapatnam - 530018.
Ph : 0891-2719380

PROCEEDINGS OF THE JOINT CHIEF ENVIRONMENTAL ENGINEER
A P POLLUTION CONTROL BOARD, ZONAL OFFICE, VISAKHAPATNAM

PRESENT: Sri T.Rajendra Reddy, M.Tech.,
Joint Chief Environmental Engineer

Procds. No. 2434/APPCB/ZO-VSP/2020 Date: 08/09/2020

Sub: APPCB – ZO-VSP – Tech. – Meeting conducted with the JNPC Manufacturers Association Members and Executive Body Members of JNPCNGPIA Service Society, APIIC, IALA at Zonal Office, Visakhapatnam on 31.08.2020 – Monitoring Committee in JN Pharamacity – Constituted - Orders issued – Reg.

Ref: 1. Meeting held with the JNPC manufacturers association members and executive body members of JNPCNGPIA service society, APIIC, IALA at Zonal Office, Visakhapatnam on 31.08.2020.
2. E-mail from the EO, JNPCMA on 04.09.2020.

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ORDER:

The Board officials, during inspection of JN Pharmacity observed seepages of effluents with high pollution load are oozing out into storm water drains which are ultimately joining Ooracheruvu thereby causing surface water, ground water pollution & soil contamination in the area. .

A meeting was held at Zonal Office Visakhapatnam on 31.08.2020 with the JNPC Manufacturers Association Members and Executive Body Members of JNPCNGPIA Service Society, APIIC, IALA and reviewed on contamination of Ooracheruvu due to the contaminated storm water runoff joining during rainy days.

It was decided in the meeting to form a committee consisting of members of association and one PCB official and one representative from Ramky Pharmacity to effectively monitor the industries to curb the illegal discharges of effluents into storm water drains and air pollution in JN Pharmacity.

The EO, JNPCMA vide ref. 2nd cited, communicated the members of the committee to monitor the industries in JN Pharmacity.

In view of the above, A.P. Pollution Control Board hereby constitute the monitoring committee with the following members to effectively monitor the industries to curb the illegal discharges of effluents into storm water drains and air pollution in JN Pharmacity.

S. No.	Name of the member	Organization/Industry	
1.	Sri. K Srinivasa Rao	M/s. Vasudha Pharma Chem Ltd	Member
2.	Sri. M Srinivasa Rao	M/s. Laurus Labs Ltd	Member
3.	Sri. B Ram Babu	M/s. Rampex Labs (P) Ltd	Member
4.	Sri. N V B S Bhaskar Rao N	M/s. Synergene Active Ingredients (P) Ltd	Member
5.	Sri. P Ravi Teja	M/s. JPR LABS (P) lTD	Member
6.	Sri. P Sri Harsha Varma	M/s. Vasudha Pharma Chem Ltd	Member
7.	Sri. M P Dora	M/s. Rakshit Pharmaceuticals (P) Ltd	Member

8.	Sri. P S Tagore	M/s. Granules Omnichem (P) Ltd - SEZ	Member
9.	Sri. D Sai Kiran	M/s. Mylan Laboratories Ltd - SEZ	Member
10.	Sri. L. Ramakrishna Rao	Assistant Manager, Safety, Ramky Pharmacity (CETP)	Member
11.	Sri. K. Suryanarayana	EO, APIIC, IALA, Parawada	Member
12.	Sri. G. Raghava Reddy	AEE, APPCB, ZO-VSP	Member convener

The committee shall:

i. Constitute teams for monitoring of industries in JN Pharmacity for illegal discharge of effluents, joining of effluents into storm water drains & air pollution in JN Pharmacity.

ii. Constitute a working team to identify reputed organizations to carryout status study on the quality of soil, water and other parameters etc and for preparation of remediation plan of Ooracheruvu, Thadi, Visakhapatnam.

iii. Sri. G. Raghava Reddy, Member Convener shall co-ordinate the monitoring team & working teams and finalize reports & action plan and submit to the Joint Chief Environmental Engineer, Zonal Office, Visakhapatnam

JOINT CHIEF ENVIRONMENTAL ENGINEER

To
All the members of monitoring committee.

Copy submitted to the Member Secretary, APPCB, Vijayawada for information
Copy to the Environmental Engineer, Regional Office, Visakhapatnam for information.
Copy to the EO, JNPCMA with a request to serve a copy of orders with respect to committee members.
Copy to the Executive Officer, APIIC, IALA, Parawada for information.
Copy to the JNPC Manufacturers Association Members and Executive Body Members of JNPCNGPIA Service Society, APIIC, IALA for information.

ANNEXURE-XI

Consolidated statement showing the directions/Showcause issued to the industries (From Jan -2023 to Feb – 2024)

S. No	Name of the industry	Date of issuing order	Remarks
1.	M/s. Laurus Labs Ltd., Unit – 3, Plot No.18, JNPC, Parawada, Anakapalli District	18.04.2023	Directions
	M/s. SVR Drugs Pvt. Ltd., Plot No.3, JN Pharmacity, Parawada, Visakhapatnam	18.04.2023	Instructions to RO
2.	M/s. SVR Drugs Pvt. Ltd., Plot No.3, JN Pharmacity, Parawada, Visakhapatnam	16.05.2023	Directions
3.	M/s. Srikar Laboratories Pvt. Ltd., Plot No.32 A, JNPC, Parawada, Anakapalli District	14.12.2023	Show cause notice
4.	M/s. Apitoria Pharma Private Limited, Unit-6 (Formerly known as M/s. Aurobindo Pharma Limited, Unit XIV), Plot No 17A, JN Pharmacity, Parawada, Visakhapatnam	16.03.2024	Directions

ANNEXURE-XII

Joint Inspection Report Pertaining To Safe Drinking Water Supply To Tadi Village in connection with Original Application No.130 of 2024 (SZ) filed before the Hon'ble NGT:

The District Revenue Officer & Addl. District Magistrate, Collector's Office, Anakapalli vide letter dated:21.06.2024 directed the Zonal Commissioner, GVMC, Anakapalli Zone, the Environmental Engineer, Pollution Control Board, Regional Office, Visakhapatnam and the Superintending Engineer, Rural Water Supply, Anakapalli to conduct joint inspection to find out the sources of drinking water to be provided to the people of Tadi Village and to submit the action taken report by 27.06.2024, so as to submit the compliance report to the Hon'ble National Green Tribunal, Southern Zone, Chennai by 30.06.2024.

The Zonal Commissioner, GVMC, Anakapalli Zone along with the EE, APPCB, Visakhapatnam has inspected Tadi Village on 25.06.2024 to inventorize the sources of drinking water around Tadi Village. During inspection, the appellant Sri Boddapalli Apparao, Sri Danaboyana Neelakanta Rao, Sri Ganisetti Satyanarayana and other officials from GVMC & APPCB were present.

The Zonal Commissioner informed that there is a 20 KL capacity tank on hill top and 10 KL capacity tank in Peda Tadi village. The villagers are drawing ground water and filling these tanks and utilizing the same for domestic purpose. In addition to this, the GVMC is supplying 5 KL of water through tanker on regular basis for domestic & drinking purposes for Tadi, Peda Tadi & Chinna Tadi Villages.

The appellants informed that earlier M/s.Vegesna Laboratories has established RO Plant at Peda Tadi Village and M/s. Visakha Pharmacity Limited (Formerly M/s. Ramky Pharmacity (India) Pvt. Ltd.,), has maintained the RO Plant and distributed the drinking water to Tadi, Peda Tadi & Chinna Tadi Villages. Whereas, M/s. Visakha Pharmacity Limited has not maintained the RO Plant for the last five years. The villagers requested to supply RO water instead of Municipal Water for drinking purposes.

The Joint Committee visited the RO Plant existing in Peda Tadi and is being maintained by private agency. At present, the agency is selling drinking water to the villagers of Tadi, Peda Tadi & Chinna Tadi.

During inspection, water samples from inlet & outlet of RO Plant were collected and submitted to the ZL, Visakhapatnam for analysis to verify the performance of the RO Plant.

The Joint Committee discussed with M/s. Visakha Pharmacity Limited and JNPC Manufactures Association pertaining to drinking water supply to Tadi, Peda Tadi & Chinna Tadi villages. During discussion, they have accepted to restore the earlier practice of drinking water supply to Tadi, Peda Tadi & Chinna Tadi villages by refurbishing the existing RO Plant and distribution of water through cans until rectification of RO Plant. The Joint Committee has directed M/s.Visakha Pharmacity Limited and JNPC Manufactures Association to submit the commitment letter for restoration of the RO water supply and supply of water through cans until rectification to Tadi, Peda Tadi & Chinna Tadi villages as per the villagers request.

M/s.Visakha Pharmacity Limited vide mail dated 29.06.2024 committed to supply the RO drinking water from 01.07.2024 to Tadi village. They also informed that they have started repair works of RO-Drinking Water Plant at Thadi Village and the repair works will be completed by 30.06.2024.

In obedience to the Hon'ble NGT Orders in connection with Original Application No.130 of 2024 (SZ), it is further to submit that the analysis results of water sample collected from the RO Plant will be obtained within two days. Once the RO Plant is refurbished by replacing membranes (filter media) etc., The quality of RO Permeate water will be analyzed to ascertain safety & potability of drinking water to be supplied to Tadi, Peda Tadi & Chinna Tadi villages.

Environmental Engineer,
A.P Pollution Control Board,
Regional Office, Visakhapatnam

Zonal Commissioner,
GVMC, Anakapalli Zone