DETAILED PROJECT REPORT ON
ESTABLISHMENT OF 5.0 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

Submitted to

M/s ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED

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PREFACE

This Detailed Project Report on Establishment of 5.0 MLD Common Effluent Treatment Plant (CETP) at APSEZ, Atchuthapuram, Visakhapatnam District, Andhra Pradesh has been prepared for ***M/s. Andhra Pradesh Industrial Infrastructure Corporation (APIIC)****, in which expected effluent generation from member industries and effluent Characteristics from the entire APSEZ area have been defined. The information, content have been used for the detailed design calculations for setting up of the 5 MLD CETP and treatment process to safe disposal of marine outfall under stipulated standards. The design calculations were carried out following the CPHEEO guidelines, Ministry of Environment and Forest, Central and State Pollution Control Board rules and regulations, Indian Standard Code of Practice, Hazardous Waste Disposal and Management concepts suitable for Indian Conditions. This report provides an conceptual treatment process designs, calculations and list of equipment's required with specifications.*

This Report contains with the Detailed Designs and drawings, and has been customized and prepared with scientific accuracy in an integrated multi subject approach. The due care has been taken for micro details and followed all the standards, procedures, norms, rules and other statutory conditions as prescribed by the respective departments and institutes related to Central and State Pollution Control Board.

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LIST OF ACRONYMS

Ac	Acre
ADB	Asian Development Bank
APIIC	Andhra Pradesh Industrial Infrastructure Corporation Limited
APSEZ	Andhra Pradesh Special Economic Zone
ATFD	Agitated Thin Film Dryer
BGL	Below Ground Level
BOD	Biological Oxygen Demand
^oC	Degree Centigrade
CETP	Common Effluent Treatment Plant
ECEC	East Coast Economic Corridor
HTDS	High Total Dissolved Solids
KL	Kiloliter
KLD	Kiloliters per Day
km	Kilometer
km^2	Square Kilometer
LPM	Liters per Minute
LTDS	Low Total Dissolved Solids
m	Meter
mm	Millimeter
m^2/day	Square Meter per Day
mg/L	Milligram per Liter
m^3	Cubic Meters
m^3/hr	Cubic Meter per Hour
MEE	Multiple Effect Evaporator
MLD	Million Liters per Day
MOEF	Ministry of Environment and Forest
MSL	Mean Sea Level
Ohm.m	Ohm Meter
PCB	Pollution Control Board
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

TVR	Thermal Vapour Recompression
VCIC	Visakhapatnam–Chennai Industrial Corridor

1 INTRODUTION

1.1 Background

Visakhapatnam–Chennai Industrial Corridor (VCIC), is a key part of the East Coast Economic Corridor (ECEC), India's first coastal corridor. GOI has selected the Asian Development Bank (ADB) as the lead partner for developing the ECEC, which will run from Kolkata (in West Bengal) to Kanyakumari (in Tamil Nadu). VCIC traverses along the nine coastal districts of Andhra Pradesh. The conceptualization and development of VCIC has received major support from Asian Development Bank (ADB).

ADB initiated the preparation of the Concept Development Plan (CDP) followed by a Regional Perspective Plan and Master Plan. Government of Andhra Pradesh has extended the maximum support in making the Industrial Corridor a reality. The long coastline dotted with strategic Ports such as Vizag Port, Gangavaram Port, Kakinada Port and Krishnapanam Port provide an opportunity to connect South East Asian, Far East markets thus making Andhra Pradesh as Global Logistics Hub.

Government of Andhra Pradesh through Andhra Pradesh Industrial Infrastructure Corporation Limited (APIIC) is planning to development the major infrastructure and utilities in the north block in Visakhapatnam node with the financial aid from ADB.

This document is standalone report prepared for the wastewater system in the initial phase of start-up area in the north block of Visakhapatnam Node envisaged to be developed by APIIC. APSEZ at Atchuthapuram area is a multiproduct SEZ developed by APIIC. APSEZ provided with infrastructural facilities for various Engineering, Chemical and Petro chemical industries located in processing area. The effluent generated from the industries in SEZ & Non- SEZ will be treated in Common Effluent Treatment Plant. The Ultimate quantity of treated effluent delivered in to the sea is 31 MLD approved by MOEF.

Report includes in detail the common effluent treatment plant, and mode of disposal along with relevant drawings and estimates.
Initial Environmental Examination (IEE) and Resettlement Plan for CETP within North Block Visakhapatnam Industrial Cluster is prepared as a stand-alone document.

1.2 Structure of Report

The design basis report is structured as follows:

1. Introduction
2. Common Effluent Treatment Plant (CETP)
3. Specifications & Details
4. Cost Estimates
5. Implementation Plan and Schedule

Limitations:

The DPR has been prepared for setting up of 5 MLD CETP considering the following regulatory conditions.

1. Effluent collection to CETP shall be through tankers from member industries.
2. Estimation of Transportation of effluent from member industries to CETP shall not be considered in this DPR.
3. Treated effluent from CETP shall be discharged through proposed guard ponds and utilizing the existing marine disposal facility.

2 COMMON EFFLUENT TREATMENT PLANT (CETP)

2.1 Perspective for CETP

Environmental issues and pollution control have become necessary components in corporate decision making. Environmental considerations have high influence in product selection, product design, manufacturing technologies, raw material usage as well as the location of the industries themselves. The multi and cross discipline nature of environmental issues has made it very difficult and complex to manage the industrial areas in a traditional manner. Therefore it has become common and popular to establish special zones for specific industrial activity and development.

Industrial pollution and environmental degradation can be minimized only when an industrial area is managed in a systematic, integrated and ecologically sound manner. Many industrial areas including the industrial area Atchutapuram requires to facilitate effluent treatment at an individual level as effluent treatment is technically complex and financially expensive. Therefore common effluent treatment facilities are the most economical and viable option for cluster of industries.

The concept of CETP is benefit for small and medium scale industries to meet the statutory norms and environmental sustainability in addition to that CETPs are avoided the number of discharge points in an industrial cluster and better monitoring and skilled manpower with better results and also reducing the cost of the effluent treatment and effective treatment of the effluent and industries more concentration on their production without any effluent treatment burdens.

Therefore, APIIC proposes to set up an integrated Common Effluent Treatment Plant at industrial area Atchutapuram to service the needs of existing and upcoming industries in Atchutapuram area.

2.1.1 Need of CETP

It has been observed that with the growing concern for wastewater treatment and the standards to be achieved, industries are attracted to Industrial Parks having CETP's as a part of the infrastructure. This not only helps the industries in obtaining the Consent for establishment (CFE) but also relieves them from the issues related to day to day operations, maintenance, disposal and meeting with the compliance of the regulatory agencies related to wastewater. The following has also been observed that by providing a CETP.

- The CAPEX is much lesser than the combined cost of ETP at individual units
- The OPEX is much lesser than the combined O&M cost of the ETP at individual units
- Better common facilities are affordable (scale of operation) and thus provided

✓ Better Monitoring and Control
✓ Experienced and trained manpower
✓ Full-fledged laboratory
✓ Updating to newer trends and technologies

Taking into consideration the need expressed by entrepreneurs (past experience) about the requirement of a Common Effluent Treatment Plan, APIIC propose to create the facility in a modular manner which will be linked to the establishment of Industries in APSEZ, Atchuthapuram Industrial area.

2.2 Industrial Sectors in APSEZ, Atchuthapuram Area

Andhra Pradesh Special Economic Zone (APSEZ) was developed by Andhra Pradesh Industrial Infrastructure Corporation in the year 2004 to promote various industries including Chemical, Bulk Drugs, Pharmaceuticals etc. The industrial park was divided into 2 zones namely Eastern Zone for mechanical, electrical and allied industries falling within the green and orange categories of Environmental Regulations and West Zone for chemical, pharmaceutical, bulk drugs and other industries under red category of Environmental Regulations. The interested entrepreneurs were allotted land for setting up their industries. The APSEZ Industrial Estate was promoted as a one stop shop offering all the infrastructure facilities including effluent treatment facility. The entrepreneurs who were allotted the land set up their manufacturing units or are in the process of setting up the units.

2.3 Stakeholders Approach

Stakeholder consultation has been conducted with member industries in APSEZ, APIIC officials, and Regulatory and Statutory department for taking the views on the proposed 5 MLD CETP. The details of effluent generation from member industries in terms of expected Low TDS and High TDS effluent quantities and quality parameters have been collected and considered for designing of 5 MLD CETP.

Photo 1: Stakeholders Consultation conducted on 3rd March 2021 for Preparation of DPR Proposed for 5 MLD Common Effluent Treatment Plant at APSEZ Atchuthapuram

Photo 2: Stakeholders Consultation conducted on 17th April 2021 for Preparation of DPR Proposed for 5 MLD Common Effluent Treatment Plant at APSEZ Atchuthapuram

2.3.1 Regulatory Review and Approvals

APSEZ, Atchuthapuram area has obtained the following statutory approvals. The details of regulatory / statutory approvals are provided in **Table 2.1**.

Table 2-1: **Review Regulatory / Statutory Approvals**

Approval Authority	Details	Reference / Remarks
Environmental Clearance (EC) for APSEZ from MoEF	1) EC for the project area is 5,683 Acres. The EC has been issued for entire processing area of 5,479 Acres in APSEZ area and comprises of industrial plots, infrastructure facilities, logistics areas, common amenities and green/ open areas etc., and entire area has been divided into five different industrial zones. The remaining 204 acres has been identified as non-processing area and comprises of township and social infrastructure facilities such as educations and medical facilities. 2) EC has been issued for Common Effluent Treatment Plant (CETP) of 31 MLD and provision for guard pond is planned for the detention of treated wastewater for about 3.5 days. 3) It was approved that treated wastewater disposal through marine outfall system to discharge the treated wastewater from APSEZ at (-) 19 m CD in Bay of Bengal and point of discharge is located at a distance of about ~3.5 km from shore. 4) Hazardous waste (CETP sludge) generated from APSEZ shall be sent to nearby Transport Storage and Disposal Facility (TSDF). As a part of sustainable environmental management plan of APSEZ, it is proposed to maintain a dedicated TSDF in an area of 50 acres of land, which can be operated for a period of 30 years outside SEZ premises. 5) Greenbelt/ green areas proposed to be developed at SEZ level is 860 acres.	Ref. F.No. 2-379/2007-IA.III dated 13.02.2012
Consent for Establishment (CFE) for APSEZ from APPCB	1) As per CFE, it was consented that the maximum wastewater generation shall not be exceed 30.54 MLD from all five zones. 2) It was consented that APSEZ shall provide the guard ponds with a capacity of 3.5 days effluent generation 3) Online monitoring system, flow with totalizer, pH,	Ref. Order No. 267/PCB/CFE/ RO-VSP/ HO/ 2012/ 3922 Dated 03.03.2012

Approval Authority	Details	Reference / Remarks
	TDS, TOC analysers shall be provided before discharging the treated effluent into the sea 4) The treated effluent shall be conveyed through an impervious pipeline for disposal into Bay of Bengal. 5) The discharge point of marine disposal shall be at a depth of 19m and at a distance of 3.5 km from land fall point through diffuser system that would result in higher initial dilution before the effluent reaches the surface as per NIO report 6) All the units of the CETPs shall be impervious to prevent ground water pollution. 7) The design details of CETP shall be submitted to PCB for approval before execution 8) Hazardous waste (CETP sludge) generated from APSEZ shall be sent to nearby Transport Storage and Disposal Facility (TSDF) at Ramky Pharmacity till the APSEZ develops their own dedicated TSDF.	

2.3.2 Expected Effluent Generation from APSEZ

The effluents generated from industries are categorized as high TDS and Low TDS effluents from entire APSEZ and present demand capacity for CETP is provided in **Table 2-2** as per the expected effluent generation.

Table 2-2: **CETP Demand capacity as per effluent generation**

As per CFE		**As per CFO**		**As per DPR**
HTDS (KLD)	LTDS (KLD)	HTDS (KLD)	LTDS (KLD)	**Combined (HTDS + LTDS)**
4359	4615	3338	2255	
Total = 8.97 MLD (HTDS+LTDS)		**Total = 5.59 MLD (HTDS+LTDS)**		**Total = 2.52 MLD (HTDS+LTDS)**

Total CETP Demand as of now is **11.49 MLD (8.97 MLD + 2.52 MLD)**

Action Plan to meet the CETP Demand:
Phase 1: Up gradation of existing AETL 1.5 MLD CETP to 2.0 MLD CETP
Phase 2: Establishing additional 3 MLD CETP by AETL.
Phase 3: Proposed 5.0 MLD CETP through ADB Funding

The total expected effluent generation from APSEZ is provided in **Table 2.3**.

Table 2-3: Effluent generation details

S.No	Type of Industries	HTDS in KL	LTDS in KL
1	Pharma	4,154	2,440
2	Spe. Chemical	204	1399
3	FMCG (Aerated drinks)	0	317
4	Water and Solvent based and Solvent Recovery	3	60
5	Engineering & Electrical	0	402
	Total	**4,360**	**4,617**

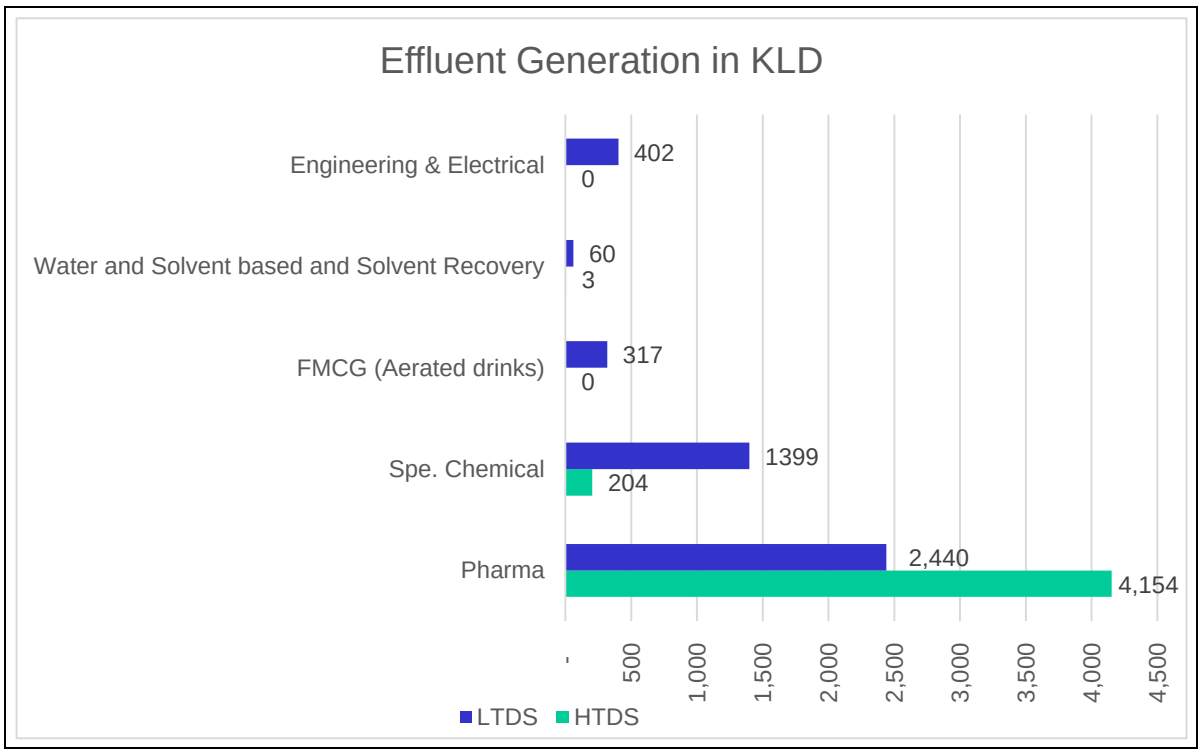

Figure 2-1: Effluent Generation from Industries as per CFE

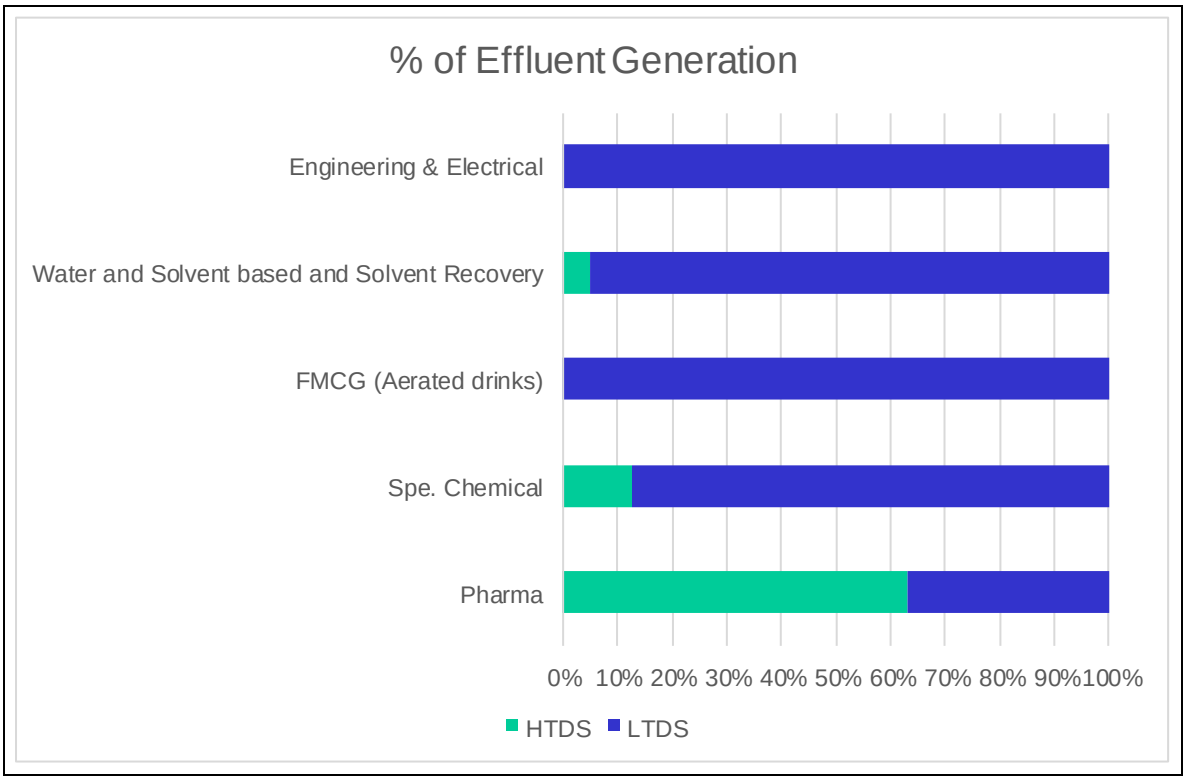

Figure 2-2: Percentage of Effluent Generation from Industries as per CFE

2.3.3 Effluent Quality Analysis from Existing CETP at APSEZ

The effluent generated from the existing industries at APSEZ have been collected from existing 1.5 MLD CETP which is being operated by AETL and analyzed in accredited laboratory to understand the quality of wastewater expected for proposed 5 MLD CETP. Also reviewed the existing effluent quality data of both LTDS and HTDS effluents which are being transported by industries to the existing CETP to obtain the scenario of effluent quality variations for considering the design parameters for proposed 5.0 MLD CETP. The HTDS and LTDS effluents were collected and analyzed in **Vimta Labs** and provided in **Table 2-4** to **Table 2-7**.

Table 2-4: **LTDS Effluent Quality Analysis of existing 1.5 MLD CETP**

S.No	Test Parameter	Method of Testing	Unit	Result
1	pH	IS 3025 (Part 11)	--	7.08
2	Conductivity	IS 3025 (Part 14)	µs/cm	4720
3	Turbidity	IS 3025 (Part 10)	NTU	40.3
4	TDS	IS 3025 (Part 16)	mg/L	2576
5	TSS	APHA 2540-D	mg/L	78
6	P.Alkalinity as (C_aCO_3)	IS 3025 (Part 23)	mg/L	Nil
7	M. Alkalinity as (C_aCO_3)	IS 3025 (Part 23)	mg/L	367.2

S.No	Test Parameter	Method of Testing	Unit	Result
8	Total Hardness as (C_aCO_3)	IS 3025 (Part 21)	mg/L	360
9	Calcium as Ca	IS 3025 (Part 46)	mg/L	88
10	Magnesium as Mg	IS 3025 (Part 46)	mg/L	34
11	Silica as S_iO_2	IS 3025 (Part 35)	mg/L	19.13
12	Sodium as Na	APHA 3500 Na	mg/L	1079
13	Potassium as K	APHA 3500 K	mg/L	101
14	Chloride	IS 3025 (Part 32)	mg/L	370.5
15	Sulphate	IS 3025 (Part 24)	mg/L	337.02
16	Nitrate as NO_3	APHA 4500 NO_3	mg/L	24.1
17	Iron as Fe	APHA 3125	mg/L	0.43
18	Fluoride as F	APHA 4500 (SPADNS Method)	mg/L	0.82
19	Chemical Oxygen Demand	IS 3025 (Part 58)	mg/L	1413.6
20	Biochemical Oxygen Demand	IS 3025 (Part 44)	mg/L	640
21	Oil and Grease	IS 3025 (Part 39)	mg/L	3.36
22	Ammonical Nitrogen as N	APHA 4500 NH_3	mg/L	20.2

Instrument used: ICP MS, UV- Visible Spectrophotometer

Table 2-5: **LTDS Effluent Quality Analysis (GC Analysis) of existing 1.5 MLD CETP**

S.No	Test Parameters	Method	Unit	Result
1	Acetic acid	In house Method	ppm	146.31
2	Iodide Solution	In house Method	ppm	Not detached
3	Chloroform	In house Method	mg/kg	BLQ
4	Methanol	In house Method	mg/kg	803.75
5	Ethyl acetate	In house Method	mg/kg	462.70
6	Toluene	In house Method	mg/kg	BLQ
7	Acetonitrile	In house Method	mg/kg	27.00
8	N-Heptane	In house Method	mg/kg	BLQ
9	Methylene Dichloride	In house Method	mg/kg	BLQ
10	Methy iso Butyl Ketone	Qualitative Screening	mg/kg	Absent
11	Iso propyt Alcohol	In house Method	mg/kg	34.85
12	Acetonitrile + Toulene	In house Method	mg/kg	27.00
13	Ethyl Acetate + Methylene Chloride	In house Method	mg/kg	462.70
14	Iso propyl Alcohol + Cyclochexane	In house Method	mg/kg	34.85
15	N- Heptane +THF	In house Method	mg/kg	15.80
16	Iso propyl alcohol + Toluene	In house Method	mg/kg	34.85
17	Ethyl acetate +N-Heptane	In house Method	mg/kg	462.70
18	Acetone	In house Method	mg/kg	30.90
19	Cyclohexane	In house Method	mg/kg	BLQ
20	N-Hexane	In house Method	mg/kg	BLQ

Table 2-6: HTDS Effluent Quality Analysis of existing 1.5 MLD CETP

S.No	Test Parameters	Method	Unit	Result
1	pH	IS 3025 (Part 11)	--	7.27
2	Conductivity	IS 3025 (Part 14)	µs/cm	83000
3	Turbidity	IS 3025 (Part 10)	NTU	21
4	TDS	IS 3025 (Part 16)	mg/L	61092
5	TSS	APHA 2540-D	mg/L	3412
6	P.Alkalinity as (C_aCO_3)	IS 3025 (Part 23)	mg/L	Nil
7	M. Alkalinity as (C_aCO_3)	IS 3025 (Part 23)	mg/L	4794
8	Total Hardness as (C_aCO_3)	IS 3025 (Part 21)	mg/L	120
9	Calcium as Ca	IS 3025 (Part 46)	mg/L	32
10	Magnesium as Mg	IS 3025 (Part 46)	mg/L	9.7
11	Silica as S_iO_2	IS 3025 (Part 35)	mg/L	46.28
12	Sodium as Na	APHA 3500 Na	mg/L	27164
13	Potassium as K	APHA 3500 K	mg/L	3224
14	Chloride	IS 3025 (Part 32)	mg/L	20639
15	Sulphate	IS 3025 (Part 24)	mg/L	7667.22
16	Nitrate as NO_3	APHA 4500 NO_3	mg/L	8146.7
17	Iron as Fe	APHA 3125	mg/L	0.56
18	Fluoride as F	APHA 4500 (SPADNS Method)	mg/L	377.92
19	Chemical Oxygen Demand	IS 3025 (Part 58)	mg/L	7228.8
20	Biochemical Oxygen Demand	IS 3025 (Part 44)	mg/L	3240
21	Oil and Grease	IS 3025 (Part 39)	mg/L	0.26
22	Ammonical Nitrogen as N	APHA 4500 NH_3	mg/L	1026

Instrument used: ICP MS, UV- Visible Spectrophotometer

Table 2-7: HTDS Effluent Quality Analysis (GC Analysis) of existing 1.5 MLD CETP

S.No	Test Parameters	Method	Unit	Result
1	Acetic acid	In house Method	ppm	84.38
2	Iodide Solution	In house Method	ppm	Not detached
3	Chloroform	In house Method	mg/kg	12.55
4	Methanol	In house Method	mg/kg	2036.90
5	Ethyl acetate	In house Method	mg/kg	1133.85
6	Toluene	In house Method	mg/kg	28.95
7	Acetonitrile	In house Method	mg/kg	778.30
8	N-Heptane	In house Method	mg/kg	16.05
9	Methylene Dichloride	In house Method	mg/kg	252.00
10	Methy iso Butyl Ketone	Qualitative Screening	mg/kg	Absent

S.No	Test Parameters	Method	Unit	Result
11	Iso propyt Alcohol	In house Method	mg/kg	877.25
12	Acetonitrile + Toulene	In house Method	mg/kg	807.25
13	Ethyl Acetate + Methylene Chloride	In house Method	mg/kg	1385.85
14	Iso propyl Alcohol + Cyclochexane	In house Method	mg/kg	877.25
15	N- Heptane +THF	In house Method	mg/kg	45.00
16	Iso propyl alcohol + Toluene	In house Method	mg/kg	2914.15
17	Ethyl acetate +N-Heptane	In house Method	mg/kg	1149.90
18	Acetone	In house Method	mg/kg	210.75
19	Cyclohexane	In house Method	mg/kg	BLQ
20	N-Hexane	In house Method	mg/kg	BLQ

2.4 CETP Location layout and Area details

The CETP is planned in the Plot No 65 of APSEZ layout. The location of the CETP is shown in **Figure 2-3**. The layout plan for 5 MLD CETP is provided in **Drawing No. 1**.

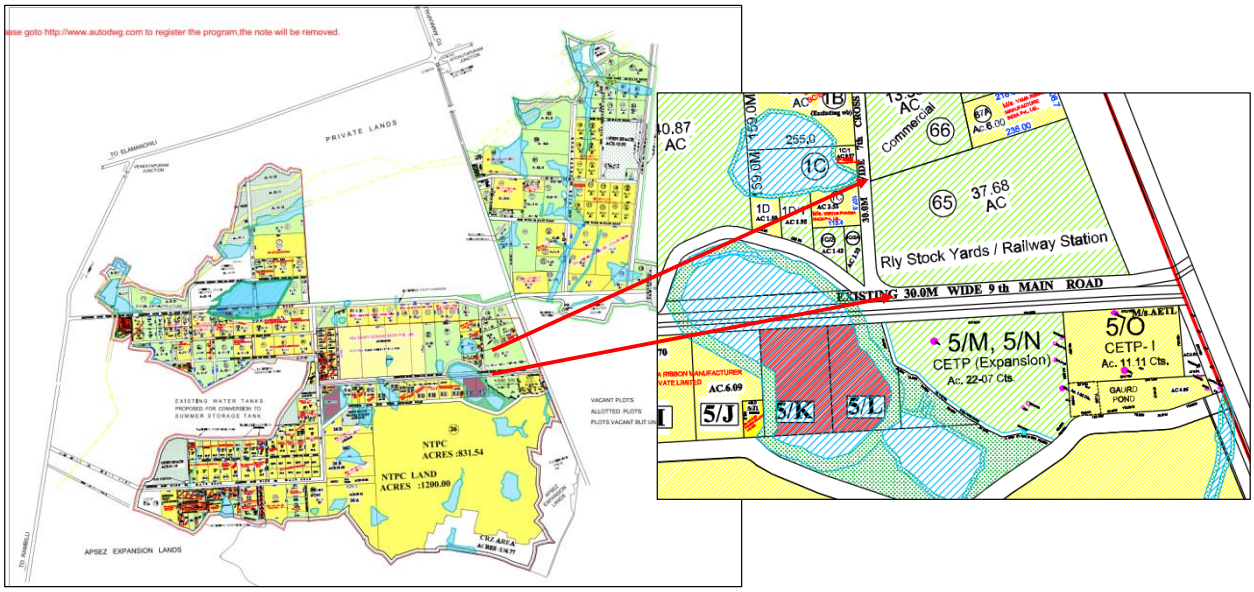

Figure 2-3: CETP location at Plot 65 (Refer Annexure No.01 for APSEZ Layout).

2.4.1 Proposed CETP Area Statement

The Site details and proposed facilities for 5 CETP are provided in **Table 2-8** and **Table 2-9.**

Table 2-8: CETP Site Details

S.No	Description	Details	
1	Total site area	33.75 Acres	
2	Survey Numbers	Pudi Village, Rambilli Mandal	273 Part, 285 Part, 284 Part, 276 Part, 275 Part, 360 Part, 305 Part, 303 Part, 286 Part, 272 Part, 361 Part, 362 Part, and 363 Part
		Nakkapalem Village, Rambilli Mandal	304 Part
3	Site Coordinates	1. 17°30'47.11"N & 82°59'39.98"E 2. 17°30'56.59"N & 82°59'36.02"E 3. 17°30'54.61"N & 82°59'16.25"E 4. 17°30'45.56"N & 82°59'17.12"E	
4	Present status	Open plot under APSEZ De-Notified Area	

Table 2-9: Proposed Area Statement for 5 MLD CETP

S.No	Description	Area in Sq.M	Area in Acres	%
1	Total site area	1,36,601	33.75 Acres	
2	Total Built-up area	85,672	21.17	
	i) Tanker unloading area	2,732	0.68	2.0%
	ii) LTDS Primary Treatment system	2,761	0.68	2.0%
	iii) HTDS Primary Treatment System	8,999	2.22	6.6%
	iv) Combined Treatment System	29,943	7.40	21.9%
	v) Co-Gen Power Plant Area	24,270	6.00	17.8%
	vi) Guard Ponds Area	6,481	1.60	4.7%
	vii) Administrative area	5,247	1.30	3.8%
	viii) Future Expansion area	3,264	0.81	2.4%
	ix) Walkway (3m wide) area	1,975	0.49	1.4%
3	Area for Greenbelt @ 25%	34,334	8.48	25.1%
4	Area for Internal Roads	16,595	4.10	12.1%
	Total	**1,36,601**	**33.75**	**100%**

2.5 CETP Capacity

The capacity of CETP has been arrived based on the stakeholders consultation with member industries in APSEZ, APIIC officials, and Regulatory and Statutory department for taking the views on the expected effluent generation in terms of quality of effluent based on type of industry and its operational activities and quantity of effluent generation in terms of High TDS and Low TDS. The data from Consent for Establishment (CFE) and Consent for Operation (CFO) issued by Pollution Control Board has been reviewed for arrive the CETP capacity.

The demand capacity required for CETP is 5 MLD in which 2 MLD High TDS and 3 MLD Low TDS effluents shall be expected from member industries.

2.6 Design Approach

The effluent treatment process is to remove the containments from wastewater related to various industrial process from Pharma, Spe. Chemical, FMCG (Aerated drinks), Water and Solvent based and Solvent Recovery, Engineering & Electrical manufacturing equipment's process water, domestic, boiler bleed off and cooling tower bleed off.

The common effluent treatment includes physical, chemical, biological and tertiary process to remove organic matter and salts.

The system mainly contain the following components

1. Collection system
2. Primary Treatment
3. Secondary treatment
4. Tertiary treatment

Ultimately treated water is discharged into sea as per guideline of marine disposal regulation standards.

Design criteria for the preparation of CETP facility is based on the guidelines laid down in CPHEEO manual. Some of the norms, design criteria and associated specification and some are designed based on experience of related field. The proposed design criteria for the components are given in the adopted technology.

Quantity of Low TDS - 3000 KLD
Quantity of High TDS - 2000 KLD
Total quantity **- 5000 KLD Capacity CETP with Co-Gen Power Plant of Capacity 6.0 MW**

2.6.1 Identification of Concepts / Alternatives Treatment Technologies

The Common Effluent Treatment Plants (CETP) are intended for effective treatment of effluent discharged from industrial clusters aiming to support the small/medium scale industries that are deprived of enough resources and technological ability to treat their effluent individually. The existing available technologies are identified and compared for selection of the suitable treatment technology for proposed CETP. The comparison of various technologies are like Activated Sludge Process (ASP), Moving Bed Bio Reactor (MBBR), and Sequencing Batch Reactor (SBR) shown in **Table 2.10**.

Table 2-10: Comparison of Alternative Treatment Technologies for CETPs

S.No.	Description	SBR	MBBR	ASP
1	Treatment flexibility	HIGH (Equalize the effluent during fill phase)	MODERATE	Low
2	Hydraulic retention time	MEDIUM	LOW	HIGH
3	Tolerates Substantial Organic Shock loads	HIGH	MODERATE	Low
4	Type of process	Suspended growth system	Combination of suspended and attached growth system	Suspended growth system
5	Bio Carrier media requirement	NO	YES	NO
6	Power consumption	Low	MODERATE	HIGH
7	Availability of phase management	YES (Phases can be increase or otherwise modified to attain desired effluent quality)	NO	No
8	Sludge retention	HIGH (Mixed liquor solids cannot be washed out by hydraulic surges because they can be held in the tank as long as necessary)	MODERATE	LOW
9	Sludge recirculation	NOT REQUIRED (Pumping is required only when excess sludge removal since the mixed liquor is always in the reactor)	NOT REQUIRED	REQUIRED
10	Sludge generation	LESS	LESS	HIGH
11	Pumping requirements reduced	LESS (Only fill time)	CONTINUOUS	CONTINUOUS
12	Secondary Clarifier for sludge settling	NOT required (Settle area is the same as the reactor area, low surface settling rates are achieved, resulting in settling of even small floc particles)	REQUIRED	REQUIRED
13	Oxygen transfer efficiency	INTERMITTENT (Dissolved oxygen level	CONTINUOUS	CONTINUOUS

S.No.	Description	SBR	MBBR	ASP
		is zero during the initial Fill phases, a greater oxygen driving gradient exists during the React phase, thus achieving higher overall oxygen transfer efficiency with the same reaction applied)		
14	Filamentous growth eliminate	HIGH (Filamentous growth can be controlled by varying the operating strategies during the Fill phase)	MODERATE	LESS
15	Foot print	MODERATE	LESS	HIGH
16	Monitoring	HIGH	MODERATE	MODERATE

2.6.2 Technology Adopted

Based on the effluent characteristics for high TDS and low TDS, different technologies have been identified and combined together in the treatment process to obtain the desired treated waste water quality as per the norms.

Table 2-11: **Details of Treatment Technologies Adopted for CETP**

S.No.	COMPONENTS	APPLICATION
I	**PRELIMINARY TREATMENT**	
a	Screens	Removal of floating matter, rags, sticks and other debris. It is placed before grit removal tank.
b	Grit removal system	Grit is heavy inorganic material in effluent such as sand, gravel and cinders. Grit is removed from effluent to minimise abrasion to pumps and equipment's. It is placed after screening tank.
c	Oil and Grease removal	To remove the Oil and Grease float on tank and it is placed before going to collection cum equalization tank by gravity separation with skimming mechanism.
II	**PRIMARY TREATMENT**	
a	Equalization	Effluent is discharged from factories in neutralised condition but sometimes it may vary depending upon the dilution, velocity and the amount of reactants. Hence character of the effluent does not remain the same throughout the day. The equalization tank should be sufficient size it may retain even the effluent of the whole day. Arrange the agitation system through air in the

S.No.	COMPONENTS	APPLICATION
		equalization tank.
b	Neutralization	Industrial effluents pH is sometimes high or sometimes low and it should be neutralised by acid or alkali solutions.
c	Clarification	Primary clariflocculator
III	**SECONDARY TREATMENT**	**HIGH TDS TREATMENT**
A	Stripper	The effluent containing high amount of organics is heated in a reboiler and passed through a stripper column to strip off the maximum low boiling organic solvents and their vapours are condensed using a condenser. The condensed vapours are partially refluxed back to the stripper to enrich the column and rest of the condensate (solvent) collected separately and send to the authorised recyclers.
B	Multiple effect evaporation	The solvent lean effluent is concentrated in a multiple effect Evaporation system to around 40-45% TDS. The dry saturated steam is used as heating medium. The system has three to five effects operating under vacuum and the vapours from the last effect are condensed to produce the process condensate. The thick liquor with 40-45% TDS will be collected separately for further treatment. The steam condensate can be used for the boiler as feed water whereas the process condensate is further treated in biological treatment plant for recycling purpose.
C	Agitated Thin Film Dryer (ATFD)	The thick liquor with 40-45% dissolved solids is dried to result in solids with 10-15% moisture. The water is removed from the thick liquor using steam as the heating media. This is indirectly heated dryer with steam on the shell side. The thick liquor at a known rate is pumped through a distributor inside the dryer. The dryer has a stirrer rotating at a slow RPM with specially designed scrappers that scraps the thin film of powder deposited on the inner shell of the dryer and the powder is collected at the bottom. The vapours from the dryer are sucked through a condenser by a dedicated blower with scrubber or activated carbon media. The steam condensate is collected in a tank and can be used as Boiler feed water.
III	**SECONDARY TREATMENT**	**COMBINED (HTDS MEE CONDENSATE & LTDS)**
a	SBR process	Conventional effluent treatment plants are required huge area and power intensive and require a lot of monitoring. This system is compact and efficient treatment option. This system is suspended growth process where the bio mass is retained within the aeration tank (SBR tank) and reduce the recycling of return sludge. Oxygen is usually added to the suspended growth process to keep the bio mass in suspension and to maintain the aerobic

S.No.	COMPONENTS	APPLICATION
		conditions. The plants are more compact and more energy efficient. A basic cycle comprises: Filling Aeration Settlement Decanting
IV	**TERTIARY TREATMENT**	
a	Multi grade sand filter	Removal of physical impurities of water like suspended solids, dirt and dust. It works on principle of retention and removal of physical impurities in a different layers through voids of the filtering media. The filter media consists of different grades of pebbles and sand.
b	Activated Carbon filter	Activated carbon to remove contaminants and impurities by using chemical adsorption. Activated carbon adsorbs free chlorine, organic compounds, colour and odour.
V	**SOLIDS HANDLING**	
a	Decanter Centrifuge/ Screw press	Dewatering aims to reduce the water content further in the generated sludge by mechanically by using Decanter Centrifuges/ screw press.

2.7 Conveyance of effluent to the CETP

In the initial stages, the wastewater will be conveyed to the CETP by tankers only. As and when the occupancy in the IP exceeds 70%, then conveyance system can be developed the details of the conveyance network system shall be worked out at a later stages. The flows anticipated in the initial stages (Considering the 31 MLD capacity for conveyance system) shall be low and even self-cleansing velocity will not be attained, hence the conveyance system can be planned once the occupancy level increases and a minimum of 70% of the 31 MLD effluent is generated.

However, the Cyanide and Chrome bearing wastewater shall be conveyed by tanker only as the flows envisaged are less. Tankers shall be of 10 or 20 KL capacity and about 250 to 300 Tankers/day are expected to empty at the CETP.

The prime responsibility of the tankers shall lie with the Industries. The EMP (Environmental Management Cell) set up at the Industrial park shall oversee the operations and also take care of issues, if any. The transporting vehicle will follow manifest system and A.P. Motor Vehicle Rules and norms as prescribed by APPCB from time to time.

2.7.1 Wastewater Collection from Individual Industries

Each industry shall have a minimum of 2 tanks for each type of wastewater generated and the holding capacity of each tank shall be for a flow of 1 day. This is proposed as per the current practice followed by APPCB. Depending on the wastewater characteristics, the unit shall have to provide screens, grit trap

and oil and grease traps at the unit level. Once a tank (for a particular type of waste stream) is filled, the CETP operator shall be informed, who shall then send his representative to check the effluent quality (finger print test) and assign the path way for onward conveyance and treatment at the CETP.

2.7.1.1 Quality control at effluent collection

The effluents transported from industries through tankers and effluent samples will be collected from top and bottom of the tanker after thoroughly mixing with air.

The project envisages setting up of state of the art quality control laboratories. There will be a control sample laboratory at the gate to collect the sample and analyze the same for inlet parameter as per the inlet standard stipulated by APPCB. Once the wastewater is accepted for treatment, further samples will be drawn and sent to the central laboratory which will conduct detailed tests for the purpose of levying treatment charges and to ensure compatibility with the treatment system being followed at the CETP.

Additionally conditions shall be laid down which are given below:

1) Industries shall collect spent solvents separately. The spent solvents shall be sent to the common solvent recovery plant.
2) The industries shall segregate the High TDS and low TDS wastewater. These shall be sent separately to the CTEP.
3) There shall be 2 separate holding tanks at industry at least 1 day holding time each for high TDS and low TDS wastewater. These shall be let off after finger print test/ acceptance by CETP operator.
4) Wastewater containing high concentration of Ammonia/ammonium salts shall be segregated and treated at industry level itself.
5) Wastewater containing cyanides and heavy metals shall be segregated and collected separately. The wastewater shall be sent separately to the CETP by tankers and treated in the treatment plant provided for the same.
6) Wastewater with any other specific pollutants that which cannot be handled at the CETP shall have to be treated for the specific pollutant at the individual industry. The CETP shall thereafter receive the following wastewater streams:

- High TDS wastewater stream
- Low TDS wastewater stream
- Cyanide bearing and alkaline waste stream
- Chromium bearing and acidic waste stream

2.7.2 Mode of Disposal of Treated Wastewater

The treated effluent from CETP shall be disposed through to marine outfall under stipulated standards. The treated effluent shall be stored in guard ponds for effluent shall be disposed through pipeline which is already established for total 31 MLD capacity. The existing marine disposal pumping infrastructure shall be utilized for discharging the treated effluent from proposed 5 MLD CETP. The guard ponds shall be constructed to store the treated effluent from proposed 5 MLD CETP as per the requirements provided in the statutory guidelines / conditions. The pipeline from 5 MLD CETP guard ponds shall be established upto existing pumping mains as part the scope of proposed 5 MLD CETP.

2.8 Wastewater Quantity and Quality

High TDS wastewater volume is expected to be about 2000 KLD and the Low TDS wastewater is expected to be about 3000 KLD. This is apart from the about 200 KLD of the metal pretreatment and finishing wastewater expected from the engineering sector.

2.8.1 CETP Inlet Standards

The definition of low TDS and high TDS wastewater is based on the CETP inlet standards are presented in **Table 2-12.** Low TDS wastewater is termed as effluent having TDS < 8000 mg/l and meeting standards which are considered based on the CFE and CFO issued by PCB to member industries.

Table 2-12: **Raw Effluent Characteristics for CETP**

S.No.	Parameter	Concentration	
		HTDS	LTDS
1	pH	5.5 – 9.0	5.5 – 9.0
2	TSS	< 3000 mg/l	< 1000 mg/l
3	TDS	>12000 mg/l to Maximum 10% (1,00,000 mg/l)	< 12000 mg/l
4	COD	> 8000 mg/l to Maximum 8% (80,000 mg/l – Methanol basis)	< 8000 mg/l
5	Ammonical Nitrogen as N	< 3000 mg/l	< 50 mg/l
6	Oil & Grease	< 20 mg/l	< 20 mg/l

The characteristics of the wastewater that are expected from the metal pre-treatment and finishing units are given in **Table 2-13 and Table 2-14**. The streams have been split in to 2 parts viz., i) alkaline and cyanide bearing wastewater and ii) acidic and chrome bearing wastewater. The individual units shall have to segregate the wastewater at the unit level. All wastewaters having TDS above 8,000 mg/l and not meeting CETP inlet standards other than heavy metals and Cyanide shall fall under High TDS stream.

Table 2-13: Expected Characteristics of Alkaline and Cyanide Bearing Effluent

S.No.	Parameter	Concentration
		Alkaline and Cyanide
1	Wastewater Flow (KLD)	100 KLD
2	pH	9 – 10.5
3	TSS	250 to 300 mg/l
4	Total HC (free and emulsified)	50 to 300 mg/l
5	Cyanides	2 to 20 mg/l
6	Heavy metals	2 to 20 mg/l

Table 2-14: Expected Characteristics of Acidic and Chrome Bearing Effluent

S.No.	Parameter	Concentration
		Acidic and Chrome
1	Wastewater Flow (KLD)	100 KLD
2	pH	2 – 4.5
3	TSS	250 to 300 mg/l
4	Total HC (free and emulsified)	10 to 50 mg/l
5	Chromium as Cr (Total)	2 to 20 mg/l

2.8.2 Wastewater Characteristics – Industry wise

The characteristics of wastewater expected from the different industry type (as considered for designing the CETP) are given in following **Table 2-15**. (All wastewaters having TDS above 12,000 mg/l and not meeting CETP inlet standards other than heavy metals and Cyanide shall fall under High TDS stream).

Table 2-15: Raw Effluent Characteristics from Industries

S.No.	Parameter	Pharma & Spe. Chemical	
		HTDS	LTDS
1	pH	5.5 – 9.0	5.5 – 9.0
2	TSS	< 3000 mg/l	< 1000 mg/l
3	TDS	Avg. 80,000 mg/l	< 12000 mg/l
4	COD	Avg. 50,000 mg/l	< 8000 mg/l
5	Ammonical Nitrogen as N	< 3000 mg/l	< 50 mg/l
6	Oil & Grease	< 20 mg/l	< 20 mg/l

2.8.3 Disposal Characteristics of Treated Wastewater

The treated effluent from CETP shall be disposed through to marine outfall under stipulated standards. The treated effluent shall be stored in guard ponds for effluent shall be disposed through pipeline which is already established for total 31 MLD capacity. The existing marine disposal pumping infrastructure

shall be utilized for discharging the treated effluent from proposed 5 MLD CETP. The guard ponds shall be constructed to store the treated effluent from proposed 5 MLD CETP as per the requirements provided in the statutory guidelines / conditions. The pipeline from 5 MLD CETP guard ponds shall be established upto existing pumping mains as part the scope of proposed 5 MLD CETP.

Table 2-16: **Expected Characteristics of CETP Treated Wastewater**

S.No.	Parameter	Concentration
1	pH	6.5 – 9
2	TSS	< 20 mg/l
3	TDS	< Sea Water TDS in mg/l
4	BOD (5 day @ 20 ^{o}C	< 30 mg/l
5	COD	< 250 mg/l
6	Temperature ^{o}C	Ambient
7	Cyanides as CN^{-}	< 0.2 mg/l
8	Chromium (Total) as Cr	< 1 mg/l
9	NH_3-N	< 50 mg/l

2.9 Proposed Treatment Scheme

The treatment process for the 5.0 MLD CETP is shown in the **Figure 2-4**.

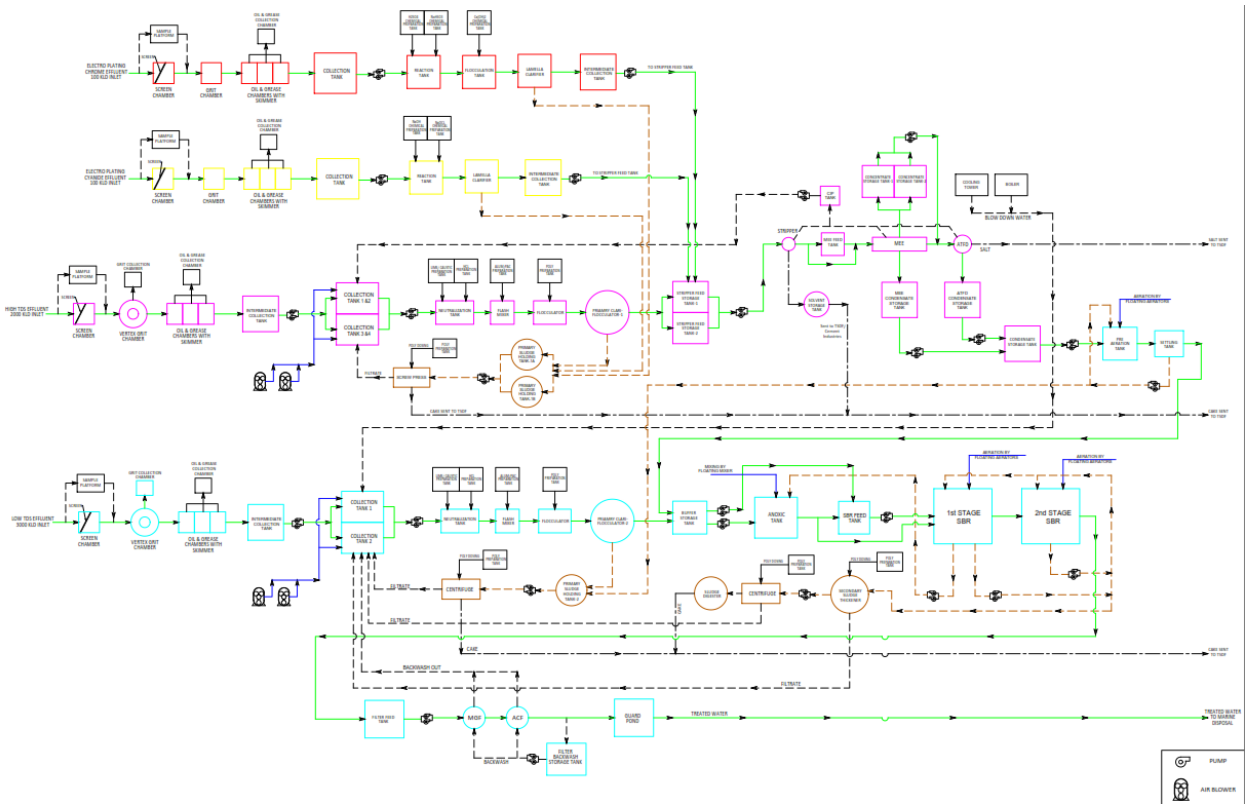

Figure 2-4: Treatment process diagram for CETP (Refer Drawing No. 201)

2.9.1 Acid and Chrome bearing Wastewater

The proposed scheme of treatment is shown in **Figure 2-5** and is described in brief below.

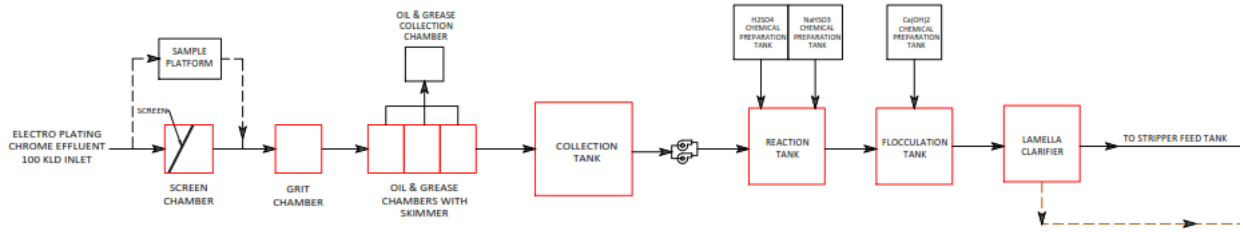

Figure 2-5: Proposed Treatment for Acid and Chrome bearing wastewater (Refer Drawing No. 201)

Wastewater bearing alkali and cyanides shall be segregated and collected in the tanks at the individual unit. Oil and grease shall be arrested at the unit itself. The wastewater shall be transported by tankers. The tankers shall be emptied in to oil and grease traps for entrapment of any oil and grease (that which would have escaped at the unit level). Following removal of oil and grease, the wastewater is taken to a sump / equalization tank having volume of 100 cum. In the equalization tank, air shall be bubbled thru a

grid. This helps in mixing and avoids settling. The wastewater from the sump is pumped at a uniform and constant rate of 5 cum/hr for onward treatment. Treatment comprises of a two stage.

The collected effluent will be feed to reaction tank where sulphuric acid will be added to reduce the pH of around 2-3 followed by dosing of sodium meta bisulfite till the whole of hexavalent chrome is converted into trivalent chrome. Lime solution will be added which will precipitate chrome in the form of hydroxide.

In the first stage reduction of hexavalent chromium to trivalent form under acidic conditions and the second stage shall be elevation of pH to about 8.2 for precipitation of chromium as chromic hydroxide which is in soluble and shall settle down.

The solid – liquid separation shall take place in the settling tank. The expected characteristics of the treated wastewater are given in **Table 2-17.** Chemicals required are H2SO4, Sodium meta bisulphite for Chromium reduction and lime for elevating pH. The supernatant i.e., treated wastewater is taken to intermittent collection tank before secondary treatment where the wastewater shall be mixed with high TDS stream and subjected to secondary & tertiary treatments.

Table 2-17: **Expected Characteristics of Treated Acidic and Chrome Bearing Effluent**

S.No.	Parameter	Concentration
		Acidic and Chrome
1	Wastewater Flow (KLD)	100 KLD
2	pH	8 – 8.5
3	TSS	< 50 mg/l
4	Total HC (free and emulsified)	< 10 mg/l
5	Chromium as Cr (Total)	< 1 mg/l

The supernatant i.e., treated wastewater is taken to mixing tank before secondary treatment where the wastewater shall be mixed with condensate from high TDS stream and primary treated LTDS wastewater and subjected to secondary & tertiary treatments. The sludge shall be collected in the sump and shall be pumped to the sludge sump for onward handling. The sludge shall be dewatered and dried prior to safe disposal.

2.9.2 Alkaline and Cyanide bearing Wastewater

The proposed scheme of treatment is shown in **Figure 2-6** and is described in brief below.

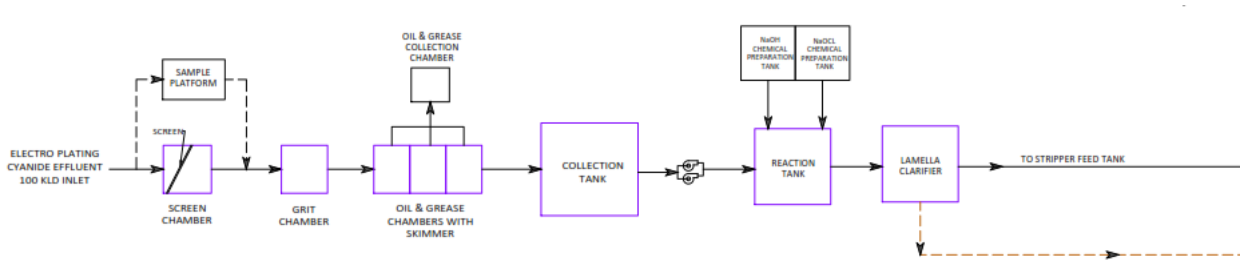

Figure 2-6: Proposed Treatment for Alkaline and Cyanide bearing wastewater (Refer Drawing No. 201)

Wastewater bearing alkali and cyanides shall be segregated and collected in the tanks at the individual unit. Oil and grease shall be arrested at the unit itself. The wastewater shall be transported by tankers. The tankers shall be emptied in to oil and grease traps for entrapment of any oil and grease (that which would have escaped at the unit level). Following removal of oil and grease, the wastewater is taken to a sump / equalization tank having volume of 100 cum. In the equalization tank, air shall be bubbled through a grid. This helps in mixing and avoids settling. The wastewater from the sump is pumped at a uniform and constant rate of 5 cum/hr for onward treatment. The collected cyanide effluents will be pumped to the reaction tank for detoxification by using Sodium hydroxide and add Sodium hypochlorite for precipitation of cyanide and heavy metals. Treatment comprises of a two stage alkaline chlorination. In the first stage chlorine shall be added under alkaline conditions and the cyanide shall be oxidized to cyanate. The cyanate is further oxidized to carbon di-oxide and nitrogen in the second stage reaction tank. Once the cyanide complex is broken the associated heavy metals are converted in to insoluble metal hydroxides and they shall settle down. The solid – liquid separation shall take place in the settling tank. The water from the reaction tank will be allowed to settle down in the lamella clarifier and supernatant will be collected in the intermittent collection tank for further treatment in High TDS stream.. Chemicals required for treatment of are NaOCl for giving Chlorine and NaOH for raising the pH. The expected characteristics of the treated wastewater are given in **Table 2-18**.

Table 2-18: **Expected Characteristics of Treated Alkaline and Cyanide Bearing Effluent**

S.No.	Parameter	Concentration
		Alkaline and Cyanide
1	Wastewater Flow (KLD)	100 KLD
2	pH	9 – 10.5
3	TSS	< 50 mg/l
4	Total HC (free and emulsified)	< 10 mg/l
5	Cyanides	< 1 mg/l
6	Heavy metals	< 2 mg/l

The supernatant i.e., treated wastewater is taken to intermittent collection tank before secondary treatment where the wastewater shall be mixed with high TDS stream and subjected to secondary &

tertiary treatments. The sludge shall be collected in the sump and shall be pumped to the sludge sump for onward handling. The sludge shall be dewatered and dried prior to safe disposal.

2.9.3 High TDS Wastewater

The proposed scheme of treatment for the high TDS wastewater is depicted in **Figure 2-19.** The total waste flow (high TDS) shall be about 2000 KLD.

Table 2-19: Characteristics of HTDS Effluent Considered

S.No.	Parameter	Concentration
		High TDS
1	pH	6.5 – 9
2	TSS	< 3000 mg/l
3	TDS	Max. 80,000 mg/l
4	COD	Avg. 50,000 mg/l
5	Oil & Grease	< 20 mg/l
6	Temperature °C	45
7	Ammonical Nitrogen as N	< 3000 mg/l

Initially, the HTDS wastewater generated from the industries shall be transported to the CETP by tankers. The tankers shall empty the HTDS wastewater into the screen chamber where the screens shall retain the coarse matter. The screens are mechanical type and are to be cleaned at regular intervals. Screens provided in this case are coarse screen followed by fine screens. The screened wastewater shall be taken to a sump. From the sump the wastewater will be pumped at an uniform rate to grit trap followed by an oil and grease trap for retaining floatables. The wastewater is then led to an equalization tank for balancing the waste flow rate and characteristics. Two numbers of equalization tanks are proposed. In the equalization tanks air shall be provided to obtain uniform characteristics of the wastewater. Neutralization of the wastewater shall be done in the equalization tank itself by adding caustic lye or sulphuric acid as the case may be. The HTDS wastewaters shall be pumped from the equalization tank at a constant and uniform rate of 100 m3 /hr for onward treatment. For primary treatment of the HTDS wastewater there shall be one stream operating @ 100 m3 /hr.

2.9.3.1 Primary Treatment for High TDS Wastewater

The wastewater is first taken to a flash mixing tank wherein chemicals are added for coagulation and pH adjustment. The flash mixing tank is provided with a motorized flash mixer device for homogenous mixing of chemicals and wastewater.

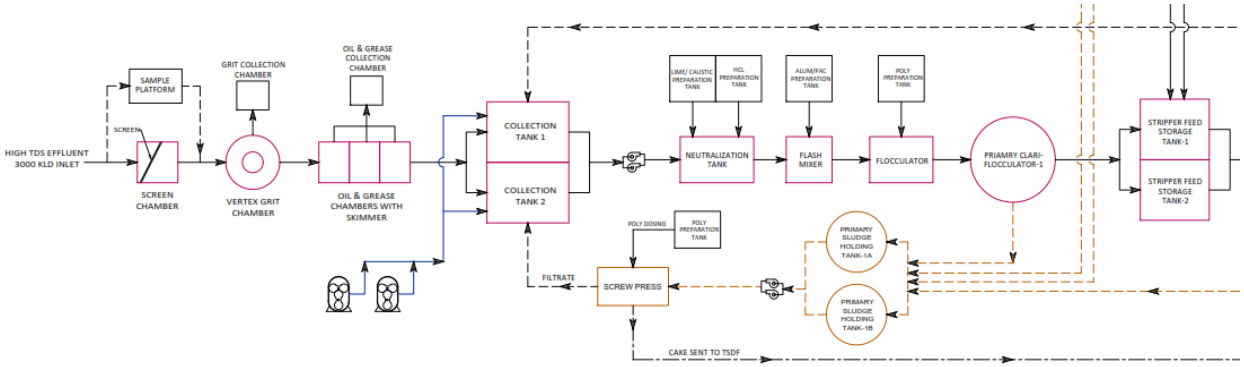

Figure 2-7: Proposed Treatment for High TDS Primary Treatment System (Refer Drawing No. 201)

Chemical preparation and feeding tanks are provided with agitators for preparation and feeding of chemicals required for treatment. For dosing of chemicals in a regulated manner dosing pumps are proposed. Following chemical coagulation the wastewater is taken to a flocculation tank for flocculation. For flocculation, a slow speed motorized flocculator is provided. The wastewater is then taken to a tube deck settling tank PRIMARY CLARIFIER for solid – liquid separation. Sludge collected in the settling tank shall be sent to sludge sump for onward handling of sludge. Chemicals required are coagulant (mainly Alum or PAC), lime and acid for maintaining pH and Polyelectrolytes for flocculation. Supernatant i.e., overflow from the primary settling tank shall be collected in a sump. From the sump, the wastewater shall be pumped at a uniform rate for onward treatment. At this stage the flow will be split into 2 equal portions. The stripper, MEE and ATFD shall be provided in 1 Nos of 1000 KLD & 2 Nos of 500 KLD. The units shall comprise of

- Stripper
- Multiple Effect Evaporator
- ATFD (Agitated Thin Film Drier)

2.9.3.2 Steam Stripper

The stripper shall be used for removal of low boiling /volatiles. These shall be condensed and removed from the top. The bottom stills shall be removed from the bottom. There shall be one number stripper catering to a flow of 1000 KLD (1 Nos) and 500 KLD (2 Nos) of High TDS wastewater. The type of stripper proposed is steam stripper. Steam stripping is effective for stripping out most VOCs from wastewater in a wide range of concentrations. The process can strip the VOCs to extremely low concentrations in one operation without a large increase in costs. The VOCs will be sold off or sent to cement kilns or sent for incineration. The stripper is coupled to MEE which forms the first unit. The bottom stills shall be sent to HWMF for disposal.

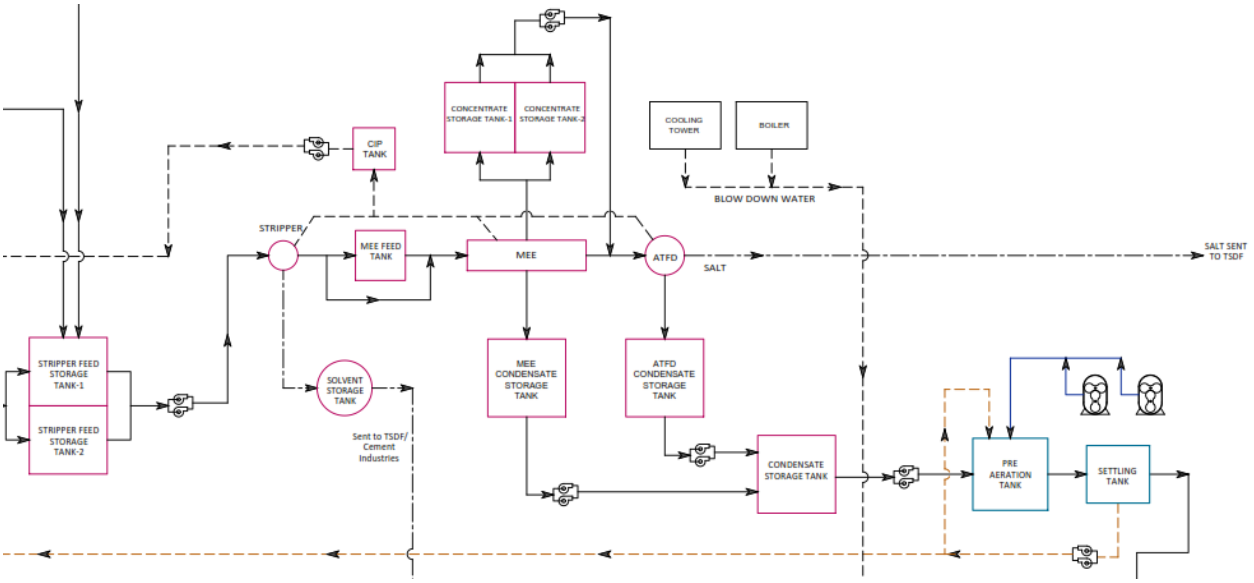

Figure 2-8: Treatment for High TDS Stripper, MEE and ATFD system (Refer Drawing No. 201)

2.9.3.3 Multiple Effect Evaporator

Following stripping of VOC's, the High TDS wastewater, will be fed to a MEE with 3 Falling film and 3 Forced Circulation effect evaporation system. The MEE catering to 47.27 m3/hr feed rate for 1000 KLD and 23.63 m3/hr feed rate for 500 KLD. The MEE will concentrate the salts contents to about 40-45%. There shall be a condenser attached to the MEE and the condensate will be collected and sent for treatment along with primary treated Low TDS wastewater. MEE is primarily used to concentrate the TDS in the wastewater. The condensate from the MEE is subjected to further treatment in the low TDS stream.

2.9.3.4 ATFD

The concentrate from the MEE is fed to an ATFD for further drying and getting the salts in a near dry state. The salts produced at the ATFD are with about 10-15% moisture content. The condensate from the AFTD is taken for treatment along with low TDS wastewater. The characteristics of the mixed condensate from the MEE and the ATFD along with the wastewater from the utilities (boiler blow down and the cooling tower bleed) are given in **Table 2-20.** The residuals generated in the pre-treatment process for the High TDS wastewater shall be suitably disposed off. The residuals generated are:

- Volatiles and bottom stills from the Stripper.
- Salts from the drier shall be bagged and sent to the hazardous waste management facility for disposal.
- Sludge form the primary ETP shall be dewatered, dried and sent to the hazardous waste management facility for disposal.

- MEE and ATFD Condensate: this shall be collected in a tank and pumped to the mixing tank for further biological treatment along with primary treated Low TDS wastewaters and Pretreated cyanide and heavy metal bearing wastewater.

Table 2-20: Characteristics of Condensate Water from MEE, ATFD and Utilities

S.No.	Parameter	MEE Condensate	ATFD Condensate	CT Water
1	pH	8.5 – 9.2	8.5 – 9.2	8.5 – 9.2
2	TSS	**	**	< 200 mg/l
3	TDS	800 mg/l	100 mg/l	3500 mg/l
4	COD	< 13,000 mg/l	< 25,000 mg/l	< 3,000 mg/l
5	Ammonical Nitrogen as N	< 500 mg/l	< 2500 mg/l	< 150 mg/l

2.9.4 Low TDS Wastewater

The proposed scheme of treatment is shown in Figure 2-6. The expected quantity of Low TDS wastewater is about 3000 KLD at full load for the 5000 KLD CETP.

2.9.4.1 Primary Treatment

For the low TDS stream, the primary treatment shall be in one module of 3 MLD. LTDS wastewater from the individual units is received by tankers and is first tested at the CETP and is either accepted/rejected or sent to HTDS stream depending on the test results.

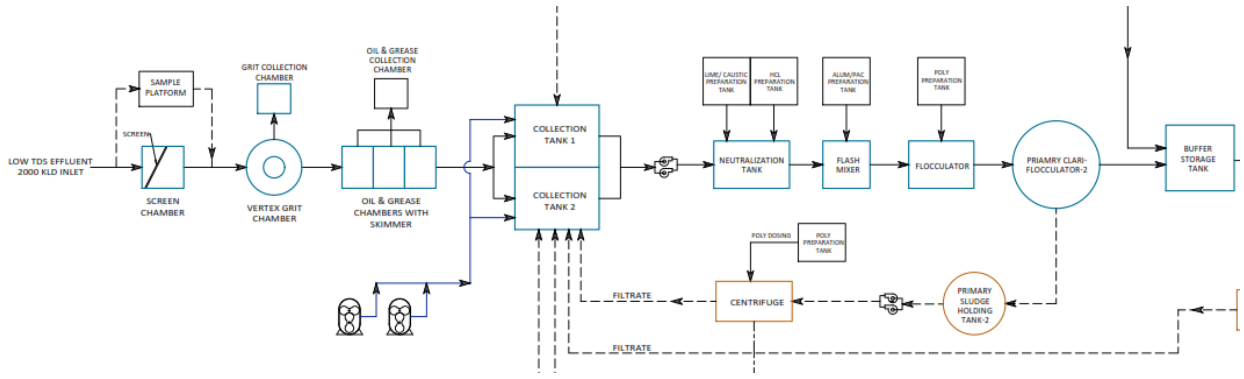

Figure 2-9: Proposed Treatment for Low TDS Primary Treatment System (Refer Drawing No. 201)

The LTDS wastewater which is accepted is led to the screen chamber. Screens shall be provided for retaining coarse matter. The screens are mechanical type and are to be cleaned at regular intervals. One coarse screen followed by fine screen shall be provided. The screened wastewater will be taken to a sump. From the sump the wastewater is pumped at a constant rate to VERTEX grit chamber for removal of grit. The wastewater from grit chamber is taken to oil and grease trap for removal of oil and grease. The wastewater is then led to an equalization tank. Here two equalization tanks are provided for

alternate use. Air mixing shall be provided in the equalization tanks to homogenise the contents. The screenings and grit shall be disposed off along with primary sludge. From the equalization tank, the wastewater is pumped at a uniform and constant rate to a flash mixing tank wherein chemicals are added for coagulation and pH adjustment. The flash mixing tank is provided with a flash mixer device for homogenous mixing of chemicals and wastewater. Chemical preparation and feeding tanks are provided with agitators for preparation and feeding of chemicals required for treatment. For dosing of chemicals in a regulated manner chemical dosing pumps are proposed. Chemicals required are coagulant (mainly Alum or PAC), lime and acid for maintaining pH and Polyelectrolytes for flocculation. Following mixing of chemicals and wastewater, the wastewater is taken to a flocculation chamber for flocculation. A mechanical flocculator shall be provided in the flocculation chamber. The wastewater is then subjected to solid – liquid separation in a primary clarifier tank. The sludge gets collected in the hopper bottom and shall be periodically withdrawn to sludge sump. The clarified water shall overflow from the tank and shall be taken to mixing tank before being subjected to secondary treatment. The expected characteristics of Low TDS wastewater after primary treatment are given in **Table 2-21.**

Table 2-21: **Characteristics of Primary Treated Low TDS Wastewater**

S.No.	Parameter	Concentration
1	pH	7.5 – 8.5
2	TSS	< 150 mg/l
3	TDS	<12000 mg/l
4	BOD (5 day @ 20 ^{o}C	< 3060 mg/l
5	COD	< 6,800 mg/l
6	Ammonical Nitrogen as N	< 40 mg/l

2.9.5 Combined Low TDS Stream + Condensate from High TDS Wastewater

The condensate from the High TDS stream and pre-treated cyanide and metal bearing wastewater shall also be treated along with the Low TDS wastewater. The condensate from high TDS stream (maximum quantity per module) from the MEE and ATFD condensate tank is pumped to the mixing tank where it gets mixed with primary treated LTDS wastewater and pre-treated cyanide and metal bearing stream. For mixing of LTDS wastewater, pre-treated Cyanide & metal wastewater and MEE condensate mixer shall be provided.

2.9.5.1 Secondary Treatment (SBR)

The characteristics of the mixed wastewater (condensate and the primary treated low TDS + pre-treated cyanide and metal bearing wastewater) which shall be fed to biological treatment are given in **Table 2-22**. The secondary treatment is proposed in 2 equal modules.

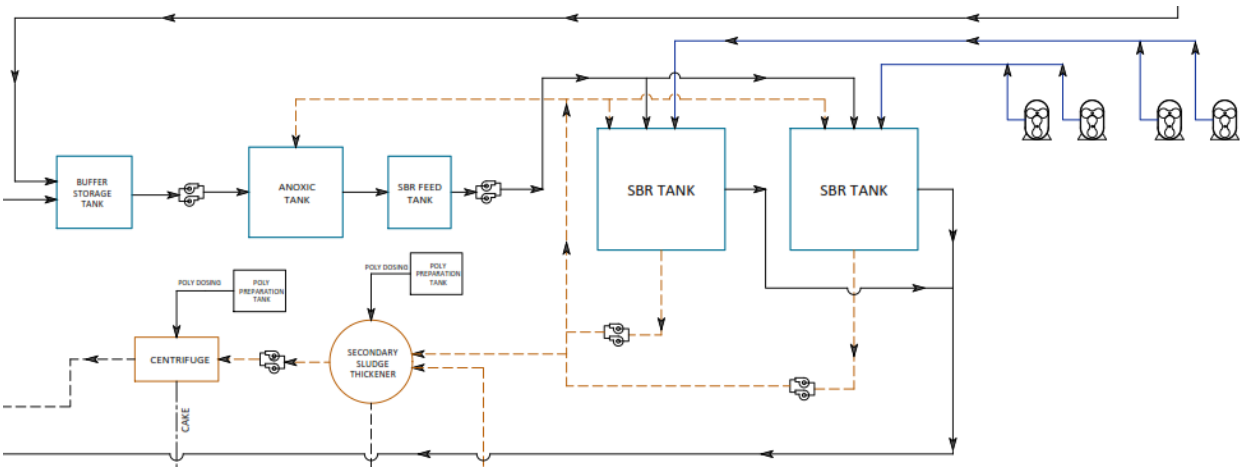

Figure 2-10: Proposed Combined Treatment for MEE Condensate and Low TDS Primary Treated Effluent (Refer Drawing No. 201)

Table 2-22: Characteristics of Combined Low TDS Stream + Condensate from High TDS Wastewater

S.No.	Parameter	Concentration
1	pH	7.5 – 8.5
2	TSS	< 50 mg/l
3	TDS	2500 mg/l
4	BOD (5 day @ 20 °C	< 2800 mg/l
5	COD	< 6,000 mg/l
6	Ammonical Nitrogen as N	< 450 mg/l

The combined wastewater shall be subjected to 2 stage biochemical oxidation and shall include Nitrification and De nitrification.

SBR is a **SEQUENTIAL BATCH REACTOR** process. It provides highest treatment efficiency possible in a single step biological process.

Biological treatment proposed here is Anoxic followed by two stage Sequential Batch Reactor. Major part of organic load shall be removed here. The aerobic organisms will degrade the high concentrated organic matter present in the effluent. The clear water from 1st stage SBR is decanted into 2nd stage SBR where reaming organic load shall be removed here. The clear water from 2nd stage SBR is decanted into intermittent collection tank for further treatment.

In SBR tanks submerged aeration system shall be provided with the help of Floating aerators to supply oxygen to microorganisms. **SBR** – System is operated in a batch reactor mode which eliminates all the inefficiencies of the continuous processes. A batch reactor is a perfect reactor, which ensures 100%

treatment. Two modules are provided to ensure continuous treatment. The complete process takes place in a single reactor, within which all biological treatment steps take place sequentially.

NO additional settling unit / secondary clarifier is required.

The complete biological operation is divided into cycles. Each cycle is of 24 hrs duration, during which all treatment steps take place.

Explanation of cyclic operation:

A basic cycle comprises:

- Filling - 2 hrs
- Aeration - 18 hrs
- Settlement - 2 hrs
- Decanting - 2 hrs

A Typical Cycle:

During the period of a cycle, the liquid is filled in the SBR Basin up to a set operating water level. Aerators are started for aeration of the effluent. After the aeration cycle, the biomass settles under perfect settling conditions. Once Settled the supernatant is removed from the SBR. Solids are wasted from the tanks during the decanting phase. These phases in a sequence constitute a cycle, which is then repeated.

Recycling of bio-sludge from SBR tanks will be done by non-clog, centrifugal, semi open type continuous duty & suitable capacity sludge re-circulation pumps.

Table 2-23: **Expected Characteristics of Secondary Treated Wastewater**

S.No.	Parameter	Concentration
1	pH	7.5 – 8.5
2	TSS	< 50 mg/l
3	TDS	< 2800 mg/l
4	BOD (5 day @ 20 °C	80 to 100 mg/l
5	COD	400 to 450 mg/l
6	Temperature °C	Ambient

2.9.6 Tertiary Treatment System

The tertiary treatment comprises of PSF and ACF.

2.9.6.1 Filtration by PSF & ACF

The clear water from Biological treatment is collected into filter feed tank from here further fed to Multigrade Sand Filter followed by activated carbon filter for removal of suspended solids and for clarity of water.

Outlet from ACF shall be treated water & meet the norms prescribed by the pollution control board for safe disposal for marine

The sludge from the tertiary settling tank is pumped to sludge sump for onward handling and disposal. The expected characteristics of the Tertiary treated wastewater are given in **Table 2-24.**

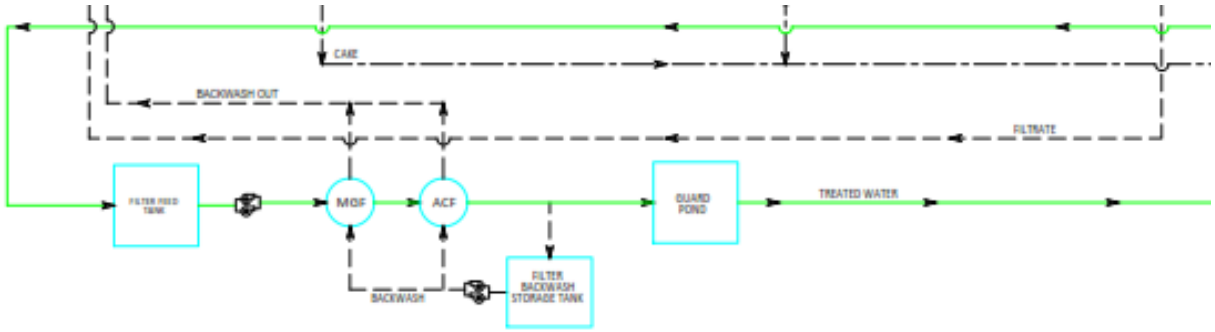

Figure 2-11: Proposed Tertiary Treatment System (Refer Drawing No. 201)

Table 2-24: **Expected Characteristics of Tertiary Treated Wastewater**

S.No.	Parameter	Concentration
1	pH	6.5 – 9
2	TSS	< 20 mg/l
3	TDS	< Sea Water TDS in mg/l
4	BOD (5 day @ 20 ^{o}C	< 100 mg/l
5	COD	< 250 mg/l
6	Temperature ^{o}C	Ambient
7	Cyanides as CN^{-}	< 0.2 mg/l
8	Chromium (Total) as Cr	< 1 mg/l
9	NH_3-N	< 50 mg/l

2.9.7 Sludge Handling & Treatment System

2.9.7.1 Primary Sludge

The sludge generated in the primary clariflocculator will be sent to primary sludge storage tank respectively for HTDS & LTDS system. The collected sludge will be feed to centrifuge / Screw press for LTDS/HTDS primary sludge) for dewatering of sludge. The dried sludge will be sent to TSDF and the filtrate will be sent to effluent collection tank.

2.9.7.2 Secondary Sludge

Sludge from SBR tanks & settling tank (Electro-Oxidation) will be sent to sludge thickener. The thickened sludge will be further feed to centrifuge for dewatering of sludge. The dried sludge will be sent to sludge digester and further sent to TSDF and the filtrate will be sent to effluent collection tank.

2.9.7.3 Sludge Disposal

The sludge and salts generated from the proposed CETP have to be disposed at Hazardous Waste Disposal Facility. The nearest facility is located in Vishakhapatnam (Ramky Pharma city). The CETP operator has to handle the sludge storage and disposal in conformity to MoEF & PCB directives. As per MoEF & PCB directives, the Hazardous waste (CETP sludge) generated from APSEZ shall be sent to nearby Transport Storage and Disposal Facility (TSDF) at Ramky Pharma city till the APSEZ develops their own dedicated TSDF.

2.10 Design Calculations

2.10.1 Process-wise Effluent Parameters Reduction

The process wise effluent parameters reduction for HTDS effluent treatment are given in **Table 2-25**.

Table 2-25: HTDS Effluent Parameters Reduction

S.No	Parameters	Unit	Value	After Primary Treatment	After Stripper	After MEE	After ATFD	Solid waste
1	Flow	m3/day	2000	1950	1920			129 ton
2	pH	-	5.5 - 9.0	7.0 - 7.5	7.0 - 7.5	5.5-6	8.5- 9	
3	TSS	mg/l	3000	450-500	100	NIL	NIL	
4	TDS	mg/l	80,000	80000	80000	500	500	
5	COD	mg/l	50000	59820	30850	13000	25000	
6	NH3-N	mg/l	3000	2100	1025	500	2900	

Table 2-26: LTDS and Combined Effluent Parameters Reduction

Sl.No.	Description	Volume	TDS		COD		BOD		NH3		TSS		HRT	Remarks
		m3	mg/lt	kg/d	mg/lt	kg/d	mg/lt	kg/d	mg/lt	kg/d	mg/lt	kg/d	Days	
1	LTDS Waste Water	3000	3500	10500	8000	24000	3600	10800	40	120	600	1800		
2	MEE Condensate	1484	800	1187	13000	19292	7800	11575	500	742	*	*		
3	ATFD Condensate	143	100	14	25000	3575	15000	2145	2500	358	*	*		
4	CT water	400	3500	1400	3000	1200	1350	540	150	60	200	80		
5	Combined Wastewater	**5027**	**2606**	**13102**	**9562**	**48067**	**4985**	**25060**	**255**	**1280**	**374**	**1880**	**10.0**	ASP -IV-VI,
														VII, VIII & IX
6	After Considering 18 % COD & 75 % SS removal efficiency at PST	2910	3500	10185	6800	19788	3060	8905	40	80	150	437		
7	Combined WW of Condensate and CT WW	2027	1283	2602	11873	24067	7035	14260	572	1160				3.0 % sludge generation
8	After pre Aeration of condensate + CT water	2027	1604	3252	4749	9627	2375	4813	486	986				60% & 15% removal efficiency of COD & NH3-N
9	After mixing with pre treated condensate and pre treated LTDS WW	4937	2722	13437	**5958**	29415	**2779**	13718	216	1066				
10	BDN / Anoxic Tank													
11	After 1st stage of SBR	4937	2722	13437	1192	5883	417	2058	65	320				80% COD & BOD & 70% NH3- N removal
12	After 2nd stage of SBR	4937	2722	13437	238	1177	63	309	26	128				80% COD & 60% NH3-N removal efficiency
13	After Tertiary Treatment	4937	2722	13437	191	941	53	262	26	128				20 % COD & 10 % BOD removal efficiency

2.10.2 Air Requirement Calculation

Table 2-27: Air requirement Calculation

Sl.No.	Description	Volume	TDS		COD		BOD		NH3		Remarks	
		m3	mg/lt	kg/d	mg/lt	kg/d	mg/lt	kg/d	mg/lt	kg/d		
1	Combined WW of Condensate and CT WW	2027	1283	2602	11873	24067	7035	14260	572	1160	60% & 20% COD & NH3-N removal efficiency	
	O2 required AOR							7487		1078	8565	kg of O2/d
	SOR										19699	kg of O2/d
											821	kg of O2/hr
	O2 Transfer										1.7	kg/kw
											483	kw/hr
	Total HP										**647**	**HP**
	11 nos of 60 HP floating aerators										**11**	**Nos**
	11 nos Blowers of 10 HP										**108**	**HP**
	Total HP										**755**	**HP**
2	After mixing with pre treated condensate and pre treated LTDS WW	4937	2722	13437	5958	29415	2779	13718	216	1066	85% BOD & 70% COD & NH3-N removal efficiency	
	O2 required AOR							17490		3468	20959	kg of O2/d
	SOR										48205	kg of O2/d
											2678	kg of O2/hr
	O2 Transfer										1.7	kg/kw
											1575	kw/hr
	Total HP										**2112**	**HP**
	35 nos of 60 HP floating aerators										**35**	**Nos**
	35 nos Blowers of 10 HP										**352**	**HP**
	Total HP										**2464**	**HP**
3	After 1st stage of SBR	4937	2722	13437	1192	5883	417	2058	65	320	80% COD, BOD & 60% COD & NH3- N removal efficiency	
	O2 required AOR							2469		892	3361	kg of O2/d
	SOR										7731	kg of O2/d
											429	kg of O2/hr
	O2 Transfer										1.7	kg/kw
											253	kw/hr
	Total HP										**339**	**HP**
	11 nos of 30 HP floating aerators										**11**	**Nos**
	11 nos Blowers of 5 HP										**56**	**HP**
	Total HP										**395**	
4	**BDN / Anoxic Tank**											
	BDN Volume	**15000**									**288**	**HP**
	Mixers										**3.8**	**Nos**
	4 nos of 75 HP mixers										**300**	**HP**
	Total HP										**3914**	**HP**

3 SPECIFICATIONS & DETAILS

3.1 Chrome Effluent Treatment System

The Chrome effluent treatment system specifications are provided in **Table 3.1**.

Specification Table 3-1: Chrome Effluent Treatment specifications

Chrome Effluent Treatment specifications			
1	**Sample Platform**		
	Application	:	To collect sample from inlet tankers
	Type	:	Rectangular
	MOC	:	RCC M30
	Size (Meters)	:	1.0 x 1.0 x 0.15 m
	Quantity	:	1 No
2	**Bar Screen Chamber**		
	Application	:	To Screen the floatable solids
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	Velocity	:	0.6 M/Sec
	Area of screen channel	:	0.01 Sq. m
	Liquid depth	:	1.0 M
	Length of the chamber	:	1.0 M
	Size (Meters)	:	1.0 x 1.0 x 1.0 LD + 0.3FB
	Effective Volume	:	1 m3
	Quantity	:	One No.
	Screen		
	Type	:	Manual
	Make	:	Fabricated
	MOC of screen	:	SS
	Bar Sizing	:	6 mm flat strip
	Bar Spacing	:	10 mm
	Size	:	600 x 1000 mm
	Quantity	:	One No.
3	**GRIT CHAMBER**		
	Application	:	For removal of Grit Particles
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	1 m3

Chrome Effluent Treatment specifications			
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Quantity	:	1 No
4	**OIL & GREASE CHAMBERS**		
	Application	:	To separate scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Effective volume	:	1 m3
	Quantity	:	3 Nos
	Total volume	:	1 m3 x 3 = 3 m3
5	**OIL & GREASE COLLECTION CHAMBER**		
	Application	:	To collect scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	1 m3
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Quantity	:	1 No
6	**CHROME EFFLUENT COLLECTION TANK**		
	Application	:	Collection of Chrome effluent
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	1 day
	Volume required	:	100 m3
	Size (Meters)	:	6.7 X 6.0 X 2.5 LD+ 0.3FB
	Quantity	:	1 No
7	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to Reaction tank
	Location	:	Inside of effluent Collection Tank
	Type	:	Non clog, Self-priming centrifugal pumps with all wetted parts in SS 316 / PP
	Make	:	Kishore / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)

Chrome Effluent Treatment specifications			
8	**REACTION TANK**		
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	20 min
	Volume	:	2 m3
	Size (Meters)	:	1.0 x 1.0 x 2.0 +0.3 FB
	Mixing arrangement	:	Agitator with Motor & Gear box arrangement
	Quantity	:	1 No
9	**FLOCCULATION TANK**		
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	10 min
	Volume	:	1 m3
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Mixing arrangement	:	Agitator with Motor & Gear box arrangement
	Quantity	:	1 No
10	**H2SO4 preparation tank**		
	Application	:	Preparation of H2SO4 Chemical
	Type	:	Circular
	MOC	:	PP FRP
	Volume	:	1 m3
	Size (m)	:	1.2 Dia x 1.0LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	40 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	1 No
11	**NaHSO3 preparation tank**		
	Application	:	Preparation of NaHSO3 Chemical
	Type	:	Circular
	MOC	:	PP FRP
	Volume	:	1 m3
	Size (m)	:	1.2 Dia x 1.0LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement

Chrome Effluent Treatment specifications			
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	40 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
12	**Ca(OH)2 preparation tank**		
	Application	:	Preparation of Ca(OH)2 Chemical
	Type	:	Circular
	MOC	:	PP FRP
	Volume	:	1 m3
	Size (m)	:	1.2 Dia x 1.0LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	40 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
13	**LAMELLA CLARIFIER**		
	Application	:	For Removal of suspended solids
	Location	:	After flocculation tank
	Type	:	Non clog, Submersible
	Make	:	Kishore / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)
14	**INTERMEDIATE COLLECTION TANK**		
	Application	:	Collection of Clear water from Lamella clarifier
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	2 hrs
	Volume required	:	10 m3
	Size (Meters)	:	2.0 X 2.5 X 2.0 LD+ 0.3FB

Chrome Effluent Treatment specifications			
	Quantity	:	1 No
15	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to stripper feed tank
	Location	:	Near Intermediate collection tank
	Type	:	Non clog, Centrifugal
	Make	:	Kirloskar / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)

3.2 Cyanide Effluent Treatment System

The Cyanide effluent treatment system specifications are provided in **Table 3.2**.

Specification Table 3-2: **Cyanide Effluent Treatment specifications**

Cyanide Effluent Treatment specifications			
1	**Sample Platform**		
	Application	:	To collect sample from inlet tankers
	Type	:	Rectangular
	MOC	:	RCC M30
	Size (Meters)	:	1.0 x 1.0 x 0.15 m
	Quantity	:	1 No
2	**Bar Screen Chamber**		
	Application	:	To Screen the floatable solids
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	Velocity	:	0.6 M/Sec
	Area of screen channel	:	0.01 Sq. m
	Liquid depth	:	1.0 M
	Length of the chamber	:	1.0 M
	Size (Meters)	:	1.0 x 1.0 x 1.0 LD + 0.3FB
	Effective Volume	:	1 m3
	Quantity	:	One No.
	Screen		

Cyanide Effluent Treatment specifications			
	Type	:	Manual
	Make	:	Fabricated
	MOC of screen	:	SS
	Bar Sizing	:	6 mm flat strip
	Bar Spacing	:	10 mm
	Size	:	600 x 1000 mm
	Quantity	:	One No.
3	**GRIT CHAMBER**		
	Application	:	For removal of Grit Particles
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	1 m3
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Quantity	:	1 No
4	**OIL & GREASE CHAMBERS**		
	Application	:	To separate scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Effective volume	:	1 m3
	Quantity	:	3 Nos
	Total volume	:	1 m3 x 3 = 3 m3
5	**OIL & GREASE COLLECTION CHAMBER**		
	Application	:	To collect scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	1 m3
	Size (Meters)	:	1.0 x 1.0 x 1.0 +0.3 FB
	Quantity	:	1 No
6	**Cyanide Effluent collection tank**		
	Application	:	Collection of Cyanide effluent
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	1 day
	Volume required	:	100 m3
	Size (Meters)	:	6.7 X 6.0 X 2.5 LD+ 0.3FB

Cyanide Effluent Treatment specifications			
	Quantity	:	1 No
7	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to Reaction tank
	Location	:	Inside of effluent Collection Tank
	Type	:	Non clog, Submersible
	Make	:	Kishore / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)
8	**REACTION TANK**		
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	20 min
	Volume	:	2 m3
	Size (Meters)	:	1.0 x 1.0 x 2.0 +0.3 FB
	Mixing arrangement	:	Agitator with Motor & Gear box arrangement
	Quantity	:	1 No
9	**NaOH preparation tank**		
	Application	:	Preparation of NaOH Chemical
	Type	:	Circular
	MOC	:	PP FRP
	Volume	:	1 m3
	Size (m)	:	1.2 Dia x 1.0LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	40 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	1 No
10	**NaOCL preparation tank**		
	Application	:	Preparation of NaOCL Chemical
	Type	:	Circular
	MOC	:	PP FRP

Cyanide Effluent Treatment specifications			
	Volume	:	1 m3
	Size (m)	:	1.2 Dia x 1.0LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	40 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	1 No
11	**LAMELLA CLARIFIER TANK**		
	Application	:	Collection of Clear water from Lamella clarifier
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	3 hrs
	Volume required	:	15 m3
	Size (Meters)	:	4.0 X 2.5 X 2.0 LD+ 0.3FB
	Quantity	:	1 No
12	**LAMELLA CLARIFIER**		
	Application	:	For Removal of suspended solids
	Location	:	After flocculation tank
	Type	:	Non clog, Submersible
	Make	:	Kishore / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)
13	**INTERMEDIATE COLLECTION TANK**		
	Application	:	Collection of Clear water from Lamella clarifier
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	5 cum/hr
	HRT	:	2 hrs
	Volume required	:	10 m3
	Size (Meters)	:	2.0 X 2.5 X 2.0 LD+ 0.3FB

Cyanide Effluent Treatment specifications			
	Quantity	:	1 No
14	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to stripper feed tank
	Location	:	Near Intermediate collection tank
	Type	:	Non clog, Centrifugal
	Make	:	Kirloskar / Equivalent
	MOC	:	CI
	Capacity	:	5 M3/Hr
	Head	:	20 Meters
	Drive	:	2 HP
	Quantity	:	2 Nos (1 W + 1 S)

3.3 HTDS Primary Treatment System

The HTDS primary treatment system specifications are provided in **Table 3.3**.

Specification Table 3-3: **HTDS Primary Treatment specifications required for CETP**

HTDS Primary Treatment specifications			
1	**Sample Platform**		
	Application	:	To collect sample from inlet tankers
	Type	:	Rectangular
	MOC	:	RCC M30
	Size (Meters)	:	2.0 x 1.0 x 0.15 m
	Quantity	:	1 No
2	**Bar Screen Chamber**		
	Application	:	To Screen the floatable solids
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	200 cum/hr
	Velocity	:	0.6 M/Sec
	Area of screen channel	:	0.23 Sq. m
	Liquid depth	:	1.0 M
	Length of the chamber	:	3.5 M
	Size (Meters)	:	3.5 x 1.5 x 1.0 LD + 0.3FB
	Effective Volume	:	5.25 m3
	Quantity	:	One No.
	Screen		
	Type	:	Manual
	Make	:	Fabricated

HTDS Primary Treatment specifications			
	MOC of screen	:	SS
	Bar Sizing	:	6 mm flat strip
	Bar Spacing	:	10 mm
	Size	:	600 x 1000 mm
	Quantity	:	One No.
3	**VORTEX TYPE GRIT REMOVAL SYSTEM**		
	Capacity	:	2 MLD
	Grit production rate (m3/day)	:	Grit Design Load: Typically < 0.1 M3/ MLD
	Settled grit specific gravity	:	2.65 and above.
	Particle Removal efficiency, 0.15 mm and above	:	95% of grit size 150 microns and larger
	Organic matter in waste grit (no TSS Removal is considered in Grit Chamber)	:	10%
4	**GRIT COLLECTION CHAMBER**		
	Application	:	For collection of Grit Particles
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	10 m3
	Size (Meters)	:	3.5 x 1.75 x 1.7 +0.3 FB
	Quantity	:	1 No
5	**OIL & GREASE CHAMBERS**		
	Application	:	To separate scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	200 cum/hr
	HRT	:	12 Min
	Volume required	:	45 m3
	Size (Meters)	:	3.5 x 3.0 x 1.5 LD + 300 FB
	Effective volume	:	15 m3
	Quantity	:	3 Nos
	Total volume	:	15 m3 x 3 = 45 m3
6	**OIL & GREASE COLLECTION CHAMBER**		
	Application	:	To collect scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	10 m3
	Size (Meters)	:	3.5 x 1.75 x 1.7 +0. FB
	Quantity	:	1 No

HTDS Primary Treatment specifications			
7	**INTERMEDIATE COLLECTION TANK**		
	Application	:	Collection of Inlet Low TDS effluent
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	200 cum/hr
	HRT	:	1 hr
	Volume required	:	200 m3
	Size (Meters)	:	13.3 x 6.0 x 2.5 LD + 0.3FB
	Quantity	:	1 No
8	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to Collection/ Equalization tank
	Location	:	Inside of Intermediate Collection Tank
	Type	:	Non clog, Submersible
	Make	:	Kishore
	MOC	:	CI
	Capacity	:	200 M3/Hr
	Head	:	20 Meters
	Drive	:	15 HP
	Quantity- 1st Stage	:	2 Nos (1 W + 1 S)
	Quantity- 2nd Stage	:	2 Nos (1 W + 1 S)
9	**COLLECTION/ EQUALIZATION TANK**		
	Application	:	Homogenization of Effluent
	Type	:	Rectangular
	Flow rate	:	100 cum/hr
	HRT	:	54 hrs
	MOC	:	RCC M30
	Volume	:	4500 m3
	Size (Meters)	:	20 x 25.0 x 3.0 LD +0.3 FB
	Effective volume	:	1500 m3
	Quantity	:	3 Nos
	Total volume	:	1500 X 3 Nos = 4500 m3
	AIR BLOWER FOR EQUILIZATION TANK		
	Type	:	Roots blower
	Air Blower capacity	:	750 cum/hr at 0.4 kg/sq.cm
	Drive	:	25 HP
	Quantity	:	6 Nos (3W+3Sb)

HTDS Primary Treatment specifications			
	Application	:	Providing proper mixing in the Equalization Tank
	Mixing arrangement-Air Purging grid		
	Type	:	Silicon Coarse bubble diffused aeration with pipeline
	MOC	:	HDPE with MS header.
	Distribution	:	Air distribution channel extending over the effective length guarantees an even distribution of air.
	Quantity	:	One Lot
	Application	:	Air distribution
10	**EFFLUENT FEED PUMPS**		
	Application	:	For effluent feed to Neutralization tank
	Location	:	Near Equalization tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	100 M3/Hr
	Head	:	15 Meters
	Drive	:	15 HP
	Quantity	:	2Nos (1W + 1S)
11	**NEUTRALIZATION TANK**		
	Application	:	Neutralization of effluent
	Location	:	After Equalization tank
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	100 m3/hr
	HRT	:	1 hr
	Volume	:	100 m3
	Size (Meters)	:	8.0 x 6.25 x 2.0+0.3 FB
	Quantity	:	1 No
	Mixing arrangement		
	Air Blower capacity	:	50 cum/hr at 0.4 kg/sq.cm
	Drive	:	5 HP
	Quantity	:	2 Nos (1W+1Sb)
	Air Grid		
	Type	:	Silicon Coarse bubble diffused aeration with pipeline
	MOC	:	HDPE with MS header.
	Quantity	:	One Lot

HTDS Primary Treatment specifications			
	Application	:	Providing proper mixing in the Neutralization Tank
12	**FLASH MIXER**		
	Application	:	Mixing of Coagulants
	Location	:	After Neutralization tank
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	100 m3/hr
	HRT	:	3 min
	Volume required	:	5 m3
	Size (Meters)	:	2.5 x 1.7 x 1.2LD+0.3 FB
	Quantity	:	1 No
	Mixing arrangement	:	Agitator with Motor arrangement
13	**FLOCCULATION TANK**		
	Application	:	Mixing of Flocculants
	Location	:	After Flash Mixer
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	100 m3/hr
	HRT	:	6 min
	Volume required	:	10 m3
	Size (mm)	:	2.5 x 2.7 x 1.5LD+0.3 FB
	Quantity	:	1 No
	Mixing arrangement	:	Agitator with Motor & Gear box arrangement
14	**Lime/ Caustic preparation tank**		
	Application	:	Preparation of Lime/ Caustic Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (m)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
15	**HCL preparation tank**		

HTDS Primary Treatment specifications			
	Application	:	Preparation of HCL Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (m)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
16	**Alum/ PAC preparation tank**		
	Application	:	Preparation of Alum/ PAC Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (m)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
17	**Poly preparation tank**		
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)

HTDS Primary Treatment specifications			
18	**PRIMARY CLARIFLOCCULATOR**		
	Application	:	For complete removal of TSS, Oil, Scum etc.,
	Location	:	After Flocculation tank
	Type	:	Circular
	MOC	:	RCC M30
	Flow rate	:	100 m3/hr
	HRT	:	4 hrs
	Volume required	:	400 m3
	Size (Meters)	:	13.0 dia X 3.0 LD+ 0.3FB
	Quantity	:	1 No
19	**SLUDGE HANDLING**		
	Total Suspended solids	:	3000 ppm
	Sludge quantity	:	300 m3
20	**PRIMARY SLUDGE HOLDING TANK**		
	Application	:	Collection of primary sludge
	Location	:	At primary clariflocculator
	Type	:	Circular
	MOC	:	RCC M30
	Size (Meters)	:	11.0 dia X 2.2 LD + 0.3 FB
	Volume	:	200 m3
	Quantity	:	1 No
21	**SLUDGE FEED PUMPS**		
	Application	:	For Sludge feed to centrifuge
	Location	:	Near Primary sludge holding tank
	Type	:	Non clog, Centrifugal, Self priming
	Make	:	Reputed
	MOC	:	CI
	Capacity	:	15 M3/Hr
	Head	:	15 Meters
	Drive	:	5 HP
	Quantity	:	2 Nos (1W + 1S)
22	**DEWATERING UNIT**		
	Application	:	Dewatering of primary sludge
	Type	:	Screw Press
	Feed flow	:	15 cum/hr
	Operation hrs/ day	:	12-16 hrs
	Quantity	:	2 No
23	**Poly preparation tank**		

HTDS Primary Treatment specifications			
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	1.5 m3
	Size (Meters)	:	1.25 dia X 1.3 +0.3 FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)

3.4 HTDS Secondary Treatment System

3.4.1 Stripper, MEE & ATFD units Specifications

Design Basis:

- Feed quantity : 1000 KLD (1 No's) & 500 KLD (2 No's)
- Specific gravity : 1.04
- Feed temperature : Ambient (30 ^{o}C)
- Operation : Continuous
- Initial concentration : Average 6.2% (W/W)
- Motive fluid is Steam at : 5 Kg / cm^2 G
- Steam Quality : Saturated, Dryness fraction > 0.96
- Cooling water temperature : 32 Deg C
- Compressed air with low due point Suitable for Instruments : 4 kg/cm^2

Tray type stripper column are proposed to remove the low volatile organics. This is to bring down bulk of COD in the effluent feed to Evaporator. For the removal of the bulk of the water from the effluent, we have considered 5 effects forced evaporation system as per the customer's requirement. Dry saturated Steam is used as motive fluid for water evaporation and the evaporator is to be operated under vacuum.

The effluent feed meeting the specifications is preheated in a Re boiler and admitted to the stripper column. In the stripper the low boiling solvents are vaporized and rise to the top of the trays stripper. The vapours are condensed in a tubular heat exchanger and solvent is collected. To improve the efficiency of stripping part of the solvent condensate is used as reflux. The solvent less effluent water

collected as bottom product of the stripper is continuously recycled back to the stripper column through the re boiler. Part of this water is sent to the MEE for concentration.

The concentration of the low COD feed to around 45% solids is effected in a 6 effect forced recirculation evaporator. The dry saturated steam is used as heating medium for water evaporation.

As the composition of the feed effluent particularly with respect to type of solvents is not known to the customer, the stripper is designed based on the assumption that most of the solvent present are low boiling with a maximum B.P of 85C. However the stripper is designed to operate at a maximum temperature of 100 C so that the maximum removal of the organics is effected.

The evaporator is calandria type long vertical tubular heat exchangers with steam on the shell side. Feed is pumped to the Calandria tubes at the desired rate and Dry saturated steam/vapor is supplied as heating medium in the jacket which causes heating of the liquor in the tubes. The vapors from each calandria are flashed in vapor separator. Suitable arrangement in the vapor separator are made for effective vapor liquid separation. The concentration of TDS is increased stage wise and in the last stage 40-45% TDS is achieved. The vapour from the last stage is condensed in a condenser and the condensate is stored by the customer.

All the 6 stages of evaporation are forced circulation type to prevent the settling of solids and also to improve the heat transfer coefficient. Calandrias will be provided with quick detachable top cover for visual inspection/ cleaning of the tubes. Sight glasses are provided in the jackets to monitor the condensate level in each effect. Each Calandria is provided with an independent pre heater to increase the feed temperature and thus better energy utilization Necessary nozzles for steam/ vapor condensate, non-condensable, air vent, product inlet, concentrate outlet etc., are provided.

The MEE system is operated under vacuum Water ring vacuum pump is considered for the vacuum generation in the system. Double mechanical seal pumps with cooling water as sealant are deployed in the entire facility for better maintenance for vacuum.

The process parameters such as vacuum, Temperatures, flow rates of various stress, the levels of liquid in the tanks, vapour separators etc., are monitored constantly through necessary field instruments electro pneumatic/electronic. The total facility is operated from a centralized electrical and instruments control panel.

3.4.1.1 Common Facility for Stripper, MEE & ATFD

The Common facility system required for Stripper, MEE & ATFD are provided in **Specification Table 3.4**.

Specification Table 3-4: Common Facility System Required for Stripper, MEE & ATFD

Common Facility System Required for Stripper, MEE & ATFD			
1	**STRIPPER FEED TANKS**		
	Application	:	For collecting the clear water from primary clariflocculator
	Location	:	After Primary clariflocculator
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	100 m3/hr
	HRT	:	8 hrs
	Volume required	:	840 m3
	Size (Meters)	:	20.0 X 7.0 X 3.0 LD + 0.3FB
	Effective volume	:	420 m3
	Quantity	:	2 Nos
	Total volume	:	420 m3 X 2= 840 m3
2	**SOLVENT STORAGE TANK (STRIPPER DISTILLATE)**		
	Application	:	For collection of stripper distillate
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	100 m3
	Size (Meters)	:	5.0 X 7.0 X 3.0 LD + 0.3FB
	Quantity	:	1 No
3	**SOLVENT TRANSFER PUMPS**		
	Application	:	Transfer of stripper solvent
	Location	:	Solvent storage tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	15.0 M3/Hr
	Head	:	15 Meters
	Drive	:	5 HP
	Quantity	:	2 Nos (1W +1S)
4	**MEE FEED TANK**		
	Application	:	For collection of stripper outlet
	Type	:	Rectangular

Common Facility System Required for Stripper, MEE & ATFD			
	MOC	:	RCC M30
	Volume	:	690 m3
	Size (Meters)	:	20.0 X 11.5 X 3.0 LD + 0.3FB
	Quantity	:	1 No
5	**MEE CONCENTRATE STORAGE TANKS**		
	Application	:	For collection of MEE Concentrate
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	342 m3
	Size (Meters)	:	20.0 X 5.7 X 3.0 LD + 0.3FB
	Effective volume	:	342 m3
	Quantity	:	2 Nos
	Total volume	:	342 m3 X 2= 684 m3
6	**MEE CONDENSATE TANK**		
	Application	:	For collection of MEE Condensate
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	600 m3
	Size (Meters)	:	20.0 X 10.0 X 3.0 LD + 0.3FB
	Quantity	:	1 No
7	**MEE CONDENSATE TRANSFER PUMPS**		
	Application	:	To transfer MEE condensate
	Location	:	MEE condensate tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	CI
	Capacity	:	100 M3/Hr
	Head	:	15 Meters
	Drive	:	20 HP
	Quantity	:	2 Nos (1W+1S)
8	**ATFD CONDENSATE TANK**		
	Application	:	For collection of MEE Condensate
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	210 m3
	Size (Meters)	:	20.0 X 3.5 X 3.0 LD + 0.3FB
	Quantity	:	1 No
9	**ATFD CONDENSATE TRANSFER PUMPS**		

Common Facility System Required for Stripper, MEE & ATFD			
	Application	:	To transfer ATFD condensate
	Location	:	ATFD condensate tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	CI
	Capacity	:	10 M3/Hr
	Head	:	15 Meters
	Drive	:	5 HP
	Quantity	:	2 Nos (1W+1S)
10	**CONDENSATE STORAGE TANK**		
	Application	:	For collection of MEE & ATFD Condensate
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	1 day
	Volume	:	1080 m3
	Size (Meters)	:	18.0 X 20.0 X 3.0 LD + 0.3FB
	Quantity	:	1 No
11	**CONDENSATE TRANSFER PUMPS**		
	Application	:	Condensate transfer to Pre-Aeration tank
	Location	:	ATFD condensate tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	CI
	Capacity	:	100 M3/Hr
	Head	:	15 Meters
	Drive	:	15 HP
	Quantity	:	2 Nos (1W+1S)
12	**CIP TANK**		
	Application	:	Cleaning In Process
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	50 m3
	Size (Meters)	:	5.0 X 4.0 X 2.5 LD + 0.3FB
	Quantity	:	2 Nos
13	**CIP water transfer pumps**		
	Application	:	To transfer CIP water to HTDS collection tanks
	Location	:	CIP tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson

Common Facility System Required for Stripper, MEE & ATFD			
	MOC	:	SS304
	Capacity	:	5 M3/Hr
	Head	:	15 Meters
	Drive	:	3 HP
	Quantity	:	2 Nos (1W+1S)
14	**ACID STORAGE TANK FOR CIP**		
	Application	:	Storage of Acid Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	50 m3
	Size (Meters)	:	5.65 dia X 2.0 LD + 0.3FB
	Quantity	:	1 No

3.4.1.2 Stripper, MEE & ATFD (1000 KLD Capacity x 1 Nos)

The Typical material balance for (1000 KLD x 1 Nos) Stripper followed by MEE & ATFD are provided in **Figure 3.1**.

TYPICAL MATERIAL BALANCE FOR (1000 KLD X 1 No's) STRIPPER FOLLOWED BY MEE, ATFD

(Hourly basis. All quantities in Kg/hr)

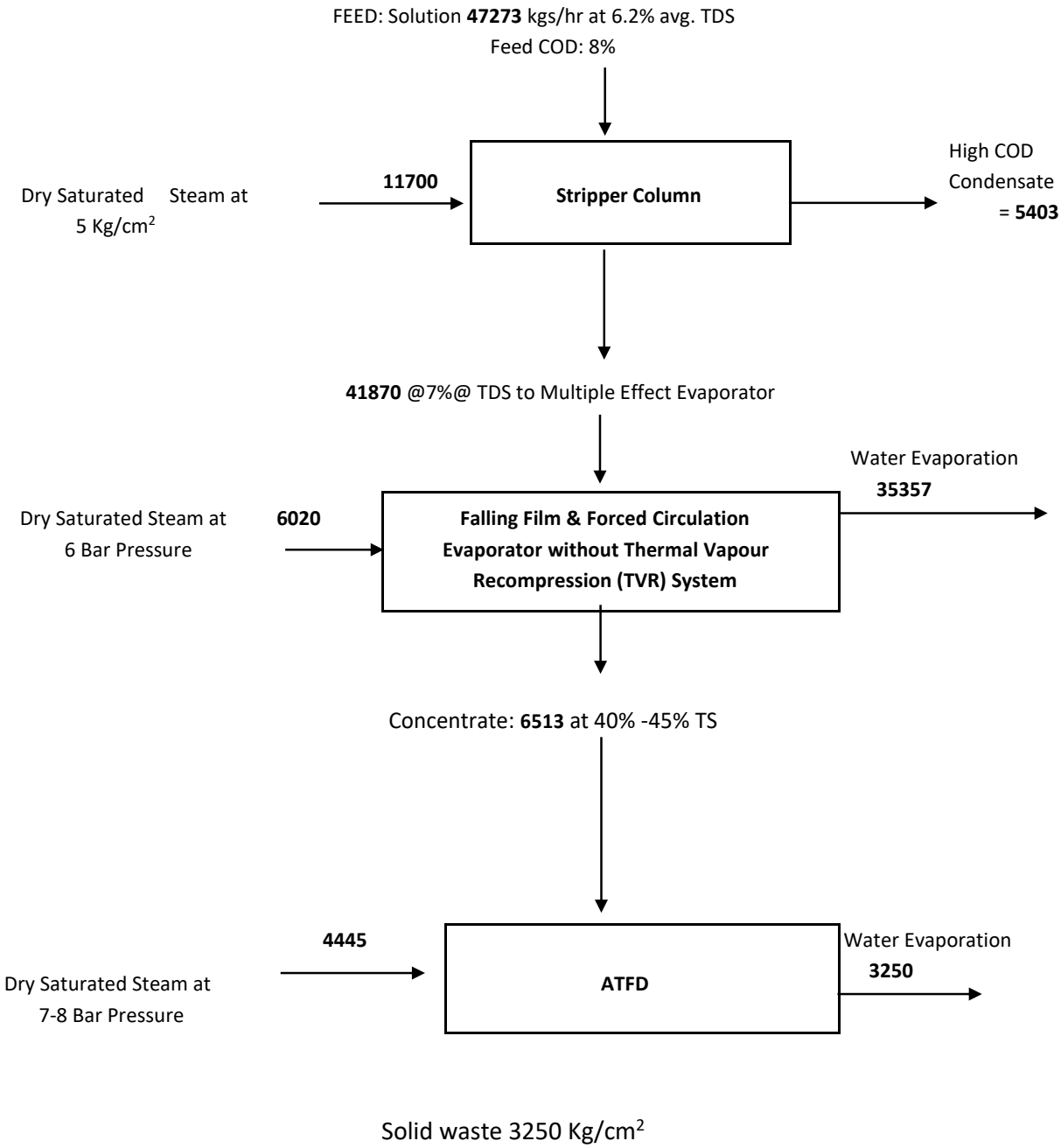

Figure 3-1: Material Balance for 1000 KLD Stripper followed by MEE & ATFD

The HTDS secondary treatment system specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos are provided in **Table 3.5**.

Specification Table 3-5: **Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos**

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
1	**STRIPPER COLUMN**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Tray column 2.5 Dia
	Type of Tray	:	Sieve
	MOC – Contact Part	:	SS 316 L
	MOC – Non Contact Part	:	MS
	Height	:	15 mts
	Quantity	:	1 Nos (1W)
2	**REBOILER**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Shell & Tube
	Dia	:	1.9 mts
	MOC - Tube	:	SS 2205, ERW, 18 SWG (1.21mm) & 3 mts Long Tube
	MOC – Shell/ Buffle	:	MS
	Dish ends /Bonnets	:	SS 2205
	Tube sheet	:	SS 2205
	Body flanges	:	MS with SS lining
	Stiffeners	:	SS 304
	Supports & Non-contact part	:	MS
	Qty	:	1 Nos (1W)
3.	**Main condenser**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Shell & Tube
	Tubes	:	SS 304, ERW, 18 SWG (1.21mm) 3 M long
	Shell	:	SS 304
	Dish ends	:	SS 304
	Tube sheet	:	SS 304
	Body flanges	:	MS with SS lining
	Stiffeners	:	SS 304
	Supports & Non-contact part	:	MS

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
	Quantity	:	1 No's (1W)
4.	**Reflux pot**		
	Application	:	Product to Stripper
	Location	:	Stripper
	Type	:	Vertical & Cylindrical
	MOC – Contact Parts	:	SS 304
	MOC – Non Contact Parts	:	MS
	Quantity	:	1 No's (1W)
5.	**BOTTOM TRANSFER PUMP**		
	Application	:	Effluent
	Location	:	Stripper
	Type	:	Non clog, Centrifugal, FLP
	MOC – Contact Parts	:	CD4MNCu
	Capacity	:	50 M3/Hr
	Head	:	40 mts
	Quantity	:	2 Nos (1W+1 S)
6	**STRIPPER FEED PUMPS**		
	Application	:	Feed to Stripper
	Location	:	Stripper feed tanks
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	50 M3/Hr
	Head	:	15 Meters
	Drive	:	20 HP
	Quantity	:	2 Nos (1W +1S)
7	**REFLUX PUMP**		
	Application	:	Enriching of stripper distillate
	Location	:	Stripper
	Type	:	Non clog, Centrifugal, FLP
	MOC	:	SS 304
	Capacity	:	15 M3/Hr
	Head	:	30 Meters
	Drive	:	5 HP
	Quantity	:	2 No's (1W +1S)
8	**PIPES & FITTING**		
	Feed and Product	:	Pipe, Stub end, Reducer, Expander, Bend – SS 316L;

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
	Condensate	:	Pipe, Stub end, Reducer, Expander, Bend – SS 304;
	Water Piping	:	SS 304
	Pipe Schedule	:	SS piping Up to 50 NB - sch-10, Above 50 NB – Sch 5 Fabricated Ducts - min 3 mm Thk
	Flanges and Nozzles	:	MS with SS Stubend or Lining, Nozzles upto 50 NB SCH 40 and above Sch 10
9	**COMPLETE INTERCONNECTING PIPING**		
	Qty	:	1 lot
	MOC – Contact parts	:	SS 316 &
	MOC – Non contact parts	:	MS
10	**Insulation & cladding**		
	Qty	:	1 lot
11	**MEE FEED STRAINER**		
	Application	:	Filter the incoming liquid.
	Type	:	Duplex Basket with filter elements
	MOC	:	SS 2205
	Filer mesh size	:	Suitable
	Quantity	:	2 No
12	**MEE FEED PUMPS**		
	Application	:	Stripper outlet
	Location	:	MEE
	Type	:	Non clog, Centrifugal, FLP
	MOC – Casing	:	CD4MnCu
	MOC – Impeller	:	CD4MnCu
	Capacity	:	50 M3/Hr
	Head	:	50 Meters
	Seal	:	Double Mechanical Seal
	Quantity	:	2 No's (1W +1S)
13	**Vapour Liquid Separators**		
	Application	:	HTDS effluent
	Location	:	MEE
	Type	:	Gas Liquid separator type
	MOC	:	SS2205, External stiffener
	MOC Supports	:	SS 316
	Quantity	:	6 No's (6 W)
14	**MEE (Calendria)**		
	Type	:	Shell & Tube 2.3 m Dia. for Falling Film and 1.5

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
			m Dia. for forced circulation type
	MOC : Tubes	:	SS 2205, ERW, 1.2 mm thick , 9 m long
	Shell	:	SS 316
	Dish Ends	:	Duplex 2205
	Tube Sheet	:	Duplex 2205
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non contact parts	:	SS 316
	Quantity	:	6 No's
15	**MEE RECIRCULATION PUMPS**		
	Application	:	Calendria 1, 2 & 3 for Falling Film
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	CD4MnCu4
	MOC – Impeller	:	CD4MnCu4
	Capacity	:	400 m3/hr
	Head	:	15 mts
	Quantity	:	6 Nos (3W +3S)
16	**MEE RECIRCULATION PUMPS**		
	Application	:	Calendria 4, 5 & 6 – Forced circulation
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	CD4MnCu4
	MOC – Impeller	:	CD4MnCu4
	Capacity	:	2100 m3/hr
	Head	:	08 mts
	Quantity	:	6 Nos (3W +3S)
17	**CONDENSATE PUMPS**		
	Application	:	Condensate
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	SS 316
	MOC – Impeller	:	SS 316
	Capacity	:	50 m3/hr
	Head	:	25 mts
	Quantity	:	2 Nos (1W +1S)

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
18	**PIPES & FITTING**		
	Feed and Product	:	Pipe, Stub end, Reducer, Expander, Bend – SS 2205;
	Condensate	:	Pipe, Stub end, Reducer, Expander, Bend – SS 304;
	Water Piping	:	SS 316
	Pipe Schedule	:	SS piping Up to 50 NB - sch-10, Above 50 NB – Sch 5 Fabricated Ducts - min 3 mm Thk
	Flanges and Nozzles	:	Slip on flanges in SS 316
	Quantity	:	1 Lot
19	**VAPOR DUCTING**		
	Qty	:	1 lot
	MOC – Contact parts	:	SS 316
	MOC – Non contact parts	:	MS
20	**Insulation & cladding**		
	Quantity	:	1 lot
	Insulation	:	Mineral wool (Loose)
	Cladding	:	Aluminium (24 Gauge)
21	**STEAM PIPING**		
	MOC	:	IBR Certification
	Quantity	:	1 Lot
22	**Surface condenser**		
	Type	:	Shell and Tube
	MOC Tubes	:	SS 316, ERW, 18 SWG, 9 m long
	Shell	:	SS 316
	Dish ends	:	SS 316
	Tube sheets	:	SS 316
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non-contact parts	:	SS 316
	Quantity	:	2 No’s (1 W+ 1 S)
23	**VACCUM PUMP with motor**		
	Type	:	Water ring type with seal water
	Make	:	Prime Vacuum Pumps
	MOC – Casing	:	SS 316
	Capacity	:	500 m3/hr FAD
	Quantity	:	2 Nos (1W+1S)
24	**SEALING WATER tank**		
	Type	:	Vertical and Cylindrical

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
	Capacity	:	500 lts
	MOC	:	SS 316
	Quantity	:	2 Nos (2W)
25	**SEALING WATER Cooler**		
	Type	:	One Plate type heat exchanger
	MOC	:	Plate in SS 316
	MOC	:	End frame – MS with SS 316
	Quantity	:	1 Nos (1 W)
26	**SEALING WATER PUMP**		
	Application	:	Water
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	SS 316
	MOC – Impeller	:	SS 316
	Capacity	:	8 m3/hr
	Head	:	16 mts
	Quantity	:	3 Nos (2W +1S)
27	**BALANCE TANK FOR ATFD'S**		
	Application	:	For collection of MEE Concentrate
	Type	:	Vertical
	MOC	:	SS 316
	Volume	:	3 KL
28	**ATFD FEED PUMPS**		
	Application	:	Feed to ATFD
	Location	:	MEE Concentrate storage tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	2 M3/Hr
	Head	:	15 Meters
	Drive	:	3 HP
	Quantity	:	10 Nos (5 W+ 5S)
29	**Dryer Assembly**		
	Location	:	ATFD
	Make	:	Crompton Greaves
	MOC	:	SS 316 Ti
	Quantity	:	5 Nos

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
30	**Surface condenser**		
	Type	:	Shell and Tube
	MOC Tubes	:	SS 316, ERW, 18 SWG, 9 m long
	Shell	:	SS 316
	Dish ends	:	SS 316
	Tube sheets	:	SS 316
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non-contact parts	:	SS 316
	Quantity	:	5 No's (5 W)
31	**Condensate Extraction Pump**		
	Application	:	Condensate
	Location	:	MEE Concentrate storage tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	2 M3/Hr
	Head	:	15 Meters
	Drive	:	3 HP
	Quantity	:	10 Nos (5 W+ 5S)
32	**Centrifugal Blower**		
	Application	:	Vapour
	MOC	:	SS304
	Quantity	:	10 Nos (5 W+ 5S)
33	**Piping and ducting**		
	Quantity	:	5 Lots
	MOC Contact parts	:	SS316
	MOC – Non Contact Parts	:	SS 304
34	**ACID STORAGE TANK FOR CIP**		
	Application	:	Storage of Acid Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	50 m3
	Size (Meters)	:	5.65 dia X 2.0 LD + 0.3FB
	Quantity	:	1 No
35	**MCC PANEL**		
			Consists of a panel made of MS CRCA sheet duly powder quoted. The panel to be pre-wired to terminal connection and equipped with all

Specifications for Stripper, MEE & ATFD of capacity 1000 KLD x 1Nos			
			starters, contractors, overloads relays for drive motors and interlock sequence. MCC non-draw out type, compartmentalized, safe area type with MPCB protection type, indoor installation, floor mounted type, dust and vermin proof, weather proof with IP 42 degree of protection. The panel will be equipped with contactors, relays, sequential timer. The panel shall be pre-wired and tested before dispatch. Each starter of MCC will be consist of MPCB, Contactor, overload relay, ON/OFF/Tripped indications, Emergency stop stay put type push button. Incomer KWH meter, Voltmeter, Ammeter. 1 HP to 7.5 HP as DOL starter. 10 HP and above feeder as STAR/DELTA STARTERS. Other Specification as per Technical Annexure given by you. VFD for Feed Pump of ATFD and ATFD Rotor. MCCB for rating up to 630 Amp. Motor efficiency IE2
36	**CABLES**		
			Copper armored cable for MOTORS and copper cable for instrumentation and push buttons
37	**CABLE TRAY**		
			G I up to 500 mm with proper SS316 structure supports by client
38	**PUSH BUTTON**		
			Local Push button to be provided near the motor wherever required IP 44 protection
39	**Control Panel (PLC) – Non Flame Proof / PC Indication:**		
			PLC is provided to incorporate the operation and start - up/shut down logic. The Plant shall be controlled through PC. We will provide PLC and SCADA run time software. Also we will provide operating screens along with necessary PLC accessories. Communication between PLC, SCADA and I/O cards will be based on Ethernet / Profinet network. Capacity of SCADA software will be as per process requirement.

3.4.1.3 Cooling Tower for 1000 KLD Capacity MEE & ATFD

The proposed Cooling Tower for 1000 KLD MEE & ATFD will have 2 Cell Cross flow Wooden Cooling Tower: Capacity: 3000 TR. The Cooling Tower is an induced draft Crossflow 2 cell Timber cooling tower designed to cool 1800 M3 /hr water from 37°C to 32°C at a design WBT of 29°C. Each cell is designed to handle 600 m3/hr and equipped with 3660 mm dia Fan Assembly driven by 30 HP/1450 RPM motor through suitable spiral bevel gear reducer. The tower has to be installed on RCC basin.

The Cooling Tower specifications for 1000 KLD for MEE & ATFD are provided in **Table 3.6**.

Specification Table 3-6: **Cooling Tower for 1000 KLD Capacity MEE & ATFD System**

1	**COOLING TOWER**		
	Capacity	:	3000 TR X 1 Nos
	No. of Cells	:	3 No's
	Make	:	Induced draft cross flow
	Flow rate	:	1800 m3/hr
	Pump Flow rates	:	600 m3/hr
	Head	:	30 Meters
	Capacity	:	50 HP
	Fan Driven	:	30 HP
	Fan motor RPM	:	1450
	Pumps Quantity	:	6 Nos (3W + 3S)

3.4.1.4 Stripper, MEE & ATFD (500 KLD Capacity x 2 Nos)

The Typical material balance for (500 KLD x 2 Nos) Stripper followed by MEE & ATFD are provided in **Figure 3.2**.

TYPICAL MATERIAL BALANCE FOR (500 KLD X 2 No's) STRIPPER FOLLOWED BY MEE, ATFD

(Hourly basis. All quantities in Kg/hr)

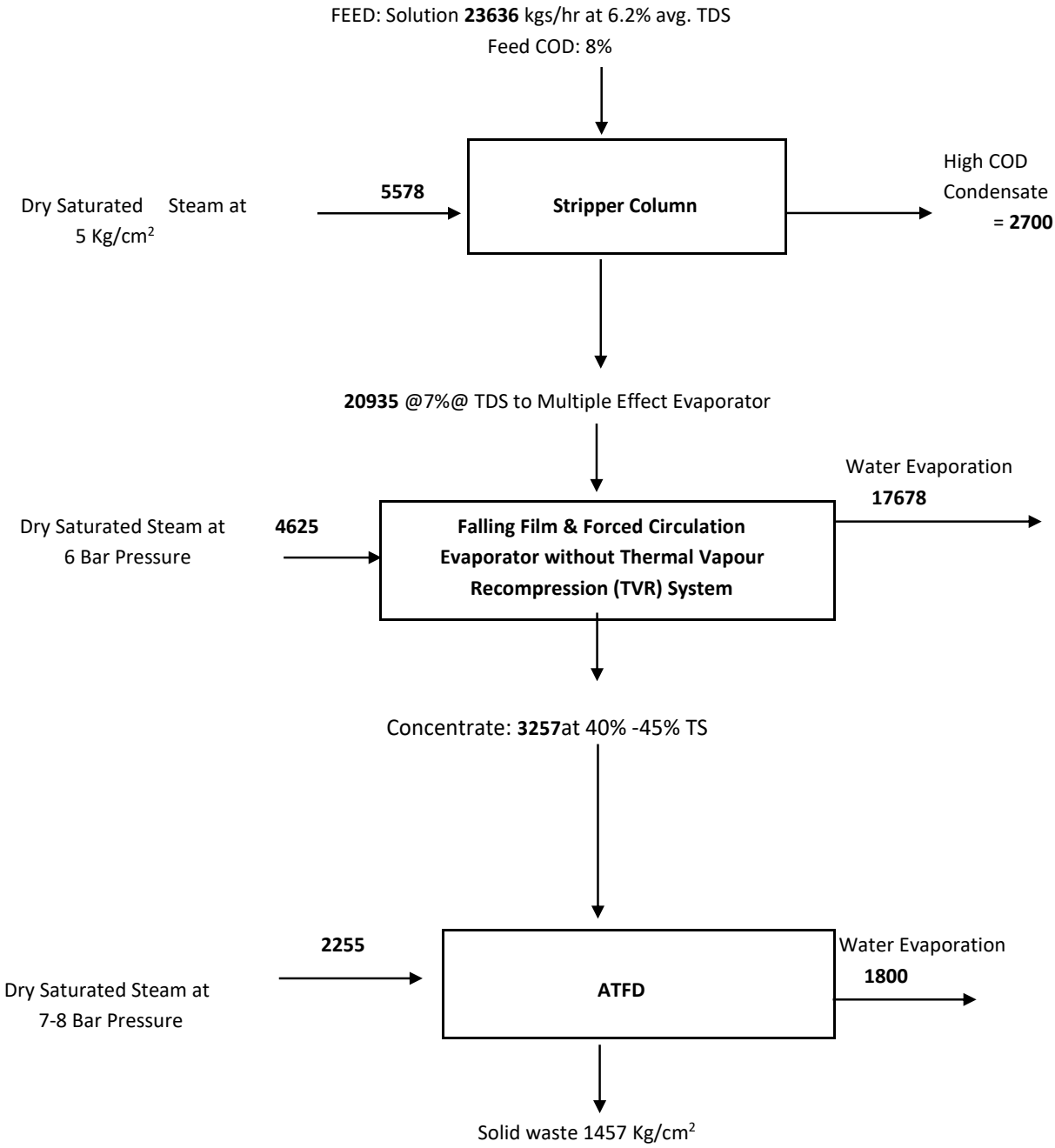

Figure 3-2: Material Balance for 500 KLD Stripper followed by MEE & ATFD

The HTDS secondary treatment system specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos are provided in **Table 3.7**.

Specification Table 3-7: **Stripper, MEE & ATFD of capacity 500 KLD x 2Nos**

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
1	**STRIPPER COLUMN**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Tray column 1.7 Dia
	Type of Tray	:	Sieve
	MOC – Contact Part	:	SS 316 L
	MOC – Non Contact Part	:	MS
	Height	:	15 mts
	Quantity	:	2 Nos (2W)
2	**REBOILER**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Shell & Tube
	Dia	:	1.3 mts
	MOC - Tube	:	SS 2205, ERW, 18 SWG (1.21mm) & 3 mts Long Tube
	MOC – Shell/ Buffle	:	MS
	Dish ends /Bonnets	:	SS 2205
	Tube sheet	:	SS 2205
	Body flanges	:	MS with SS lining
	Stiffeners	:	SS 304
	Supports & Non-contact part	:	MS
	Qty	:	2 Nos (2W)
3.	**Main Condenser**		
	Application	:	High COD & TDS effluent
	Location	:	Stripper
	Type	:	Shell & Tube
	Tubes	:	SS 304, ERW, 18 SWG (1.21mm) 3 M long
	Shell	:	SS 304
	Dish ends	:	SS 304
	Tube sheet	:	SS 304
	Body flanges	:	MS with SS lining
	Stiffeners	:	SS 304
	Supports & Non-contact part	:	MS
	Quantity	:	2 No’s (2W)

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
4.	**Reflux pot**		
	Application	:	Product to Stripper
	Location	:	Stripper
	Type	:	Vertical & Cylindrical
	MOC – Contact Parts	:	SS 304
	MOC – Non Contact Parts	:	MS
	Quantity	:	2 No's (2W)
5.	**BOTTOM TRANSFER PUMP**		
	Application	:	Effluent
	Location	:	Stripper
	Type	:	Non clog, Centrifugal, FLP
	MOC – Contact Parts	:	CD4MNCu
	Capacity	:	25 M3/Hr
	Head	:	30 mts
	Quantity	:	4 Nos (2W+2 S)
6	**STRIPPER FEED PUMPS**		
	Application	:	Feed to Stripper
	Location	:	Stripper feed tanks
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	25 M3/Hr
	Head	:	15 Meters
	Drive	:	10 HP
	Quantity	:	4 Nos (2W +2S)
7	**REFLUX PUMP**		
	Application	:	Enriching of stripper distillate
	Location	:	Stripper
	Type	:	Non clog, Centrifugal, FLP
	MOC	:	SS 304
	Capacity	:	7.5 M3/Hr
	Head	:	30 Meters
	Drive	:	5 HP
	Quantity	:	4 No's (2W +2S)
8	**PIPES & FITTING**		
	Feed and Product	:	Pipe, Stub end, Reducer, Expander, Bend – SS 316L;
	Condensate	:	Pipe, Stub end, Reducer, Expander, Bend – SS 304;

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
	Water Piping	:	SS 304
	Pipe Schedule	:	SS piping Up to 50 NB - sch-10, Above 50 NB – Sch 5 Fabricated Ducts - min 3 mm Thk
	Flanges and Nozzles	:	MS with SS Stubend or Lining, Nozzles upto 50 NB SCH 40 and above Sch 10
9	**COMPLETE INTERCONNECTING PIPING**		
	Qty	:	1 lot
	MOC – Contact parts	:	SS 316 &
	MOC – Non contact parts	:	MS
10	**Insulation & cladding**		
	Qty	:	1 lot
11	**MEE FEED STRAINER**		
	Application	:	Filter the incoming liquid.
	Type	:	Duplex Basket with filter elements
	MOC	:	SS 2205
	Filer mesh size	:	Suitable
	Quantity	:	2 No
12	**MEE FEED PUMPS**		
	Application	:	Stripper outlet
	Location	:	MEE
	Type	:	Non clog, Centrifugal, FLP
	MOC – Casing	:	CD4MnCu
	MOC – Impeller	:	CD4MnCu
	Capacity	:	25 M3/Hr
	Head	:	40 Meters
	Seal	:	Double Mechanical Seal
	Quantity	:	4 No’s (2W +2S)
13	**Vapour Liquid Separators**		
	Application	:	HTDS effluent
	Location	:	MEE
	Type	:	Gas Liquid separator type
	MOC	:	SS2205, External stiffener
	MOC Supports	:	SS 316
	Quantity	:	8 No’s (8 W)
14	**MEE (Calendria)**		
	Type	:	Shell & Tube 1.3 m Dia. for Falling Film and 1.2 m Dia. for forced circulation type
	MOC : Tubes	:	SS 2205, ERW, 1.2 mm thick , 9 m long

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
	Shell	:	SS 316
	Dish Ends	:	Duplex 2205
	Tube Sheet	:	Duplex 2205
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non-contact parts	:	SS 316
	Quantity	:	8 No's
15	**MEE RECIRCULATION PUMPS**		
	Application	:	Calendria 1, & 2 for Falling Film
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	CD4MnCu4
	MOC – Impeller	:	CD4MnCu4
	Capacity	:	130 m3/hr
	Head	:	15 mts
	Quantity	:	8 Nos (4W +4S)
16	**MEE RECIRCULATION PUMPS**		
	Application	:	Calendria 3 & 4 – Forced circulation
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	CD4MnCu4
	MOC – Impeller	:	CD4MnCu4
	Capacity	:	700 m3/hr
	Head	:	08 mts
	Quantity	:	6 Nos (4W +2S)
17	**CONDENSATE PUMPS**		
	Application	:	Condensate
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	SS 316
	MOC – Impeller	:	SS 316
	Capacity	:	25 m3/hr
	Head	:	30 mts
	Quantity	:	4 Nos (2W +2S)
18	**PIPES & FITTING**		
	Feed and Product	:	Pipe, Stub end, Reducer, Expander, Bend – SS

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
			2205;
	Condensate	:	Pipe, Stub end, Reducer, Expander, Bend – SS 304;
	Water Piping	:	SS 316
	Pipe Schedule	:	SS piping Up to 50 NB - sch-10, Above 50 NB – Sch 5 Fabricated Ducts - min 3 mm Thk
	Flanges and Nozzles	:	Slip on flanges in SS 316
	Quantity	:	2 Lot
19	**VAPOR DUCTING**		
	Qty	:	2 lot
	MOC – Contact parts	:	SS 316
	MOC – Non contact parts	:	MS
20	**Insulation & cladding**		
	Quantity	:	2 lot
	Insulation	:	Mineral wool (Loose)
	Cladding	:	Aluminium (24 Gauge)
21	**STEAM PIPING**		
	MOC	:	IBR Certification
	Quantity	:	2 Lot
22	**Surface condenser**		
	Type	:	Shell and Tube
	MOC Tubes	:	SS 316, ERW, 18 SWG, 9 m long
	Shell	:	SS 316
	Dish ends	:	SS 316
	Tube sheets	:	SS 316
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non-contact parts	:	SS 316
	Quantity	:	4 No’s (2 W+ 2 S)
23	**VACCUM PUMP with motor**		
	Type	:	Water ring type with seal water
	Make	:	Prime Vacuum Pumps
	MOC – Casing	:	SS 316
	Capacity	:	400 m3/hr FAD
	Quantity	:	4 Nos (2W+2S)
24	**SEALING WATER tank**		
	Type	:	Vertical and Cylindrical
	Capacity	:	500 lts
	MOC	:	SS 316

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
	Quantity	:	4 Nos (4W)
25	**SEALING WATER Cooler**		
	Type	:	One Plate type heat exchanger
	MOC	:	Plate in SS 316
	MOC	:	End frame – MS with SS 316
	Quantity	:	2 Nos (2 W)
26	**SEALING WATER PUMP**		
	Application	:	Water
	Location	:	MEE
	Type	:	Centrifugal with Double Mechanical Sea, Non FLP
	MOC – Casing	:	SS 316
	MOC – Impeller	:	SS 316
	Capacity	:	8 m3/hr
	Head	:	16 mts
	Quantity	:	6 Nos (4W +2S)
27	**BALANCE TANK FOR ATFD'S**		
	Application	:	For collection of MEE Concentrate
	Type	:	Vertical
	MOC	:	SS 316
	Volume	:	3 KL
28	**ATFD FEED PUMPS**		
	Application	:	Feed to ATFD
	Location	:	MEE Concentrate storage tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	2 M3/Hr
	Head	:	15 Meters
	Drive	:	3 HP
	Quantity	:	12 Nos (6 W+ 6 S)
29	**Dryer Assembly**		
	Location	:	ATFD
	Make	:	Crompton Greaves
	MOC	:	SS 316 Ti
	Quantity	:	6 Nos
30	**Surface condenser**		
	Type	:	Shell and Tube

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
	MOC Tubes	:	SS 316, ERW, 18 SWG, 9 m long
	Shell	:	SS 316
	Dish ends	:	SS 316
	Tube sheets	:	SS 316
	Body Flanges	:	SS 316
	Stiffeners	:	SS 316
	MOC Non-contact parts	:	SS 316
	Quantity	:	6 No's (6 W)
31	**Condensate Extraction Pump**		
	Application	:	Condensate
	Location	:	MEE Concentrate storage tank
	Type	:	Non clog, Centrifugal, FLP
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	2 M3/Hr
	Head	:	15 Meters
	Drive	:	3 HP
	Quantity	:	12 Nos (6 W+ 6S)
32	**Centrifugal Blower**		
	Application	:	Vapour
	MOC	:	SS304
	Quantity	:	12 No's (6W +6 S)
33	**Piping and ducting**		
	Quantity	:	10 Lots
	MOC Contact parts	:	SS316
	MOC – Non Contact Parts	:	SS 304
34	**ACID STORAGE TANK FOR CIP**		
	Application	:	Storage of Acid Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	50 m3
	Size (Meters)	:	5.65 dia X 2.0 LD + 0.3FB
	Quantity	:	1 No
35	**MCC PANEL**		
			Consists of a panel made of MS CRCA sheet duly powder quoted. The panel to be pre-wired to terminal connection and equipped with all starters, contractors, overloads relays for drive motors and interlock sequence. MCC

Specifications for Stripper, MEE & ATFD of capacity 500 KLD x 2Nos			
			non-draw out type, compartmentalized, safe area type with MPCB protection type, indoor installation, floor mounted type, dust and vermin proof, weather proof with IP 42 degree of protection. The panel will be equipped with contactors, relays, sequential timer. The panel shall be pre-wired and tested before dispatch. Each starter of MCC will be consist of MPCB, Contactor, overload relay, ON/OFF/Tripped indications, Emergency stop stay put type push button. Incomer KWH meter, Voltmeter, Ammeter. 1 HP to 7.5 HP as DOL starter. 10 HP and above feeder as STAR/DELTA STARTERS. Other Specification as per Technical Annexure given by you. VFD for Feed Pump of ATFD and ATFD Rotor. MCCB for rating up to 630 Amp. Motor efficiency IE2
36	**CABLES**		
			Copper armored cable for MOTORS and copper cable for instrumentation and push buttons
37	**CABLE TRAY**		
			G I up to 500 mm with proper SS316 structure supports by client
38	**PUSH BUTTON**		
			Local Push button to be provided near the motor wherever required IP 44 protection
39	**Control Panel (PLC) – Non Flame Proof / PC Indication:**		
			PLC is provided to incorporate the operation and start - up/shut down logic. The Plant shall be controlled through PC. We will provide PLC and SCADA run time software. Also we will provide operating screens along with necessary PLC accessories. Communication between PLC, SCADA and I/O cards will be based on Ethernet / Profinet network. Capacity of SCADA software will be as per process requirement.

3.4.1.5 Cooling Tower for 500 KLD Capacity MEE & ATFD

The proposed Cooling Tower for 1000 KLD MEE & ATFD will have 2 Cell Cross flow Wooden Cooling Tower: Capacity: 2000 TR Our Cooling Tower is an induced draft Crossflow 2 cell Timber cooling tower designed to cool 1000 M3 /hr water from 37°C to 32°C at a design WBT of 29°C. Each cell is designed to handle 500 M3 /hr and equipped with 3660 mm dia Fan Assembly driven by 25 HP/1450 RPM motor through suitable spiral bevel gear reducer. The tower has to be installed on RCC basin.

The Cooling Tower specifications for 500 KLD for MEE & ATFD are provided in **Table 3.8**.

Specification Table 3-8: **Cooling Tower for 500 KLD Capacity MEE & ATFD System**

1	**COOLING TOWER**		
	Capacity	:	2000 TR X 2 Nos
	No. of Cells	:	2 No's
	Make	:	Induced draft cross flow
	Flow rate	:	1000 m3/hr
	Pump Flow rates	:	500 m3/hr
	Head	:	30 Meters
	Capacity	:	40 HP
	Fan Driven	:	25 HP
	Fan motor RPM	:	1450
	Pumps Quantity	:	4 Nos (2W + 2S)

3.4.2 Design Basis for Stripper, MEE & ATFD

The design basis for Stripper, MEE & ATFD are provided in **Table 3-9**.

Table 3-9: **Design Basis for Stripper, MEE & ATFD System**

S.No	Parameters	Nos of Unit	CT Flow Rate (KL/hr)	Steam Consumption (Ton/hr)	Power Consumption (KW/hr)
1000 KLD Stripper, MEE & ATFD System					
1	Stripper	1	580	11700	114
2	MEE	1	750	6020	430
3	ATFD	5	325	4445	280
	Total flow rate		**1655**	**22165**	**824**
	For 1 Nos		**1655**		
500 KLD Stripper, MEE & ATFD System					
1	Stripper	1	290	5578	50
2	MEE	1	495	4625	170
3	ATFD	3	213	2253	168
	Total flow rate		**998**	**12456**	**338**
	For 2 Nos		**1996**		

3.4.3 Instrumentation Specifications for Stripper, MEE & ATFD

The instrumentation list and specifications for Stripper, MEE & ATFD are provided in **Table 3-10** and **Table 3-11**.

Specification Table 3-10: **Instrumentation List for Stripper, MEE & ATFD (for each Unit)**

S. No	Description	Qty
1.	PC – 1 No. with Window Operating Software. Processor i7, Windows 10 (for each unit)	1
2.	SCADA-Run time (RT) software (SCADA backup software, license key and software installation procedure will be provided) (for each unit)	1
3	Electromagnetic flow meter (for each unit)	16
4	Vortex flow meter (for each unit)	7
5	Guided wave radar level transmitter –	1 Lot
6	Temperature Transmitter with Thermowell	1 Lot
7	Vacuum Transmitter	1 Lot
8	Steam control valve	1 Lot
9.	Steam pressure transmitter	1 Lot
10	Fluid control valve	1 Lot
11	Pressure gauges	1 Lot
12	Vacuum gauges	1 Lot
13	VFD	1 Lot
14	Temperature gauges	1 Lot

Specification Table 3-11: Instrumentation Specifications for Stripper, MEE & ATFD

S.No.	Description	Make
1	Electromagnetic flow meter	E&H
1.	Pumps Centrifugal	Microfinish /Sintech /SPX Johnson/ Kirloskar
2.	Vacuum Pumps	PPI/TMVT/KVS
3	PHE	Alfa Laval / GEA / Sondex
4	Manual Valves	Aqua Control/Marck Valves
5	Bearing	SKF
6	MCC	Siemens / Allen Bradley / Schindler / ABB
7	PLC	Siemens / Allen Bradley / Schindler / ABB
8	Level Transmitters & Control loop	Emerson / ABB /Yokogawa
9.	Pressure Transmitters	Emerson / ABB /Yokogawa
10	Magnetic flow meter with Totalizer	E&H / Emerson/ABB
11	Steam flow meter (IBR) with Totalizer	E&H / Emerson/ABB
12	Control Valves	Dembla Valves /Pneucon/ Samson
13	Pressure Gauge	Radix / Wika / Pioneer / Gauges Bourdon
14	Pressure Switch	Switzer/ GIC / Gauges Bourdon
15	Vacuum Gauge	Radix / Pioneer / Gauges Bourdon
16	Vacuum Transmitters	Rosemount/ Yokogawa/Eureka / ABB
17	Temperature Scanner	General Instruments/Radix/ Gauges Bourdon
18	Temperature Indicator(RTD)	Temperature Indicator(RTD)
19	Level Gauge	Pune Techtrol/General Instruments
20	Metal Tube Rotameter	Eureka / SPINK
21	Motors	Crompton Greaves / Siemens/BBL/Havell
22	Electrical Switchgears	Siemens / Schindler / L&T
23	Cablings & Cable Trays	Polycab / Finolex
24	Mechanical seals(DMS)	Eagle Burgmann
25	Push Button, Indication & Selector Switch	Siemens
26	Ammeters & Voltmeters	Rishabh / AE
27	Energy Meters	L&T / Schindler
28	Screw Pump	Chemec /Rotomach

3.4.4 MOC Specifications for MEE, Stripper & ATFD

Specification Table 3-12: MOC Specifications for Stripper, MEE & ATFD

1. STRIPPER COLUMN	
CAPACITY	: MATCHING TO PLANT
MOC	: BODY FLANGES: SS 304
MAIN SHELL	: SS 316L
TRAYS (FLOAT VALVE TRAYS)	: SS 316 IMTP
FLASH VESSEL	: SS 316
FLANGE- SHELL SIDE	: SS 316
NOZZLES- SHELL SIDE	: SS 316
FLANGE- VESSEL SIDE	: SS 316
NOZZLES- VESSEL SIDE	: SS 316
GASKETS	: NAF
NUT& BOLT	: GI
2. REBOILER	
MAIN SHELL	: MS/ CS
TOP COVER	: SS 316
BOTTOM COVER	: SS 316
TUBE SHEET	: SS 316
TUBES	: SS 316
FLANGE- TUBE SIDE	: SS 304
NOZZLES- TUBE SIDE	: SS 304
GASKETS	: NAF
NUT& BOLT	: GI

*This will have a bunch of ss tubes mounted in a vertical shell. The effluent is circulated in the tubes and steam on the shell side. The unit will be complete with necessary fittings and accessories.

3. PRIMARY CONDENSER (STRIPPER)	
TUBE SHEET	: SS 316
TUBES	: SS 316
FLANGE- SHELL SIDE	: SS 316
NOZZLES- SHELL SIDE	: SS 316
GASKETS	: NAF
NUT& BOLT	: GI
4. SECONDARY CONDENSER (STRIPPER)	
TUBE SHEET	: SS 316
TUBES	: SS 316
FLANGE- SHELL SIDE	: SS 316
NOZZLES- SHELL SIDE	: SS 316
GASKETS	: NAF
NUT& BOLT	: GI

*This will have a bunch of SS tubes. The water is circulated in the tubes and the solvent vapours get condensed on the shell side. The condenser will be complete with necessary fittings and accessories.

5. RECIRCULATION PUMP WITH MOTOR	
CASING	: CF8M
IMPELLER	: CF8M
SHAFT	: SS 316
SLEEVE	: CF8M

For recirculation of the effluent in stripper column through Reboiler and transferring the product from bottom of the stripper column to the first effect of Multiple Effect Evaporator.

This pump is with sanitary design and mechanical shaft seal capable of pumping the required feed rate. The pump will have sealing arrangement and will be coupled to an electric motor of suitable horsepower rating.

6. INTERCONNECTING PIPING FOR FEED	
QUANTITY	: 1 LOT
PIPE	: SS 316
FLANGES	: SS 316 ASA 150
VALVES	: CONTACT PARTS SS 316

Complete with necessary pipes, union, bends, tees, valves, pipe supports, etc. for interconnecting various components of the plant based on a compact layout.

7. REFLUX PUMP	
CASING	: CF8M
IMPELLER	: CF8M
SHAFT	: SS 316
SLEEVE	: CF8M
REFLEX POT	
SHELL	: SS 316
FLANGES	: SS 316
VALVES	: SS 316

8. INTER CONNECTING PIPING FOR VAPOURS	
PIPE	: SS 316
FLANGES	: SS 316
PRESSURE GAUGE / RTD	: SS 304 DIAL, 4” SIZE
VACUUM GAUGE	: SS 304 DIAL, 6” SIZE

MULTIPLE EFFECT EVAPORATION PLANT:

9. CALANDRIA	
MAIN SHELL	: SS 316L
BOTTOM COVER	: SS 316L
TOP COVER	: SS 316L
TUBE SHEETS	: SS 316L

TUBES SEAMLESS	: TITANIUM GR.2 (1MM THK.)
FLANGE- TUBE SIDE	: SS 316
NOZZLES- TUBE SIDE	: SS 316
GASKETS	: NAF
NUT& BOLT	: GI

10. PRE HEATER

MAIN SHELL	: SS 316
BOTTOM COVER	: SS 316
TOP COVER	: SS 316
TUBE SHEETS	: SS 316
TUBES	: SS 316L (SEAMLESS)
FLANGE- TUBE SIDE	: SS 316
NOZZLES- TUBE SIDE	: SS 316
GASKETS	: NAF
NUT& BOLT	: GI

11. PUMPS

A. FEED PUMPS

CASING	: CF8M
IMPELLER	: CF8M
SHAFT	: SS 316
SLEEVE	: CF8M

B. RE CIRCULATION PUMPS

CASING	: CF8M
IMPELLER	: CF8M
SHAFT	: SS 316
SLEEVE	: CF8M

C. CONCENTRATE OUTLET PUMPS

CASING	: CF8
IMPELLER	: CF8
SHAFT	: SS 304
SLEEVE	: CF8M-8

D. SEAL WATER PUMP

CASING	: CI
IMPELLER	: CI
SHAFT	: EN-8

E. ML TRANSFER PUMP

CASING	: CF8M
IMPELLER	: CF8M
SHAFT	: SS 316

F. VAPOR SEPARATORS

SHELL	: SS 316
FLANGES	: SS 316

NOZZLES	: SS 316

12. SURFACE CONDENSER

MAIN SHELL	: SS 316
END COVER	: SS 316
TUBE SHEET	: SS 316
TUBES	: SS 316
FLANGE- SHELL SIDE	: SS 304
NOZZLES- SHELL SIDE	: SS 304
GASKETS	: NAF
NUT& BOLT	: GI
WATER RING VACUUM PUMP / JET EJECTOR	: CI WITH SS 304 INTERNALS

ATFD (Agitated Thin Film Dryer):

13. ATFD

SHELL	: SS 316
AGITATION	: SS 316
JACKET	: MS

14. ATFD CONDENSER

MAIN SHELL	: SS 304
END COVER	: SS 304
TUBE SHEET	: SS 304
TUBES	: SS 304

15. STEAM JET EJECTOR/ THERMO – COMPRESSOR

BODY	: SS 304
DIFFUSER	: SS 304
NOZZLE	: SS 316
FLANGES	: SS 304

16. VAPOR DUCTS

SHELL	: SS 316L
FLANGES	: SS 304

17. PROCESS/ RECIRCULATION PIPES & FITTINGS

PIPE	: SS 316L
FLANGES	: SS 304
VALVES	: CONTACT PARTS SS 316

18. NON- CONDENSABLE & CONDENSATE PIPES

PIPE	: SS 304
FLANGES	: SS 304
VALVES	: CONTACT PARTS SS 304

19. FEED TANK

SHELL	: SS 316
NOZZLE	: SS 316
FLANGES	: SS 316

20. CONDENSATE COLLECTION POT

SHELL	: SS 304
NOZZLE	: SS 304
FLANGES	: SS 304

21. FEED , CONDENSATE -FLOW TRANSMITTER	: PTFE LINED AND SS 316 ELECTRODE
22. FEED, CONDENSATE- CONTROL VALVE	: CF8M
23. ELECTRICAL PANEL	: GI POWDER COATED 14/16 SWG SHEET,
24. PRESSURE GAUGES	: SS 304 DIAL 4”SIZE
25. VACUUM GAUGES	: SS 304 DIAL, 6” SIZE
26. PROCESS PIPES & FITTINGS	
27. PIPE	: SS 316
28. FLANGES	: SS 316
29. VALVES	: CONTACT PARTS SS 316

30. CONDENSATE TANK

SHELL	: SS 304
FLANGES	: SS 304
NOZZLES	: SS 304

31. VAPOUR PIPING

PIPE	: SS 316L
FLANGES	: SS 316L

3.5 LTDS Primary Treatment System

The HTDS primary treatment system specifications are provided in **Table 3.13**.

Specification Table 3-13: **LTDS Primary Treatment specifications required for CETP**

LTDS Primary Treatment specifications			
1	**Sample Platform**		
	Application	:	To collect sample from inlet tankers
	Type	:	Rectangular
	MOC	:	RCC M30
	Size (Meters)	:	2.0 x 1.0 x 0.15
	Quantity	:	1 No
2	**Bar Screen Chamber**		
	Application	:	To Screen the floatable solids
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	200 cum/hr
	Velocity	:	0.6 M/Sec
	Area of screen channel	:	0.35 Sq. m
	Liquid depth	:	1.0 M
	Length of the chamber	:	3.5 M
	Size (Meters)	:	3.5 x 1.5 x 1.0 LD + 0.3FB
	Effective Volume	:	5.25 m3
	Quantity	:	1 No
	Screen		
	Type	:	Manual
	Make	:	Fabricated
	MOC of screen	:	SS
	Bar Sizing	:	6 mm flat strip
	Bar Spacing	:	10 mm
	Size	:	600 x 1000 mm
	Quantity	:	One No.
3	**VORTEX TYPE GRIT REMOVAL SYSTEM**		
	Capacity	:	3 MLD
	Grit production rate (m3/day)	:	Grit Design Load: Typically < 0.1 M3/ MLD
	Settled grit specific gravity	:	2.65 and above.
	Particle Removal efficiency, 0.15 mm and above	:	95% of grit size 150 microns and larger

LTDS Primary Treatment specifications			
	Organic matter in waste grit (no TSS Removal is considered in Grit Chamber)	:	10%
4	**GRIT COLLECTION CHAMBER**		
	Application	:	For collection of Grit Particles
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	10 m3
	Size (Meters)	:	1.5 x 4.0 x 1.7 LD + 0.3 FB
	Quantity	:	1 No
5	**OIL & GREASE CHAMBERS**		
	Application	:	To separate scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	300 cum/hr
	HRT	:	12 Min
	Volume	:	60 m3
	Size (Meters)	:	4.0 x 3.35 x 1.5 LD + 0.3 FB
	Effective volume	:	20 m3
	Quantity	:	3 Nos
	Total volume	:	20 m3 x 3 = 60 m3
6	**OIL & GREASE COLLECTION CHAMBER**		
	Application	:	To collect scum
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	10 m3
	Size (Meters)	:	1.5 x 4.0 x 1.7 LD + 0.3 FB
	Quantity	:	1 No
7	**INTERMEDIATE COLLECTION TANK**		
	Application	:	Collection of Inlet raw effluent
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	300 cum/hr
	HRT	:	1 hr
	Volume	:	300 m3
	Size (Meters)	:	13.85 X 7.20 X 3.0 LD + 0.3FB
	Quantity	:	1 No
8	**EFFLUENT TRANSFER PUMPS**		

LTDS Primary Treatment specifications			
	Application	:	For effluent transfer to Collection/ Equalization tank
	Location	:	Inside of Intermediate Collection Tank
	Type	:	Non clog, Submersible
	Make	:	Kishore
	MOC	:	CI
	Capacity	:	300 M3/Hr
	Head	:	20 Meters
	Drive	:	40 HP
	Quantity- 1st Stage	:	2 Nos (1 W + 1 S)
	Quantity- 2nd Stage	:	2 Nos (1 W + 1 S)
9	**COLLECTION/ EQUALIZATION TANK**		
	Application	:	Collection and Homogenization of Effluent
	Type	:	Rectangular
	Flow rate	:	150 cum/hr
	HRT	:	32 hrs
	MOC	:	RCC M30
	Volume	:	4000 m3
	Size (Meters)	:	22.25 x 30.0 x 3.0 LD +0.3 FB
	Effective volume	:	2000 m3
	Quantity	:	2 Nos
	Total volume provided	:	2000 X 2 Nos = 4000 m3
10	**AIR BLOWER FOR EQUILIZATION TANK**		
	Type	:	Roots blower
	Air Blower capacity	:	1000 cum/hr at 0.4 kg/sq.cm
	Drive	:	50 HP
	Quantity	:	4 Nos (2W+2Sb)
	Application	:	Providing proper mixing in the Equalization Tank
	Mixing arrangement-Air Purging grid		
	Type	:	Silicon Coarse bubble diffused aeration system with Pipeline
	MOC	:	HDPE with MS header.
	Distribution	:	Air distribution channel extending over the effective length guarantees an even distribution of air.
	Quantity	:	One Lot
	Application	:	Air distribution

LTDS Primary Treatment specifications			
11	**EFFLUENT FEED PUMPS**		
	Application	:	For effluent feed to Neutralization tank
	Location	:	Near Equalization tank
	Type	:	Non clog, Centrifugal
	Make	:	Antico
	MOC	:	PP
	Capacity	:	150 M3/Hr
	Head	:	15 Meters
	Drive	:	20 HP
	Quantity	:	2 Nos (1W + 1S)
12	**NEUTRALIZATION TANK**		
	Application	:	Neutralization of effluent
	Location	:	After Equalization tank
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	150 m3/hr
	HRT	:	40 min
	Volume required	:	100 m3
	Size (Meters)	:	7.5 X 6.7 X 2.0+0.3 FB
	Quantity	:	1 No
	Mixing arrangement		
	Air Blower capacity	:	50 cum/hr at 0.4 kg/sq.cm
	Drive	:	5 HP
	Quantity	:	2 Nos (1W+1Sb)
	Air Grid		
	Type	:	Silicon Coarse bubble diffused aeration system Pipeline
	MOC	:	HDPE with MS header.
	Quantity	:	One Lot
	Application	:	Providing proper mixing in the Neutralization Tank
13	**FLASH MIXER**		
	Application	:	Mixing of Coagulants
	Location	:	After Neutralization tank
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	150 m3/hr
	HRT	:	3 min
	Volume	:	7.5 m3

LTDS Primary Treatment specifications			
	Size (Meters)	:	3.0 x 2.10 x 1.2 LD +0.3 FB
	Quantity	:	1 No
	Mixing arrangement	:	Agitator with Motor arrangement
14	**FLOCCULATION TANK**		
	Application	:	Mixing of Flocculants
	Location	:	After Flash Mixer
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	150 m3/hr
	HRT	:	8 min
	Volume	:	20 m3
	Size (Meters)	:	3.0 x 4.45 x 1.5 LD +0.3 FB
	Quantity	:	1 No
	Mixing arrangement	:	Agitator with Motor & Gear box arrangement
15	**Lime/ Caustic preparation tank**		
	Application	:	Preparation of Lime/ Caustic Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
16	**HCL preparation tank**		
	Application	:	Preparation of HCL Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm

LTDS Primary Treatment specifications			
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
17	**Alum/ PAC preparation tank**		
	Application	:	Preparation of Alum/ PAC Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
18	**Poly preparation tank**		
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
19	**PRIMARY CLARIFLOCCULATOR**		
	Application	:	For removal of TSS
	Location	:	After Flocculation tank
	Type	:	Circular
	MOC	:	RCC M30
	Flow rate	:	150 m3/hr
	HRT	:	4 hrs
	Volume	:	600 m3
	Size (Meters)	:	16.0 dia X 3.0 LD+ 0.3FB
	Quantity	:	1 No

LTDS Primary Treatment specifications			
20	**SLUDGE HANDLING**		
	Total Suspended solids	:	600 ppm
	Sludge quantity	:	135 m3
21	**PRIMARY SLUDGE HOLDING TANKS**		
	Application	:	Collection of primary sludge
	Location	:	At primary clariflocculator
	Type	:	Circular
	MOC	:	RCC M30
	Size (Meters)	:	8.75 dia X 2.5 LD + 0.3 FB
	Volume	:	150 m3
	Quantity	:	2 Nos
	Total volume	:	150 m3 X 2 = 300 m3
22	**SLUDGE FEED PUMPS**		
	Application	:	For Sludge feed to screw press
	Location	:	Near Primary sludge holding tanks
	Type	:	Non clog, Centrifugal, Self priming
	Make	:	Kirloskar
	MOC	:	CI
	Capacity	:	15 M3/Hr
	Head	:	15 Meters
	Drive	:	5 HP
	Quantity	:	6 Nos (3W + 3S)
23	**DEWATERING UNIT**		
	Application	:	Dewatering of primary sludge
	Type	:	Centrifuge decanter
	Operation hrs	:	16 hrs
	Feed flow	:	15 m3/hr
	Quantity	:	1 Nos
24	**Poly preparation tank**		
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	3 m3
	Size (Meters)	:	1.5 x 1.35 x 1.5LD +0.3FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH

LTDS Primary Treatment specifications			
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)

3.6 Combined LOW TDS STREAM + CONDENSATE FROM HIGH TDS Treatment System

The combined LTDS primary treated effluent and Condensate from HTDS treatment system specifications are provided in **Table 3.14**.

Specification Table 3-14: **Combined LTDS Stream + Condensate from HTDS Treatment system**

Specification for Combined LTDS + MEE Condensate Effluent from HTDS Treatment system			
1	**PRE-AERATION TANK**		
	Application	:	For Removal of organic load
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	5 days
	Volume	:	10,000 m3
	Size (Meters)	:	50.0 X 40.0 X 5.0 LD+ 0.5FB
	Quantity	:	1 No
	AIR REQUIREMENT		
	Organic load	:	14260 Kg/day as BOD 1160 Kg/day as NH3-N
	Removal efficiency	:	COD : 60% BOD : 25% NH3-N : 20%
	Oxygen required		
	Oxygen required	:	8565 kg of O2/ day
	Power consumption		755 HP
	AERATION SYSTEM		
	Type of aerators	:	Floating aerators with blower
	Capacity of aerators	:	60 HP
	Capacity of blowers	:	10 HP
	Quantity	:	11 Nos
2	**SETTLING TANK**		
	Application	:	For Removal of Suspended Solids
	Type	:	Rectangular
	MOC	:	RCC M30

Specification for Combined LTDS + MEE Condensate Effluent from HTDS Treatment system			
	HRT	:	4 hrs
	Volume	:	804 m3
	Size (Meters)	:	12.0 X 20.0 X 3.35 LD + 0.3FB
	Quantity	:	1 No
3	**SLUDGE RECYCLING PUMPS**		
	Application	:	For Sludge recycling to Pre-Aeration tank
	Location	:	Near Settling Tank
	Type	:	Non clog, Centrifugal, Self priming
	MOC	:	CI
	Capacity	:	40 M3/Hr
	Head	:	15 Meters
	Drive	:	7.5 HP
	Quantity	:	2 Nos (1W + 1S)
4	**BUFFER STORAGE TANK**		
	Application	:	For collecting the clear water from primary clariflocculator & Condensate effluent
	Location	:	After Primary clariflocculator
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	250 m3/hr
	HRT	:	8 Hr
	Volume	:	1800 m3
	Size (Meters)	:	30.0 x 20.0 x 3.0 LD+ 0.3FB
	Quantity	:	1 No
5	**ANOXIC FEED PUMPS**		
	Application	:	For effluent feed to Anoxic tank
	Location	:	Near Buffer Storage Tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	85 M3/Hr
	Head	:	15 Meters
	Drive	:	10 HP
	Quantity	:	2 Nos (1W + 1S)
6	**ANOXIC TANK**		
	Location	:	After Buffer storage tank
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	250 m3/hr

Specification for Combined LTDS + MEE Condensate Effluent from HTDS Treatment system			
	HRT	:	3 days
	Volume required	:	15,000 m3
	Size (Meters)	:	35.0 x 43.0 x 5.0 LD+ 0.5FB
	Effective volume	:	7,500 m3
	Quantity	:	2 Nos
	Total volume	:	7,500 X 2= 15,000 m3
	Mixing arrangement	:	
	Type of mixers	:	Floating aerators
	Capacity of aerators	:	40 HP
	Quantity	:	4 Nos (2 Nos for each tank)
7	**EFFLUENT TRANSFER PUMPS**		
	Application	:	For effluent transfer to SBR feed tank
	Location	:	Near Buffer Storage Tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	200 M3/Hr
	Head	:	15 Meters
	Drive	:	30 HP
	Quantity	:	2 Nos (1W + 1S)
8	**SBR FEED TANK**		
	Application	:	For collection of overflow from Anoxic tank & feed to SBR tanks
	Location	:	After Anoxic tank
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	12 hrs
	Volume	:	2700 m3
	Size (Meters)	:	14.0 x 43.0 x 4.5 LD+ 0.3FB
	Quantity	:	1 No
9	**SBR FEED PUMPS**		
	Application	:	For effluent feed to SBR Tanks
	Location	:	Near SBR Feed Tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	320 M3/Hr
	Head	:	15 Meters
	Drive	:	40 HP

Specification for Combined LTDS + MEE Condensate Effluent from HTDS Treatment system			
	Quantity	:	8 Nos (4W + 4S)
10	**1st STAGE SBR**		
	Application	:	For Removal of organic load
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	8 days
	Volume	:	40,000 m3
	Size (Meters)	:	66.7 X 120.0 X 5.0 LD+ 0.5FB
	Quantity	:	1 No
	No of SBR Units	:	4 Nos
	Volume of each SBR unit	:	10,000 m3
	AIR REQUIREMENT		
	Organic load	:	14784 kg/ day (13718 Kg/day as BOD + 1066 Kg/day as NH3-N)
	Removal efficiency	:	COD : 70% BOD : 85% NH3-N : 70%
	Oxygen required		
	Oxygen required	:	20959 kg of O2/ day
	Power consumption		2464 HP
	AERATION SYSTEM		
	Type of aerators	:	Floating aerators with blower
	Capacity of aerators	:	60 HP
	Capacity of blowers	:	10 HP
	Quantity	:	35 Nos
11	**RAS PUMPS (NO3-N)**		
	Application	:	NO3- N Recirculation
	Location	:	Near SBR tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	285 M3/Hr
	Head	:	15 Meters
	Drive	:	40 HP
	Quantity	:	2Nos (1W + 1S)
12	**RAS PUMPS**		
	Application	:	Sludge Recirculation/ Transfer
	Location	:	Near SBR tank
	Type	:	Non clog, Centrifugal

Specification for Combined LTDS + MEE Condensate Effluent from HTDS Treatment system			
	MOC	:	CI
	Capacity	:	80 M3/Hr
	Head	:	15 Meters
	Drive	:	10 HP
	Quantity	:	2Nos (1W + 1S)
13	**2nd STAGE SBR**		
	Application	:	For Removal of organic load
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	2 days
	Volume	:	10,000 m3
	Size (Meters)	:	66.7 X 30.0 X 5.0 LD+ 0.5FB
	Quantity	:	1 No
	No of SBR Units	:	4 Nos
	Volume of each SBR unit	:	2500 m3
	AIR REQUIREMENT		
	Organic load	:	2377 kg/ day (2058 Kg/day as BOD + 320 Kg/day as NH3-N)
	Removal efficiency	:	COD : 80% BOD : 80% NH3-N : 60%
	Oxygen required		
	Oxygen required	:	3361 kg of O2/ day
	Power consumption		395 HP
	AERATION SYSTEM		
	Type of aerators	:	Floating aerators with blower
	Capacity of aerators	:	30 HP
	Capacity of blowers	:	5 HP
	Quantity	:	11 Nos
14	**RAS PUMPS**		
	Application	:	Sludge Recirculation/ Transfer
	Location	:	Near SBR tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	80 M3/Hr
	Head	:	15 Meters
	Drive	:	10 HP
	Quantity	:	2Nos (1W + 1S)

3.7 Tertiary Treatment System

The tertiary treatment system specifications are provided in **Table 3.15**.

Specification Table 3-15: **Tertiary Treatment system**

Tertiary Treatment system Specifications			
1	**FILTER FEED TANK**		
	Application	:	For Collection of clear water and feed to Filters
	Type	:	Rectangular
	MOC	:	RCC M30
	Flow rate	:	250 cum/hr
	HRT	:	12 hrs
	Volume	:	2500 m3
	Size (Meters)	:	28.0 X 30.0 X 3.0 LD + 0.3FB
	Quantity	:	1 No
2	**FILTER FEED PUMPS**		
	Application	:	For effluent feed to Multigrade Sand Filter
	Location	:	Near Filter feed tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	250 M3/Hr
	Head	:	25-30 Meters
	Drive	:	50 HP
	Quantity	:	2 Nos (1W + 1S)
3	**MULTI GRADE SAND FILTER**		
	Application	:	Removal of Suspended Solids
	Location	:	After Filter feed
	Type	:	Vertical ,Cylindrical
	MOC	:	MSEP
	SOR	:	12 cum/sq.m/hr.
	Flow	:	250 cum/hr
	Area	:	22.72 sq.m
	Diameter	:	3000 mm
	Height	:	2000 mm
	Media	:	Sand, pebbles, Gravel
	Quantity	:	2 Nos
4	**ACTIVATED CARBON FILTER**		

Tertiary Treatment system Specifications			
	Application	:	Removal of Suspended Solids
	Location	:	After Filter feed
	Type	:	Vertical ,Cylindrical
	MOC	:	MSEP
	SOR	:	10 cum/sq.m/hr.
	Flow	:	250 cum/hr
	Area	:	25 sq.m
	Diameter	:	3300 mm
	Height	:	2000 mm
	Media	:	Pebbles, Activated carbon
	Quantity	:	2 Nos
5	**FILTER BACKWASH TANK**		
	Application	:	Collection of treated water for backwashing of Filters
	Type	:	Rectangular
	MOC	:	RCC M30
	Volume	:	300 m3
	Size (Meters)	:	12.0 X 10.0 X 2.5 LD + 0.3FB
	Quantity	:	1 No
6	**FILTER BACKWASH PUMPS**		
	Application	:	For backwash of MGF & ACF
	Location	:	Near Filter backwash tank
	Type	:	Non clog, Centrifugal
	MOC	:	CI
	Capacity	:	300 M3/Hr
	Head	:	25-30 Meters
	Drive	:	50 HP
	Quantity	:	2 Nos (1W + 1S)
7	**GUARD POND**		
	Application	:	Collection of treated water
	Type	:	Rectangular
	MOC	:	RCC M30
	HRT	:	3.5 days
	Volume required	:	17,250 m3
	Size (Meters)	:	55.60 X 35.0 X 3.0 LD + 0.3FB
	Effective volume	:	5830 m3
	Quantity	:	3 Nos
	Total volume	:	5838 m3 X 3= 17,514 m3

3.8 Sludge Handling and Treatment System

The Sludge handling and treatment system specifications are provided in **Table 3.16**.

Specification Table 3-16: Sludge Handling and Treatment system

Sludge Handling and Treatment system Specifications			
1	**SLUDGE HANDLING**		
	Sludge quantity	:	410 m3
2	**SECONDARY SLUDGE THICKENER**		
	Application	:	Collection & Thickening of secondary sludge
	Location	:	After SBR tanks
	Type	:	Circular
	MOC	:	RCC M30
	Size (Meters)	:	25.0 dia X 3.0 LD + 0.3 FB
	Volume	:	1500 m3
	Quantity	:	2 Nos
	Total volume	:	1500 m3 X 2 = 3000 m3
3	**Poly preparation tank**		
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	1.5 m3
	Size (Meters)	:	1.25 dia X 1.3 +0.3 FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
4	**CENTRIFUGE FEED PUMPS**		
	Application	:	For transferring of secondary thickened sludge
	Location	:	At Secondary sludge thickener
	Type	:	Non clog, Centrifugal, Screw
	MOC	:	CI
	Capacity	:	15 M3/Hr
	Head	:	15 Meters
	Drive	:	5 HP
	Quantity	:	4 Nos (2W + 2S)

Sludge Handling and Treatment system Specifications			
5	**DEWATERING UNIT**		
	Application	:	Dewatering of secondary sludge
	Type	:	Centrifuge
	Feed flow	:	15 cum/hr
	Operation hrs/ day	:	16 hrs
	Quantity	:	2 Nos
6	**Poly preparation tank**		
	Application	:	Preparation of Poly electrolyte Chemical
	Type	:	Circular
	MOC	:	RCC M30
	Volume	:	1.5 m3
	Size (Meters)	:	1.25 dia X 1.3 +0.3 FB
	Mixing arrangement	:	Agitator with Motor arrangement
	Quantity	:	1 No
	Dosing Pumps		
	Capacity	:	100 LPH
	Pressure	:	4 kg/sq.cm
	MOC	:	PP
	Quantity	:	2 Nos (1W+1S)
7	**SLUDGE DIGESTER**		
	Location	:	After sludge thickener
	Type	:	Circular
	MOC	:	RCC M30
	Size (Meters)	:	25.0 dia X 6.0 LD + 0.3 FB
	Volume	:	3000 m3
	Quantity	:	1 No

3.9 Utilities

3.9.1 Boiler Specifications & Details

Specification Table 3-17: Boiler required for CETP

1	**SEAL WATER TRANSFER PUMPS**		
	Type	:	Non clog, Centrifugal
	Make	:	Johnson
	MOC	:	SS 304
	Capacity	:	5 M3/Hr
	Head	:	15 Meters
	Drive	:	2 HP
	Quantity	:	7 Nos
2	**BOILER**		
	Capacity	:	60 TPH - 1 No

3.9.2 Co-Gen Plant Specifications & Details

The design basis for Co-Gen Plant is provided in **Table 3-18**.

The advantage of installing the 6.0 MW Co-Gen Plant is power savings upto Rs. 1.18 Crore per month (approximately) after the payback period of 1 years 10 months.

Table 3-18: **Design Basis for Co-Gen Plant**

S.No	Description	Unit	Requirements
1	Type of captive power plant		6.0 MW Full back pressure co-generation power plant
2	Gross power output	MW	6.0
3	Generation voltage	KV	11
4	Type of Boiler		AFBC
5	Capacity of Boiler	TPH	60 TPH
6	Fuel		Imported coal
7	Source water		Surface Water
8	Process Steam Requirement		57 TPH @ 6 Kg/cm² G
9	Steam Pressure at Main steam stop Valve	Kg/cm² G	67
10	Steam Temperature at Main steam stop valve outlet	°C	490
11	Fuels to be fired		100 % Imported coal
12	Efficiency of Boiler	%	82
13	Fuel GCV	Kcal/kg	4000
14	TG inlet steam temperature	°C	485
15	TG inlet steam pressure	Kg/cm² G	64
16	Process steam flow	TPH	60
17	TG exhaust steam pressure	Kg/cm² G	6.0
18	Make up water temperature	°C	32
19	Process condensate return flow to De-aerator	%	60
20	Condensate return temperature to De-aerator	°C	70
21	Fuel Cost	Rs./Ton	4000
22	Depreciation	%	5.28
23	O & M cost	Lakh /MW	85
24	APEPDCL Energy Cost 11 KV level	Rs./Unit	6.3
25	Land required	Acres	5

3.9.3 Comparison of Co-gen Plant with Process Boiler Details

Table 3-19: Cost Benefit Analysis for Co-Gen Vs Process Boiler

Co-Gen Plant Vs Process Boiler				
Cost Benefit Analysis				
S.No	**DESCRIPTION**	**UOM**	**Co-Gen**	**Process Boiler**
1	Project Cost Incl Tax	Cr	47	24
1.1	Site Development	Cr	0.5	0.2
1.2	Boiler with ESP & Chimney	Cr	22	16.25
1.3	STG with water cooled condenser	Cr	4.5	0
1.4	BOP Mech	Cr	3	3
1.5	BOP E &I	Cr	4	1.75
1.6	Civil	Cr	7	1.5
1.7	Other Packages	Cr	1.5	0
1.8	Construction	Cr	4	1
1.9	Pre-operating and statutory	Cr	0.5	0.3
2	O & M Cost per hr	Rs	5900	5500 (aux power Incl)
3	Fuel cost per hr	Rs.	59220	48292
4	Steam generation per hr	ton	60	60
5	Net power generation per hr	units	5000	0
6	Power cost per unit	Rs	2.26	
7	Total power generation per year (330 Days)	Mn.units	39.6	
8	Net Savings per year @ 6.3 grid energy charge	Cr	15.99	
9	Net increse of investment for co-gen	Cr	23	
10	Interest @ 11%	Cr	2.63	
11	Depriciation@5.28%	Cr	1.34	
12	Total Cost 1st Year	Cr	26.97	
14	Balance Cost 2 nd year	Cr	10.97	
15	Interest @ 11%	Cr	1.21	
16	Depriciation@5.28%	Cr	0.64	
17	Total Cost 2 nd Year	Cr	12.82	
18	Balance Cost 3rd year	Cr	-3.17	
19	Simple pay back	1 years 10 months		

Assumptions

1. Co-gen Aux power considered 1000 units per hr
2. O&M cost has taken from standards
2. Land required 6 acres
3. Imported coal at 4000 GCV
4. Grid energy cost has taken at 11 KV level 6.35 per unit

3.10 Other Works Details

1	**Motor Control Centre**		
	Application	:	For operation and protection of all electrical items.
	Incoming	:	Incoming MCCB of adequate rating, ammeter, voltmeter, copper bus bar and phase indicating lamps.
	Outgoing	:	Outgoing Contactors of suitable rating of DOL type for motor rating up to 10 HP and Star-Delta type for motor ratings above 10 HP, thermal overload relay with built-in single phase preventer and HRC fuses for extra protection.
	Make	:	All electrical items shall be of L&T, English Electric, GEC, Crompton, IMP, MECO or Siemens.
	Electrical cabling	:	All interconnecting cabling within ETP shall be in PVC insulated, armoured /unarmoured, aluminium conductor of standard make. Cabling, as far as practicable, shall be underground.
2	**Interconnecting Piping and Valves**		
	Application	:	Interconnection between the various units of the CETP
	Pipes	:	All piping shall be in HDPE/PVC/GI/MS and of Suitable size & pressure rating.
	Valves	:	All valves shall be of polypropylene/CI/GM/ HDPE
3	**Erection & Commissioning**		
	To erect the CETP. After erection of the CETP, the entire plant shall be commissioned to obtain the desired results. An operation and Maintenance manual shall also be provided to the client.		
4	**Miscellaneous items**		
	Miscellaneous items like protective railing, stairs, ladders, tools and tackles, storm water drainage, area illumination, furniture in the office and the laboratory, electrical fittings in the buildings and the CETP etc., all complete for the proper, safe and effective operations of the CETP shall be a part of the tender supply.		
5	**DG set**		
	To provide power to critical equipment for uninterrupted operation of the CETP. Capacity- 2000 KVA, Quantity- 4 Nos		

3.11 Electrical Load Details

3.11.1 Cyanide Effluent Treatment System

Table 3-20: Electrical load required for Cyanide Effluent Treatment System

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
1	Oil skimmer	0.5	1	1	-	10	5	3.75	0.5
2	Effluent Transfer pumps	2	2	1	1	10	20	15	2
3	Effluent feed pumps at EQT	2	2	1	1	24	48	36	2
4	Stirrer for Reaction tank	0.5	1	1	-	24	12	9	0.5
5	Stirrers for Chemical preparation tanks	0.5	2	2	-	24	24	18	1
6	Dosing pumps	0.5	2	2	-	24	24	18	1
TOTAL							**133**	**99.75**	**7.0**

3.11.2 Chrome Effluent Treatment System

Table 3-21: Electrical load required for Chrome Effluent Treatment System

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
1	Oil skimmer	0.5	1	1	-	10	5	1	0.5
2	Effluent Transfer pumps	2	2	1	1	10	20	2	2
3	Effluent feed pumps at EQT	2	2	1	1	24	48	3	2
4	Stirrer for Reaction tank	0.5	1	1	-	24	12	4	0.5
5	Stirrer for Flocculator	0.5	1	1	-	24	12	5	0.5
6	Stirrers for Chemical preparation tanks	0.5	3	3	-	24	36	6	1.5
7	Dosing pumps	0.5	3	3	-	24	36	7	
TOTAL							**169**	**126.75**	**8.5**

3.11.3 HTDS Effluent Treatment System

Table 3-22: Electrical load required for HTDS Effluent Treatment System

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
1	Vertex grit removal system	10	1	1	-	10	100	75	10
2	Oil skimmer	1	3	3	-	10	30	22.5	3
3	Effluent Transfer pumps	30	4	1	3	10	300	225	30
4	Effluent feed pumps at EQT	15	2	1	1	20	300	225	15
5	Air blowers for EQT	25	6	3	3	20	1500	1125	75
6	Air blowers for Neutralization tank	5	2	1	1	20	100	75	5
7	Stirrer for flash mixer	2	1	1	-	20	40	30	2
8	Stirrer for Flocculator	2	1	1	-	20	40	30	2
9	Stirrers for Chemical preparation tanks	0.5	7	7	-	20	70	52.5	3.5
10	Flocculator mechanism for primary clariflocculator	3	1	1	-	20	60	45	3
11	Scraper mechanism for primary clariflocculator	2	1	1	-	20	40	30	2
12	Screw press feed pumps	5	6	3	3	20	300	225	15
13	Screw press	5	3	3	-	8	120	90	15
14	Acid/ Alkali dosing pump	0.5	1	1	-	20	10	7.5	0.5
15	Alum dosing pump	0.5	1	1	-	20	10	7.5	0.5
16	Poly dosing pump	0.5	1	1	-	20	10	7.5	0.5
17	Poly dosing pump at screw press	0.5	1	1	-	20	10	7.5	0.5
TOTAL							**3040**	**2280**	**182.5**

3.11.4 Stripper, MEE and ATFD Treatment System

Table 3-23: Electrical load required for HTDS Stripper, MEE & ATFD System

S.No	Description	Electrical load (HP)	Qty (Nos)	Working hrs	Total Load/ day (HP)	Total Load (Kw/hr)
	1000 KLD Capacity					
1	Solvent Stripper	114	1	20	114	
2	MEE	480	1	20	480	
3	ATFD	56	5	20	280	
4	Cooling tower	240	1	20	240	
	Sub-Total	890				890
	500 KLD Capacity					
1	Solvent Stripper	50	2	20	100	
2	MEE	170	2	20	340	
3	ATFD	56	6	20	336	
4	Cooling tower	130	2	20	260	
	Sub-Total	406			For 2 Nos	812
	Total					**1702**

3.11.5 LTDS Effluent Treatment System

Table 3-24: Electrical load required for LTDS Effluent Treatment System

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
1	Vertex grit removal system	10	1	1	-	10	100	75	10
2	Oil skimmer	1	3	3	-	10	30	22.5	3
3	Effluent Transfer pumps	40	4	1	3	10	400	300	40
4	Effluent feed pumps at EQT	20	2	1	1	20	400	300	20
5	Air blowers for EQT	50	4	2	2	24	2400	1800	100
6	Air blowers for Neutralization tank	5	2	1	1	24	120	90	5
7	Stirrer for flash mixer	2	1	1	-	20	40	30	2
8	Stirrer for Flocculator	2	1	1	-	20	40	30	2
9	Stirrers for Chemical	0.5	5	5	-	20	50	37.5	2.5

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
	preparation tanks								
10	Flocculator mechanism for primary clariflocculator	3	1	1	-	24	72	54	3
11	Scraper mechanism for primary clariflocculator	2	1	1	-	24	48	36	2
12	Centrifuge feed pumps	5	1	1	1	12	60	45	5
13	Centrifuge	30	1	1	-	12	360	270	30
14	Acid/ Alkali dosing pump	0.5	2	1	1	20	10	7.5	0.5
15	Alum dosing pump	0.5	2	1	1	20	10	7.5	0.5
16	Poly dosing pump	0.5	2	1	1	20	10	7.5	0.5
17	Poly dosing pump at Centrifuge	0.5	2	1	1	20	10	7.5	0.5
18	Aerators with Blower for Pre-Aeration tank	70	11	11	-	24	18480	13860	770
19	Sludge recycling/ transfer pumps	7.5	2	1	1	3	22.5	16.9	7.5
20	Effluent feed pumps to Anoxic tank	10	2	1	1	20	200	150	10
21	Effluent transfer pumps to SBR feed tank	30	2	1	1	20	600	450	30
22	Mixer for Anoxic tank	40	4	4	-	24	3840	2880	160
23	SBR Feed pumps	40	8	4	4	8	1280	960	160
24	Aerators with Blower for SBR-1	70	35	35	-	18	44100	33075	2450
25	Aerators with Blower for SBR-2	35	11	11	-	18	6930	5197.5	385
26	RAS Pumps (NO3-N) at SBR-1	40	2	1	1	18	720	540	40
27	RAS Pumps at SBR-1	10	2	1	1	3	30	22.5	10
28	RAS Pumps at SBR-2	10	2	1	1	3	30	22.5	10
29	Sludge thickener	5	1	1	-	24	120	90	5

S.No	Description	Electrical load (HP)	Qty (Nos)	Working Qty	Stand by Qty	Working hrs	Total Load/ day (HP)	Total Power/ day (KW)	Connected load
	mechanism								
30	Poly dosing pump at sludge thickener	0.5	1	1	-	20	10	7.5	0.5
31	Poly dosing pump at Centrifuge	0.5	3	3	-	16	24	18	1.5
32	Centrifuge feed pumps	5	4	2	2	16	160	120	10
33	Centrifuge	30	2	2	-	16	960	720	60
34	SBR Decanting system	7.5	8	4	4	20	600	450	30
35	Filter feed pumps	50	2	1	1	20	1000	750	50
36	Filter backwash pumps	50	2	1	1	2	100	75	50
37	Laboratory	7.5	1	1		12	90	67.5	7.5
38	Office Furniture + Fixtures	15	1	1		12	180	135	15
39	Area Illumination	15	1	1		8	120	90	15
TOTAL							**83756.5**	**62817.4**	**4503.5**

3.11.6 Total Power Consumption

Table 3-25: Power Consumption for 5 MLD CETP

S.No	Total Power consumption	Value	Unit
1	Chrome effluent Treatment	126.75	Kw/ day
2	Cyanide effluent Treatment	99.75	Kw/ day
3	High TDS Effluent- Primary Treatment	2,280.00	Kw/ day
4	Low TDS Effluent – Primary Treatment & Combined Biological Treatment	62,817.38	Kw/ day
5	HTDS Effluent Stripper, MEE & ATFD Treatment	40,848.50	Kw/ day
	Total Power consumption	**1,06,171.88**	**Kw/ day**

3.12 Laboratory Equipment Details

3.12.1 Laboratory Equipment Specifications

The laboratory equipment specifications required are provided in **Table 3-26**.

Table 3-26: **Laboratory Equipment Specifications**

S.No	Name of the Equipment	Specifications	Quantity (Nos)
1	Digital pH Meter	*Make: EI-112 Alpha , Range: 1-14	1
2	Digital TDS Meter	*Make: EI-651, Range 0 - 99 ppt	1
3	Digital DO Meter	Range 0 - 12	1
4	Hot air oven	Size: 14" x 14" x 14" Stainless steel chamber	1
5	BOD Incubator	Fully automatic digital,	1
6	COD Digester		1
7	Multi Photo meter		1
8	Weighing balance	Capacity : 200 Grams	1
9	Digital Turbidity meter	Range 0 - 1000 NTU	1
10	Portable vacuum pump		1
11	Water Bath		1
12	Hot Plate		1
13	Magnetic Stirrer		1
14	Muffle furnace		1
15	Jar Test apparatus		1
16	Required Glass Ware	-	Lot

3.12.2 Glassware required for Laboratory

Table 3-27: **Glassware required for Laboratory**

S.No	Name of Glassware	Quantity
1	Beakers 500 ml	2 nos
2	Beakers 250 ml	6 nos
2	Pipette 10 ml	2 nos
3	Pipette 5 ml	2 nos
4	Pipette 2 ml	2nos
5	Pipette 1 ml	2 nos
6	Pipette 25 ml	2nos
7	Pipette 1.5 ml	2nos
8	Burette	2nos
9	Burette stand	2nos

S.No	Name of Glassware	Quantity
10	Open reflex flasks	15nos
11	Reflux stand capacity 15 nos	1 nos
12	Spatula's big, small, medium	5 nos
13	Reagent bottles 1000 ml	5 nos
14	Reagent bottles 500 ml	5 nos
15	Measuring cylinder 1000ml	1 nos
16	Measuring cylinder 50 ml	1 nos
17	Measuring cylinder 25ml	1 nos
18	Magnetic stirrer	3 nos
19	Volumetric flasks 250 ml	3 nos
21	Magnetic beads	20 nos
22	Plastic bottles	5 nos
23	BOD bottles 300 ml	6nos
24	Distillation unit	1nos
25	Sample analysis beakers 500 ml	2 nos
26	Whats man filter paper	1 box
27	Volumetric flask 1000 ml	2 nos
28	Separating funnel 1000 ml	1 nos
29	Petroleum eather	100 ml
30	TSS setup with funnel arrangement	1 no
31	Tissue Paper	10 Roll
32	Gloves	5nos
33	Rubber Bulbs	15nos

3.13 List of Electrical and Mechanical Equipment Makes

The list of electrical and mechanical equipment makes are given in **Table 3-28**.

Table 3-28: **Electro-Mechanical & Instrumentation required for CETP**

S.No	Description	Make
1	Fabricated items	AQUAFLOW
2	Effluent transfer/ feed pumps	Kirloskar/ Johnson/ Kishore
3	Air blowers	Everest blowers/ Usha Compressors/ A1 Blowers or Equivalent
4	Jet Aerators	Eurodetox/ Eurotek
5	Vertex grit mechanism	Smith & Loveless/ Suez
6	Coarse bubble diffusers	Scogen/ W2P/ Air flex

S.No	Description	Make
7	Fine bubble diffusers	Scogen/ W2P/ Air flex
8	Sludge transfer pumps	Kirloskar/ Johnson/ CRI
9	Sludge Screw pumps	Netz/ Roto dyne
10	Chemical Dosing pumps	Edose/ Positive metering
11	Centrifuge	Whirler/ W2P/ Alfa Laval
12	Screw Press	SNP/ Auric
13	Reduction gear boxes	Elecon/ Indofab/ Equivalent
14	DG Set	Kirloskar/ Crompton
15	Panel Components	Siemens / L & T
16	Cables	Finolex/Polycab
17	Push Buttons	Siemens/L&T/FCG & Baliga/BCH
18	Pressure Gauges	H Guru/Forbes Marshall
19	Instrumentation	Siemens/ forbes marshall
20	Interconnecting pipes & fittings	UPVC- Aashirwad / Astral / Supreme MS- Jindal/ Equivalent HDPE- Triveni/ Nagarjuna Polymers/ Equiv

Table 3-29: **List of Items Make**

S.No.	Description	Make
	Civil Items	
1.	Reinforcement Steel	SAIL, TISCO, Vishaka, JSW
2.	Concrete Admixtures	Sika, FOSROC, CICO, Metconete, FRC, Chemistic
3	Cement 53 Grade	ACC, Ultratech, JK, Lakshmi, Sagar
4	Paints	Asian, Berger, J&N
5	Cement Paint	Super Snocem, NITCOCEM
6	CI Pipes & Fittings Manhole Frames	RIF, SRIF
7	GI/ MS pipes	Tata, Jindal, BST, Surya Roshni
8	GI Fittings	'R' brand, Unik, KS
9.	RCC Hume pipes	Indian Hume Pipe Co or Equivalent
10	Pressed Steel Door/ windows frame TIL	Perfect Industrial Products, or Equivalent
11	Standard Rolled	Agew, Ahmedabad Steel Craft
12	Glazed Tiles	Somani, Orient, Johnson & Johnson
13	PVC water stops	Maruti or Equivalent
14	PP ball valves	Dinesh Plastic, Jyoti plastic, Vishal, Poly valves
15	HDPE pipes and fittings	PIL, Hasti, KWH, Godavari, Rel-Pipe or Equivalent
16	Flame Arrestor	HE or Equivalent
17	Level Switches	Premier, Levcon, Chemtrols, Rich systems or

S.No.	Description	Make
		Equivalent
18	Pressure Gauge	H Guru, Gluck, Forbes Marshall, Bells, Fiebeg
19	CI Butterfly valve	Audco, KSB, Leader, BDK
20	CI Sluce/ Check valve	Audco, Leader, BDK
21	SW Pipes	Perfect, Burn or Equivalent
	Electrical Items	
1.	LT Switchgear	L&T, Siemens, GEC Alsthom
2.	Ammeters/ Volmeter	AE, IMP, Meco
3	Current transformer	AE/ IMP/ Meco
4	MCCB	L&T, Siemens, MDS (Legrand)
5	Energy Meter Electronic	HPCL, Universal, Jaipur, REIL
6	Power/Control Cables, Wires	CCI, Fort Gloster, Finolex, Skytone, Rolex, Havells
7	Indication lamps	LED type Binay, Siemens, L&T
8	Weather proof boxes for isolators, push button	Hansu, Hensel
9.	Electric Motors	Siemen, Bharat Bijlee, Crompton, GE Alsthom, Kirloskar
10	DG Set	Powerica – Cummins, Eicher, Caterpilar, Crompton
	Mechanical Items	
1.	Effluent non clog pumps Johnson	Kirloskar, Stork, Jyoti, KSB, Maxflow,
2.	Air Diffuser	Rehau, EDI USA, Kwan
3	Air Blower	Everest, Kay, equivalent
4	Agitator	Euroteck, Voltas, HGE, Amitron, Sacede, Paramount, Envirad, Indavara or equivalent
5	Reduction Gear Box	Radicon, power build, Essenpro
6	Aerator	Euroteck, Voltas, Amitron, Paramount, HE, Sacede, Envirad or Equivalent
7	Chemical Dosing System	SR Metering, Watson marlow, Positive metering, Sandur, Milton Roy, Control Aid Engineers
8	Sludge screw pumps	Hydro, Equivalent or Equivalent
9.	Mechanical Sludge Dewatering Equipment	Tekno fanghi, Hydro, Pennwalt, Humbolt or Equivalent
10	Agitators, Mixers, gates, screens	Indavara, Positive metering, Milton Roy or Equivalent
11	PSF, ACC and other vessels	Indavara, Aventura or Equivalent
12	Flash mixers, flocculators, clarifiers	Indavara, Paramount, Voltas, Envirad or Equivalent

3.14 Civil Works Construction Specifications

All structures shall be provided with protective railing (GI pipe railing with 40 mm vertical of 1 m height and 2 horizontal bars of 32 mm). Walkways (1.2 m wide) shall have to be provided all-round the structures as per requirement. All structures shall be provided with water proof treatment and protective coatings (Sulphur resistance etc.,) as per requirement. The final structure after hydro testing shall be provided with painting of approved color.

Concrete:
a) RCC M-30: Concrete corresponding to minimum cement (53 Grade) content as per IS 456 using weigh batcher/ mixer with 20mm size graded machine crushed metal from approved quarry, fine aggregate, water, etc.
b) PCC : Concrete corresponding to minimum cement (53 Grade) content as per IS 456 using weigh batcher/ mixer with coarse aggregate from approved quarry, fine aggregate, water, etc.

Steel: TMT/HYSD bars of FE415

Brick work: Brick Masonry in CM (1:4) with Bricks with traditional size 23 x 11 x 7 cms of 2 class as per IS 1077-1992

RR masonry: RR Masonry in CM (1:4) as required (other than Granite, Dolomite and Trap)

Plastering: Plastering providing and making with good quality sand and fine finishing as required at site. External plastering with 1:3 mix and internal plastering with 1:4 mix

Painting: Painting of all civil structures with one coat of white cement (primer) and two coats of water proofing cement paint of approved brand (snowcem) and shade

Flooring:
a) Flooring with 40 mm thick Rough Cuddapah/ Shabad stones, set over base coat of cement mortar (1:8) 12mm thick and smooth finished as required
b) Supply and fixing of tiles in admin, laboratory, electrical, chemical store, etc

Doors: Supply and fixing of wooden door shutters with commercial ply conforming to IS:2202 and solid wooden frame for admin building, laboratory, electrical, chemical store rooms, etc. as required along with necessary fixtures

Windows: Supply and fixing of two track or three track sliding window (Aluminum) for admin building, laboratory, electrical, chemical store rooms, etc as required along with necessary fixtures

Sanitary ware: Supply and fixing of toilet ware, wash basins, taps and fixtures as required.

Electrical items: Supply and provide required number of electrical items like but not limiting to fan/ AC, internal luminaries, switch boards, cables and wires, sockets and switches, fuse, MCB, etc. for admin building, laboratory electrical, chemical store, etc

Note: In case the contractor is using any material other than the ones mentioned in the above, detailed specification and the price for each item should be provided.

4 COST ESTIMATION FOR CETP

4.1 General Abstract Estimate:

The General Abstract estimate for 5 MLD CETP is given in **Table 4-1**.

Table 4-1: **General Abstract Estimate for 5 MLD CETP**

SL.NO	DESCRIPTION	PRICE (Crore)
1	Civil Works	₹ 1,27,09,07,059.93
2	Electro-Mechanical Works	₹ 1,13,84,28,552.00
3	Captive Power Plant - 5.0 MWPH	₹ 47,00,00,000.00
4	DG Set 1000 KVA x 3 Nos	₹ 3,00,00,000.00
5	Pipeline from Guard pond to existing Marine disposal pumping station	₹ 50,00,000.00
6	Transformer Yard	₹ 40,00,000.00
7	Street Lighting	₹ 30,00,000.00
8	Laboratory Equipment with Glassware	₹ 30,00,000.00
9	Online Monitoring System with CC Camera's	₹ 25,00,000.00
10	Tools and Tackles	₹ 10,00,000.00
A	**Sub Total**	**₹ 2,92,78,35,611.93**
1	Fire Safety and Fire Hydrant System	₹ 50,00,000.00
2	Provision for APSPDCL towards SLC & SD charges	₹ 50,00,000.00
3	Greenbelt & Landscaping	₹ 25,00,000.00
4	Environmental Monitoring - Construction Phase	₹ 25,00,000.00
5	Seigniorage Charges	₹ 1,07,30,081.34
B	**Sub Total**	**₹ 2,57,30,081.34**
C	**Total (A + B)**	**₹ 2,95,35,65,693.27**
1	Price Escalation / Charges @ 10%	₹ 29,53,56,569.33
2	PMC Consultant @2%	₹ 5,90,71,313.87
3	Contingency @1.5%	₹ 4,43,03,485.40
4	Quality Control @ 0.75%	₹ 2,21,51,742.70
5	Tender Premium @ 5%	₹ 14,76,78,284.66
6	NAC @ 0.1%	₹ 29,53,565.69
7	Unforseen @ 2%	₹ 5,90,71,313.87
8	GST – 12% (Civil items)	₹ 15,25,08,847.19
9	GST – 18% (EM and items of 2 to 9)	₹ 29,82,47,139.36
	TOTAL PROJECT COST	**₹ 4,03,49,07,955.33**
	TOTAL PROJECT COST in Crores	**403.49**

4.2 Estimate for Civil Units

The Abstract of Civil Structures is for CETP is given in **Table 4-2**. The Detailed Estimates are provided in **Annexure 1.1 to Annexure 1.5**.

Table 4-2: **Abstract of Civil Structures for CETP**

ABSTRACT OF CIVIL STRUCTURES FOR 5 MLD CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs.)**	**Total Amount (Rs.)**
1	Earthwork excavation for foundations in hard murrum soil by manual/JCB, other than hard rock (ordinary rocks) depositing & stacking the excavated materials on bank with initial lead of 10m and initial lift of 2m in loamy and clayey soils like red earth, ordinary gravelly soils, hard murrum soils, including shoring, strutting, sheeting planking and dewatering including cost of hire charges of T&P, labour charges etc., Complete for finished item of work. (No Blasting work)	CuM.	59,274.85	₹ 101.77	₹60,32,401.54
2	Filling with useful available excavated earth (excluding rock) in trenches, sides of foundations and basement with initial lead in layers not exceeding 15cm thick, consolidating each deposited layer by watering and ramming including all operational, incidental labour charges, hire charges of T & P etc complete for finished item of work.	CuM.	23,317.82	₹ 271.77	₹63,37,083.48
3	Laying P.C.C (1:4:8) using 40mm machine crushed HBG metal, cement, sand for leveling course under foundations and flooring including cost and conveyance of all materials at site, seigneiorage charges ,machine mixing placing, compacting, curing with all leads and lifts etc., complete for finished item of work as directed by Engineer at site.	CuM.	11,381.06	₹ 6,028.66	₹6,86,12,534.99
4	Supply and placing of the Design Mix Concrete of M30 corresponding to IS 456 using WEIGH BATCHER/ MIXER with 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate (sand)	CuM.	17,771.12	₹ 10,047.47	₹17,85,54,833.37

ABSTRACT OF CIVIL STRUCTURES FOR 5 MLD CETP					
1	2	3	4	5	6
S.No.	Description of Item	Unit	Quantity	Unit Rate (Rs.)	Total Amount (Rs.)
	coarse aggregate, water etc., to site and including Seigniorage charges, sales & other taxes on all materials including all operational, incidental and labour charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work (APSS No. 402) with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curing etc. complete but excluding cost of steel and its fabrication charges for finished item of work and including all labour charges, hire charges of all T&P, all taxes etc., complete for the finished item of work asdirected by the Engineer - In - Charge. FOUNDATIONS, PLINTH, PEDESTALS (Below Plinth)				
5	Supply and placing of the Design Mix Concrete of M30 corresponding to IS 456 using WEIGH BATCHER/ MIXER with 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate (sand) coarse aggregate, water etc., to site and including Seigniorage charges, sales & other taxes on all materials including all operational, incidental and labour charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work (APSS No. 402) with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curing etc. complete but excluding cost of steel and its fabrication charges for finished item of work and including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as	CuM.	19,492.30	₹ 10,538.29	₹20,54,15,553.09

ABSTRACT OF CIVIL STRUCTURES FOR 5 MLD CETP					
1	2	3	4	5	6
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs.)**	**Total Amount (Rs.)**
	directed by the Engineer - In - Charge. COLUMNS, LINTELS, WATER TANKS, RCC WALLS IN BUILDINGS				
6	Supply, Fitting and Placing TMT bar reinforcement (Fe500) including decoiling, bending, cracking and tying them after placing in position as directed by the Engineer-in-charge including cost and conveyance of steel and binding wire all taxes labour charges for all operations etc., complete for finished item of work as directed by the Engineer - In- Charge and as per Technical Specification 1100 & 1600 MORTH	RMT	5,067.65	₹ 70,532.19	₹35,74,32,133.65
7	Providing shuttering using wooden brackets, wooden wall plates, wooden runners and steel plate form work as per the approved plan and other accessories as per the standard trade practice including material, labour cost and conveyance of all other consumable accessories, taxes etc complete for finished item of work for plain walls	SqM.	1,09,476.29	₹ 750.00	₹8,21,07,216.33
8	Plastering with CM(1:4), 12mm thick including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer -In-Charge.	SqM.	29,845.01	₹ 187.24	₹55,88,178.74
9	Providing Acid / Alkali Resistance Tiles as per the requirement including labour, material, conveyance of all items as per the direction of Engineer in charge .	SqM.	572.93	₹ 1,495.00	₹8,56,527.36
10	CC Flooring of 100mm thick, with M15 CM (1:2:4) / Vacuum Dewatered Flooring, m2	SqM.	31,773.17	₹ 750.00	₹2,38,29,875.47
11	Painting to new walls with 3 coats of white wash to give an even shade after thoroughly brushing the surface to remove all dirt and remains of loose powdered materials to work site and all operational, incidental, labour charges etc, complete for finished item of work as per SS 911 for all plastered surfaces…	SqM.	11,124.88	₹ 85.00	₹9,45,614.63
12	Provisions for Internal CC Roads as per the requirement	Rmt	2,795.95		₹8,91,66,892.28

ABSTRACT OF CIVIL STRUCTURES FOR 5 MLD CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs.)**	**Total Amount (Rs.)**
13	Provision of Internal Drains along the Road	Rmt	2,795.95	₹ 2,682.45	₹75,00,000.00
14	Handrail Fabrication, erection with MS pipes and painting	LS			₹25,00,000.00
15	Provisions for Compound Wall with gate around the CETP Site as per the requirements	Rmt	1,499.11	6,500.00	₹97,44,215.00
16	Provision for other Structures	SqM.	18,857.00	₹ 12,000.00	₹22,62,84,000.00
Total					**₹1,27,09,07,059.93**

4.2.1 Estimation of Internal Roads

The Abstract of Internal Roads is in **Table 4-3**.

Table 4-3: **Abstract Sheet – Internal Roads for CETP**

ABSTRACT SHEET – INTERNAL ROADS FOR CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
1	Clearing and grubbing jungle including uprooting rank vegetation, grass, bushes, shrubs, sapling and trees girth upto 300mm, removal of stumps of trees cut earlier stacking of serviceable materials to be used or auctioned and disposal of unserviceable materials upto a lead of 1000 mts including removal and disposal of top organic soil not exceeding 150mm in thickness by mechanical means in area of light jungle.	Sqm	25,005.02	1.92	₹ 48,009.63
2	Excavation for road work in soil with hydraulic excavator including cutting, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross-sections, with all lifts and lead and depositing the excavated soil on the banks including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge as per Technical Specification Clause 302.3 MORD/301 MORTH	Cum	12,486.65	103.94	₹ 12,97,862.82
3	Construction of embankment with borrowed earth from outside area deposited at site by road way cutting and excavation for foundation of other structures using dozer, including watering, grading and compacting each layer to required proctors density with OMC compaction with vibratory roller of 8 Tonnes capacity, maintaining the required camber in the formation including all labour charges, hire& operational charges of, power roller, mortar grader, water tanker, all water leads, all taxes etc. complete as per requirement of table 300.1 and 300.2	Cum	6,243.33	686.35	₹ 42,85,107.49

ABSTRACT SHEET – INTERNAL ROADS FOR CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	as per Technical Specification clause 301.5 MORD/305 MORTH. (payment will be based on levels for finished item of work).				
4	Compaction of original ground with maximum of six passes of vibratory power road roller including filling in depression occurring during rolling as per MOST specification No.305(3.4) and as directed by the Engineer-in-Charge	sqm	20,811.09	14.66	₹ 3,05,090.58
5	Forming road embankment / Gravel sub grade with Gravel with CBR more than 10% brought from approved source spreading in layers not more than 150mm thick, sectioning to required camber & gradient, watering and compacting each layer top rectors density with OMC compaction using 80 to 100 KN capacity vibratory roller including cost and conveyance of all materials (viz), gravel, water etc., to site, seigniorage charges, hire and operational charges of power roller and other T&P etc., complete duly maintaining the required camber & gradient in the formation as directed by Engineer-in-Charge. (payment on level basis) (RBR-SBBS- (iii) - P.No.158 - Chapter-4	Cum	10,405.55	388.41	₹ 40,41,617.73
6	Construction of granular sub-base by providing HBG material (66% of 9.50mm to 4.75mm HBG (IRC) Machine crushed metal and 34% of 2.36mm and below HBGIRC) Machine crushed metal with CBR not less than 20 including spreading in uniform layers with motor grader or by approved means, on prepared surface mixing by mix in place method with rotavator approved means at OMC and compacting with vibratory roller to achieve the desired density etc., complete for finished item of work as directed by the Engineer-In-Charge: including the cost and conveyance of all materials ie stone dust, stone aggregates of specified sizes water etc to site labour	Cum	3,121.66	1,439.52	₹ 44,93,711.94

ABSTRACT SHEET – INTERNAL ROADS FOR CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	charges for all operational hire etc and operational charges of power roller and other T & Pall taxes etc complete. As per RBR-SBBS-I (iii) Chap-4 pgNo:158)				
7	Providing Dry Lean concrete with Plain Cement concrete nominal mix (1:4:8) prop (Cement : fine aggregate: coarse aggregate) using 40mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site, seigniorage charges on all materials, labour charges, for mixing , laying, concrete, Compacting, finishing top surface to the required level curing	Cum	3,121.66	4,643.67	₹ 1,44,95,961.10
8	Supply and placing separation membrane of impermeable vergin plastic sheeting 125 Micrins thick uniformly over already laid PCC in single layer without rinkles including cost and conveyance of all material and all labour charges for spreading under Pavements labor as directed by the Engineer-in-charge etc., complete - 1 Sqm	Sqm	20,811.09	20.00	₹ 4,16,221.80
9	Construction of Un reinforced plain cement concrete pavement M 30 Grade over a prepared sub base, coarse and fine aggregates, confirming to IS 383, Crushed Stone aggregate of 20mm and 10mm size graded granite chips as per table 1500.1, mixed in a concrete mixer of not less than 0.2 Cum capacity and appropriate weigh batcher using approved mix design with minimum cement content of 419Kg/ Cum laid in alternate panels with approved fixed side frame work of Steel Channel, wedges, Steel plates including leveling the form work as per drawing, cleaning the surface wit Air compressor initially and spreading the concrete with shovels, rakes, compacted with needle, plate and screed vibrators and finished in continuous operation of lines and gade, curing of concrete slab for 14 days including cost and	Cum	6,243.33	8,875.82	₹ 5,54,14,661.74

ABSTRACT SHEET – INTERNAL ROADS FOR CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	conveyance charges, seigniorage charges of materials, Hire and Operational Charges of all T&P, all taxes., diversion of traffic etc., complete for Finished item of work as per the drawing, as per Technical Specification Clause No 1501 MORD and as directed by the Engineer-In-Charge				
10	Providing and spreading gravel for shoulders with side slopes 2:1 in layers each not exceeding 150mm thick over embankment including sectioning each layer to proper camber, watering, compaction with vibratory roller of 8-10t capacity including cost and conveyance of gravel to site, seigniorage charges, all taxes, labour charges for all operations, hire and operational charges of power roller and other T&P etc., complete for finished item of work.	Cum	6,458.64	292.96	₹ 18,92,124.49
	Kerb Stone				
11	Construction of cement concrete kerb with top and bottom width 115 and 165 respectively ,250mm high in M20 grade PCC on M10 grade foundation 150MM thick, foundation have 50MM projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete manually, all complete as per clause 408 MORTH	Sqm	5,591.90	398.66	₹ 22,29,286.74
12	Painting to Kerb stones with two coats over primer coat (Total Three coats) with synthetic enamel paint in all shades on new plastered / concrete surfaces including cost and conveyance of all materials, cement primer grade - II, all incidental and operational charges, all taxes etc complete as per drawing and technical specification clause 1701MORD. (vide page 451 of RBR - TSRA -6)	Sqm	2,795.95	88.43	₹ 2,47,236.23
Total					**₹ 8,91,66,892.28**

4.2.2 Seigniorage Charges for 5 MLD CETP

The Seigniorage Charges for 5 MLD CETP has been given in **Table 4-4**.

Table 4-4: **Seigniorage Charges for 5 MLD CETP**

Seigniorage Charges for CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
A	**Civil Items**				
3	Plain Cement concrete (1:5:10) using 40mm metal with Concrete mixture including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer - In - Charge. All work upto plinth level.	Cum	11,381.06	₹ 126.00	₹ 14,34,013.43
4	Supply and placing of the Design Mix Concrete of M30 corresponding to IS456 using WEIGH BATCHER / MIXER with 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate (sand) coarse aggregate, water etc., to site and including Seigniorage charges, sales & other taxes on all materials including all operational, incidental and labour charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work (APSS No. 402) with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curing etc. complete but excluding cost of steel and its fabrication charges for finished item of work and including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge.	Cum	17,771.12	₹ 112.00	₹ 19,90,365.87

Seigniorage Charges for CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	FOUNDATIONS, PLINTH, PEDESTALS (Below Plinth)				
5	Supply and placing of the Design Mix Concrete of M30 corresponding to IS456 using WEIGH BATCHER / MIXER with 20mm size graded machine crushed hard granite metal (coarse aggregate) from approved quarry including cost and conveyance of all materials like cement, fine aggregate(sand) coarse aggregate, water etc., to site and including Seigniorage charges, sales & other taxes on all materials including all operational, incidental and labour charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication charges for finished item of work (APSS No. 402) with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curing etc. complete but excluding cost of steel and its fabrication charges for finished item of work and including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer - In - Charge. COLUMNS, LINTELS, WATER TANKS, RCC WALLS IN BUILDINGS	Cum	19,492.30	₹ 112.00	₹ 21,83,138.05
8	Plastering with CM(1:4),12mm thick including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge.	Sqm	29,845.01	₹ 15.00	₹ 4,47,675.08
	SUB TOTAL				**₹ 60,55,192.42**
B	**Internal CC Road** as per the requirement				
3	Construction of embankment with borrowed earth from outside area deposited at site by	Cum	6,243.33	₹ 45.00	₹ 2,80,949.72

Seigniorage Charges for CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	road way cutting and excavation for foundation of other structures using dozer, including watering, grading and compacting each layer to required proctors density with OMC compaction with vibratory rollerof 8 Tonnes capacity, maintaining the required camber in the formation including all labour charges, hire & operational charges of, power roller, mortar grader, water tanker, all water leads, all taxes etc. complete as per requirement of table300.1and 300.2 as per Technical Specification clause 301.5 MORD/ 305 MORTH. (payment will be based on levels for finished item of work).				
5	Forming road embankment/ Gravel subgrade with Gravel with CBR more than 10% brought from approved source spreading in layers not more than150mm thick, sectioning to required camber & gradient, watering and compacting each layer top roctors density with OMC compaction using 80 to100 KN capacity vibratory roller including cost and conveyance of all materials (viz), gravel, water etc., to site, seigniorage charges, hire and operational charges of power roller and other T&P etc., complete duly maintaining the required camber & gradient in the formation as directed by Engineer-in-Charge. (payment on level basis) (RBR - SBBS - (iii)- P.No. 158 - Chapter-4	Cum	10,405.55	₹ 57.60	₹ 5,99,359.39
6	Construction of granular sub-base by providing HBG material (66% of 9.50mm to 4.75mm HBG (IRC) Machine crushed metal and 34% of 2.36 mm and below HBGIRC) Machine crushed metal with CBR not less than 20 including spreading in uniform layers with motor grader or by approved means, on	Cum	3,121.66	₹ 115.20	₹ 3,59,615.64

Seigniorage Charges for CETP					
1	2	3	4	5	6
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	prepared surface mixing by mix in place method with rotavator approved means at OMC and compacting with vibratory roller to achieve the desired density etc., complete for finished item of work as directed by the Engineer-In-Charge including the cost and conveyance of all materials ie stone dust, stone aggregates of specified sizes water etc to site labour charges for all operational hire etc and operational charges of power roller and other T & P all taxes etc complete. As per RBR- SBBS- I(iii) Chap-4 pg No:158)				
7	Providing Dry Lean concrete with Plain Cement concrete nominal mix (1:4:8) prop (Cement : fine aggregate: coarse aggregate) using 40mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site, seigniorage charges on all materials, labour charges, for mixing , laying, concrete , Compacting, finishing top surface to the required level curing etc., complete for finished item of work for foundation and under flooring bed.	Cum	3,121.66	₹ 126.00	₹ 3,93,329.60
8	Construction of Un reinforced plain cement concrete pavement M 30 Grade over a prepared subbase, coarse and fine aggregates, confirming to IS383, Crushed Stone aggregate of 20mm and 10mm size graded granite chips as per table 1500.1, mixed in a concrete mixer of not less than 0.2Cum capacity and appropriate weigh batcher using approved mix design with minimum cement content of 419 Kg/Cum laid in alternate panels with approved fixed side frame work of Steel Channel, wedges,	Cum	20,811.09	₹ 126.00	₹ 26,22,197.34

Seigniorage Charges for CETP					
1	**2**	**3**	**4**	**5**	**6**
S.No.	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (in Rs.)**	**Total Amount (Rs.)**
	Steel plates including leveling the formwork as per drawing, cleaning the surface with Air compressor initially and spreading the concrete with shovels, rakes, compacted with needle, plate and screed vibrators and finished in continuous operation of lines and gade, curing of concrete slab for 14 days including cost and conveyance charges, seigniorage charges of materials, Hire and Operational Charges of all T&P, all taxes., diversion of traffic etc., complete for Finished item of work as per the drawing, as per Technical Specification Clause No 1501 MORD and as directed by the Engineer-In-Charge				
10	Providing and spreading gravel for shoulders with side slopes 2:1 in layers each not exceeding 150mm thick over embankment including sectioning each layer to proper camber, watering, compaction with vibratory roller of 8-10t capacity including cost and conveyance of gravel to site, seigniorage charges, all taxes, labour charges for all operations, hire and operational charges of power roller and other T&P etc., complete for finished item of work.	Cum	6,458.64	₹ 57.60	₹ 3,72,017.92
11	Construction of cement concrete kerb with top and bottom width 115 and 165 respectively ,250mm high in M20 grade PCC on M10 grade foundation 150MM thick, foundation have 50MM projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete manually, all complete as per clause 408 MORTH	Cum	5,591.90	₹ 8.48	₹ 47,419.31
	SUB - TOTAL				**₹ 46,74,888.92**
Total (A + B)					**₹ 1,07,30,081.34**

4.3 Estimate for Electro-Mechanical Items

The Cost estimate for Mechanical & Electrical items are given in **Table 4-5**. The detailed estimates are provided in **Annexure 2.1**.

Table 4-5: **Summary of Cost Estimate for Electro-Mechanical Items**

SL.NO	DESCRIPTION	PRICE (Crore)
I	CHROME EFFLUENT TREATMENT	₹ 11,42,055.00
II	CYANIDE EFFLUENT TREATMENT	₹ 9,51,405.00
III	HIGH TDS EFFLUENT- PRIMARY TREATMENT	₹ 1,87,14,450.00
IV	LOW TDS EFFLUENT- PRIMARY TREATMENT	₹ 1,75,02,900.00
V	COMBINED LOW TDS & MEE CONDENSATE EFFLUENT- BIOLOGICAL & TERTIARY TREATMENT	₹ 30,47,22,660.00
A	**Sub Total**	**₹ 34,30,33,470.00**
1	Interconnecting Piping & Fittings @ 15%	₹ 5,14,55,020.50
2	Automation @ 15%	₹ 5,14,55,020.50
3	Electrical panel @ 10%	₹ 3,43,03,347.00
4	Electrical works @ 15%	₹ 5,14,55,020.50
5	Stripper, MEE & ATFD System	₹ 56,15,00,000.00
	TOTAL	**₹ 1,09,32,01,878.50**
1	Commissioning @ 5% (for A and Item 5)	₹ 4,52,26,673.50
	TOTAL COST	**₹ 1,13,84,28,552.00**
	TOTAL COST in Crores	**113.84**

4.3.1 Estimate for Stripper, MEE & ATFD for High TDS System

The Cost estimate for Stripper, MEE & ATFD for HTDS is given in **Table 4-6.**

Table 4-6: **Estimate for Stripper, MEE & ATFD for High TDS System**

S. NO.	DESCRIPTION	Qty.	Estimated Cost each (INR LAKHS)	Total Estimated cost (INR LAKHS)	REMARKS
1.	**Civil Works**				
	1000 KLD stripper, MEE & ATFD	1 Lot			35m X 10m X 18 m.
	3000 TR cooling tower	1 Lot			19m X 9.1m X 1.6 m
	500 KLD Stripper, MEE & ATFD	2 Lot			25m X 10m X 18 m
	2000 TR cooling tower	2 Lot			10.5m X 8.5m X 1.6 m
	Pipe rack structure for steam & Utility lines	1 Lot			
	Tank form area for Feed, condensate, Concentrate & CIP	2 Lot			
	Pumps foundation & Miscellaneous	2 Lot			
2.	**Mechanical, Electrical & Instrumentation works**				
	1000 KLD stripper, MEE & ATFD	1 Lot	2591.00	**2591.00**	
	3000 TR cooling tower	1 Lot	52.00	**52.00**	
	3000 TR cooling tower pumps	1 Lot	20.00	**20.00**	
	500 KLD Stripper, MEE & ATFD	2 Lot	1359.00	**2718.00**	
	2000 TR cooling tower	2 Lot	32.00	**64.00**	
	2000 TR cooling tower pump	2 Lot	12.00	**24.00**	
	Pumps for Common facility treatment	14	1.00	**14.00**	
	IBR piping work beyond battery limits	200 m	35.00	**35.00**	
	All piping work beyond battery limits	400 m	30.00	**30.00**	
	Power connections beyond battery Limits	200 m	35.00	**35.00**	
	Instrumentation Air Supply	100 m	14.00	**14.00**	
	Flow Meters	9 No's	2.00	**18.00**	
3	Stripper, MEE, Atfds, Boiler, Ro Plant Lighting				Included in Electro mechanical items
4	Air Conditioning Of MEE &Boiler PLC Room				Included in Electro mechanical items
5	Fire Fighting System &				Included in Electro mechanical items
6	Fire Hydrant System At Boiler & MEE				Included in Electro mechanical items
7	Provide Suitable Fire Extinguishers				Included in Electro mechanical items

S. NO.	DESCRIPTION	Qty.	Estimated Cost each (INR LAKHS)	Total Estimated cost (INR LAKHS)	REMARKS
8	Provide Rubber Mats, Sand Buckets At All Electrical Panels & T/F Yard				Included in Electro mechanical items
	Total Cost			**5615.00**	
	Say			**56.15 Cr**	

Note: Civil Works cost is included in Civil estimate and cost of items 3 to 8 are included in electro-mechanical items

4.4 Estimate for Operation and Maintenance of CETP

The Summary of Operation & Maintenance cost for CETP is provided in **Table 4-7**.

Table 4-7: **Summary of Cost Estimate for Operation & Maintenance of CETP**

SL.NO	DESCRIPTION	PRICE (Crore)
1	Electrical Power	₹ 1,03,41,854.69
2	Coal Charges	₹ 3,83,18,400.00
3	Water Charges including Treatment Cost	₹ 17,28,000.00
4	Manpower	₹ 1,06,75,000.00
5	Chemicals for High TDS Effluent Treatment	₹ 63,35,340.00
6	Chemicals for Low TDS Effluent Treatment	₹ 61,17,000.00
7	Sludge Disposal	₹ 2,00,33,400.00
8	Laboratory Testing and Analysis	₹ 2,50,000.00
9	Civil and Mechanical Maintenance Works	₹ 12,00,000.00
	TOTAL COST	**₹ 9,49,98,994.69**
	TOTAL COST in Crores	**9.50**

4.4.1 Power required for Operation and Maintenance of CETP

The Power required for Operation and Maintenance of CETP is given in **Table 4-8**.

Table 4-8: **Power Consumption for 5 MLD CETP**

S.No	Total Power consumption	Value	Unit
1	Chrome effluent	126.75	Kw/ day
2	Cyanide effluent	99.75	Kw/ day
3	High TDS Effluent- Primary treatment	2,280.00	Kw/ day
4	Low TDS Effluent	62,817.38	Kw/ day
5	Stripper, MEE & ATFD	40,848.00	Kw/ day
	Total Power consumption	**1,06,171.88**	**Kw/ day**
	AP State charges @ 5% on Total	5,308.59	**Kw/ day**
	Unit cost	6.30	Rs.
A	**Total Cost**	**33,444.14**	Rs.
	Captive Power Plant	1,00,863.28	Kw/ day
	Unit cost	2.26	Rs.
B	Total Cost	2,27,951.02	Rs.
A + B	**Total cost/ day**	**2,61,395.16**	**Rs**
	Total Cost/ month	**1,03,41,854.69**	**Rs**

4.4.2 Coal Cost for Operation and Maintenance of CETP

The Coal required for Operation and Maintenance of CETP and cost estimate is given in **Table 4-9**.

Table 4-9: **Coal Estimate for Operation and Maintenance of 5 MLD CETP**

S.No	Description	Value	Unit
1	Coal Required	3,19,320	Kg/ day
2	Total Quantity per month	9,579.60	Ton/month
3	Coal Charges per Ton	4,000.00	Rs
	Total Cost per month	**3,83,18,400.00**	**Rs**

4.4.3 Water Charge for Operation and Maintenance of CETP

The Water required for Operation and Maintenance of CETP and cost estimate is given in **Table 4-10**.

Table 4-10: **Water required and Cost Estimate for Operation and Maintenance of 5 MLD CETP**

S.No	Description	Value	Unit
1	Water Required	768	KL/ day
2	Total Quantity per month	23,040.00	KL/month
3	Water Charges per KL including treatment cost	75	Rs
	Total Cost per month	**17,28,000.00**	**Rs**

4.4.4 Manpower required for Operation and Maintenance of CETP

The Manpower required for Operation and Maintenance of CETP is given in **Table 4-11**.

Table 4-11: **Manpower required for Operation and Maintenance of CETP**

S.No.	Description	Shifts	No's/ Shift	Total	Qualification & Experience	Job Profile
1	General Manager	General	1	1	BE(Chem)/M.Sc with minimum of 10 years of similar experience	Responsible for overall OPERATION of the facility. GM will be a single point at site. He will also provide management information to the customer in the form of monthly MIS and help out with the supervision activity.
2	Manager-operations	General	1	1	BE(Chem)/M.Sc with minimum of 10 years of similar experience	Complete operations of the plant.
3	Manager-Lab	General	1	1	M.Sc with minimum of 5-10 years of similar experience	Responsible for complete analysis and R&D.
4	Manager-Accounts	General	1	1	B.com with minimum of 5-10 years of similar experience	Responsible for accounts

S.No.	Description	Shifts	No's/ Shift	Total	Qualification & Experience	Job Profile
5	Manager- P&A	General	1	1	Graduation with Minimum of 5-10 years of similar experience	Responsible for HRD activities.
7	Manager-Maintenance	General	1	1	BE (Mech) with minimum of 5-10 years of similar experience	Responsible for maintenance works.
8	Manager - Electrical	General	1	1	BE (Electrical) with minimum of 5-10 years of similar experience.	Responsible for electrical related works.
9	Process Engineers	Three shifts + General	4	4	BE(Chem)/M.Sc with minimum of 5 years of similar experience	Responsible for the quality of the treatment.
10	Operator and Firemen for Boiler	Three shifts + General	3	12	IBR GRADED with 5-6 years' experience 1-Class A, 3-class B	Responsible for the operations part of the mentioned utilities will work closely with end utility user to ensure optimum utilization of the utilities.
11	Operator for (450 KLD x 7) Nos MEE&ATFD	Three shifts + General	4	16	DME/ BSC 2-3 years' experience	Responsible for the operations part of the mentioned MEE.
12	Operators for Primary, secondary treatment.	Three shifts + General	4	16	ITI with 2-3 years' experience	Responsible for the routine maintenance works.
13	Electrician, Mechanic &Technician	ROC-shift &General shift	4	16	ITI with 2-3 years' experience	Will take care of all electrical & instrumentation requirement.
14	Manpower for CPP	ROC-shift &General shift	5	20	SUITABLE	Responsible for CPP operation

S.No.	Description	Shifts	No's/ Shift	Total	Qualification & Experience	Job Profile
15	Coal & Ash handling in shift. Coal Day bunker filling, stores handling etc.	ROC Shift and General shift	10	40	Casual, trained 2-3 years' experience	Responsible for the coal bunker filling, coal and ash handling in ROC shifts. (As recommended by the Boiler Supplier).
16	Helpers for MEE, ATFD inclusive of Maintenance	Roc and General shifts	8	32	Casual Trained	Would be assisting the Facility Management Team and sludge handling
17	Helpers for secondary treatment	Roc and General Shift	8	24	Causal trained	Would be assisting the facility management team.
18	Supervisors	ROC, A,B&C	4	12	Diploma/ITI with one year exp.	Assist Engineers to smooth operation of the plant.
19	Laboratory	General & C	16	20	B.Sc-chemistry with two years exp.	Day to day analysis for required parameters.
20	Security guards	General, A,B&C	7	21	10^{th} Class and trained with one year exp.	Round the clock security for entire plant.
21	Gardening	General	25	25	Causal trained with one year exp.	Gardening for entire plant area and housekeeping.
22	Sample inspection	General	3	12	Causal trained	Collect the samples at identified locations.
23	Safety engineer	General	1	1	Graduate Qualified safety engineer	Monitor the safety in the entire plant.
24	Safety staff	General, A,B&C	4	4	Graduate	Monitor the safety gadgets and work permits.
25	Office staff	General	10	10	Graduate/underg raduate with two years' experience	Day to day administration and accounts.
26	Manager-Civil	General	1	1	Graduate (civil) with 10 years' experience.	All civil related works.
27	Civil engineers & Supervisors	General	2	2	Diploma/B.Tech (civil) with 2-3 years' experience	All civil activities supervision.
28	Stores	General	1	1	Graduate with three years' experience	Maintenance of spares and issue.

S.No.	Description	Shifts	No's/ Shift	Total	Qualification & Experience	Job Profile
29	Purchase	General	1	1	Graduate with three years' experience.	Procurement of spares.
30	Purchase& stores	General	2	2	Graduate/Under graduate with two years' experience	Assistance to stores and purchase.
31	Maintenance	General	6	6	ITI	All maintenance works
Total				**305**		

4.4.5 Chemicals required for Operation and Maintenance of CETP

The Chemicals required for Operation and Maintenance of CETP is given in **Table 4-12**.

Table 4-12: **Chemicals required for Operation and Maintenance of CETP**

S.No	Name of the Chemical	Quantity/ day	Unit	Unit cost (Rs.)	Total (Rs.)
2000 KLD HIGH TDS / COD EFFLUENTS					
1	HCL	8,000.00	Kgs	6.00	48,000.00
2	NaOH	2,000.00	Kgs	42.00	84,000.00
3	Ferric Alum	253.00	Kgs	16.00	4,048.00
4	Polyelectrolyte	10.00	Kgs	310.00	3,100.00
5	HNO3 (Nitric acid)	1,715.00	Kgs	42.00	72,030.00
	Total/ day				**2,11,178.00**
	Total/ month				**63,35,340.00**
3000 KLD LOW TDS/COD EFFLUENTS					
1	HCL	10,000.00	Kgs	6.00	60,000.00
2	NaOH	3,000.00	Kgs	42.00	1,26,000.00
3	Ferric Alum	300.00	Kgs	16.00	4,800.00
4	Polyelectrolyte	35.00	Kgs	310.00	10,850.00
5	NaOCL	90.00	Kgs	25.00	2,250.00
	Total/ day				**2,03,900.00**
	Total/ month				**61,17,000.00**

4.4.6 Sludge Disposal Estimate for Operation and Maintenance of CETP

The Sludge disposal estimate for Operation and Maintenance of CETP is given in **Table 4-13**.

Table 4-13: **Sludge disposal estimate for Operation and Maintenance of CETP**

S.No	Name of the Chemical	Quantity	Unit	Dried Sludge (Ton /day)	Unit cost	Total
1	High TDS- Primary	300	m3/day	5.6	6500	₹ 36,530.00
2	Low TDS- Primary	135	m3/day	2.5	6500	₹ 16,250.00
3	Low TDS- Secondary	410	m3/day	45	6500	₹ 2,92,500.00
4	ATFD Powder	6164	kg/hr	129	2500	₹ 3,22,500.00
	Total/ day			**182.12**		**₹ 6,67,780.00**
	Total/ month					**₹ 2,00,33,400.00**

5 IMPLEMENTATION PLAN AND ITS SCHEDULE

The mode of procurement for the development of the CETP infrastructure along with its associate components would be on EPC based on the requirements.

The Asian Development Bank's procurement guidelines document available in ADB official website was reviewed. It was noticed that there are multiple procedure for the bid process and different Standard Bidding Documents (SBD) for each.

Considering the method of procurement being followed by APIIC, it is proposed to use SBD Works (Single Stage, Two Envelope) model contract document for inviting the implementing agencies.

6 ANNEXURES & DRAWINGS

6.1 Annexure 1.1: Abstract of Civil Quantities

	Work item No	1	2	3	4	5	6	7	8	9	10	11
S.No	Description of Works	Earth work Excavation for foundation.	Re-Filling with useful available excavated earth	Laying P.C.C (1:4:8) using 40mm machine crushed HBG metal, cement, sand for levelling	Supply and placing of the design mix concrete M30 grade corresponding. Foundations, Plinth, Pedestals (Below Plinth)	Supply and placing of the design mix concrete M30 grade corresponding. Columns, Lintels, Water Tanks, RCC Walls in Buildings	Providing Thermo Mechanical Treated (TMT) of different diameters of RCC works	Plain Shuttering	Plastering 12mm thick in two coats using screened sand with base cost of 8 mm thick in CM (1:6)	Tiling	First Floor-CC Finish	Painting 3 coats of white wash
	CIVIL WORKS	m3	m3	m3	m3	m3	MT	m2	m2	m2	m2	m2
A.	100KLD CHROME EFFLUENT TREATMENT											
1	Sample platform											
2	BAR SCREEN CHAMBER	13.12	7.87	1.63	2.49	7.97	1.47	45.55	9.18	28.65	1.00	5.40
3	GRIT CHAMBER	13.12	7.87	1.53	2.63	7.97	1.46	45.55	9.18	28.65	1.00	5.40
4	OIL & GREASE CHAMBER	39.37	23.62	4.90	7.47	23.92	4.38	136.65	27.54	85.94	3.00	16.20
5	OIL & GREASE COLLECTION CHAMBER	13.12	7.87	1.63	2.49	7.97	1.46	45.55	9.18	28.65	1.00	5.40
6	CHROME EFFLUENT COLLECTION TANK	36.94	22.16	14.73	10.73	36.44	6.60	310.03	137.76	28.65	40.20	71.12
7	REACTION CHAMBER	14.58	8.75	1.76	3.19	9.06	1.46	71.13	24.38	28.65	2.00	13.80
8	FLOCCULATION TANK	13.12	7.87	1.63	2.78	7.97	1.46	45.55	9.18	28.65	1.00	5.40
9	LEMELLA CLARIFIER	17.82	10.69	4.58	4.68	13.07	2.35	110.25	44.28	28.65	10.00	`
B.	100KLD CYANIDE EFFLUENT TREATMENT											
10	Sample platform											
11	BAR SCREEN CHAMBER	13.12	7.87	1.63	2.49	7.97	1.46	45.55	9.18	28.65	1.00	5.40
12	GRIT CHAMBER	13.12	7.87	1.53	2.63	7.97	1.46	45.55	9.18	28.65	1.00	5.40
13	OIL & GREASE CHAMBER	39.37	23.62	4.90	7.47	23.92	4.38	136.65	27.54	85.94	3.00	16.20
14	OIL & GREASE COLLECTION CHAMBER	13.12	7.87	1.63	2.49	7.97	1.46	45.55	9.18	28.65	1.00	5.40
15	CYANIDE EFFLUENT COLLECTION TANK	36.94	22.16	14.73	10.73	36.44	1.46	310.03	137.76	28.65	40.20	71.12
16	REACTION CHAMBER	14.58	8.75	1.76	3.19	9.06	1.46	71.13	24.38	28.65	2.00	13.80
17	LEMELLA CLARIFIER	17.82	10.69	4.58	4.68	13.07	2.21	110.25	44.28	28.65	10.00	23.40
18	INTERMEDIATE COLLECTION TANK	14.58	8.75	2.65	3.19	10.90	1.69	96.85	38.18	28.65	5.00	20.70
C.	2MLD HIGH TDS EFFLUENT TREATMENT											
19	Sample platform											
20	BAR SCREEN CHAMBER	19.68	11.81	3.50	4.28	6.08	1.45	87.35	24.44	-	5.25	13.00
21	GRIT COLLECTION CHAMBER	17.82	10.69	3.31	4.87	8.61	1.89	90.18	25.20	-	6.13	21.00
22	OIL & GREASE CHAMBER	17.82	10.69	4.43	5.21	10.65	2.22	111.98	38.34	-	10.50	23.40
23	OIL & GREASE COLLECTION CHAMBER	17.82	10.69	3.31	4.87	8.61	1.89	90.18	25.20	-	6.13	21.00
24	INTERMEDIATE COLLECTION CHAMBER	36.94	22.16	14.73	10.73	36.44	6.60	310.03	137.76	-	40.20	71.12
25	High TDS COLLECCTION / EQUALISATION TANK	1,574.88	944.93	523.53	493.57	871.96	191.17	5,524.82	1,455.96	-	1,500.00	564.96
26	NEUTRALIZATION TANK	43.74	26.24	17.13	11.02	29.92	5.73	323.44	127.42	-	50.00	65.55
27	FLASH MIXER	17.82	10.69	2.95	3.70	6.40	1.41	93.67	28.73	-	4.25	12.60
28	FLOCCULATION TANK	17.82	10.69	3.66	3.88	9.05	1.81	110.56	34.92	-	6.75	18.72
29	LIME / CAUSTIC PREPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
30	HCL PREPARATIION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
31	ALUM / PAC PREPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
32	POLY PREPPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
33	PRIMARY CLARIFLOCCULATOR	257.09	154.26	62.29	80.58	141.51	31.09	879.76	349.73	-	132.67	142.03
34	PRIMARY SLUDGE HOLDING TANKS	192.82	115.69	46.01	61.02	105.09	23.25	622.04	142.95	-	94.99	91.90

	Work item No	1	2	3	4	5	6	7	8	9	10	11
S.No	Description of Works	Earth work Excavation for foundation.	Re-Filling with useful available excavated earth	Laying P.C.C (1:4:8) using 40mm machine crushed HBG metal, cement, sand for levelling	Supply and placing of the design mix concrete M30 grade corresponding. Foundations, Plinth, Pedestals (Below Plinth)	Supply and placing of the design mix concrete M30 grade corresponding. Columns, Lintels, Water Tanks, RCC Walls in Buildings	Providing Thermo Mechanical Treated (TMT) of different diameters of RCC works	Plain Shuttering	Plastering 12mm thick in two coats using screened sand with base cost of 8 mm thick in CM (1:6)	Tiling	First Floor-CC Finish	Painting 3 coats of white wash
	CIVIL WORKS	m3	m3	m3	m3	m3	MT	m2	m2	m2	m2	m2
35	POLY PREPPARATION TANK AT SCREWPRESS	14.58	8.75	11.23	3.35	5.69	1.27	86.75	14.34	-	1.23	8.05
D.	STRIPPER, MEE, ATFD											
36, 37, 38, 39, 40, 41, 42	Stripper feed tanks, Solvent storage tank, MEE feed tank, MEE Concentrate storage tanks, MEE Condensate tank, ATFD Condensate tank, CIP tank/ MEE drain tank	1,089.13	653.48	384.80	350.42	789.29	159.56	5,137.77	1,939.08	-	1,107.00	546.48
43, 44, 45	Condensate storage tank, Buffer storage tank, Settling tank	1,168.95	701.37	417.03	375.45	749.40	157.48	4,750.64	1,329.24	-	2,416.00	534.60
46	PRE - AREATION TANK	3,165.48	1,899.29	926.85	1,400.67	1,846.62	454.62	9,349.82	2,186.80	-	2,500.00	1,100.00
47	ACID STORAGE TANK FOR CIP	32.81	19.68	12.75	11.13	39.04	7.02	345.97	84.18	-	25.06	43.36
E.	3MLD LOW TDS EFFLUENT TREATMENT											
1	Sample platform											
49	BAR SCREEN CHAMBER	19.68	11.81	3.50	4.28	6.08	1.45	87.35	24.44	-	5.25	13.00
50	GRIT COLLECTION CHAMBER	17.82	10.69	3.31	4.94	8.21	1.84	101.77	33.60	-	6.00	22.00
51	OIL & GREASE CHAMBER	53.46	32.08	15.52	16.32	35.64	7.27	392.33	151.20	-	40.20	79.38
52	OIL & GREASE COLLECTION CHAMBER	17.82	10.69	3.31	4.94	8.36	1.86	102.04	33.60	-	6.00	22.00
53	INTERMEDIATE COLLECTION TANK	157.46	94.48	24.78	33.16	86.85	16.80	538.15	172.92		99.72	138.93
54	LOW TDS COLLECCTION / EQUALISATION TANK	1,682.53	1,009.52	504.94	586.06	820.02	196.85	5,499.04	1,370.16	-	1,350.00	693.00
55	NEUTRALIZATION TANK	43.74	26.24	17.19	11.02	29.84	5.72	323.44	127.42	-	50.25	65.32
56	FLASH MIXER	17.82	10.69	3.54	3.86	7.88	1.64	111.36	34.47	-	6.30	18.36
57	FLOCCULATION TANK	17.82	10.69	5.52	4.29	13.18	2.45	148.37	51.48	-	13.50	27.00
58	LIME / CAUSTIC PREPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
59	HCL PREPARATIION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
60	ALUM / PAC PREPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
61	POLY PREPPARATION TANK	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
62	PRIMARY CLARIFLOCCULATOR	257.09	154.26	79.11	82.56	177.97	36.47	1,046.67	349.73	-	200.96	380.16
63	PRIMARY SLUDGE HOLDING TANKS	192.82	115.69	34.29	54.42	82.49	19.17	531.03	188.69	-	60.10	195.95
64	POLY PREPPARATION TANK AT CENTRIFUGE	17.82	10.69	2.25	3.46	5.50	1.25	73.45	18.00	-	2.03	10.26
F.	5 MLD COMBINED LOW TDS & MEE CONDENSATE EFFLUENT TREATMENT											
65,66	Anoxic tank, SBR Feed Tank	7,467.03	4,480.22	1,596.85	3,179.24	2,926.71	854.83	16,317.46	3,757.60	-	3,629.20	1,408.00
67	SBR TANK - 1	12,822.30	7,693.38	3,228.11	5,632.68	5,907.48	1,615.62	31,012.53	6,275.50	-	8,004.00	2,053.70
68	SBR TANK - 2	3,433.87	2,060.32	829.34	1,460.17	1,781.73	453.87	9,063.07	3,401.20	-	2,001.00	1,063.70
69,70	/Filter Feed Tank (Previously Intermitent Tank)Filter backwash storage tank	1,045.95	627.57	312.25	281.19	535.21	114.30	3,366.10	977.46	-	940.00	454.74
71	GUARD POND	20,411.82	-	1,237.08	2,319.51	-	324.73	3,133.68	3,133.68	-	5,838.00	-
72	SECONDARY SLUDGE THICKENER	1,542.56	925.54	530.59	485.93	1,043.45	71.37	2,006.17	349.73	-	490.63	271.62
73	SLUDGE DIGESTER	1,868.18	1,120.91	423.71	670.47	1,064.70	242.92	5,289.71	699.47	-	981.25	543.25

	Work item No	1	2	3	4	5	6	7	8	9	10	11
S.No	Description of Works	Earth work Excavation for foundation.	Re-Filling with useful available excavated earth	Laying P.C.C (1:4:8) using 40mm machine crushed HBG metal, cement, sand for levelling	Supply and placing of the design mix concrete M30 grade corresponding. Foundations, Plinth, Pedestals (Below Plinth)	Supply and placing of the design mix concrete M30 grade corresponding. Columns, Lintels, Water Tanks, RCC Walls in Buildings	Providing Thermo Mechanical Treated (TMT) of different diameters of RCC works	Plain Shuttering	Plastering 12mm thick in two coats using screened sand with base cost of 8 mm thick in CM (1:6)	Tiling	First Floor-CC Finish	Painting 3 coats of white wash
	CIVIL WORKS	m3	m3	m3	m3	m3	MT	m2	m2	m2	m2	m2
74	POLY PREPPARATION TANK AT SLUDGE THICKENER	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
75	POLY PREPPARATION TANK AT CENTRIFUGE	17.82	10.69	2.25	3.46	5.50	1.25	74.59	18.00	-	2.03	10.26
	Total	**59,274.85**	**23,317.82**	**11,381.06**	**17,771.12**	**19,492.30**	**5,067.65**	**1,09,476.29**	**29,845.01**	**572.93**	**31,773.17**	**11,124.88**

6.2 Annexure 1.2: Detailed Civil Tank Sizing Sheet

Annexure 1.2: Detailed Civil Tank Sizing Sheet for 5 MLD CETP																		
		Tank dimensions										Column			Beam			
S.No	Structure	Unit	Vol (Cum) /Area (Sqm)	Nos	Length (m)	Breadth (m)	Depth (m)	FB (m)	Total Height (m)	Wall (Thickness) (m)	Base Raft (m)	PCC (Thickness) (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
A	**100KLD CHROME EFFLUENT TREATMENT**																	
1	Sample platform	SqM.	1.0	1	1.00	1.00												
2	Bar Screen chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
3	Grit chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
4	Oil & Grease chambers	CuM.	3.9	3	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.35	3.08	0.30	0.30
5	Oil & Grease collection chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
6	Chrome Effluent collection tank	CuM.	112.6	1	6.70	6.00	2.50	0.30	2.80	0.18	0.20	0.15	0.30	0.45	1.55	35.70	0.30	0.30
													0.30	0.45	1.55			
7	Reaction tank	CuM.	4.6	1	2.00	1.00	2.00	0.30	2.30	0.15	0.15	0.15	0.30	0.30	1.55	4.80	0.30	0.30
8	Flocculation tank	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
9	Lamella Clarifier	CuM.	18.0	1	4.00	2.50	1.50	0.30	1.80	0.15	0.15	0.15	0.30	0.45	2.05	11.80	0.30	0.30
B	**100KLD CYANIDE EFFLUENT TREATMENT**																	
10	Sample platform	SqM.	1.0	1	1.00	1.00												
11	Bar Screen chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
12	Grit chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
13	Oil & Grease chambers	CuM.	3.9	3	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
14	Oil & Grease collection chamber	CuM.	1.3	1	1.00	1.00	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	3.08	0.30	0.30
15	Cyanide Effluent collection tank	CuM.	112.6	1	6.70	6.00	2.50	0.30	2.80	0.18	0.20	0.15	0.30	0.45	1.55	35.70	0.30	0.30
													0.30	0.45	1.55			
16	Reaction tank	CuM.	4.6	1	2.00	1.00	2.00	0.30	2.30	0.15	0.15	0.15	0.30	0.30	1.55	4.80	0.30	0.30
17	Lamella Clarifier	CuM.	18.0	1	4.00	2.50	1.50	0.30	1.80	0.15	0.15	0.15	0.30	0.45	2.00	11.80	0.30	0.30
18	Intermediate Collection tank	CuM.	11.5	1	2.00	2.50	2.00	0.30	2.30	0.15	0.15	0.15	0.30	0.30	2.50	7.80	0.30	0.30
C	**2MLD HIGH TDS EFFLUENT TREATMENT**																	
19	Sample platform	SqM.	2.0	1	2.00	1.00												
20	Bar Screen chamber	CuM.	6.8	1	3.50	1.50	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	9.70	0.30	0.30
21	Grit collection chamber	CuM.	12.3	1	1.75	3.50	1.70	0.30	2.00	0.18	0.18	0.15	0.30	0.45	1.55	9.30	0.30	0.30
22	Oil & Grease chambers	CuM.	56.7	3	3.50	3.00	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	11.80	0.30	0.30
23	Oil & Grease collection chamber	CuM.	12.3	1	1.75	3.50	1.70	0.30	2.00	0.18	0.18	0.15	0.30	0.45	1.55	9.30	0.30	0.30
24	Intermediate Collection tank	CuM.	223.4	1	13.30	6.00	2.50	0.30	2.80	0.18	0.20	0.15	0.30	0.45	1.55	35.70	0.30	0.30
													0.30	0.45	1.55			
25	High TDS Effluent collection tanks	CuM.	4,950.0	3	20.00	25.00	3.00	0.30	3.30	0.30	0.30	0.15	0.45	0.45	1.40	856.50	0.45	0.45
													0.45	0.45	4.70	208.20	0.15	0.38
26	Neutralization tank	CuM.	92.5	1	6.00	6.70	2.00	0.30	2.30	0.18	0.15	0.15	0.30	0.30	3.00	29.40	0.30	0.30
													0.30	0.30	5.30			
27	Flash mixer	CuM.	6.4	1	2.50	1.70	1.20	0.30	1.50	0.18	0.15	0.15	0.30	0.45	1.85	7.20	0.30	0.30
28	Flocculation tank	CuM.	12.2	1	2.50	2.70	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.85	9.20	0.30	0.30
29	Lime/ Caustic preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.85	4.50	0.30	0.30
30	HCL preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.85	4.50	0.30	0.30
31	Alum/ PAC preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.85	4.50	0.30	0.30
32	Poly preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
33	Primary Clariflocculator	CuM.	437.8	1	13.00	dia	3.00	0.30	3.30	0.35	0.30	0.15	0.45	0.45	1.10	131.50	0.45	0.60
													0.45	0.45	1.10			

Annexure 1.2: Detailed Civil Tank Sizing Sheet for 5 MLD CETP																		
		Tank dimensions										Column			Beam			
S.No	Structure	Unit	Vol (Cum) /Area (Sqm)	Nos	Length (m)	Breadth (m)	Depth (m)	FB (m)	Total Height (m)	Wall (Thickness) (m)	Base Raft (m)	PCC (Thickness) (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
34	Primary Sludge holding tank	CuM.	237.5	1	11.00	dia	2.20	0.30	2.50	0.35	0.30	0.15	0.45	0.45	1.10	102.76	0.45	0.60
													0.45	0.45	1.10			
35	Poly preparation tank at Screw Press	CuM.	2.0	1	1.25	dia	1.30	0.30	1.60	0.18	0.30	0.15	0.30	0.30	2.80	6.23	0.30	0.30
D	**STRIPPER, MEE & ATFD**																	
36	Stripper feed tanks	CuM.	924.0	2	20.00	7.00	3.00	0.30	3.30									
37	Solvent storage tank	CuM.	115.5	1	5.00	7.00	3.00	0.30	3.30				0.45	0.45	1.40	500.70	0.45	0.45
38	MEE feed tank	CuM.	759.0	1	20.00	11.50	3.00	0.30	3.30									
39	MEE Concentrate storage tanks	CuM.	752.4	2	20.00	5.70	3.00	0.30	3.30	0.30	0.30	0.15						
40	MEE Condensate tank	CuM.	660.0	1	20.00	10.00	3.00	0.30	3.30				0.45	0.45	4.70	275.20	0.15	0.38
41	ATFD Condensate tank	CuM.	231.0	1	20.00	3.50	3.00	0.30	3.30									
42	CIP tank/ MEE drain tank	CuM.	112.0	2	5.00	4.00	2.50	0.30	2.80									
43	Condensate storage tank	CuM.	1,188.0	1	18.00	20.00	3.00	0.30	3.30									
													0.45	0.45	1.40	530.50	0.45	0.45
44	Buffer storage tank	CuM.	1,980.0	1	30.00	20.00	3.00	0.30	3.30	0.30	0.30	0.15						
													0.45	0.45	4.70	177.20	0.15	0.38
45	Settling tank	CuM.	792.0	1	12.00	20.00	3.00	0.30	3.30									
46	Pre-Aeration tank	CuM.	13,750.0	1	50.00	50.00	5.00	0.50	5.50	0.30	0.40	0.15	0.60	0.60	0.95	978.40	60.00	0.65
													0.60	0.60	6.45	197.60	0.40	0.45
47	Acid storage tank for CIP	CuM.	57.6	1	5.65	dia	2.00	0.30	2.30	0.18	0.30	0.15	0.30	0.30	1.10	53.95	0.30	0.30
													0.30	0.30	4.40			
E	**3 MLD LOW TDS EFFLUENT PRIMARY TREATMENT**																	
48	Sample platform	SqM.	2.0	1	2.00	1.00												
49	Bar Screen chamber	CuM.	6.8	1	3.50	1.50	1.00	0.30	1.30	0.15	0.15	0.15	0.30	0.30	1.55	9.70	0.30	0.30
50	Grit collection chamber	CuM.	12.0	1	1.50	4.00	1.70	0.30	2.00	0.18	0.18	0.15	0.30	0.45	1.55	9.80	0.30	0.30
51	Oil & Grease chambers	CuM.	72.4	3	4.00	3.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	13.50	0.30	0.30
52	Oil & Grease collection chamber	CuM.	12.0	1	1.50	4.00	1.70	0.30	2.00	0.18	0.20	0.15	0.30	0.45	1.55	9.80	0.30	0.30
53	Intermediate Collection tank	CuM.	329.1	1	13.85	7.20	3.00	0.30	3.30	0.30	0.20	0.15	0.45	0.45	1.40	54.10	0.45	0.30
													0.45	0.45	4.70			
54	Low TDS Collection/ Equalization tanks	CuM.	4,405.5	2	22.25	30.00	3.00	0.30	3.30	0.30	0.30	0.15	0.45	0.45	1.40	370.80	0.45	0.30
													0.45	0.45	1.40	103.20	0.15	0.38
55	Neutralization tank	CuM.	115.6	1	7.50	6.70	2.00	0.30	2.30	0.18	0.15	0.15	0.30	0.30	3.00	29.40	0.30	0.30
													0.30	0.30	3.00			
56	Flash mixer	CuM.	9.5	1	3.00	2.10	1.20	0.30	1.50	0.18	0.15	0.15	0.30	0.45	1.55	9.00	0.30	0.30
57	Flocculation tank	CuM.	24.3	1	3.00	4.50	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	13.80	0.30	0.30
58	Lime/ Caustic preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
59	HCL preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
60	Alum/ PAC preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
61	Poly preparation tank	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
62	Primary Clariflocculator	CuM.	663.2	1	16.00	dia	3.00	0.30	3.30	0.35	0.30	0.15	0.45	0.45	1.10	145.60	0.45	0.60
													0.45	0.45	3.40			
63	Primary Sludge holding tanks	CuM.	336.6	2	8.75	dia	2.50	0.30	2.80	0.35	0.30	0.15	0.45	0.45	1.10	55.85	0.45	0.60

Annexure 1.2: Detailed Civil Tank Sizing Sheet for 5 MLD CETP																		
		Tank dimensions											Column			Beam		
S.No	Structure	Unit	Vol (Cum) /Area (Sqm)	Nos	Length (m)	Breadth (m)	Depth (m)	FB (m)	Total Height (m)	Wall (Thickness) (m)	Base Raft (m)	PCC (Thickness) (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
													0.45	0.45	1.10			
64	Poly preparation tank at Centrifuge	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	3.35	4.50	0.30	0.30
F	5 MLD COMBINED LOW TDS & MEE CONDENSATE EFFLUENT TREATMENT																	
65	Anoxic tank	CuM.	16,555.0	2	35.00	43.00	5.00	0.50	5.50	0.30	0.40	0.15	0.60	0.60	0.95	1554.20	0.60	0.65
													0.60	0.60	6.45	333.60	0.40	0.45
66	SBR feed tank	CuM.	3,010.0	1	14.00	43.00	4.50	0.50	5.00									
													0.60	0.60	0.95	3540.70	0.60	0.65
67	SBR Tank-1	CuM.	44,022.0	1	66.70	120.00	5.00	0.50	5.50	0.30	0.40	0.15	0.60	0.60	6.45	373.40	0.40	0.45
													0.60	0.60	0.95	921.70	0.60	0.65
68	SBR Tank-2	CuM.	11,005.5	1	66.70	30.00	5.00	0.50	5.50	0.30	0.40	0.15	0.60	0.60	6.45	188.60	0.40	0.45
													0.45	0.45	1.40	426.70	0.45	0.30
69	Filter Feed Tank (Previously Intermitent Tank)	CuM.	2,772.0	1	28.00	30.00	3.00	0.30	3.30	0.30	0.30	0.15						
													0.45	0.45	4.70	139.80	0.15	0.38
70	Filter backwash storage tank	CuM.	330.0	1	10.00	10.00	3.00	0.30	3.30									
													0.45	0.45	1.40	971.50	0.45	0.30
71	Guard pond	CuM.	19,265.4	3	55.60	35.00	3.00	0.30	3.30	3.00	0.30	0.15						
													0.45	0.45	1.40	177.80	0.15	0.38
72	Secondary Sludge thickener	CuM.	3,238.1	2	25.00	dia	3.00	0.30	3.30	0.35	0.30	0.15	0.45	0.45	1.10	268.83	0.45	0.60
													0.45	0.45	4.40			
73	Sludge digester	CuM.	3,189.1	1	25.00	dia	6.20	0.30	6.50	0.45	0.35	0.15	0.45	0.45	1.10	268.83	0.45	0.60
													0.45	0.45	4.40			
74	Poly preparation tank at sludge thickener	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30
75	Poly preparation tank at centrifuge	CuM.	3.6	1	1.50	1.35	1.50	0.30	1.80	0.18	0.20	0.15	0.30	0.45	1.55	4.50	0.30	0.30

Annexure 1.2: Detailed Civil Tank Sizing Sheet for 5 MLD CETP																		
		Tank dimensions											Column			Beam		
S.No	Structure	Unit	Vol (Cum) /Area (Sqm)	Nos	Length (m)	Breadth (m)	Depth (m)	FB (m)	Total Height (m)	Wall (Thickness) (m)	Base Raft (m)	PCC (Thickness) (m)	Length (m)	Width (m)	Depth (m)	Length (m)	Width (m)	Depth (m)
G	**OTHER STRUCTURES**		**Sq.M**	**Qty**	**Length**	**Width**	**Height**											
1	Vertex Grit chamber	SqM.	96.0	2	8.00	6.00												
2	Sludge dewatering unit-1	SqM.	150.0	1	15.00	10.00	4.00											
3	Sludge dewatering unit-2	SqM.	600.0	1	30.00	20.00	4.00											
4	Sludge dewatering unit-3	SqM.	150.0	1	15.00	10.00	4.00											
5	Stripper, MEE	SqM.	14,080.0	1														
6	ATFD	SqM.																
7	ATFD Sludge storage area	SqM.																
8	Cooling tower	SqM.																
9	Diesel power house	SqM.	500.0	1	20.00	25.00												
10	Control panel/ PCC room	SqM.	600.0	1	20.00	30.00												
11	Transformer yard	SqM.	625.0	1	25.00	25.00												
12	Office Building (G+1)	SqM.	300.0	1	30.00	10.00												
13	Engineers canteen	SqM.	150.0	1	10.00	15.00												
14	Workers canteen	SqM.	150.0	1	10.00	15.00												
15	Maintenance area	SqM.	450.0	1	15.00	30.00												
16	Central stores	SqM.	625.0	1	25.00	25.00												
17	Worker room	SqM.	103.5	1	11.50	9.00												
18	Staff room	SqM.	171.0	1	19.00	9.00												
19	Gents toilet	SqM.	15.8	1	4.50	3.50												
20	Ladies toilet	SqM.	15.8	1	4.5	3.5												
21	Security cabin	SqM.	45.0	3	3	5												
22	Laboratory room- inlet tankers	SqM.	30.0	1	5	6												
23	Internal roads & street lighting	RM.		1	2,796.0													
24	Compound wall	RM.		1	1,499.1													
	OTHER STRUCTURES TOTAL		**18,857.0**															

6.3 Annexure 1.3: Measurement Sheet – Civil Components

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED

Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
A.		**100KLD CHROME EFFLUENT**							
2		**BAR SCREEN CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	
2		Re-Filling	CuM.					**7.87**	
3		PCC						**1.63**	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						**2.49**	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						**7.97**	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					**1.47**	
7		Shuttering						**45.55**	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						**9.18**	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	1.00	1.00		**1.00**	
11		Painting						**5.40**	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
3		**GRIT CHAMBER**							

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED

Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	
2		Re-Filling	CuM.					**7.87**	
3		PCC						**1.53**	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.30	0.15	0.21	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						**2.63**	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.45	0.30	0.42	
5		RCC M30(Above Plinth)						**7.97**	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**45.55**	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						**9.18**	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	1.00	1.00		**1.00**	
11		Painting						**5.40**	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
4		**OIL & GREASE CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	**39.37**
2		Re-Filling	CuM.					**7.87**	**23.62**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED
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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
3		PCC						1.63	4.90
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						2.49	7.47
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						7.97	23.92
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					1.46	4.38
7		Shuttering						45.55	136.65
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						9.18	27.54
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					28.65	85.94
10		Top & Flooring	SqM.	1	1.00	1.00		1.00	3.00
11		Painting						5.40	16.20
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
5		**OIL & GREASE COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	13.12	
2		Re-Filling	CuM.					7.87	
3		PCC						1.63	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						2.49	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						7.97	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					1.46	
7		Shuttering						45.55	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						9.18	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					28.65	
10		Top & Flooring	SqM.	1	1.00	1.00		1.00	
11		Painting						5.40	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
6		**CHROME EFFLUENT COLLECTION TANK**							
1		EarthWork	CuM.					36.94	
				1	1.80	1.50	1.80	4.86	
				8	1.65	1.35	1.80	32.08	
2		Re-Filling	CuM.					22.16	
3		PCC						14.73	
	i	PCC Under Footings	CuM.	1	1.80	1.50	0.15	0.41	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
				8	1.65	1.35	0.15	2.67	
	ii	Plinth Beam	CuM.	1	35.70	0.45	0.15	2.41	
	iii	Base on Ground	CuM.	1	6.00	6.70	0.23	9.25	
4		RCC M30(Below Plinth)						**10.73**	
	i	Footing	CuM.	1	1.65	1.35	0.38	0.84	
				8	1.50	1.20	0.35	5.04	
	ii	Column	CuM.	9	0.30	0.45	1.35	1.64	
	iii	Plinth Beam	CuM.	1	35.70	0.30	0.30	3.21	
5		RCC M30(Above Plinth)						**36.44**	
	i	Column	CuM.	1	0.30	0.45	1.55	0.21	
				8	0.30	0.45	4.35	4.70	
	ii	Beam	CuM.	1	35.70	0.30	0.30	3.21	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	28.40	0.75	0.15	3.20	
	v	Base Slab	CuM.	1	6.00	6.70	0.20	8.04	
	vi	Walls: Long	CuM.	2	6.70	2.80	0.18	6.57	
	vii	Walls: Short	CuM.	2	5.60	2.80	0.18	5.49	
6		Steel (Tor)	Ton.					**6.60**	
7		Shuttering						**310.03**	
	i	Footing	SqM.	1	1.65	1.35	0.38	2.25	
				8	1.50	1.20	0.35	15.12	
	ii	Shuttering Plinth Beam	SqM.	1	48.40	0.30		14.52	
	iii	Shuttering Wall: Inner	SqM.	1	23.80	2.80		66.64	
	iv	Shuttering Wall: Outer	SqM.	1	25.40	2.80		71.12	
	v	Shuttering Column	SqM.	1	1.20	3.00		3.60	
				8	1.20	5.80		55.68	
	vi	Shuttering Beam	SqM.	1	48.40	0.30		14.52	
	vii	Shuttering Base Slab	SqM.	1	6.70	6.00		40.20	
	viii	Shuttering Slab Side	SqM.	1	25.40	0.20		5.08	
	ix	Shuttering Walkway Slab	SqM.	1	28.40	0.75		21.30	
8		Plastering						**137.76**	
	i	Plastering: Inner	SqM.	1	23.80	2.80		66.64	
	ii	Plastering: Outer	SqM.	1	25.40	2.80		71.12	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	6.70	6.00		**40.20**	
11		Painting						**71.12**	
	i	Painting: Long Wall	SqM.	2	6.70	2.80		37.52	
	ii	Painting: Short Wall	SqM.	2	6.00	2.80		33.60	
7		**REACTION CHAMBER**							
1		EarthWork	CuM.	4	1.50	1.35	1.80	**14.58**	

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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
2		Re-Filling	CuM.					**8.75**	
3		PCC						**1.76**	
	i	PCC Under Footings	CuM.	4	1.35	1.20	0.15	0.97	
	ii	Plinth Beam	CuM.	1	4.80	0.45	0.15	0.32	
	iii	Base on Ground	CuM.	1	2.00	1.00	0.23	0.46	
4		RCC M30(Below Plinth)						**3.19**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	4.80	0.30	0.30	0.43	
5		RCC M30(Above Plinth)						**9.06**	
	i	Column	CuM.	4	0.30	0.30	3.85	1.39	
	ii	Beam	CuM.	1	4.80	0.30	0.30	0.43	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.50	0.75	0.15	0.84	
	v	Base Slab	CuM.	1	2.00	1.00	0.15	0.30	
	vi	Walls: Long	CuM.	2	2.00	1.35	0.15	0.81	
	vii	Walls: Short	CuM.	2	0.65	1.35	0.15	0.26	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**71.13**	
	i	Footing	SqM.	4	1.35	1.20	0.35	6.12	
	ii	Shuttering Plinth Beam	SqM.	1	9.60	0.30		2.88	
	iii	Shuttering Wall: Inner	SqM.	1	4.60	2.30		10.58	
	iv	Shuttering Wall: Outer	SqM.	1	6.00	2.30		13.80	
	v	Shuttering Column	SqM.	4	1.20	5.80		27.84	
	vi	Shuttering Beam	SqM.	1	9.60	0.30		2.88	
	vii	Shuttering Base Slab	SqM.	1	2.00	1.00		2.00	
	viii	Shuttering Slab Side	SqM.	1	6.00	0.15		0.90	
	ix	Shuttering Walkway Slab	SqM.	1	5.50	0.75		4.13	
8		Plastering						**24.38**	
	i	Plastering: Inner	SqM.	1	4.60	2.30		10.58	
	ii	Plastering: Outer	SqM.	1	6.00	2.30		13.80	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	2.00	1.00		**2.00**	
11		Painting						**13.80**	
	i	Painting: Long Wall	SqM.	2	2.00	2.30		9.20	
	ii	Painting: Short Wall	SqM.	2	1.00	2.30		4.60	
8		**FLOCCULATION TANK**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	
2		Re-Filling	CuM.					**7.87**	
3		PCC						**1.63**	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						**2.78**	
	i	Footing	CuM.	4	1.20	1.20	0.35	2.02	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						**7.97**	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**45.55**	
	i	Footing	SqM.	4	1.20	1.20	0.35	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						**9.18**	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	1.00	1.00		**1.00**	
11		Painting						**5.40**	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
9		**LEMELLA CLARIFIER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**4.58**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	11.80	0.45	0.15	0.80	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Base on Ground	CuM.	1	4.00	2.50	0.23	2.30	
4		RCC M30(Below Plinth)						**4.68**	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	11.80	0.30	0.30	1.06	
5		RCC M30(Above Plinth)						**13.07**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	11.80	0.30	0.30	1.06	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	10.50	0.75	0.15	1.18	
	v	Base Slab	CuM.	1	4.00	2.50	0.15	1.50	
	vi	Walls: Long	CuM.	2	4.00	1.35	0.15	1.62	
	vii	Walls: Short	CuM.	2	2.15	1.35	0.15	0.87	
6		Steel (Tor)	Ton.					**2.35**	
7		Shuttering						**110.25**	
	i	Footing	SqM.	4	1.50	1.30	0.35	6.72	
	ii	Shuttering Plinth Beam	SqM.	1	11.80	0.30		3.54	
	iii	Shuttering Wall: Inner	SqM.	1	11.60	1.80		20.88	
	iv	Shuttering Wall: Outer	SqM.	1	13.00	1.80		23.40	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	23.60	0.30		7.08	
	vii	Shuttering Base Slab	SqM.	1	4.00	2.50		10.00	
	viii	Shuttering Slab Side	SqM.	1	13.00	0.15		1.95	
	ix	Shuttering Walkway Slab	SqM.	1	10.50	0.75		7.88	
8		Plastering						**44.28**	
	i	Plastering: Inner	SqM.	1	11.60	1.80		20.88	
	ii	Plastering: Outer	SqM.	1	13.00	1.80		23.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	4.00	2.50		**10.00**	
11		Painting						**23.40**	
	i	Painting: Long Wall	SqM.	2	4.00	1.80		14.40	
	ii	Painting: Short Wall	SqM.	2	2.50	1.80		9.00	

B.		**100KLD CYANIDE EFFLUENT TREATEMENT**							
11		**BAR SCREEN CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	
2		Re-Filling	CuM.					**7.87**	
3		PCC						**1.63**	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
4		RCC M30(Below Plinth)						2.49	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						7.97	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					1.46	
7		Shuttering						45.55	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						9.18	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					28.65	
10		Top & Flooring	SqM.	1	1.00	1.00		1.00	
11		Painting						5.40	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
12		**GRIT CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	13.12	
2		Re-Filling	CuM.					7.87	
3		PCC						1.53	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.30	0.15	0.21	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						2.63	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.45	0.30	0.42	
5		RCC M30(Above Plinth)						**7.97**	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**45.55**	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						**9.18**	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	1.00	1.00		**1.00**	
11		Painting						**5.40**	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
13		**OIL & GREASE CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	**13.12**	**39.37**
2		Re-Filling	CuM.					**7.87**	**23.62**
3		PCC						**1.63**	**4.90**
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						**2.49**	**7.47**
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
5		RCC M30(Above Plinth)						7.97	23.92
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					1.46	4.38
7		Shuttering						45.55	136.65
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						9.18	27.54
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					28.65	85.94
10		Top & Flooring	SqM.	1	1.00	1.00		1.00	3.00
11		Painting						5.40	16.20
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
14		**OIL & GREASE COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.35	1.35	1.80	13.12	
2		Re-Filling	CuM.					7.87	
3		PCC						1.63	
	i	PCC Under Footings	CuM.	4	1.35	1.35	0.15	1.09	
	ii	Plinth Beam	CuM.	1	4.60	0.45	0.15	0.31	
	iii	Base on Ground	CuM.	1	1.00	1.00	0.23	0.23	
4		RCC M30(Below Plinth)						2.49	
	i	Footing	CuM.	4	1.20	1.20	0.30	1.73	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	3.08	0.30	0.30	0.28	
5		RCC M30(Above Plinth)						7.97	
	i	Column	CuM.	4	0.30	0.30	2.90	1.04	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Beam	CuM.	1	3.08	0.30	0.30	0.28	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	1.00	1.00	0.15	0.15	
	vi	Walls: Long	CuM.	2	1.00	1.35	0.15	0.41	
	vii	Walls: Short	CuM.	2	0.70	1.35	0.15	0.28	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**45.55**	
	i	Footing	SqM.	4	1.20	1.20	0.30	5.76	
	ii	Shuttering Plinth Beam	SqM.	1	5.60	0.30		1.68	
	iii	Shuttering Wall: Inner	SqM.	1	2.80	1.35		3.78	
	iv	Shuttering Wall: Outer	SqM.	1	4.00	1.35		5.40	
	v	Shuttering Column	SqM.	4	1.20	4.25		20.40	
	vi	Shuttering Beam	SqM.	1	5.60	0.30		1.68	
	vii	Shuttering Base Slab	SqM.	1	1.00	1.00		1.00	
	viii	Shuttering Slab Side	SqM.	1	4.00	0.15		0.60	
	ix	Shuttering Walkway Slab	SqM.	1	7.00	0.75		5.25	
8		Plastering						**9.18**	
	i	Plastering: Inner	SqM.	1	2.80	1.35		3.78	
	ii	Plastering: Outer	SqM.	1	4.00	1.35		5.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	1.00	1.00		**1.00**	
11		Painting						**5.40**	
	i	Painting: Long Wall	SqM.	2	1.00	1.35		2.70	
	ii	Painting: Short Wall	SqM.	2	1.00	1.35		2.70	
15		**CYANIDE EFFLUENT COLLECTION TANK**							
1		EarthWork	CuM.					**36.94**	
				1	1.80	1.50	1.80	4.86	
				8	1.65	1.35	1.80	32.08	
2		Re-Filling	CuM.					**22.16**	
3		PCC						**14.73**	
	i	PCC Under Footings	CuM.	1	1.80	1.50	0.15	0.41	
				8	1.65	1.35	0.15	2.67	
	ii	Plinth Beam	CuM.	1	35.70	0.45	0.15	2.41	
	iii	Base on Ground	CuM.	1	6.00	6.70	0.23	9.25	
4		RCC M30(Below Plinth)						**10.73**	
	i	Footing	CuM.	1	1.65	1.35	0.38	0.84	
				8	1.50	1.20	0.35	5.04	
	ii	Column	CuM.	9	0.30	0.45	1.35	1.64	
	iii	Plinth Beam	CuM.	1	35.70	0.30	0.30	3.21	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
5		RCC M30(Above Plinth)						**36.44**	
	i	Column	CuM.	1	0.30	0.45	1.55	0.21	
				8	0.30	0.45	4.35	4.70	
	ii	Beam	CuM.	1	35.70	0.30	0.30	3.21	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	28.40	0.75	0.15	3.20	
	v	Base Slab	CuM.	1	6.00	6.70	0.20	8.04	
	vi	Walls: Long	CuM.	2	6.70	2.80	0.18	6.57	
	vii	Walls: Short	CuM.	2	5.60	2.80	0.18	5.49	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**310.03**	
	i	Footing	SqM.	1	1.65	1.35	0.38	2.25	
				8	1.50	1.20	0.35	15.12	
	ii	Shuttering Plinth Beam	SqM.	1	48.40	0.30		14.52	
	iii	Shuttering Wall: Inner	SqM.	1	23.80	2.80		66.64	
	iv	Shuttering Wall: Outer	SqM.	1	25.40	2.80		71.12	
	v	Shuttering Column	SqM.	1	1.20	3.00		3.60	
				8	1.20	5.80		55.68	
	vi	Shuttering Beam	SqM.	1	48.40	0.30		14.52	
	vii	Shuttering Base Slab	SqM.	1	6.70	6.00		40.20	
	viii	Shuttering Slab Side	SqM.	1	25.40	0.20		5.08	
	ix	Shuttering Walkway Slab	SqM.	1	28.40	0.75		21.30	
8		Plastering						**137.76**	
	i	Plastering: Inner	SqM.	1	23.80	2.80		66.64	
	ii	Plastering: Outer	SqM.	1	25.40	2.80		71.12	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	6.70	6.00		**40.20**	
11		Painting						**71.12**	
	i	Painting: Long Wall	SqM.	2	6.70	2.80		37.52	
	ii	Painting: Short Wall	SqM.	2	6.00	2.80		33.60	
16		**REACTION CHAMBER**							
1		EarthWork	CuM.	4	1.50	1.35	1.80	**14.58**	
2		Re-Filling	CuM.					**8.75**	
3		PCC						**1.76**	
	i	PCC Under Footings	CuM.	4	1.35	1.20	0.15	0.97	
	ii	Plinth Beam	CuM.	1	4.80	0.45	0.15	0.32	
	iii	Base on Ground	CuM.	1	2.00	1.00	0.23	0.46	
4		RCC M30(Below Plinth)						**3.19**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Plinth Beam	CuM.	1	4.80	0.30	0.30	0.43	
5		RCC M30(Above Plinth)						**9.06**	
	i	Column	CuM.	4	0.30	0.30	3.85	1.39	
	ii	Beam	CuM.	1	4.80	0.30	0.30	0.43	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	7.50	0.75	0.15	0.84	
	v	Base Slab	CuM.	1	2.00	1.00	0.15	0.30	
	vi	Walls: Long	CuM.	2	2.00	1.35	0.15	0.81	
	vii	Walls: Short	CuM.	2	0.65	1.35	0.15	0.26	
6		Steel (Tor)	Ton.					**1.46**	
7		Shuttering						**71.13**	
	i	Footing	SqM.	4	1.35	1.20	0.35	6.12	
	ii	Shuttering Plinth Beam	SqM.	1	9.60	0.30		2.88	
	iii	Shuttering Wall: Inner	SqM.	1	4.60	2.30		10.58	
	iv	Shuttering Wall: Outer	SqM.	1	6.00	2.30		13.80	
	v	Shuttering Column	SqM.	4	1.20	5.80		27.84	
	vi	Shuttering Beam	SqM.	1	9.60	0.30		2.88	
	vii	Shuttering Base Slab	SqM.	1	2.00	1.00		2.00	
	viii	Shuttering Slab Side	SqM.	1	6.00	0.15		0.90	
	ix	Shuttering Walkway Slab	SqM.	1	5.50	0.75		4.13	
8		Plastering						**24.38**	
	i	Plastering: Inner	SqM.	1	4.60	2.30		10.58	
	ii	Plastering: Outer	SqM.	1	6.00	2.30		13.80	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	2.00	1.00		**2.00**	
11		Painting						**13.80**	
	i	Painting: Long Wall	SqM.	2	2.00	2.30		9.20	
	ii	Painting: Short Wall	SqM.	2	1.00	2.30		4.60	
17		**LEMELLA CLARIFIER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**4.58**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	11.80	0.45	0.15	0.80	
	iii	Base on Ground	CuM.	1	4.00	2.50	0.23	2.30	
4		RCC M30(Below Plinth)						**4.68**	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	11.80	0.30	0.30	1.06	
5		RCC M30(Above Plinth)						**13.07**	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	11.80	0.30	0.30	1.06	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	10.50	0.75	0.15	1.18	
	v	Base Slab	CuM.	1	4.00	2.50	0.15	1.50	
	vi	Walls: Long	CuM.	2	4.00	1.35	0.15	1.62	
	vii	Walls: Short	CuM.	2	2.15	1.35	0.15	0.87	
6		Steel (Tor)	Ton.					**2.21**	
7		Shuttering						**110.25**	
	i	Footing	SqM.	4	1.50	1.30	0.35	6.72	
	ii	Shuttering Plinth Beam	SqM.	1	11.80	0.30		3.54	
	iii	Shuttering Wall: Inner	SqM.	1	11.60	1.80		20.88	
	iv	Shuttering Wall: Outer	SqM.	1	13.00	1.80		23.40	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	23.60	0.30		7.08	
	vii	Shuttering Base Slab	SqM.	1	4.00	2.50		10.00	
	viii	Shuttering Slab Side	SqM.	1	13.00	0.15		1.95	
	ix	Shuttering Walkway Slab	SqM.	1	10.50	0.75		7.88	
8		Plastering						**44.28**	
	i	Plastering: Inner	SqM.	1	11.60	1.80		20.88	
	ii	Plastering: Outer	SqM.	1	13.00	1.80		23.40	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	4.00	2.50		**10.00**	
11		Painting						**23.40**	
	i	Painting: Long Wall	SqM.	2	4.00	1.80		14.40	
	ii	Painting: Short Wall	SqM.	2	2.50	1.80		9.00	
18		**INTERMEDIATE COLLECTION TANK**							
1		EarthWork	CuM.	4	1.50	1.35	1.80	**14.58**	
2		Re-Filling	CuM.					**8.75**	
3		PCC						**2.65**	
	i	PCC Under Footings	CuM.	4	1.35	1.20	0.15	0.97	
	ii	Plinth Beam	CuM.	1	7.80	0.45	0.15	0.53	
	iii	Base on Ground	CuM.	1	2.50	2.00	0.23	1.15	
4		RCC M30(Below Plinth)						**3.19**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.30	1.35	0.49	
	iii	Plinth Beam	CuM.	1	4.80	0.30	0.30	0.43	
5		RCC M30(Above Plinth)						**10.90**	
	i	Column	CuM.	4	0.30	0.30	3.85	1.39	
	ii	Beam	CuM.	1	7.80	0.30	0.30	0.70	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	12.00	0.75	0.15	1.35	
	v	Base Slab	CuM.	1	2.50	2.00	0.15	0.75	
	vi	Walls: Long	CuM.	2	2.50	1.35	0.15	1.01	
	vii	Walls: Short	CuM.	2	1.65	1.35	0.15	0.67	
6		Steel (Tor)	Ton.					**1.69**	
7		Shuttering						**96.85**	
	i	Footing	SqM.	4	1.35	1.20	0.35	6.12	
	ii	Shuttering Plinth Beam	SqM.	1	15.60	0.30		4.68	
	iii	Shuttering Wall: Inner	SqM.	1	7.60	2.30		17.48	
	iv	Shuttering Wall: Outer	SqM.	1	9.00	2.30		20.70	
	v	Shuttering Column	SqM.	4	1.20	5.80		27.84	
	vi	Shuttering Beam	SqM.	1	15.60	0.30		4.68	
	vii	Shuttering Base Slab	SqM.	1	2.50	2.00		5.00	
	viii	Shuttering Slab Side	SqM.	1	9.00	0.15		1.35	
	ix	Shuttering Walkway Slab	SqM.	1	12.00	0.75		9.00	
8		Plastering						**38.18**	
	i	Plastering: Inner	SqM.	1	7.60	2.30		17.48	
	ii	Plastering: Outer	SqM.	1	9.00	2.30		20.70	
9		Tiling	SqM.					**28.65**	
10		Top & Flooring	SqM.	1	2.50	2.00		**5.00**	
11		Painting						**20.70**	
	i	Painting: Long Wall	SqM.	2	2.50	2.30		11.50	
	ii	Painting: Short Wall	SqM.	2	2.00	2.30		9.20	

C.		**2 MLD HIGH TDS EFFLUENT PRIMARY TREATMENT**							
20		**BAR SCREEN CHAMBER**							
1		EarthWork	CuM.	6	1.35	1.35	1.80	**19.68**	
2		Re-Filling	CuM.					**11.81**	
3		PCC						**3.50**	
	i	PCC Under Footings	CuM.	6	1.35	1.35	0.15	1.64	
	ii	Plinth Beam	CuM.	1	9.70	0.45	0.15	0.65	
	iii	Base on Ground	CuM.	1	3.50	1.50	0.23	1.21	
4		RCC M30(Below Plinth)						**4.28**	
	i	Footing	CuM.	6	1.20	1.20	0.30	2.59	
	ii	Column	CuM.	6	0.30	0.30	1.50	0.81	
	iii	Plinth Beam	CuM.	1	9.70	0.30	0.30	0.87	
5		RCC M30(Above Plinth)						**6.08**	
	i	Column	CuM.	6	0.30	0.30	2.90	1.57	
	ii	Beam	CuM.	1	9.70	0.30	0.30	0.87	
	iii	StairCase	CuM.						

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iv	Walkway	CuM.	1	8.00	0.75	0.15	0.90	
	v	Base Slab	CuM.	1	3.50	1.50	0.15	0.79	
	vi	Walls: Long	CuM.	2	3.50	1.30	0.15	1.37	
	vii	Walls: Short	CuM.	2	1.50	1.30	0.15	0.59	
6		Steel (Tor)	Ton.					**1.45**	
7		Shuttering						**87.35**	
	i	Footing	SqM.	6	1.20	1.20	0.30	8.64	
	ii	Shuttering Plinth Beam	SqM.	1	18.20	0.30		5.46	
	iii	Shuttering Wall: Inner	SqM.	1	8.80	1.30		11.44	
	iv	Shuttering Wall: Outer	SqM.	1	10.00	1.30		13.00	
	v	Shuttering Column	SqM.	6	1.20	4.25		30.60	
	vi	Shuttering Beam	SqM.	1	18.20	0.30		5.46	
	vii	Shuttering Base Slab	SqM.	1	3.50	1.50		5.25	
	viii	Shuttering Slab Side	SqM.	1	10.00	0.15		1.50	
	ix	Shuttering Walkway Slab	SqM.	1	8.00	0.75		6.00	
8		Plastering						**24.44**	
	i	Plastering: Inner	SqM.	1	8.80	1.30		11.44	
	ii	Plastering: Outer	SqM.	1	10.00	1.30		13.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.50	1.50		**5.25**	
11		Painting						**13.00**	
	i	Painting: Long Wall	SqM.	2	3.50	1.30		9.10	
	ii	Painting: Short Wall	SqM.	2	1.50	1.30		3.90	
21		**GRIT COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**3.31**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.30	0.30	0.15	0.42	
	iii	Base on Ground	CuM.	1	3.50	1.75	0.23	1.41	
4		RCC M30(Below Plinth)						**4.87**	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	9.30	0.45	0.30	1.26	
5		RCC M30(Above Plinth)						**8.61**	
	i	Column	CuM.	4	0.30	0.45	3.55	1.92	
	ii	Beam	CuM.	1	9.30	0.30	0.30	0.84	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	10.50	0.75	0.15	1.18	
	v	Base Slab	CuM.	1	3.50	1.75	0.18	1.07	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vi	Walls: Long	CuM.	2	3.75	2.00	0.18	2.63	
	vii	Walls: Short	CuM.	2	1.40	2.00	0.18	0.98	
6		Steel (Tor)	Ton.					1.89	
7		Shuttering						90.18	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	18.60	0.30		5.58	
	iii	Shuttering Wall: Inner	SqM.	1	5.60	2.00		11.20	
	iv	Shuttering Wall: Outer	SqM.	1	7.00	2.00		14.00	
	v	Shuttering Column	SqM.	4	1.50	5.00		30.00	
	vi	Shuttering Beam	SqM.	1	18.60	0.30		5.58	
	vii	Shuttering Base Slab	SqM.	1	3.50	1.75		6.13	
	viii	Shuttering Slab Side	SqM.	1	10.50	0.18		1.84	
	ix	Shuttering Walkway Slab	SqM.	1	10.50	0.75		7.88	
8		Plastering						25.20	
	i	Plastering: Inner	SqM.	1	5.60	2.00		11.20	
	ii	Plastering: Outer	SqM.	1	7.00	2.00		14.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.50	1.75		6.13	
11		Painting						21.00	
	i	Painting: Long Wall	SqM.	2	3.50	2.00		14.00	
	ii	Painting: Short Wall	SqM.	2	1.75	2.00		7.00	
22		**OIL & GREASE CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	17.82	53.46
2		Re-Filling	CuM.					10.69	32.08
3		PCC						4.43	13.29
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	11.80	0.30	0.15	0.53	
	iii	Base on Ground	CuM.	1	3.50	3.00	0.23	2.42	
4		RCC M30(Below Plinth)						5.21	15.63
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	11.80	0.45	0.30	1.59	
5		RCC M30(Above Plinth)						10.65	31.94
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	11.80	0.30	0.30	1.06	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	16.00	0.75	0.15	1.80	
	v	Base Slab	CuM.	1	3.50	3.00	0.20	2.10	
	vi	Walls: Long	CuM.	2	3.50	1.80	0.18	2.21	
	vii	Walls: Short	CuM.	2	2.65	1.80	0.18	1.67	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
6		Steel (Tor)	Ton.					2.22	6.66
7		Shuttering						111.98	335.94
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	19.60	0.30		5.88	
	iii	Shuttering Wall: Inner	SqM.	1	10.30	1.80		18.54	
	iv	Shuttering Wall: Outer	SqM.	1	11.00	1.80		19.80	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	19.60	0.30		5.88	
	vii	Shuttering Base Slab	SqM.	1	3.50	3.00		10.50	
	viii	Shuttering Slab Side	SqM.	1	13.00	0.20		2.60	
	ix	Shuttering Walkway Slab	SqM.	1	16.00	0.75		12.00	
8		Plastering						38.34	115.02
	i	Plastering: Inner	SqM.	1	10.30	1.80		18.54	
	ii	Plastering: Outer	SqM.	1	11.00	1.80		19.80	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.50	3.00		10.50	31.50
11		Painting						23.40	70.20
	i	Painting: Long Wall	SqM.	2	3.50	1.80		12.60	
	ii	Painting: Short Wall	SqM.	2	3.00	1.80		10.80	
23		**OIL & GREASE COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	17.82	
2		Re-Filling	CuM.					10.69	
3		PCC						3.31	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.30	0.30	0.15	0.42	
	iii	Base on Ground	CuM.	1	3.50	1.75	0.23	1.41	
4		RCC M30(Below Plinth)						4.87	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	9.30	0.45	0.30	1.26	
5		RCC M30(Above Plinth)						8.61	
	i	Column	CuM.	4	0.30	0.45	3.55	1.92	
	ii	Beam	CuM.	1	9.30	0.30	0.30	0.84	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	10.50	0.75	0.15	1.18	
	v	Base Slab	CuM.	1	3.50	1.75	0.18	1.07	
	vi	Walls: Long	CuM.	2	3.75	2.00	0.18	2.63	
	vii	Walls: Short	CuM.	2	1.40	2.00	0.18	0.98	
6		Steel (Tor)	Ton.					1.89	
7		Shuttering						90.18	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	18.60	0.30		5.58	
	iii	Shuttering Wall: Inner	SqM.	1	5.60	2.00		11.20	
	iv	Shuttering Wall: Outer	SqM.	1	7.00	2.00		14.00	
	v	Shuttering Column	SqM.	4	1.50	5.00		30.00	
	vi	Shuttering Beam	SqM.	1	18.60	0.30		5.58	
	vii	Shuttering Base Slab	SqM.	1	3.50	1.75		6.13	
	viii	Shuttering Slab Side	SqM.	1	10.50	0.18		1.84	
	ix	Shuttering Walkway Slab	SqM.	1	10.50	0.75		7.88	
8		Plastering						**25.20**	
	i	Plastering: Inner	SqM.	1	5.60	2.00		11.20	
	ii	Plastering: Outer	SqM.	1	7.00	2.00		14.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.50	1.75		**6.13**	
11		Painting						**21.00**	
	i	Painting: Long Wall	SqM.	2	3.50	2.00		14.00	
	ii	Painting: Short Wall	SqM.	2	1.75	2.00		7.00	
24		**INTERMEDIATE COLLECTION CHAMBER**							
1		EarthWork	CuM.					**36.94**	**73.87**
				1	1.80	1.50	1.80	4.86	
				8	1.65	1.35	1.80	32.08	
2		Re-Filling	CuM.					**22.16**	**44.32**
3		PCC						**14.73**	**29.47**
	i	PCC Under Footings	CuM.	1	1.80	1.50	0.15	0.41	
				8	1.65	1.35	0.15	2.67	
	ii	Plinth Beam	CuM.	1	35.70	0.45	0.15	2.41	
	iii	Base on Ground	CuM.	1	6.00	6.70	0.23	9.25	
4		RCC M30(Below Plinth)						**10.73**	**21.46**
	i	Footing	CuM.	1	1.65	1.35	0.38	0.84	
				8	1.50	1.20	0.35	5.04	
	ii	Column	CuM.	9	0.30	0.45	1.35	1.64	
	iii	Plinth Beam	CuM.	1	35.70	0.30	0.30	3.21	
5		RCC M30(Above Plinth)						**36.44**	**72.87**
	i	Column	CuM.	1	0.30	0.45	1.55	0.21	
				8	0.30	0.45	4.35	4.70	
	ii	Beam	CuM.	1	35.70	0.30	0.30	3.21	
	iii	StairCase	CuM.					5.03	
	iv	Walkway	CuM.	1	28.40	0.75	0.15	3.20	
	v	Base Slab	CuM.	1	6.00	6.70	0.20	8.04	
	vi	Walls: Long	CuM.	2	6.70	2.80	0.18	6.57	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vii	Walls: Short	CuM.	2	5.60	2.80	0.18	5.49	
6		Steel (Tor)	Ton.					**6.60**	**13.21**
7		Shuttering						**310.03**	**620.06**
	i	Footing	SqM.	1	1.65	1.35	0.38	2.25	
				8	1.50	1.20	0.35	15.12	
	ii	Shuttering Plinth Beam	SqM.	1	48.40	0.30		14.52	
	iii	Shuttering Wall: Inner	SqM.	1	23.80	2.80		66.64	
	iv	Shuttering Wall: Outer	SqM.	1	25.40	2.80		71.12	
	v	Shuttering Column	SqM.	1	1.20	3.00		3.60	
				8	1.20	5.80		55.68	
	vi	Shuttering Beam	SqM.	1	48.40	0.30		14.52	
	vii	Shuttering Base Slab	SqM.	1	6.70	6.00		40.20	
	viii	Shuttering Slab Side	SqM.	1	25.40	0.20		5.08	
	ix	Shuttering Walkway Slab	SqM.	1	28.40	0.75		21.30	
8		Plastering						**137.76**	**275.52**
	i	Plastering: Inner	SqM.	1	23.80	2.80		66.64	
	ii	Plastering: Outer	SqM.	1	25.40	2.80		71.12	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	6.70	6.00		**40.20**	**80.40**
11		Painting						**71.12**	**142.24**
	i	Painting: Long Wall	SqM.	2	6.70	2.80		37.52	
	ii	Painting: Short Wall	SqM.	2	6.00	2.80		33.60	
25		**High TDS COLLECCTION / EQUALISATION TANK**							
1		EarthWork	CuM.					**1574.88**	**524.96**
				52	3.30	3.30	1.80	1019.30	
				38	2.85	2.85	1.80	555.58	
2		Re-Filling	CuM.					**944.93**	**314.98**
3		PCC						**523.53**	**174.51**
	i	PCC Under Footings	CuM.	52	3.30	3.30	0.15	84.94	
				38	2.85	2.85	0.15	46.30	
	ii	Plinth Beam	CuM.	1	600.50	0.53	0.15	47.29	
	iii	Base on Ground	CuM.	1	60.00	25.00	0.23	345.00	
4		RCC M30(Below Plinth)						**493.57**	**164.52**
	i	Footing	CuM.	52	3.15	3.15	0.53	270.88	
				38	2.70	2.70	0.43	117.73	
	ii	Column	CuM.	52	0.45	0.45	1.13	11.85	
				38	0.45	0.45	1.13	8.66	
	iii	Plinth Beam	CuM.	1	600.50	0.38	0.38	84.45	
5		RCC M30(Above Plinth)						**871.96**	**290.65**
	i	Column	CuM.	52	0.45	0.45	1.40	14.74	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
				38	0.45	0.45	4.70	36.17	
	ii	Beam	CuM.	1	600.50	0.45	0.45	121.60	
	iii	Beam	CuM.	1	195.60	0.15	0.38	11.00	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	173.00	0.75	0.15	19.46	
	vi	Base Slab	CuM.	1	60.00	25.00	0.30	450.00	
	vii	Walls: Long	CuM.	2	60.60	3.30	0.30	119.99	
	viii	Walls: Short	CuM.	4	25.00	3.30	0.30	99.00	
6		Steel (Tor)	Ton.					**191.17**	**63.72**
7		Shuttering						**5524.82**	**1841.61**
	i	Footing	SqM.	52	12.60	0.53	0.30	343.98	
				38	10.80	0.43		174.42	
	ii	Shuttering Plinth Beam	SqM.	1	1201.00	0.38		450.38	
	iii	Shuttering Wall: Inner	SqM.	1	170.00	3.30		561.00	
				4	25.00	3.30		330.00	
	iv	Shuttering Wall: Outer	SqM.	1	171.20	3.30		564.96	
	v	Shuttering Column	SqM.	52	1.80	2.53		236.34	
				38	1.80	2.53		172.71	
	vi	Shuttering Beam	SqM.	1	600.50	1.35		810.68	
	vii	Shuttering Tie Beam	SqM.	1	195.60	0.90		176.04	
	viii	Shuttering Base Slab	SqM.	1	60.30	25.30		1525.59	
	ix	Shuttering Slab Side	SqM.	1	170.00	0.30		51.00	
	x	Shuttering Walkway Slab	SqM.	1	170.30	0.75		127.73	
8		Plastering						**1455.96**	**485.32**
	i	Plastering: Inner	SqM.	1	170.00	3.30		561.00	
				4	25.00	3.30		330.00	
	ii	Plastering: Outer	SqM.	1	171.20	3.30		564.96	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	60.00	25.00		**1500.00**	**500.00**
11		Painting						**564.96**	**188.32**
	i	Painting: Long Wall	SqM.	2	60.60	3.30		399.96	
	ii	Painting: Short Wall	SqM.	2	25.00	3.30		165.00	
26		**NEUTRALIZATION TANK**							
1		EarthWork	CuM.	12	1.50	1.35	1.80	**43.74**	
2		Re-Filling	CuM.					**26.24**	
3		PCC						**17.13**	
	i	PCC Under Footings	CuM.	12	1.50	1.35	0.15	3.65	
	ii	Plinth Beam	CuM.	1	29.40	0.45	0.15	1.98	
	iii	Base on Ground	CuM.	1	8.00	6.25	0.23	11.50	
4		RCC M30(Below Plinth)						**11.02**	

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED

Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Footing	CuM.	12	1.35	1.20	0.35	6.80	
	ii	Column	CuM.	12	0.30	0.30	1.45	1.57	
	iii	Plinth Beam	CuM.	1	29.40	0.30	0.30	2.65	
5		RCC M30(Above Plinth)						**29.92**	
	i	Column	CuM.	2	0.30	0.30	3.00	0.54	
				10	0.30	0.30	5.30	4.77	
	ii	Beam	CuM.	1	29.40	0.30	0.30	2.65	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	30.20	0.75	0.15	3.40	
	v	Base Slab	CuM.	1	8.00	6.25	0.15	7.50	
	vi	Walls: Long	CuM.	2	8.00	2.30	0.18	6.44	
	vii	Walls: Short	CuM.	2	5.75	2.30	0.18	4.63	
6		Steel (Tor)	Ton.					**5.73**	
7		Shuttering						**323.44**	
	i	Footing	SqM.	12	1.35	1.20	0.35	21.42	
	ii	Shuttering Plinth Beam	SqM.	1	55.40	0.30		16.62	
	iii	Shuttering Wall: Inner	SqM.	1	27.00	2.30		62.10	
	iv	Shuttering Wall: Outer	SqM.	1	28.40	2.30		65.32	
	v	Shuttering Column	SqM.	2	1.20	3.00		7.20	
				10	1.20	5.30		63.60	
	vi	Shuttering Beam	SqM.	1	55.40	0.30		16.62	
	vii	Shuttering Base Slab	SqM.	1	7.50	6.70		50.25	
	viii	Shuttering Slab Side	SqM.	1	28.40	0.15		4.26	
	ix	Shuttering Walkway Slab	SqM.	1	21.40	0.75		16.05	
8		Plastering						**127.42**	
	i	Plastering: Inner	SqM.	1	27.00	2.30		62.10	
	ii	Plastering: Outer	SqM.	1	28.40	2.30		65.32	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	8.00	6.25		**50.00**	
11		Painting						**65.55**	
	i	Painting: Long Wall	SqM.	2	8.00	2.30		36.80	
	ii	Painting: Short Wall	SqM.	2	6.25	2.30		28.75	
27		**FLASH MIXER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.95**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	7.20	0.45	0.15	0.49	
	iii	Base on Ground	CuM.	1	2.50	1.70	0.23	0.98	
4		RCC M30(Below Plinth)						**3.70**	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	7.20	0.30	0.30	0.65	
5		RCC M30(Above Plinth)						**6.40**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	7.20	0.30	0.30	0.65	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	11.40	0.75	0.15	1.28	
	v	Base Slab	CuM.	1	2.50	1.70	0.15	0.64	
	vi	Walls: Long	CuM.	2	2.50	1.50	0.18	1.31	
	vii	Walls: Short	CuM.	2	1.35	1.50	0.18	0.71	
6		Steel (Tor)	Ton.					**1.41**	
7		Shuttering						**93.67**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	8.95	1.50		13.43	
	iv	Shuttering Wall: Outer	SqM.	1	10.20	1.50		15.30	
	v	Shuttering Column	SqM.	4	1.50	5.80		34.80	
	vi	Shuttering Beam	SqM.	1	18.00	0.30		5.40	
	vii	Shuttering Base Slab	SqM.	1	2.50	1.70		4.25	
	viii	Shuttering Slab Side	SqM.	1	8.40	0.15		1.26	
	ix	Shuttering Walkway Slab	SqM.	1	11.40	0.75		8.55	
8		Plastering						**28.73**	
	i	Plastering: Inner	SqM.	1	8.95	1.50		13.43	
	ii	Plastering: Outer	SqM.	1	10.20	1.50		15.30	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	2.50	1.70		**4.25**	
11		Painting						**12.60**	
	i	Painting: Long Wall	SqM.	2	2.50	1.50		7.50	
	ii	Painting: Short Wall	SqM.	2	1.70	1.50		5.10	
28		**FLOCCULATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**3.66**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.20	0.45	0.15	0.62	
	iii	Base on Ground	CuM.	1	2.70	2.50	0.23	1.55	
4		RCC M30(Below Plinth)						**3.88**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Plinth Beam	CuM.	1	9.20	0.30	0.30	0.83	
5		RCC M30(Above Plinth)						**9.05**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	9.20	0.30	0.30	0.83	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	13.40	0.75	0.20	2.01	
	v	Base Slab	CuM.	1	2.70	2.50	0.20	1.35	
	vi	Walls: Long	CuM.	2	2.70	1.80	0.18	1.70	
	vii	Walls: Short	CuM.	2	2.15	1.80	0.18	1.35	
6		Steel (Tor)	Ton.					**1.81**	
7		Shuttering						**110.56**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	18.00	0.30		5.40	
	iii	Shuttering Wall: Inner	SqM.	1	9.00	2.30		20.70	
	iv	Shuttering Wall: Outer	SqM.	1	10.40	2.30		23.92	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	18.00	0.30		5.40	
	vii	Shuttering Base Slab	SqM.	1	2.70	2.50		6.75	
	viii	Shuttering Slab Side	SqM.	1	10.40	0.15		1.56	
	ix	Shuttering Walkway Slab	SqM.	1	13.40	0.75		10.05	
8		Plastering						**34.92**	
	i	Plastering: Inner	SqM.	1	9.00	1.80		16.20	
	ii	Plastering: Outer	SqM.	1	10.40	1.80		18.72	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	2.70	2.50		**6.75**	
11		Painting						**18.72**	
	i	Painting: Long Wall	SqM.	2	2.70	1.80		9.72	
	ii	Painting: Short Wall	SqM.	2	2.50	1.80		9.00	
29		**LIME / CAUSTIC PREPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
30		**HCL PREPARATIION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	

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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
31		**ALUM / PAC PREPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	

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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
32		**POLY PREPPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
33		**PRIMARY CLARIFLOCCULATOR**							
1		EarthWork	CuM.	12	3.45	3.45	1.80	**257.09**	
2		Re-Filling	CuM.					**154.26**	
3		PCC						**62.29**	
	i	PCC Under Footings	CuM.	12	3.45	3.45	0.15	21.42	
	ii	Plinth Beam	CuM.	1	131.50	0.53	0.15	10.36	
	iii	Base on Ground (Circular)	CuM.	1	13.00	Dia	0.23	30.51	
4		RCC M30(Below Plinth)						**80.58**	
	i	Footing	CuM.	12	3.30	3.30	0.45	58.81	
	ii	Column	CuM.	12	0.45	0.45	1.35	3.28	
	iii	Plinth Beam	CuM.	1	131.50	0.38	0.38	18.49	
5		RCC M30(Above Plinth)						**141.51**	
	i	Column	CuM.	4	0.45	0.45	1.10	0.89	
				8	0.45	0.45	4.40	7.13	
	ii	Beam	CuM.	1	131.50	0.45	0.60	35.51	
	iii	Base Slab	CuM.	1	13.00	Dia	0.30	39.80	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	32.50	0.75	0.30	9.75	
	vi	Walls: Circular	CuM.	1	13.00	3.30	0.35	48.44	
6		Steel (Tor)	Ton.					**31.09**	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
7		Shuttering						**879.76**	
	i	Footing		12	3.30	3.30	0.45	71.28	
	ii	Shuttering Plinth Beam		1	254.80	0.38		95.55	
	iii	Shuttering Wall: Inner	SqM.	1	40.84	3.30		134.77	
	iv	Shuttering Wall: Outer	SqM.	1	43.04	3.30		142.03	
	v	Shuttering Column	SqM.	4	1.80	2.45		17.64	
				8	1.80	5.75		82.80	
	vi	Shuttering Beam	SqM.	1	254.80	0.60		152.88	
	vii	Shuttering Base Slab	SqM.	1	13.00	dia		132.67	
	viii	Shuttering Walkway	SqM.	1	47.75	0.75		35.81	
	ix	Shuttering Slab Side	SqM.	1	47.75	0.30		14.33	
8		Plastering						**349.73**	
	i	Plastering: Inner	SqM.	1	48.38	3.30		159.65	
	ii	Plastering: Outer	SqM.	1	57.60	3.30		190.08	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	13.00	dia		**132.67**	
11		Painting						**142.03**	
	i	Painting:Circular Wall	SqM.	1	43.04	3.30		142.03	
34		**PRIMARY SLUDGE HOLDING TANKS**							
1		EarthWork	CuM.	9	3.45	3.45	1.80	**192.82**	
2		Re-Filling	CuM.					**115.69**	
3		PCC						**46.01**	
	i	PCC Under Footings	CuM.	9	3.45	3.45	0.15	16.07	
	ii	Plinth Beam	CuM.	1	102.76	0.53	0.15	8.09	
	iii	Base on Ground (Circular)	CuM.	1	11.00	Dia	0.23	21.85	
4		RCC M30(Below Plinth)						**61.02**	
	i	Footing	CuM.	9	3.30	3.30	0.45	44.10	
	ii	Column	CuM.	9	0.45	0.45	1.35	2.46	
	iii	Plinth Beam	CuM.	1	102.76	0.38	0.38	14.45	
5		RCC M30(Above Plinth)						**105.09**	
	i	Column	CuM.	1	0.45	0.45	1.10	0.22	
				8	0.45	0.45	4.40	7.13	
	ii	Beam	CuM.	1	102.76	0.45	0.60	27.75	
	iii	Base Slab	CuM.	1	11.00	Dia	0.30	28.50	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	41.47	0.75	0.30	9.33	
	vi	Walls: Circular	CuM.	1	36.76	2.50	0.35	32.17	
6		Steel (Tor)	Ton.					**23.25**	
7		Shuttering						**622.04**	
	i	Footing		9	3.30	3.30	0.45	53.46	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Shuttering Plinth Beam		1	168.76	0.38		63.29	
	iii	Shuttering Wall: Inner	SqM.	1	34.56	2.50		86.40	
	iv	Shuttering Wall: Outer	SqM.	1	36.76	2.50		91.90	
	v	Shuttering Column	SqM.	1	1.80	2.45		4.41	
				8	1.80	5.75		82.80	
	vi	Shuttering Beam	SqM.	1	168.76	0.60		101.26	
	vii	Shuttering Base Slab	SqM.	1	11.00	dia		94.99	
	viii	Shuttering Walkway	SqM.	1	41.47	0.75		31.10	
	ix	Shuttering Slab Side	SqM.	1	41.47	0.30		12.44	
8		Plastering						**142.95**	
	i	Plastering: Inner	SqM.	1	27.49	2.50		68.73	
	ii	Plastering: Outer	SqM.	1	29.69	2.50		74.23	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	11.00	dia		**94.99**	
11		Painting						**91.90**	
	i	Painting:Circular Wall	SqM.	1	36.76	2.50		91.90	
35		**POLY PREPPARATION TANK AT SCREWPRESS**							
1		EarthWork	CuM.	4	1.50	1.35	1.80	**14.58**	
2		Re-Filling	CuM.					**8.75**	
3		PCC						**11.23**	
	i	PCC Under Footings	CuM.	4	1.50	1.35	0.15	1.22	
	ii	Plinth Beam	CuM.	1	53.95	0.53	0.15	4.25	
	iii	Base on Ground (Circular)	CuM.	1	1.25	Dia	0.23	5.76	
4		RCC M30(Below Plinth)						**3.35**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.30	1.45	0.52	
	iii	Plinth Beam	CuM.	1	6.23	0.30	0.30	0.56	
5		RCC M30(Above Plinth)						**5.69**	
	i	Column	CuM.	4	0.30	0.30	4.40	1.58	
	ii	Beam	CuM.	1	6.23	0.30	0.30	0.56	
	iii	Base Slab	CuM.	1	1.25	Dia	0.30	0.37	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	7.85	0.75	0.30	1.77	
	vi	Walls: Circular	CuM.	1	5.03	1.60	0.18	1.41	
6		Steel (Tor)	Ton.					**1.27**	
7		Shuttering						**86.75**	
	i	Footing		4	1.35	1.20	0.35	7.14	
	ii	Shuttering Plinth Beam		1	11.36	0.38		4.26	
	iii	Shuttering Wall: Inner	SqM.	1	3.93	1.60		6.29	
	iv	Shuttering Wall: Outer	SqM.	1	5.03	1.60		8.05	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	v	Shuttering Column	SqM.	4	1.50	4.90		29.40	
	vi	Shuttering Beam	SqM.	1	11.36	0.30		3.41	
	vii	Shuttering Base Slab	SqM.	1	1.25	dia		1.23	
	viii	Shuttering Walkway	SqM.	1	7.85	0.75		25.80	
	ix	Shuttering Slab Side	SqM.	1	7.85	0.15		1.18	
8		Plastering						**14.34**	
	i	Plastering: Inner	SqM.	1	3.93	1.60		6.29	
	ii	Plastering: Outer	SqM.	1	5.03	1.60		8.05	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.25	dia		**1.23**	
11		Painting						**8.05**	
	i	Painting:Circular Wall	SqM.	1	5.03	1.60		8.05	

D.		**2MLD HIGH TDS EFFLUENT TREATMENT (STRIPPER, MEE &ATFD)**							
36, 37, 38, 39, 40, 41, 42		**Stripper feed tanks, Solvent storage tank, MEE feed tank, MEE Concentrate storage tanks, MEE Condensate tank, ATFD Condensate tank, CIP tank/ MEE drain tank**							
1		EarthWork	CuM.					**1089.13**	
				36	3.15	3.15	1.80	642.98	
				34	2.70	2.70	1.80	446.15	
2		Re-Filling	CuM.					**653.48**	
3		PCC						**384.80**	
	i	PCC Under Footings	CuM.	36	3.15	3.15	0.15	53.58	
				34	2.70	2.70	0.15	37.18	
	ii	Plinth Beam	CuM.	1	500.70	0.53	0.15	39.43	
	iii	Base on Ground	CuM.	1	51.60	20.00	0.23	237.36	
				1	5.00	7.00	0.23	8.05	
				2	5.00	4.00	0.23	9.20	
4		RCC M30(Below Plinth)						**350.42**	
	i	Footing	CuM.	36	3.00	3.00	0.53	170.10	
				34	2.55	2.55	0.43	93.96	
	ii	Column	CuM.	36	0.45	0.45	1.13	8.20	
				34	0.45	0.45	1.13	7.75	
	iii	Plinth Beam	CuM.	1	500.70	0.38	0.38	70.41	
5		RCC M30(Above Plinth)						**789.29**	
	i	Column	CuM.	36	0.45	0.45	1.40	10.21	
				34	0.45	0.45	4.70	32.36	

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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Beam	CuM.	1	500.70	0.45	0.45	101.39	
				1	275.20	0.15	0.38	15.48	
	iii	StairCase	CuM.					5.88	
	iv	Walkway	CuM.	1	301.20	0.75	0.15	33.89	
	v	Base Slab	CuM.	1	51.60	20.00	0.30	309.60	
				1	5.00	7.00	0.30	10.50	
				2	5.00	4.00	0.30	12.00	
	vi	Walls: Long	CuM.	2	52.20	3.30	0.30	103.36	
				2	5.30	3.30	0.30	10.49	
				2	5.30	3.30	0.30	10.49	
	vii	Walls: Short	CuM.	2	20.00	3.30	0.30	39.60	
				6	20.00	3.30	0.20	79.20	
				1	7.00	3.30	0.30	6.93	
				2	4.00	3.30	0.30	7.92	
6		Steel (Tor)	Ton.					**159.56**	
7		Shuttering						**5137.77**	
	i	Footing	SqM.	36	12.00	0.53	0.30	226.80	
				34	10.20	0.43		147.39	
	ii	Shuttering Plinth Beam	SqM.	1	1001.40	0.38		375.53	
	iii	Shuttering Wall: Inner	SqM.	1	143.20	3.30		472.56	
				1	24.00	3.30		79.20	
				2	18.00	3.30		118.80	
				8	20.00	3.30		528.00	
	iv	Shuttering Wall: Outer	SqM.	1	169.20	3.30		558.36	
	v	Shuttering Column	SqM.	36	1.80	2.53		163.62	
				34	1.80	2.53		154.53	
	vi	Shuttering Beam	SqM.	1	500.70	1.35		675.95	
				1	275.20	0.90		247.68	
	vii	Shuttering Base Slab	SqM.	1	51.60	20.00		1032.00	
				1	5.00	7.00		35.00	
				2	5.00	4.00		40.00	
	viii	Shuttering Slab Side	SqM.	1	143.20	0.30		42.96	
				1	17.00	0.30		5.10	
				2	14.00	0.30		8.40	
	ix	Shuttering Walkway Slab	SqM.	1	301.20	0.75		225.90	
8		Plastering						**1939.08**	
	i	Plastering: Inner	SqM.	1	143.20	3.30		472.56	
				1	24.00	3.30		79.20	
				2	18.00	3.30		118.80	
				12	20.00	3.30		792.00	
	ii	Plastering: Outer	SqM.	1	144.40	3.30		476.52	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
9		Tiling	SqM.						
10		Top & Flooring	SqM.					1107.00	
				1	51.60	20.00		1032.00	
				1	5.00	7.00		35.00	
				2	5.00	4.00		40.00	
11		Painting						546.48	
	i	Painting: Long Wall	SqM.	2	52.20	3.30		344.52	
				4	5.30	3.30		69.96	
	ii	Painting: Short Wall	SqM.	2	20.00	3.30		132.00	
43, 44, 4		**Condensate storage tank, Buffer storage tank, Settling tank**							
1		EarthWork	CuM.					1168.95	
				39	3.15	3.15	1.80	696.56	
				36	2.70	2.70	1.80	472.39	
2		Re-Filling	CuM.					701.37	
3		PCC						417.03	
	i	PCC Under Footings	CuM.	39	3.15	3.15	0.15	58.05	
				36	2.70	2.70	0.15	39.37	
	ii	Plinth Beam	CuM.	1	530.50	0.53	0.15	41.78	
	iii	Base on Ground	CuM.	1	60.40	20.00	0.23	277.84	
4		RCC M30(Below Plinth)						375.45	
	i	Footing	CuM.	39	3.00	3.00	0.53	184.28	
				36	2.55	2.55	0.43	99.49	
	ii	Column	CuM.	39	0.45	0.45	1.13	8.88	
				36	0.45	0.45	1.13	8.20	
	iii	Plinth Beam	CuM.	1	530.50	0.38	0.38	74.60	
5		RCC M30(Above Plinth)						749.40	
	i	Column	CuM.	39	0.45	0.45	1.40	11.06	
				36	0.45	0.45	4.70	34.26	
	ii	Beam	CuM.	1	530.50	0.45	0.45	107.43	
				1	177.20	0.15	0.38	9.97	
	iii	StairCase	CuM.					5.88	
	iv	Walkway	CuM.	1	163.80	0.75	0.15	18.43	
	v	Base Slab	CuM.	1	60.40	20.00	0.30	362.40	
	vi	Walls: Long	CuM.	2	61.00	3.30	0.30	120.78	
	vii	Walls: Short	CuM.	4	20.00	3.30	0.30	79.20	
6		Steel (Tor)	Ton.					157.48	
7		Shuttering						4750.64	
	i	Footing	SqM.	39	12.00	0.53	0.30	245.70	
				36	10.20	0.43		156.06	
	ii	Shuttering Plinth Beam	SqM.	1	1061.00	0.38		397.88	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Shuttering Wall: Inner	SqM.	1	160.80	3.30		530.64	
				4	20.00	3.30		264.00	
	iv	Shuttering Wall: Outer	SqM.	1	163.20	3.30		538.56	
	v	Shuttering Column	SqM.	39	1.80	2.53		177.26	
				36	1.80	2.53		163.62	
	vi	Shuttering Beam	SqM.	1	530.50	1.35		716.18	
				1	177.20	0.90		159.48	
	vii	Shuttering Base Slab	SqM.	1	60.70	20.30		1232.21	
	viii	Shuttering Slab Side	SqM.	1	160.80	0.30		48.24	
	ix	Shuttering Walkway Slab	SqM.	1	161.10	0.75		120.83	
8		Plastering						**1329.24**	
	i	Plastering: Inner	SqM.	1	160.80	3.30		530.64	
				4	20.00	3.30		264.00	
	ii	Plastering: Outer	SqM.	1	162.00	3.30		534.60	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	2	60.40	20.00		**2416.00**	
11		Painting						**534.60**	
	i	Painting: Long Wall	SqM.	2	61.00	3.30		402.60	
	ii	Painting: Short Wall	SqM.	2	20.00	3.30		132.00	
46		**PRE - AREATION TANK**							
1		EarthWork	CuM.					**3165.48**	
				64	4.35	4.35	1.80	2179.87	
				36	3.90	3.90	1.80	985.61	
2		Re-Filling	CuM.					**1899.29**	
3		PCC						**926.85**	
	i	PCC Under Footings	CuM.	64	4.35	4.35	0.15	181.66	
				36	3.90	3.90	0.15	82.13	
	ii	Plinth Beam	CuM.	1	978.40	0.60	0.15	88.06	
	iii	Base on Ground	CuM.	1	50.00	50.00	0.23	575.00	
4		RCC M30(Below Plinth)						**1400.67**	
	i	Footing	CuM.	64	4.20	4.20	0.75	846.72	
				36	3.75	3.75	0.63	316.41	
	ii	Column	CuM.	64	0.60	0.60	1.05	24.19	
				36	0.60	0.60	1.18	15.23	
	iii	Plinth Beam	CuM.	1	978.40	0.45	0.45	198.13	
5		RCC M30(Above Plinth)						**1846.62**	
	i	Column	CuM.	64	0.60	0.60	0.95	21.89	
				36	0.60	0.60	6.45	83.59	
	ii	Beam	CuM.	1	978.40	0.60	0.65	381.58	
	iii	Beam	CuM.	1	197.60	0.40	0.45	35.57	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	203.00	0.75	0.30	45.68	
	vi	Base Slab	CuM.	1	50.00	50.00	0.40	1000.00	
	vii	Walls: Long	CuM.	2	50.00	3.00	0.30	90.00	
				2	50.00	2.50	0.20	50.00	
	viii	Walls: Short	CuM.	2	49.40	3.00	0.30	88.92	
				2	49.40	2.50	0.20	49.40	
6		Steel (Tor)	Ton.					**454.62**	
7		Shuttering						**9349.82**	
	i	Footing	SqM.	64	4.20	4.20	0.75	806.40	
				36	3.75	3.75	0.63	337.50	
	ii	Shuttering Plinth Beam	SqM.	1	1956.80	0.45		880.56	
	iii	Shuttering Wall: Inner	SqM.	1	197.60	5.50		1086.80	
	iv	Shuttering Wall: Outer	SqM.	1	200.00	5.50		1100.00	
	v	Shuttering Column	SqM.	64	2.40	2.00		307.20	
				36	2.40	7.63		659.23	
	vi	Shuttering Beam	SqM.	1	1956.80	0.65		1271.92	
	vii	Shuttering Tie Beam	SqM.	1	197.60	0.85		167.96	
	viii	Shuttering Base Slab	SqM.	1	50.00	50.00		2500.00	
	ix	Shuttering Slab Side	SqM.	1	200.00	0.40		80.00	
	x	Shuttering Walkway Slab	SqM.	1	203.00	0.75		152.25	
8		Plastering						**2186.80**	
	i	Plastering: Inner	SqM.	1	197.60	5.50		1086.80	
	ii	Plastering: Outer	SqM.	1	200.00	5.50		1100.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	50.00	50.00		**2500.00**	
11		Painting						**1100.00**	
	i	Painting: Long Wall	SqM.	2	50.00	5.50		550.00	
	ii	Painting: Short Wall	SqM.	2	50.00	5.50		550.00	
47		**ACID STORAGE TANK FOR CIP**							
1		EarthWork	CuM.	9	1.50	1.35	1.80	**32.81**	
2		Re-Filling	CuM.					**19.68**	
3		PCC						**12.75**	
	i	PCC Under Footings	CuM.	9	1.50	1.35	0.15	2.73	
	ii	Plinth Beam	CuM.	1	53.95	0.53	0.15	4.25	
	iii	Base on Ground (Circular)	CuM.	1	5.65	Dia	0.23	5.76	
4		RCC M30(Below Plinth)						**11.13**	
	i	Footing	CuM.	9	1.35	1.20	0.35	5.10	
	ii	Column	CuM.	9	0.30	0.30	1.45	1.17	
	iii	Plinth Beam	CuM.	1	53.95	0.30	0.30	4.86	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
5		RCC M30(Above Plinth)						39.04	
	i	Column	CuM.	1	0.30	0.30	1.10	0.10	
				8	0.30	0.30	4.40	3.17	
	ii	Beam	CuM.	1	53.95	0.30	0.30	4.86	
	iii	Base Slab	CuM.	1	5.65	Dia	0.30	18.03	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	23.56	0.75	0.30	5.30	
	vi	Walls: Circular	CuM.	1	18.85	2.30	0.18	7.59	
6		Steel (Tor)	Ton.					7.02	
7		Shuttering						345.97	
	i	Footing		9	1.35	1.20	0.35	16.07	
	ii	Shuttering Plinth Beam		1	103.38	0.38		38.77	
	iii	Shuttering Wall: Inner	SqM.	1	17.75	2.30		40.83	
	iv	Shuttering Wall: Outer	SqM.	1	18.85	2.30		43.36	
	v	Shuttering Column	SqM.	1	1.80	2.45		4.41	
				8	1.80	5.75		82.80	
	vi	Shuttering Beam	SqM.	1	103.38	0.30		31.01	
	vii	Shuttering Base Slab	SqM.	1	5.65	dia		60.10	
	viii	Shuttering Walkway	SqM.	1	23.56	0.75		25.80	
	ix	Shuttering Slab Side	SqM.	1	18.85	0.15		2.83	
8		Plastering						84.18	
	i	Plastering: Inner	SqM.	1	17.75	2.30		40.83	
	ii	Plastering: Outer	SqM.	1	18.85	2.30		43.36	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	5.65	dia		25.06	
11		Painting						43.36	
	i	Painting:Circular Wall	SqM.	1	18.85	2.30		43.36	

E.		**3MLD LOW TDS EFFLUENT TREATMENT**							
49		**BAR SCREEN CHAMBER**							
1		EarthWork	CuM.	6	1.35	1.35	1.80	19.68	
2		Re-Filling	CuM.					11.81	
3		PCC						3.50	
	i	PCC Under Footings	CuM.	6	1.35	1.35	0.15	1.64	
	ii	Plinth Beam	CuM.	1	9.70	0.45	0.15	0.65	
	iii	Base on Ground	CuM.	1	3.50	1.50	0.23	1.21	
4		RCC M30(Below Plinth)						4.28	
	i	Footing	CuM.	6	1.20	1.20	0.30	2.59	
	ii	Column	CuM.	6	0.30	0.30	1.50	0.81	
	iii	Plinth Beam	CuM.	1	9.70	0.30	0.30	0.87	
5		RCC M30(Above Plinth)						6.08	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Column	CuM.	6	0.30	0.30	2.90	1.57	
	ii	Beam	CuM.	1	9.70	0.30	0.30	0.87	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.00	0.75	0.15	0.90	
	v	Base Slab	CuM.	1	3.50	1.50	0.15	0.79	
	vi	Walls: Long	CuM.	2	3.50	1.30	0.15	1.37	
	vii	Walls: Short	CuM.	2	1.50	1.30	0.15	0.59	
6		Steel (Tor)	Ton.					**1.45**	
7		Shuttering						**87.35**	
	i	Footing	SqM.	6	1.20	1.20	0.30	8.64	
	ii	Shuttering Plinth Beam	SqM.	1	18.20	0.30		5.46	
	iii	Shuttering Wall: Inner	SqM.	1	8.80	1.30		11.44	
	iv	Shuttering Wall: Outer	SqM.	1	10.00	1.30		13.00	
	v	Shuttering Column	SqM.	6	1.20	4.25		30.60	
	vi	Shuttering Beam	SqM.	1	18.20	0.30		5.46	
	vii	Shuttering Base Slab	SqM.	1	3.50	1.50		5.25	
	viii	Shuttering Slab Side	SqM.	1	10.00	0.15		1.50	
	ix	Shuttering Walkway Slab	SqM.	1	8.00	0.75		6.00	
8		Plastering						**24.44**	
	i	Plastering: Inner	SqM.	1	8.80	1.30		11.44	
	ii	Plastering: Outer	SqM.	1	10.00	1.30		13.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.50	1.50		**5.25**	
11		Painting						**13.00**	
	i	Painting: Long Wall	SqM.	2	3.50	1.30		9.10	
	ii	Painting: Short Wall	SqM.	2	1.50	1.30		3.90	
50		**GRIT COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**3.31**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.80	0.30	0.15	0.44	
	iii	Base on Ground	CuM.	1	4.00	1.50	0.23	1.38	
4		RCC M30(Below Plinth)						**4.94**	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	9.80	0.45	0.30	1.32	
5		RCC M30(Above Plinth)						**8.21**	
	i	Column	CuM.	4	0.30	0.45	3.55	1.92	
	ii	Beam	CuM.	1	9.80	0.30	0.30	0.88	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	4.00	1.50	0.18	1.05	
	vi	Walls: Long	CuM.	2	4.00	2.00	0.18	2.80	
	vii	Walls: Short	CuM.	2	1.10	2.00	0.18	0.77	
6		Steel (Tor)	Ton.					**1.84**	
7		Shuttering						**101.77**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	19.60	0.30		5.88	
	iii	Shuttering Wall: Inner	SqM.	1	5.80	2.00		11.60	
	iv	Shuttering Wall: Outer	SqM.	1	11.00	2.00		22.00	
	v	Shuttering Column	SqM.	4	1.50	5.00		30.00	
	vi	Shuttering Beam	SqM.	1	19.60	0.30		5.88	
	vii	Shuttering Base Slab	SqM.	1	4.00	1.50		6.00	
	viii	Shuttering Slab Side	SqM.	1	11.00	0.18		1.93	
	ix	Shuttering Walkway Slab	SqM.	1	14.00	0.75		10.50	
8		Plastering						**33.60**	
	i	Plastering: Inner	SqM.	1	5.80	2.00		11.60	
	ii	Plastering: Outer	SqM.	1	11.00	2.00		22.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	4.00	1.50		**6.00**	
11		Painting						**22.00**	
	i	Painting: Long Wall	SqM.	2	4.00	2.00		16.00	
	ii	Painting: Short Wall	SqM.	2	1.50	2.00		6.00	
51		**OIL & GREASE CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	**53.46**
2		Re-Filling	CuM.					**10.69**	**32.08**
3		PCC						**5.17**	**15.52**
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	13.50	0.30	0.15	0.61	
	iii	Base on Ground	CuM.	1	4.00	3.35	0.23	3.08	
4		RCC M30(Below Plinth)						**5.44**	**16.32**
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	13.50	0.45	0.30	1.82	
5		RCC M30(Above Plinth)						**11.88**	**35.64**
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	13.50	0.30	0.30	1.22	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	15.70	0.75	0.15	1.77	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	v	Base Slab	CuM.	1	4.00	3.35	0.20	2.68	
	vi	Walls: Long	CuM.	2	4.00	1.80	0.18	2.52	
	vii	Walls: Short	CuM.	2	3.00	1.80	0.18	1.89	
6		Steel (Tor)	Ton.					**2.42**	**7.27**
7		Shuttering						**130.78**	**392.33**
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	25.80	0.30		7.74	
	iii	Shuttering Wall: Inner	SqM.	1	13.30	1.80		23.94	
	iv	Shuttering Wall: Outer	SqM.	1	14.70	1.80		26.46	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	25.80	0.30		7.74	
	vii	Shuttering Base Slab	SqM.	1	4.00	3.35		13.40	
	viii	Shuttering Slab Side	SqM.	1	14.70	0.20		2.94	
	ix	Shuttering Walkway Slab	SqM.	1	15.70	0.75		11.78	
8		Plastering						**50.40**	**151.20**
	i	Plastering: Inner	SqM.	1	13.30	1.80		23.94	
	ii	Plastering: Outer	SqM.	1	14.70	1.80		26.46	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	4.00	3.35		**13.40**	**40.20**
11		Painting						**26.46**	**79.38**
	i	Painting: Long Wall	SqM.	2	4.00	1.80		14.40	
	ii	Painting: Short Wall	SqM.	2	3.35	1.80		12.06	
52		**OIL & GREASE COLLECTION CHAMBER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**3.31**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.80	0.30	0.15	0.44	
	iii	Base on Ground	CuM.	1	4.00	1.50	0.23	1.38	
4		RCC M30(Below Plinth)						**4.94**	
	i	Footing	CuM.	4	1.50	1.35	0.35	2.84	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	9.80	0.45	0.30	1.32	
5		RCC M30(Above Plinth)						**8.36**	
	i	Column	CuM.	4	0.30	0.45	3.55	1.92	
	ii	Beam	CuM.	1	9.80	0.30	0.30	0.88	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	7.00	0.75	0.15	0.79	
	v	Base Slab	CuM.	1	4.00	1.50	0.20	1.20	
	vi	Walls: Long	CuM.	2	4.00	2.00	0.18	2.80	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vii	Walls: Short	CuM.	2	1.10	2.00	0.18	0.77	
6		Steel (Tor)	Ton.					1.86	
7		Shuttering						102.04	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	19.60	0.30		5.88	
	iii	Shuttering Wall: Inner	SqM.	1	5.80	2.00		11.60	
	iv	Shuttering Wall: Outer	SqM.	1	11.00	2.00		22.00	
	v	Shuttering Column	SqM.	4	1.50	5.00		30.00	
	vi	Shuttering Beam	SqM.	1	19.60	0.30		5.88	
	vii	Shuttering Base Slab	SqM.	1	4.00	1.50		6.00	
	viii	Shuttering Slab Side	SqM.	1	11.00	0.20		2.20	
	ix	Shuttering Walkway Slab	SqM.	1	14.00	0.75		10.50	
8		Plastering						33.60	
	i	Plastering: Inner	SqM.	1	5.80	2.00		11.60	
	ii	Plastering: Outer	SqM.	1	11.00	2.00		22.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	4.00	1.50		6.00	
11		Painting						22.00	
	i	Painting: Long Wall	SqM.	2	4.00	2.00		16.00	
	ii	Painting: Short Wall	SqM.	2	1.50	2.00		6.00	
53		**INTERMEDIATE COLLECTION TANK**							
1		EarthWork	CuM.					157.46	
				12	2.70	2.70	1.80	157.46	
2		Re-Filling	CuM.					94.48	
3		PCC						24.78	
	i	PCC Under Footings	CuM.	12	2.70	2.70	0.15	13.12	
	ii	Plinth Beam	CuM.	1	35.70	0.45	0.15	2.41	
	iii	Base on Ground	CuM.	1	6.00	6.70	0.23	9.25	
4		RCC M30(Below Plinth)						33.16	
	i	Footing	CuM.	12	2.55	2.55	0.43	33.16	
	ii	Column	CuM.	9	0.30	0.45	1.38	1.67	
	iii	Plinth Beam	CuM.	1	54.10	0.38	0.38	7.61	
5		RCC M30(Above Plinth)						86.85	
	i	Column	CuM.	2	0.45	0.45	1.40	0.57	
				10	0.45	0.45	4.70	9.52	
	ii	Beam	CuM.	1	54.10	0.45	0.30	7.30	
	iii	Tie Beam	CuM.	1	40.30	0.15	0.38	2.27	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	45.10	0.75	0.20	6.77	
	vi	Base Slab	CuM.	1	13.85	7.20	0.20	19.94	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vii	Walls: Long	CuM.	2	13.85	3.30	0.30	27.42	
	viii	Walls: Short	CuM.	2	6.60	3.30	0.30	13.07	
6		Steel (Tor)	Ton.					**16.80**	
7		Shuttering						**538.15**	
	i	Footing	SqM.	12	2.55	2.55	0.43	52.02	
	ii	Shuttering Plinth Beam	SqM.	1	78.20	0.30		23.46	
	iii	Shuttering Wall: Inner	SqM.	1	24.70	2.80		69.16	
	iv	Shuttering Wall: Outer	SqM.	1	27.70	2.80		77.56	
	v	Shuttering Column	SqM.	2	1.80	2.85		10.26	
				10	1.80	6.15		110.70	
	vi	Shuttering Beam	SqM.	1	78.20	0.30		23.46	
	vii	Shuttering Tie Beam	SqM.	1	48.30	0.53		25.36	
	viii	Shuttering Base Slab	SqM.	1	13.85	7.20		99.72	
	ix	Shuttering Walkway Slab	SqM.	1	45.10	0.75		33.83	
	x	Shuttering Slab Side	SqM.	1	42.10	0.30		12.63	
8		Plastering						**172.92**	
	i	Plastering: Inner	SqM.	1	24.70	3.30		81.51	
	ii	Plastering: Outer	SqM.	1	27.70	3.30		91.41	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	13.85	7.20		**99.72**	
11		Painting						**138.93**	
	i	Painting: Long Wall	SqM.	2	13.85	3.30		91.41	
	ii	Painting: Short Wall	SqM.	2	7.20	3.30		47.52	
54		**LOW TDS COLLECCTION / EQUALISATION TANK**							
1		EarthWork	CuM.					**841.27**	**1682.53**
				28	3.15	3.15	1.80	500.09	
				26	2.70	2.70	1.80	341.17	
2		Re-Filling	CuM.					**504.76**	**1009.52**
3		PCC						**252.47**	**504.94**
	i	PCC Under Footings	CuM.	28	3.15	3.15	0.15	41.67	
				26	2.70	2.70	0.15	28.43	
	ii	Plinth Beam	CuM.	1	370.80	0.49	0.15	27.11	
	iii	Base on Ground	CuM.	1	30.00	22.50	0.23	155.25	
4		RCC M30(Below Plinth)						**293.03**	**586.06**
	i	Footing	CuM.	28	3.15	3.15	0.53	145.86	
				26	2.70	2.70	0.43	80.55	
	ii	Column	CuM.	28	0.45	0.45	1.28	7.23	
				26	0.45	0.45	1.38	7.24	
	iii	Plinth Beam	CuM.	1	370.80	0.38	0.38	52.14	
5		RCC M30(Above Plinth)						**410.01**	**820.02**

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Column	CuM.	28	0.45	0.45	1.40	7.94	
				26	0.45	0.45	4.70	24.75	
	ii	Beam	CuM.	1	370.80	0.45	0.30	50.06	
	iii	Beam	CuM.	1	103.20	0.15	0.38	5.81	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	108.00	0.75	0.20	16.20	
	vi	Base Slab	CuM.	1	30.00	22.50	0.30	202.50	
	vii	Walls: Long	CuM.	2	30.00	3.30	0.30	59.40	
	viii	Walls: Short	CuM.	2	21.90	3.30	0.30	43.36	
6		Steel (Tor)	Ton.					**98.43**	**196.85**
7		Shuttering						**2749.52**	**5499.04**
	i	Footing	SqM.	28	3.15	3.15	0.53	186.98	
				26	2.70	2.70	0.43	120.74	
	ii	Shuttering Plinth Beam	SqM.	1	741.60	0.38		278.10	
	iii	Shuttering Wall: Inner	SqM.	1	102.60	3.30		338.58	
	iv	Shuttering Wall: Outer	SqM.	1	105.00	3.30		346.50	
	v	Shuttering Column	SqM.	28	1.80	2.68		134.82	
				26	1.80	5.98		279.63	
	vi	Shuttering Beam	SqM.	1	741.60	0.30		222.48	
	vii	Shuttering Tie Beam	SqM.	1	103.20	0.53		54.18	
	viii	Shuttering Base Slab	SqM.	1	30.00	22.50		675.00	
	ix	Shuttering Slab Side	SqM.	1	105.00	0.30		31.50	
	x	Shuttering Walkway Slab	SqM.	1	108.00	0.75		81.00	
8		Plastering						**685.08**	**1370.16**
	i	Plastering: Inner	SqM.	1	102.60	3.30		338.58	
	ii	Plastering: Outer	SqM.	1	105.00	3.30		346.50	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	30.00	22.50		**675.00**	**1350.00**
11		Painting						**346.50**	**693.00**
	i	Painting: Long Wall	SqM.	2	30.00	3.30		198.00	
	ii	Painting: Short Wall	SqM.	2	22.50	3.30		148.50	
55		**NEUTRALIZATION TANK**							
1		EarthWork	CuM.	12	1.50	1.35	1.80	**43.74**	
2		Re-Filling	CuM.					**26.24**	
3		PCC						**17.19**	
	i	PCC Under Footings	CuM.	12	1.50	1.35	0.15	3.65	
	ii	Plinth Beam	CuM.	1	29.40	0.45	0.15	1.98	
	iii	Base on Ground	CuM.	1	7.50	6.70	0.23	11.56	
4		RCC M30(Below Plinth)						**11.02**	
	i	Footing	CuM.	12	1.35	1.20	0.35	6.80	

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram

Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Column	CuM.	12	0.30	0.30	1.45	1.57	
	iii	Plinth Beam	CuM.	1	29.40	0.30	0.30	2.65	
5		RCC M30(Above Plinth)						**29.84**	
	i	Column	CuM.	2	0.30	0.30	3.00	0.54	
				10	0.30	0.30	5.30	4.77	
	ii	Beam	CuM.	1	29.40	0.30	0.30	2.65	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	30.20	0.75	0.15	3.40	
	v	Base Slab	CuM.	1	7.50	6.70	0.15	7.54	
	vi	Walls: Long	CuM.	2	7.50	2.30	0.18	6.04	
	vii	Walls: Short	CuM.	2	6.10	2.30	0.18	4.91	
6		Steel (Tor)	Ton.					**5.72**	
7		Shuttering						**323.44**	
	i	Footing	SqM.	12	1.35	1.20	0.35	21.42	
	ii	Shuttering Plinth Beam	SqM.	1	55.40	0.30		16.62	
	iii	Shuttering Wall: Inner	SqM.	1	27.00	2.30		62.10	
	iv	Shuttering Wall: Outer	SqM.	1	28.40	2.30		65.32	
	v	Shuttering Column	SqM.	2	1.20	3.00		7.20	
				10	1.20	5.30		63.60	
	vi	Shuttering Beam	SqM.	1	55.40	0.30		16.62	
	vii	Shuttering Base Slab	SqM.	1	7.50	6.70		50.25	
	viii	Shuttering Slab Side	SqM.	1	28.40	0.15		4.26	
	ix	Shuttering Walkway Slab	SqM.	1	21.40	0.75		16.05	
8		Plastering						**127.42**	
	i	Plastering: Inner	SqM.	1	27.00	2.30		62.10	
	ii	Plastering: Outer	SqM.	1	28.40	2.30		65.32	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	7.50	6.70		**50.25**	
11		Painting						**65.32**	
	i	Painting: Long Wall	SqM.	2	7.50	2.30		34.50	
	ii	Painting: Short Wall	SqM.	2	6.70	2.30		30.82	
56		**FLASH MIXER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**3.54**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	9.00	0.45	0.15	0.61	
	iii	Base on Ground	CuM.	1	3.00	2.10	0.23	1.45	
4		RCC M30(Below Plinth)						**3.86**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	9.00	0.30	0.30	0.81	
5		RCC M30(Above Plinth)						**7.88**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	9.00	0.30	0.30	0.81	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	13.20	0.75	0.15	1.49	
	v	Base Slab	CuM.	1	3.00	2.10	0.15	0.95	
	vi	Walls: Long	CuM.	2	3.00	1.80	0.18	1.89	
	vii	Walls: Short	CuM.	2	1.50	1.80	0.18	0.95	
6		Steel (Tor)	Ton.					**1.64**	
7		Shuttering						**111.36**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	8.95	2.30		20.59	
	iv	Shuttering Wall: Outer	SqM.	1	10.20	2.30		23.46	
	v	Shuttering Column	SqM.	4	1.50	5.80		34.80	
	vi	Shuttering Beam	SqM.	1	18.00	0.30		5.40	
	vii	Shuttering Base Slab	SqM.	1	2.50	2.00		5.00	
	viii	Shuttering Slab Side	SqM.	1	10.20	0.15		1.53	
	ix	Shuttering Walkway Slab	SqM.	1	13.20	0.75		9.90	
8		Plastering						**34.47**	
	i	Plastering: Inner	SqM.	1	8.95	1.80		16.11	
	ii	Plastering: Outer	SqM.	1	10.20	1.80		18.36	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	3.00	2.10		**6.30**	
11		Painting						**18.36**	
	i	Painting: Long Wall	SqM.	2	3.00	1.80		10.80	
	ii	Painting: Short Wall	SqM.	2	2.10	1.80		7.56	
57		**FLOCCULATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**5.52**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	13.80	0.45	0.15	0.93	
	iii	Base on Ground	CuM.	1	4.50	3.00	0.23	3.11	
4		RCC M30(Below Plinth)						**4.29**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	13.80	0.30	0.30	1.24	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
5		RCC M30(Above Plinth)						13.18	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	13.80	0.30	0.30	1.24	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	18.00	0.75	0.20	2.70	
	v	Base Slab	CuM.	1	4.50	3.00	0.20	2.70	
	vi	Walls: Long	CuM.	2	4.50	1.80	0.18	2.84	
	vii	Walls: Short	CuM.	2	3.00	1.80	0.18	1.89	
6		Steel (Tor)	Ton.					2.45	
7		Shuttering						148.37	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	27.60	0.30		8.28	
	iii	Shuttering Wall: Inner	SqM.	1	13.60	2.30		31.28	
	iv	Shuttering Wall: Outer	SqM.	1	15.00	2.30		34.50	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	27.60	0.30		8.28	
	vii	Shuttering Base Slab	SqM.	1	4.50	3.00		13.50	
	viii	Shuttering Slab Side	SqM.	1	15.00	0.15		2.25	
	ix	Shuttering Walkway Slab	SqM.	1	18.00	0.75		13.50	
8		Plastering						51.48	
	i	Plastering: Inner	SqM.	1	13.60	1.80		24.48	
	ii	Plastering: Outer	SqM.	1	15.00	1.80		27.00	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	4.50	3.00		13.50	
11		Painting						27.00	
	i	Painting: Long Wall	SqM.	2	4.50	1.80		16.20	
	ii	Painting: Short Wall	SqM.	2	3.00	1.80		10.80	
58		**LIME / CAUSTIC PREPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	17.82	
2		Re-Filling	CuM.					10.69	
3		PCC						2.25	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						3.46	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						5.50	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
59		**HCL PREPARATIION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
60		**ALUM / PAC PREPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					1.25	
7		Shuttering						74.59	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						18.00	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		2.03	
11		Painting						10.26	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
61		**POLY PREPPARATION TANK**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	17.82	
2		Re-Filling	CuM.					10.69	
3		PCC						2.25	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						3.46	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						5.50	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
6		Steel (Tor)	Ton.					1.25	
7		Shuttering						74.59	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						18.00	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		2.03	
11		Painting						10.26	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	
62		**PRIMARY CLARIFLOCCULATOR**							
1		EarthWork	CuM.	12	3.45	3.45	1.80	257.09	
2		Re-Filling	CuM.					154.26	
3		PCC						79.11	
	i	PCC Under Footings	CuM.	12	3.45	3.45	0.15	21.42	
	ii	Plinth Beam	CuM.	1	145.60	0.53	0.15	11.47	
	iii	Base on Ground (Circular)	CuM.	1	16.00	Dia	0.23	46.22	
4		RCC M30(Below Plinth)						82.56	
	i	Footing	CuM.	12	3.30	3.30	0.45	58.81	
	ii	Column	CuM.	12	0.45	0.45	1.35	3.28	
	iii	Plinth Beam	CuM.	1	145.60	0.38	0.38	20.48	
5		RCC M30(Above Plinth)						177.97	
	i	Column	CuM.	4	0.45	0.45	1.10	0.89	
				8	0.45	0.45	4.40	7.13	
	ii	Beam	CuM.	1	145.60	0.45	0.60	39.31	
	iii	Base Slab	CuM.	1	16.00	Dia	0.30	60.29	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	36.73	0.75	0.30	11.02	
	vi	Walls: Circular	CuM.	1	16.00	3.30	0.35	59.33	
6		Steel (Tor)	Ton.					36.47	
7		Shuttering						1046.67	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Footing		12	3.30	3.30	0.45	71.28	
	ii	Shuttering Plinth Beam		1	277.18	0.38		103.94	
	iii	Shuttering Wall: Inner	SqM.	1	48.38	3.30		159.65	
	iv	Shuttering Wall: Outer	SqM.	1	57.60	3.30		190.08	
	v	Shuttering Column	SqM.	4	1.80	2.45		17.64	
				8	1.80	5.75		82.80	
	vi	Shuttering Beam	SqM.	1	277.18	0.60		166.31	
	vii	Shuttering Base Slab	SqM.	1	16.00	dia		200.96	
	viii	Shuttering Walkway	SqM.	1	48.97	0.75		36.73	
	ix	Shuttering Slab Side	SqM.	1	57.60	0.30		17.28	
8		Plastering						**349.73**	
	i	Plastering: Inner	SqM.	1	48.38	3.30		159.65	
	ii	Plastering: Outer	SqM.	1	57.60	3.30		190.08	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	16.00	dia		**200.96**	
11		Painting						**380.16**	
	i	Painting:Circular Wall	SqM.	2	57.60	3.30		380.16	
63		**PRIMARY SLUDGE HOLDING TANKS**							
1		EarthWork	CuM.	9	3.45	3.45	1.80	**192.82**	**385.64**
2		Re-Filling	CuM.					**115.69**	**231.38**
3		PCC						**34.29**	**68.58**
	i	PCC Under Footings	CuM.	9	3.45	3.45	0.15	16.07	
	ii	Plinth Beam	CuM.	1	55.85	0.53	0.15	4.40	
	iii	Base on Ground (Circular)	CuM.	1	8.75	Dia	0.23	13.82	
4		RCC M30(Below Plinth)						**54.42**	**108.84**
	i	Footing	CuM.	9	3.30	3.30	0.45	44.10	
	ii	Column	CuM.	9	0.45	0.45	1.35	2.46	
	iii	Plinth Beam	CuM.	1	55.85	0.38	0.38	7.85	
5		RCC M30(Above Plinth)						**82.49**	**164.99**
	i	Column	CuM.	1	0.45	0.45	1.10	0.22	
				8	0.45	0.45	4.40	7.13	
	ii	Beam	CuM.	1	55.85	0.45	0.60	15.08	
	iii	Base Slab	CuM.	1	8.75	Dia	0.30	18.03	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	34.40	0.75	0.30	7.74	
	vi	Walls: Circular	CuM.	1	29.69	3.30	0.35	34.29	
6		Steel (Tor)	Ton.					**19.17**	**38.34**
7		Shuttering						**531.03**	**1062.07**
	i	Footing		9	3.30	3.30	0.45	53.46	
	ii	Shuttering Plinth Beam		1	109.60	0.38		41.10	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Shuttering Wall: Inner	SqM.	1	27.49	3.30		90.72	
	iv	Shuttering Wall: Outer	SqM.	1	29.69	3.30		97.98	
	v	Shuttering Column	SqM.	1	1.80	2.45		4.41	
				8	1.80	5.75		82.80	
	vi	Shuttering Beam	SqM.	1	109.60	0.60		65.76	
	vii	Shuttering Base Slab	SqM.	1	8.75	dia		60.10	
	viii	Shuttering Walkway	SqM.	1	34.40	0.75		25.80	
	ix	Shuttering Slab Side	SqM.	1	29.69	0.30		8.91	
8		Plastering						**188.69**	**377.39**
	i	Plastering: Inner	SqM.	1	27.49	3.30		90.72	
	ii	Plastering: Outer	SqM.	1	29.69	3.30		97.98	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	8.75	dia		**60.10**	**120.20**
11		Painting						**195.95**	**391.91**
	i	Painting:Circular Wall	SqM.	2	29.69	3.30		195.95	
64		**POLY PREPPARATION TANK AT CENTRIFUGE**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**73.45**	
	i	Footing	SqM.	4	1.50	1.35	0.35	6.84	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	

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Common Effluent Treatment Plant
Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	

F.		**5 MLD COMBINED LOW TDS & MEE CONDENSATE EFFLUENT TREATMENT**							
65, 66		**Anoxic tank, SBR Feed Tank**							
1		EarthWork	CuM.					**7467.03**	
				171	4.35	4.35	1.80	5824.35	
				60	3.90	3.90	1.80	1642.68	
2		Re-Filling	CuM.					**4480.22**	
3		PCC						**1596.85**	
	i	PCC Under Footings	CuM.	171	4.35	4.35	0.15	485.36	
				60	3.90	3.90	0.15	136.89	
	ii	Plinth Beam	CuM.	1	1554.20	0.60	0.15	139.88	
	iii	Base on Ground	CuM.	1	84.40	43.00	0.23	834.72	
4		RCC M30(Below Plinth)						**3179.24**	
	i	Footing	CuM.	171	4.20	4.20	0.75	2262.33	
				60	3.75	3.75	0.63	527.34	
	ii	Column	CuM.	171	0.60	0.60	0.90	55.40	
				60	0.60	0.60	0.90	19.44	
	iii	Plinth Beam	CuM.	1	1554.20	0.45	0.45	314.73	
5		RCC M30(Above Plinth)						**2926.71**	
	i	Column	CuM.	171	0.60	0.60	0.95	58.48	
				60	0.60	0.60	6.45	139.32	
	ii	Beam	CuM.	1	1554.20	0.60	0.65	606.14	
				1	333.60	0.40	0.45	60.05	
	iii	StairCase	CuM.					8.06	
	iv	Walkway	CuM.	1	343.80	0.75	0.15	38.68	
	v	Base Slab	CuM.	1	84.40	43.00	0.40	1451.68	
	vi	Walls: Long	CuM.	2	85.00	5.50	0.30	280.50	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	vii	Walls: Short	CuM.	2	43.00	5.50	0.30	141.90	
				2	43.00	5.50	0.30	141.90	
6		Steel (Tor)	Ton.					**854.83**	
7		Shuttering						**16317.46**	
	i	Footing	SqM.	171	16.80	0.75	0.30	2154.60	
				60	15.00	0.63		562.50	
	ii	Shuttering Plinth Beam	SqM.	1	3108.40	0.45		1398.78	
	iii	Shuttering Wall: Inner	SqM.	1	254.80	5.50		1401.40	
				4	43.00	5.50		946.00	
	iv	Shuttering Wall: Outer	SqM.	1	257.20	5.50		1414.60	
	v	Shuttering Column	SqM.	171	2.40	1.85		759.24	
				60	2.40	1.85		266.40	
	vi	Shuttering Beam	SqM.	1	1554.20	1.90		2952.98	
				1	333.60	1.30		433.68	
	vii	Shuttering Base Slab	SqM.	1	84.70	43.30		3667.51	
	viii	Shuttering Slab Side	SqM.	1	254.80	0.40		101.92	
	ix	Shuttering Walkway Slab	SqM.	1	343.80	0.75		257.85	
8		Plastering						**3757.60**	
	i	Plastering: Inner	SqM.	1	254.80	5.50		1401.40	
				4	43.00	5.50		946.00	
	ii	Plastering: Outer	SqM.	1	256.40	5.50		1410.20	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	84.40	43.00		**3629.20**	
11		Painting						**1408.00**	
	i	Painting: Long Wall	SqM.	2	85.00	5.50		935.00	
	ii	Painting: Short Wall	SqM.	2	43.00	5.50		473.00	
67		**SBR TANK - 1**							
1		EarthWork	CuM.					**12822.30**	
				280	4.35	4.35	1.80	9536.94	
				120	3.90	3.90	1.80	3285.36	
2		Re-Filling	CuM.					**7693.38**	
3		PCC						**3228.11**	
	i	PCC Under Footings	CuM.	280	4.35	4.35	0.15	794.75	
				120	3.90	3.90	0.15	273.78	
	ii	Plinth Beam	CuM.	1	3540.70	0.60	0.15	318.66	
	iii	Base on Ground	CuM.	1	120.00	66.70	0.23	1840.92	
4		RCC M30(Below Plinth)						**5632.68**	
	i	Footing	CuM.	280	4.20	4.20	0.75	3704.40	
				120	3.75	3.75	0.63	1054.69	
	ii	Column	CuM.	280	0.60	0.60	1.05	105.84	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
				120	0.60	0.60	1.18	50.76	
	iii	Plinth Beam	CuM.	1	3540.70	0.45	0.45	716.99	
5		RCC M30(Above Plinth)						**5907.48**	
	i	Column	CuM.	280	0.60	0.60	0.95	95.76	
				120	0.60	0.60	6.45	278.64	
	ii	Beam	CuM.	1	3540.70	0.60	0.65	1380.87	
	iii	Beam	CuM.	1	373.40	0.40	0.45	67.21	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	376.40	0.75	0.30	84.69	
	vi	Base Slab	CuM.	1	120.00	66.70	0.40	3201.60	
	vii	Walls: Long	CuM.	2	120.00	3.00	0.30	216.00	
				2	120.00	2.50	0.20	120.00	
	viii	Walls: Short	CuM.	5	66.10	3.00	0.30	297.45	
				5	66.10	2.50	0.20	165.25	
6		Steel (Tor)	Ton.					**1615.62**	
7		Shuttering						**31012.53**	
	i	Footing	SqM.	280	4.20	4.20	0.75	3528.00	
				120	3.75	3.75	0.63	1125.00	
	ii	Shuttering Plinth Beam	SqM.	1	7081.40	0.45		3186.63	
	iii	Shuttering Wall: Inner	SqM.	1	767.60	5.50		4221.80	
	iv	Shuttering Wall: Outer	SqM.	1	373.40	5.50		2053.70	
	v	Shuttering Column	SqM.	280	2.40	2.00		1344.00	
				120	2.40	7.63		2197.44	
	vi	Shuttering Beam	SqM.	1	7081.40	0.65		4602.91	
	vii	Shuttering Tie Beam	SqM.	1	373.40	0.85		317.39	
	viii	Shuttering Base Slab	SqM.	1	120.00	66.70		8004.00	
	ix	Shuttering Slab Side	SqM.	1	373.40	0.40		149.36	
	x	Shuttering Walkway Slab	SqM.	1	376.40	0.75		282.30	
8		Plastering						**6275.50**	
	i	Plastering: Inner	SqM.	1	767.60	5.50		4221.80	
	ii	Plastering: Outer	SqM.	1	373.40	5.50		2053.70	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	120.00	66.70		**8004.00**	
11		Painting						**2053.70**	
	i	Painting: Long Wall	SqM.	2	120.00	5.50		1320.00	
	ii	Painting: Short Wall	SqM.	2	66.70	5.50		733.70	
68		**SBR TANK - 2**							
1		EarthWork	CuM.					**3433.87**	
				55	4.35	4.35	1.80	1873.33	
				57	3.90	3.90	1.80	1560.55	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
2		Re-Filling	CuM.					**2060.32**	
3		PCC						**829.34**	
	i	PCC Under Footings	CuM.	55	4.35	4.35	0.15	156.11	
				57	3.90	3.90	0.15	130.05	
	ii	Plinth Beam	CuM.	1	921.70	0.60	0.15	82.95	
	iii	Base on Ground	CuM.	1	66.70	30.00	0.23	460.23	
4		RCC M30(Below Plinth)						**1460.17**	
	i	Footing	CuM.	55	4.20	4.20	0.75	727.65	
				57	3.75	3.75	0.63	500.98	
	ii	Column	CuM.	55	0.60	0.60	1.05	20.79	
				57	0.60	0.60	1.18	24.11	
	iii	Plinth Beam	CuM.	1	921.70	0.45	0.45	186.64	
5		RCC M30(Above Plinth)						**1781.73**	
	i	Column	CuM.	55	0.60	0.60	0.95	18.81	
				57	0.60	0.60	6.45	132.35	
	ii	Beam	CuM.	1	921.70	0.60	0.65	359.46	
	iii	Beam	CuM.	1	188.60	0.40	0.45	33.95	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	196.40	0.75	0.30	44.19	
	vi	Base Slab	CuM.	1	66.70	30.00	0.40	800.40	
	vii	Walls: Long	CuM.	2	66.70	3.00	0.30	120.06	
				2	66.70	2.50	0.20	66.70	
	viii	Walls: Short	CuM.	5	29.40	3.00	0.30	132.30	
				5	29.40	2.50	0.20	73.50	
6		Steel (Tor)	Ton.					**453.87**	
7		Shuttering						**9063.07**	
	i	Footing	SqM.	55	4.20	4.20	0.75	693.00	
				57	3.75	3.75	0.63	534.38	
	ii	Shuttering Plinth Beam	SqM.	1	1843.40	0.45		829.53	
	iii	Shuttering Wall: Inner	SqM.	1	191.00	5.50		1050.50	
	iv	Shuttering Wall: Outer	SqM.	1	193.40	5.50		1063.70	
	v	Shuttering Column	SqM.	55	2.40	2.00		264.00	
				57	2.40	7.63		1043.78	
	vi	Shuttering Beam	SqM.	1	1843.40	0.65		1198.21	
	vii	Shuttering Tie Beam	SqM.	1	188.60	0.85		160.31	
	viii	Shuttering Base Slab	SqM.	1	66.70	30.00		2001.00	
	ix	Shuttering Slab Side	SqM.	1	193.40	0.40		77.36	
	x	Shuttering Walkway Slab	SqM.	1	196.40	0.75		147.30	
8		Plastering						**3401.20**	
	i	Plastering: Inner	SqM.	1	133.40	5.50		733.70	
	ii	Plastering: Outer	SqM.	1	485.00	5.50		2667.50	

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	66.70	30.00		**2001.00**	
11		Painting						**1063.70**	
	i	Painting: Long Wall	SqM.	2	66.70	5.50		733.70	
	ii	Painting: Short Wall	SqM.	2	30.00	5.50		330.00	
69,70		**/Filter Feed Tank (Previously Intermitent Tank)Filter backwash storage tank**							
1		EarthWork	CuM.					**1045.95**	
				28	3.30	3.30	1.80	548.86	
				34	2.85	2.85	1.80	497.10	
2		Re-Filling	CuM.					**627.57**	
3		PCC						**312.25**	
	i	PCC Under Footings	CuM.	28	3.30	3.30	0.15	45.74	
				34	2.85	2.85	0.15	41.42	
	ii	Plinth Beam	CuM.	1	112.80	0.53	0.15	8.88	
	iii	Base on Ground	CuM.	1	28.00	30.00	0.23	193.20	
				1	10.00	10.00	0.23	23.00	
4		RCC M30(Below Plinth)						**281.19**	
	i	Footing	CuM.	28	3.15	3.15	0.53	145.86	
				34	2.70	2.70	0.43	105.34	
	ii	Column	CuM.	28	0.45	0.45	1.13	6.38	
				34	0.45	0.45	1.13	7.75	
	iii	Plinth Beam	CuM.	1	112.80	0.38	0.38	15.86	
5		RCC M30(Above Plinth)						**535.21**	
	i	Column	CuM.	28	0.45	0.45	1.40	7.94	
				34	0.45	0.45	4.70	32.36	
	ii	Beam	CuM.	1	426.70	0.45	0.30	57.60	
				1	139.80	0.15	0.38	7.86	
	iii	StairCase	CuM.					0.00	
	iv	Walkway	CuM.	1	139.00	0.75	0.15	15.64	
	v	Base Slab	CuM.	1	28.00	30.00	0.30	252.00	
				1	10.00	10.00	0.30	30.00	
	vi	Walls: Long	CuM.	2	28.60	3.30	0.30	56.63	
				2	10.30	3.30	0.00	0.00	
	vii	Walls: Short	CuM.	2	30.00	3.30	0.30	59.40	
				1	10.00	3.30	0.30	9.90	
6		Steel (Tor)	Ton.					**114.30**	
7		Shuttering						**3366.10**	
	i	Footing	SqM.	28	12.60	0.53	0.30	185.22	
				34	10.80	0.43		156.06	
	ii	Shuttering Plinth Beam	SqM.	1	225.60	0.38		84.60	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	iii	Shuttering Wall: Inner	SqM.	1	116.00	3.30		382.80	
				1	40.00	5.50		220.00	
	iv	Shuttering Wall: Outer	SqM.	1	118.40	3.30		390.72	
	v	Shuttering Column	SqM.	28	1.80	2.53		127.26	
				34	1.80	2.53		154.53	
	vi	Shuttering Beam	SqM.	1	426.70	1.05		448.04	
				1	139.80	0.90		125.82	
	vii	Shuttering Base Slab	SqM.	1	28.00	30.00		840.00	
				1	10.00	10.00		100.00	
	viii	Shuttering Slab Side	SqM.	1	116.00	0.30		34.80	
				1	40.00	0.30		12.00	
	ix	Shuttering Walkway Slab	SqM.	1	139.00	0.75		104.25	
8		Plastering						**977.46**	
	i	Plastering: Inner	SqM.	1	116.00	3.30		382.80	
				1	43.00	3.30		141.90	
	ii	Plastering: Outer	SqM.	1	137.20	3.30		452.76	
9		Tiling	SqM.						
10		Top & Flooring	SqM.					**940.00**	
				1	28.00	30.00		840.00	
				1	10.00	10.00		100.00	
11		Painting						**454.74**	
	i	Painting: Long Wall	SqM.	2	28.60	3.30		188.76	
				2	10.30	3.30		67.98	
	ii	Painting: Short Wall	SqM.	2	30.00	3.30		198.00	
71		**GUARD POND**							
1		EarthWork	CuM.	1	169.00	36.60	3.30	**20411.82**	
2		Re-Filling	CuM.					**0.00**	
3		PCC		1	169	36.6	0.2	**1237.08**	
4		RCC M30(Below Plinth)						**2319.51**	
	i	Slab	CuM.	1	168.90	36.50	0.30	1849.46	
	ii	Walls: Long	CuM.	2	167.40	3.30	0.30	331.45	
		Walls: Short		4	35.00	3.30	0.30	138.60	
5		RCC M30(Above Plinth)						**0.00**	
6		Steel (Tor)	Ton.					**324.73**	
7		Shuttering						**3133.68**	
	iii	Shuttering Wall: Inner	SqM.	1	403.60	3.30		1331.88	
				4	35.00	3.30		462.00	
	iv	Shuttering Wall: Outer	SqM.	1	406.00	3.30		1339.80	
8		Plastering						**3133.68**	
	i	Plastering: Inner	SqM.	1	403.60	3.30		1331.88	

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
				4	35.00	3.30		462.00	
	ii	Plastering: Outer	SqM.	1	406.00	3.30		1339.80	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	166.80	35.00		**5838.00**	
11		Painting						**0.00**	
72		**SECONDARY SLUDGE THICKENER**							
1		EarthWork	CuM.	24	3.45	3.45	1.80	**514.19**	**1542.56**
2		Re-Filling	CuM.					**308.51**	**925.54**
3		PCC						**176.86**	**530.59**
	i	PCC Under Footings	CuM.	24	3.45	3.45	0.15	42.85	
	ii	Plinth Beam	CuM.	1	268.83	0.53	0.15	21.17	
	iii	Base on Ground (Circular)	CuM.	1	25.00	Dia	0.23	112.84	
4		RCC M30(Below Plinth)						**161.98**	**485.93**
	i	Footing	CuM.	24	3.30	3.30	0.45	117.61	
	ii	Column	CuM.	24	0.45	0.45	1.35	6.56	
	iii	Plinth Beam	CuM.	1	268.83	0.38	0.38	37.80	
5		RCC M30(Above Plinth)						**347.82**	**1043.45**
	i	Column	CuM.	12	0.45	0.45	1.10	2.67	
				12	0.45	0.45	4.40	10.69	
	ii	Beam	CuM.	1	268.83	0.45	0.60	72.58	
	iii	Base Slab	CuM.	1	25.00	Dia	0.30	147.19	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	87.20	0.75	0.30	19.62	
	vi	Walls: Circular	CuM.	1	25.00	3.30	0.35	95.06	
6		Steel (Tor)	Ton.					**71.37**	**214.11**
7		Shuttering						**2006.17**	**6018.51**
	i	Footing		24	3.30	3.30	0.45	142.56	
	ii	Shuttering Plinth Beam		1	534.37	0.38		200.39	
	iii	Shuttering Wall: Inner	SqM.	1	79.48	3.30		262.28	
	iv	Shuttering Wall: Outer	SqM.	1	82.31	3.30		271.62	
	v	Shuttering Column	SqM.	12	1.80	2.45		52.92	
				12	1.80	5.75		124.20	
	vi	Shuttering Beam	SqM.	1	616.68	0.60		370.01	
	vii	Shuttering Base Slab	SqM.	1	25.00	dia		490.63	
	viii	Shuttering Walkway	SqM.	1	87.20	0.75		65.40	
	ix	Shuttering Slab Side	SqM.	1	87.20	0.30		26.16	
8		Plastering						**349.73**	**1049.20**
	i	Plastering: Inner	SqM.	1	48.38	3.30		159.65	
	ii	Plastering: Outer	SqM.	1	57.60	3.30		190.08	
9		Tiling	SqM.						

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S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
10		Top & Flooring	SqM.	1	25.00	dia		490.63	1471.88
11		Painting						271.62	814.87
	i	Painting:Circular Wall	SqM.	1	82.31	3.30		271.62	
73		**SLUDGE DIGESTER**							
1		EarthWork	CuM.	24	4.65	4.65	1.80	934.09	1868.18
2		Re-Filling	CuM.					560.46	1120.91
3		PCC						211.86	423.71
	i	PCC Under Footings	CuM.	24	4.65	4.65	0.15	77.84	
	ii	Plinth Beam	CuM.	1	268.83	0.53	0.15	21.17	
	iii	Base on Ground (Circular)	CuM.	1	25.00	Dia	0.23	112.84	
4		RCC M30(Below Plinth)						335.24	670.47
	i	Footing	CuM.	24	4.50	4.50	0.60	291.60	
	ii	Column	CuM.	24	0.45	0.45	1.20	5.83	
	iii	Plinth Beam	CuM.	1	268.83	0.38	0.38	37.80	
5		RCC M30(Above Plinth)						532.35	1064.70
	i	Column	CuM.	12	0.45	0.45	1.10	2.67	
				12	0.45	0.45	4.40	10.69	
	ii	Beam	CuM.	1	268.83	0.45	0.60	72.58	
	iii	Base Slab	CuM.	1	25.00	Dia	0.35	171.72	
	iv	StairCase	CuM.						
	v	Walkway	CuM.	1	87.20	0.75	0.30	19.62	
	vi	Walls: Circular	CuM.	1	25.00	6.50	0.45	255.06	
6		Steel (Tor)	Ton.					121.46	242.92
7		Shuttering						2644.86	5289.71
	i	Footing		24	4.50	4.50	0.45	194.40	
	ii	Shuttering Plinth Beam		1	534.37	0.38		200.39	
	iii	Shuttering Wall: Inner	SqM.	1	79.48	6.50		516.62	
	iv	Shuttering Wall: Outer	SqM.	1	82.31	6.50		535.02	
	v	Shuttering Column	SqM.	12	1.80	2.45		52.92	
				12	1.80	8.95		193.32	
	vi	Shuttering Beam	SqM.	1	616.68	0.60		370.01	
	vii	Shuttering Base Slab	SqM.	1	25.00	dia		490.63	
	viii	Shuttering Walkway	SqM.	1	87.20	0.75		65.40	
	ix	Shuttering Slab Side	SqM.	1	87.20	0.30		26.16	
8		Plastering						349.73	699.47
	i	Plastering: Inner	SqM.	1	48.38	3.30		159.65	
	ii	Plastering: Outer	SqM.	1	57.60	3.30		190.08	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	25.00	dia		490.63	981.25
11		Painting						271.62	543.25

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Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
	i	Painting:Circular Wall	SqM.	1	82.31	3.30		271.62	
74		**POLY PREPPARATION TANK AT SLUDGE THICKENER**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	

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Common Effluent Treatment Plant

Annexure 1.3: Measurement Sheet - Civil Components

S.No		Description of Item	Unit	No	Length (m)	Breadth (m)	Depth (m)	Quantity	Quantity for Total Nos
75		**POLY PREPPARATION TANK AT CENTRIFUGE**							
1		EarthWork	CuM.	4	1.65	1.50	1.80	**17.82**	
2		Re-Filling	CuM.					**10.69**	
3		PCC						**2.25**	
	i	PCC Under Footings	CuM.	4	1.65	1.50	0.15	1.49	
	ii	Plinth Beam	CuM.	1	4.50	0.45	0.15	0.30	
	iii	Base on Ground	CuM.	1	1.50	1.35	0.23	0.47	
4		RCC M30(Below Plinth)						**3.46**	
	i	Footing	CuM.	4	1.35	1.20	0.35	2.27	
	ii	Column	CuM.	4	0.30	0.45	1.45	0.78	
	iii	Plinth Beam	CuM.	1	4.50	0.30	0.30	0.41	
5		RCC M30(Above Plinth)						**5.50**	
	i	Column	CuM.	4	0.30	0.45	3.35	1.81	
	ii	Beam	CuM.	1	4.50	0.30	0.30	0.41	
	iii	StairCase	CuM.						
	iv	Walkway	CuM.	1	8.70	0.75	0.20	1.31	
	v	Base Slab	CuM.	1	1.50	1.35	0.20	0.41	
	vi	Walls: Long	CuM.	2	1.50	1.80	0.18	0.95	
	vii	Walls: Short	CuM.	2	1.00	1.80	0.18	0.63	
6		Steel (Tor)	Ton.					**1.25**	
7		Shuttering						**74.59**	
	i	Footing	SqM.	4	1.50	1.35	0.35	7.98	
	ii	Shuttering Plinth Beam	SqM.	1	9.00	0.30		2.70	
	iii	Shuttering Wall: Inner	SqM.	1	4.30	2.30		9.89	
	iv	Shuttering Wall: Outer	SqM.	1	5.70	2.30		13.11	
	v	Shuttering Column	SqM.	4	1.50	4.80		28.80	
	vi	Shuttering Beam	SqM.	1	9.00	0.30		2.70	
	vii	Shuttering Base Slab	SqM.	1	1.50	1.35		2.03	
	viii	Shuttering Slab Side	SqM.	1	5.70	0.15		0.86	
	ix	Shuttering Walkway Slab	SqM.	1	8.70	0.75		6.53	
8		Plastering						**18.00**	
	i	Plastering: Inner	SqM.	1	4.30	1.80		7.74	
	ii	Plastering: Outer	SqM.	1	5.70	1.80		10.26	
9		Tiling	SqM.						
10		Top & Flooring	SqM.	1	1.50	1.35		**2.03**	
11		Painting						**10.26**	
	i	Painting: Long Wall	SqM.	2	1.50	1.80		5.40	
	ii	Painting: Short Wall	SqM.	2	1.35	1.80		4.86	

6.4 Annexure 1.4: Measurement Sheet – CETP Internal Roads

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED							
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram							
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Annexure 1.4: Measurement Sheet - CETP Internal Roads							
S.No	**Description of Item**	**Unit**	**No**	**Length**	**Breadth**	**Depth**	**Quantity**
1	Clearing and grubbing jungle including uprooting rank vegetation, grass, bushes, shrubs, sapling and trees girth upto 300mm, removal of stumps of trees cut earlier stacking of serviceable materials to be used or auctioned and disposal of unserviceable materials upto a lead of 1000 mts including removal and disposal of top organic soil not exceeding 150 mm in thickness by mechanical means in area of light jungle.						
	Road	SqM.	1	1,345.13	10.50		14,123.87
	Add for variations	SqM.	1	1,450.82	7.50		10,881.15
		SqM.					25,005.02
2	Excavation for road work in soil with hydraulic excavator including cutting, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross-sections, with all liftsand lead and depositing the excavated soil on the banks including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as diercted by the Engineer-In-Charge as per Technical Specification Clause 302.3 MORD/301 MORTH						
	Road	Cum	1	1,345.13	9.00	0.60	7,263.70
	Add for variations	Cum	1	1,450.82	6.00	0.60	5,222.95
		Cum					12,486.65
3	Construction of embankment with borrowed earth from outside area deposited at site by road way cutting and excavation for foundation of other structures using dozer, including watering, grading and compacting each layer to required proctors density with OMC compaction with vibratory roller of 8 Tonnes capacity, maintaining the required camber in the formation including all labour charges, hire& operational charges of, power roller, mortar grader, water tanker, all water leads, all taxes etc. complete as per requirement of table 300.1 and 300.2 as per Technical Specification clause 301.5 MORD/305 MORTH. (payment will be based on levels for finished item of work).						
	50% of the Total EWE quantity	Cum					6,243.33
4	Compaction of orginal ground with maximum of six passess of vibratory power road roller including filling in depression occuring during rolling as per MOST specification No.305(3.4) and as directed by the Engineer-in-Charge						
	Road	Sqm	1	1,345.13	9.00		12,106.17
	Add for variations	Sqm	1	1,450.82	6.00		8,704.92
		Sqm					20,811.09

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Annexure 1.4: Measurement Sheet - CETP Internal Roads							
S.No	**Description of Item**	**Unit**	**No**	**Length**	**Breadth**	**Depth**	**Quantity**
5	Forming road embankment / Gravel sub grade with Gravel with CBR more than 10% brought from approved sources preading in layers not more than 150mm thick, sectioning to required camber & gradient, watering and compacting each layer toproctors density with OMC compaction using 80 to 100 KN capacity vibratory roller including cost and conveyance of all materials (viz), gravel, water etc., to site, seigniorage charges, hire and operational charges of power roller and other T&P etc., complete duly maintaining the required camber & gradient in theformation as directed by Engineer-in-Charge. (payment on levelbasis) (RBR-SBBS- (iii) - P.No.158 - Chapter-4						
	Road	Cum	1	1,345.13	9.00	0.50	6,053.09
	Add for variations	Cum	1	1,450.82	6.00	0.50	4,352.46
		Cum					10,405.55
6	Construction of granular sub-base by providing HBG material (66% of 9.50mm to 4.75mm HBG (IRC) Machine crushed metal and 34% of 2.36mm and below HBGIRC) Machine crushed metal with CBR not less than 20 including spreading in uniform layers with motor grader or by approved means, on prepared surface mixing by mix in place method with rotavator approved means at OMC and compacting with vibratory roller to achive the desired density etc., complete for finished item of work as directed by the Engineer-In-Charge: including the cost and conveyance of all materials ie stone dust, stone aggregates of specified sizes water etc to site labour charges for all operational hire etc and operational charges of power roller and other T & Pall taxes etc complete. As per RBR-SBBS-I (iii) Chap-4 pgNo:158)						
	Road	Cum	1	1,345.13	9.00	0.15	1,815.93
	Add for variations	Cum	1	1,450.82	6.00	0.15	1,305.74
		Cum					3,121.66
7	Providing Dry Lean concrete with Plain Cement concrete nominal mix (1:4:8) prop (Cement : fine aggregate: coarse aggregate) using 40mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site, seigniorage charges on all materials, labour charges, for mixing , laying, concrete, Compacting, finishing top surface to the required level curing under flooring bed.						
	For CC road	Cum	1	1,345.13	9.00	0.15	1,815.93
	Add for variations	Cum	1	1,450.82	6.00	0.15	1,305.74
		Cum					3,121.66
8	Supply and placing seperation membrane of impermiable vergin plastic sheeting 125 Micrins thick uniformly over already laid PCC in single layer with out rinkles including cost and conveyance of all material and all labour charges for spreading under Pavements labor as directed by the Engineer-in-charge etc., complete - 1 Sqm						
	For CC road	Sqm	1	1,345.13	9.00		12,106.17
	Add for variations	Sqm	1	1,450.82	6.00		8,704.92
		Sqm					20,811.09

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED							
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram							
Common Effluent Treatment Plant							
Annexure 1.4: Measurement Sheet - CETP Internal Roads							
S.No	**Description of Item**	**Unit**	**No**	**Length**	**Breadth**	**Depth**	**Quantity**
9	Construction of Un reinforced plain cement concrete pavement M 30 Grade over a prepared sub base, coarse and fine aggregates, confirming to IS 383, Crushed Stone aggregate of 20mm and 10mm size graded granite chips as per table 1500.1, mixed in a concrete mixer of not less than 0.2 Cum capacity and appropriate weigh batcher using approved mix design with minimum cement content of 419Kg/ Cumlaid in alternate panels with aproved fixed side frame work of Steel Channel, wedges, Steel plates including leveling the form work as per drawing, cleaning the surface wit Air compressor initially and spreadsing the concrete with shovels, rakes, compacted with needle, plate and screed vibrators and finished in continous operation of linesand gade, curing of concrete slab for 14 days including cost and conveyance charges, seigniorage charges of materials, Hire and Operational Charges of all T&P, all taxes., diversion of traffic etc., complete for FInished item of work as per the drawing, as per Technical Specification Clause No 1501 MORD and as directed by the Engineer-In-Charge						
	Road	Cum	1	1,345.13	9.00	0.30	3,631.85
	Add for variations	Cum	1	1,450.82	6.00	0.30	2,611.48
		Cum					6,243.33
10	Providing and spreading gravel for shoulders with side slopes 2:1 in layers each not exceeding 150mm thick over embankment including sectioning each layer to proper camber, watering, compaction with vibratory roller of 8-10t capacity including costand conveyance of gravel to site, seigniorage charges,all taxes, labour charges for all operations, hire and operational charges of power roller and other T&P etc.,complete for finished item of work.						
	Road	Cum	2	1,345.13	2.10	0.55	3,107.25
		Cum	2	1,450.82	2.10	0.55	3,351.39
	Bell mouth	Cum					6,458.64
	Kerb Stone						
11	Construction of cement concrete kerb with top and bottom width 115 and 165 respectively ,250mm high in M20 grade PCC on M10 grade foundation 150MM thick, foundation have 50MM projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete manually, all complete as per clause 408 MORTH						
	Below Kerb for road	Rmt	2	1,345.13			2,690.26
	Add for variations	Rmt	2	1,450.82			2,901.64
		Rmt					5,591.90
12	Painting to Kerb stones with two coats over primer coat (Total Three coats) with synthetic enamel paint in all shades on new plastered / concrete surfaces including cost and conveyance of all materials, cement primer grade - II, all incidental and operational charges, all taxes etc complete as per drawing and technical specification clause 1701MORD. (vide page 451 of RBR -TSRA -6)						
	Below Kerb for road	Sqm	4	1,345.13		0.25	1,345.13
	Add for variations	Sqm	4	1,450.82		0.25	1,450.82
		Sqm					2,795.95

6.5 Annexure 1.5: Rate Analysis – Civil Components

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
1	Earth work excavation for foundations and depositingon bank for all lifts and with an initial lead of 10mincluding all operational, incidental, labour chargessuch as shoring ,sheeting, planking, strutting, etc.complete for finished item of work including seigniorage excluding dewatering charges etc as per SS - 20 B (APSS 308). Ordinary soils - Mechanical Means - Upto 3m depth including all labour charges, all taxes, Hire & Operational charges of all T&P complete for Finished item of work as directed by the Engineer-				
	BLD - CSTN -2-2				
	Unit = 1 Cum				
	Taking output = 240 cum				
	a)Labour				
	Mate	day	-		
	Mazdoor (Unskilled)	day	8.32	460.00	3,827.20
	Add Area Allowance @ 20%		0%	3,827.20	-
	b)Machinery				
	Hydraulic Excavator 1 cum bucket capacity	hour	6	2,945.00	17,670.00
				Sub Total	**21,497.20**
	D) Overheads & Contractors Profit @ 13.62%		13.62%	21,497.20	**2,926.84**
	Cost for 240CuM				24,424.04
	Rate per 1 Cum				**101.77**

2(a)	Plain Cement concrete **(1:2:4)** using 40 mm metal with Concrete mixture including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge All work upto plinth level.				
	BLD-CSTN-3-7				
	Unit=1cum				
	A.MATERIALS				
	Cement	kg	320	7.00	2,240.00
	Coarse aggregate 40 mm	cum	0.9	1,387.80	1,249.02
	Fine aggregate (Sand)	cum	0.45	2,409.99	1,084.50
	Water (including for curing)	kl	1.2	110.00	132.00
	B.MACHINERY				
	Concrete Mixer 10/ 7 cft (0.2/0.8 cum) capacity	hour	1	566.10	566.10
	C.LABOUR				
	Mason 1st class	day	0.1	550.00	55.00
	Mazdoor (Unskilled)	day	1.98	460.00	910.80
	Add Area Allowance @ 20%		0%	965.80	-
				Sub Total	**6,237.42**
	D) Overheads & Contractors Profit @13.62%		13.62%	6,237.42	**849.22**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
	Rate per 1 Cum				**7,086.64**

2(b)	Plain Cement concrete (1:4:8) using 40mm metal with concrete mixture All work upto plinth level. (BLD-CSTN-3-4)				
	Unit=1cum				
	A.MATERIALS:				
	Cement	kg	162	7.00	1,134.00
	Coarse aggregate 40 mm	cum	0.9	1,387.80	1,249.02
	Fine aggregate (Sand)	cum	0.45	2,409.99	1,084.50
	Water (including for curing)	kl	1.2	110.00	132.00
	B.MACHINERY				
	Concrete Mixer 10/7 cft (0.2/0.8 cum) capacity	hour	1	566.10	566.10
	C.LABOUR:				
	Mason 1st class	day	0.1	550.00	55.00
	Mazdoor (unskilled)	day	2.36	460.00	1,085.60
	Add Area Allowance @ 20%		0%	1,140.60	-
				Sub Total	**5,306.22**
	D) Overheads & Contractors Profit @ 13.62%		13.62%	5,306.22	**722.44**
	Rate for 1Cum				**6,028.66**

3	Supply and placing of the Design Mix Concrete of M30 corresponding to IS 456 using WEIGH BATCHER /MIXER with 20mm size graded machine crushed hardgranite metal (coarse aggregate) from approved quarryincluding cost and conveyance of all materials like cement, fine aggregate (sand) coarse aggregate, water etc., to site and including Seigniorage charges, sales & other taxes on all materials including all operational, incidental and labour charges such as weigh batching, machine mixing, laying concrete, curing etc., complete but excluding cost of steel and its fabrication chargesfor finished item of work (APSS No. 402) with minimum cement content as per IS code from standard suppliers approved by the department including pumping, centering, shuttering, laying concrete, vibrating, curingetc. complete but excluding cost of steel and its fabrication charges for finished item of work and including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge.				
	BLD-CSTN-3-14				

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
A	FOUNDATIONS, PLINTH, PEDESTALS (Below Plinth)				
	Unit: Cum				
	A)Labour				
	Mason 1st class	day	0.13	550.00	71.50
	Mason 2nd class	day	0.27	500.00	135.00
	Mazdoor unskilled (Man & Woman)	day	4.6	460.00	2,116.00
	Add Area Allowance @ 20%		0%	2,322.50	-
	B)Machinery				
	Concrete Mixer 10/7 cft (0.2/0.8 cum) capacity	hour	1.33	566.10	752.91
	Vibrator hire charges	hour	1.33	223.00	296.59
	Water (including for curing)	kl	1.2	110.00	132.00
	C)Material				
	20mm HBG graded metal	cum	0.8	2,016.80	1,613.44
	Sand	cum	0.4	2,314.99	926.00
	Cement	kg	400	7.00	2,800.00
				Sub Total	**8,843.44**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	8,843.44	**1,204.03**
	Rate for 1Cum				**10,047.47**

4	COLUMNS, LINTELS, WATERTANKS, RCC WALLS IN BUILDINGS				
	Unit: Cum				
	A)Labour				
	Mason 1st class	day	0.17	550.00	93.50
	Mason 2nd class	day	0.17	500.00	85.00
	Mazdoor unskilled (Man & Woman)	day	5.6	460.00	2,576.00
	Add Area Allowance @ 20%		0%	2,754.50	-
	B)Machinery				
	Concrete Mixer 10/7 cft (0.2/0.8 cum) capacity	hour	1.33	566.10	752.91
	Vibrator hire charges	hour	1.33	223.00	296.59
	Water (including for curing)	kl	1.2	110.00	132.00
	C)Material				
	20mm HBG graded metal	cum	0.8	2,016.80	1,613.44
	Sand	cum	0.4	2,314.99	926.00
	Cement	kg	400	7.00	2,800.00
				Sub Total	**9,275.44**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	9,275.44	**1,262.85**
	Rate for 1Cum				**10,538.29**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
5	Supply, Fitting and Placing TMT bar reinforcement (Fe 500) including decoiling, bending, cracking and tying them after placing in position as directed by the Engineer-in-charge including cost and conveyance of steel and binding wire all taxes labour charges for all operations etc., complete for finished item of work as directed by the Engineer-In-Charge and as per Technical Specification 1100 & 1600 MORTH				
	Unit: 1 MT				
	a)Labour				
	Black Smith	Nos	2	525.00	1,050.00
	Heavy Mazdoor	Nos	6.4	460.00	2,944.00
	Add Area Allowance @ 20%		0%	3,994.00	-
	b)Machinery				
	Binding wire	Kg	6	56.00	336.00
	TMT/HYSD Bars Fe 500	MT	1.05	55,000.00	57,750.00
				Sub Total	**62,080.00**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	62,080.00	**8,452.19**
	Rate for 1Cum				**70,532.19**

6	Plastering with CM (1:4), 12 mm thick including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as directed by the Engineer-In-Charge.				
	For Grading I Material				
	BLD-CSTN-8-2				
	Unit=10sqm				
	a)Labour				
	Mason 1st class	day	0.6	550.00	330.00
	Mazdoor (Unskilled)	day	0.96	460.00	441.60
	Add Area Allowance @ 20%		0%	771.60	-
	b)Machinery				
	Nil	Hrs	0	-	-
	c)Material				
	Cement Mortar (1:4)	Cum	0.15	5,842.64	876.40
				Sub Total	**1,648.00**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	1,648.00	**224.37**
	Rate per 10 SqM				**1,872.37**
	Rate per 1 SQM				**187.24**

7	**Cement Mortar (1:4)**				
	BLD-CSTN-1-5				

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
	Unit:Cum				
	A)Labour				
	Mazdoor	day	0.2	460.00	92.00
	Add Area Allowance @ 20%		0%	92.00	-
	(B)Machinery				
	Nil	Hrs	0	-	-
	(c)Material				
	Cement	kg	360	7.00	2,520.00
	Sand (including 5% wastage)	Cum	1.05	2,409.99	2,530.49
				Sub Total	**5,142.49**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	5,142.49	**700.15**
	Rate for 1 CuM				**5,842.64**

8	Filling with useful available excavated earth (excluding rock) in trenches, sides of foundations and basement with initial lead in layers not exceeding 15 cm thick,consolidating each deposited layer by watering and ramming including cost and conveyance of water towork site and all operational, incidental, labour charges, all taxes, hire and Operational charges of all T & P etc., complete for finished item of work and as directed by Engineer-In-Charge BLD-CSTN-2-8(17)				
	Considering 6Cum output				
	a)Labour				
	Mazdoor (Unskilled)	day	3.12	460.00	**1,435.20**
	Add Area Allowance @ 20%		0%	1,435.20	-
	D)Overheads & Contractors Profit @ 13.62%		13.62%	1,435.20	**195.40**
	Total for 6Cum				**1,630.60**
	Rate for 1Cum				**271.77**

9	Supplying, fabricating, erection and fixing in position all heavy steel works like trusses, stanchions, heavy beams including cost of welding rods, power charges, erecting in positions to the line & grade and fixing by using chain pulley blocks derek pole arrangements and cranes, etc complete including all incidental,hire & operational charges of tools & plants, cranes complete at all heights for finished item of work.				
	A.Materials				
	STRUCTURAL STEEL	MT	1.05	55,000.00	57,750.00
	Labour fabrication	Kg	1000	29.00	29,000.00
	labour fixing	Kg	1000	19.00	19,000.00

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Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.5: Rate Analysis - Civil Components					
S.No	**Description of Item**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**
	Rateper 1MT				
				Sub Total	1,05,750.00
	D)Overheads & Contractors Profit @ 13.62%		13.62%	1,05,750.00	14,397.86
	Rate for 1RM				**1,20,147.86**

10	Roofing will be provided with 0.5mm thick galvanized /pre painted G.I. profiled sheets fixed to the purlins with 14 size self drilling screws with neoprene washer. Side laps are stitched with self tapping/ drillings crews. End laps are to be sealed with 25x3 mm Butyl tape. The sheets are provided with anti capillary grove. Cost including cost of the sheets, bolts nuts srews washers etc., and labour for fixing, scaffolding, all incidentals, cost and operational charges of T&P, all taxes complete for finished item of work.				
	As per SSR	Sqm	1	760.00	**760.00**
	D)Overheads & Contractors Profit @ 13.62%		13.62%	760.00	**103.47**
	Rate for 1Cum				**863.47**

6.6 Annexure 1.6: Rate Analysis – CETP Internal Roads

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
1	Clearing and grubbing jungle includinguprooting rank vegetation, grass, bushes, shrubs, sapling and trees girth upto 300mm, removal of stumps of trees cut earlier stacking of serviceable materials to be used or auctioned and disposal of unserviceable materials upto a lead of 1000mts including removal and disposal of top organic soil not exceeding 150mm in thickness by mechanical means in area of light jungle.				
	Data Units: 1000 SqM				
	Work in spector	Day	0.5	615.00	307.50
	Mazdoor	Day	3	460.00	1,380.00
				Sub Total	**1,687.50**
	Overheads & Contractors Profit @ 13.62%		13.62%	1,687.50	**229.75**
	Rate per 1000 SqM				1,917.25
	Rate per 1 SqM				**1.92**

2	Excavation for roadwork in soil withhydraulic excavator including cutting, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross-sections, with all lifts and lead and depositing the excavated soil on the banks including all labour charges, hire charges of all T&P, all taxes etc complete for the finished item of work as diercted by the Engineer-In-Charge as per Technical Specification Clause 302.3 MORD/301				
	Unit = 1 cum				
	Taking out put = 180 cum				
	a)Labour				
	Mate	day	0.08	500.00	40.00
	Mazdoor (Unskilled)	day	2	460.00	920.00
	Add Area Allowance @ 20%		0%	960.00	-
	b)Machinery				
	Dozer 80 HP	Hrs	6	2,584.40	15,506.40
				Sub Total	**16,466.40**
	c&d) Overheads & Contractors Profit		13.62%	16,466.40	**2,241.90**
	Cost for 180 cum (a+b+c+d)				18,708.30
	Rate per1 cum				**103.94**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
3	Formation of Road Embankment with useful earth obtained from local sources spreading in layers along the road alignment at low laying area not more than 150 mm thick sectioning to required camber and gradient watering and compacting each layer top roctorsdesity with OMC compaction using 8 to 10 T capacity of vibray roller including cost of conveyance of all materials, water etc. to site hire and operational charges of smooth wheeled roller and other T & P all taxes etc complete dully maintenance required camber and gradient in the formation as directed by the engineer-in-charge				
	Considering 100 Cum out put				
	a)Labour				
	Mate	day	0.04	500.00	20.00
	Mazdoor (skilled)	day	1	460.00	460.00
	Add Area Allowance @ 20%		0%	480.00	-
	Machinery				
	Hydraulic excavator 1 cum	hr	1.67	2,945.40	4,918.82
	Add 10% of cost		10%	2,761.20	276.12
	Dozer 50 HP	hr	0.5	1,635.00	817.50
	Mortargrader	hr	1	3,192.00	3,192.00
	Vibratary Roller 8-10 T	hr	1	2,924.90	2,924.90
	Water tanker 6 KL capacity	hr	4	691.00	2,764.00
	Material				
	EarthCost	cum	100	174.93	17,493.00
	Water	kl	12	110.00	1,320.00
				Sub Total	**34,186.34**
	Overheads & Contractors Profit		13.62%	34,186.34	**4,654.47**
	Rateper 100 Cum				38,840.81
	Rate per Cum				**388.41**

4	**Compaction of original ground** with maximum of six passess of vibratory power road roller including filling in depression occuring during rolling as per MOST specification No.305(3.4) and as directed by the Engineer -in-Charge				
	Unit: 1 sqm				
	OUT PUT: 600 sqm				
	Labour				
	Mazdoor	day	2.08	460.00	956.80
	Add Area Allowance @ 20%		0%	956.80	-
	Machinery				
	Tractor with Ripper	hour	9	456.00	4,104.00
	vibratory roller	hour	7.5	2,924.90	21,936.75
	Mortargrader	hour	6	3,192.00	19,152.00

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
	Water tanker 6KL capacity	hour	4	691.00	2,764.00
	Material				
	Water	kl	24	110.00	2,640.00
				Sub Total	51,553.55
	Add overheads @ 13.615%		13.62%	51,553.55	7,019.02
	Rate per 600 Sqm				58,572.57
	Rate per 1 Cum				97.62
	Rate per 1 Sqm				**14.66**

5	Laying Plain Cement concrete (1:4:8) using minimum cement content of 162 kgs per cum, 40mm size HBG machine crushed stone aggregate confirming to table 1000-1 and fine aggregate conforming to table1000-2 of MORT &H specification including cost, seigniorage conveyance of all materials (viz) cement, stoneaggregate, sand, water etc.,to site, labour charges for all operations, machine mixing, laying, finishing smooth to required level, curing, all taxes, all other incidental and operational charges etc, complete for finished item of work as per MORT & H specification 2100 (4th revision) and as directed by the Engineer-in-charge for open foundations.				
	Labour				
	Mason -Cl-I	day	0.1	550.00	55.00
	Mazdoor (Unskilled)	day	1.39	460.00	639.40
	Add Area Allowance @ 20%		0%	694.40	-
	Machinery				
	Concrete mixer 0.4/ 0.28 cum capacity	Hour	0.4	566.10	226.44
	Material				
	Cement	Ton	0.162	7,000.00	1,134.00
	Coarse aggregate (40mm Metal)	Cum	0.9	1,387.80	1,249.02
	Coarse sand	Cum	0.45	2,179.99	981.00
	Rate for 1Cum (I+II+III)			Sub Total	**4,284.86**
	Overhead charges & Contractors profit @ 13.615%		13.62%	4,284.86	**358.81**
	Rateper1Cum				**4,643.67**

6	Construction of Cement Concrete Kerb with top and bottom width of 115 and165mm respectively, 250mm high in M20 Grade PCC on M10 grade foundation150mm Thick, foundation having 50mm projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete laid manually, all complete as per clause 408 Morth.				
	Unit = Running Metre				

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
	Taking Output = 360 Metre				
	Using Concrete Mixer				
	Cement Concrete				
	Cement Concrete of grade M20 = 12.60 Cum				
	Cement Concrete of grade M10 for base = 11.61 Cum				
	Total Concrete = 24.21 Cum				
	A)Labour				
	Mason	Day	2	500.00	1,000.00
	Mazdoor	Day	16.72	460.00	7,691.20
	B)Machinary				
	Kerb Casting Machine @ 60 meters/Hour	Hour	6	538.00	3,228.00
	Concrete Mixer 0.48/0.28 Cum Capacity	Hour	12	566.10	6,793.20
	C)Material				
	Crushed stone aggregate 20mm nominal size 59%	Cum	21.79	2,016.80	43,946.07
	Coarse Sand 30 Percent	Cum	10.9	2,179.99	23,761.89
	Cement	Mt	5.7	7,000.00	39,900.00
				Sub Total	**1,26,320.36**
	Add OH & CP		13.62%	1,26,320.36	**17,198.52**
	Rate for 360 Meters				1,43,518.88
	Rate per 1 Meter				**398.66**

7	Construction of Granular surface coarse by providing well graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method, with rotavator at OMC compactingwith Three wheel 80-100 KN Static roller /Vibratory roller capacity to achieve desired density complete for Finished Item of work including Hire and opeational charges of all t&P, Labour charges, all taxes all seignoragaes charges complete for finished item of work as directed by the Enginer incharge.				
	UnitCum				
	Output 300 Cum				
	Labour				
	Mate	Day	0.4	500.00	200.00
	Mazdoor Skilled	Day	2	523.00	1,046.00
	Mazdoor UnSkilled	Day	8	460.00	3,680.00
	Add Area Allowance @ 20%		0%	4,926.00	-
	Machinery				
	Motor grader 110HP @ 50cum per hour	Hr	6	3,192.00	19,152.00
	Vibratory Roller	Hr	6	2,924.90	17,549.40
	Water Tanker	Hr	3	691.00	2,073.00
	Tractor with Rotavator	Hr	12	456.00	5,472.00
	Material				
	Gravel	Cum	384	181.93	69,861.12

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
					1,19,033.52
	Add OH & CP		13.62%	1,19,033.52	**16,206.41**
	Total for 300 Cum				1,35,239.93
	Total for 1 Cum				**450.80**

8	Construction of granular sub-base by providing HBG material (66% of 9.50mm to 4.75mm HBG (IRC) Machine crushed metal and 34% of 2.36mm and below HBGIRC) Machine crushed metal with CBR not less than 20 including spreading inuniform layers with motor grader or by approved means, on prepared surface mixing by mix in place method with rotavator approved means at OMC and compacting with vibratory roller to achive the desired density etc., complete for finished item of work as directed by the Engineer-In-Charge : including the cost and conveyance of all materials ie stone dust, stone aggregates of specified sizes water etc to site labour charges for all operational hire etc and operational charges of power roller and other T & P all taxes etc complete. As per RBR - SBBS- I(iii) Chap-4 pg No: 158)				
	RBR- SBBS-1Aiii				
	Unit=cum				
	Taking output = 300 cum				
	a)Labour				
	Mate	Nos.	0.4	500.00	200.00
	Mazdoor (Skilled)	Nos.	2	523.00	1,046.00
	Mazdoor (Unskilled)	Nos.	8	460.00	3,680.00
	Add Area Allowance @ 20%		0%	4,926.00	-
	b)Machinery				
	Motor grader 110HP @ 50 cum per hour		6	3,192.00	19,152.00
	Three wheel 80-100 kN static roller @ 10 cum per hour		30		
	OR				
	Vibratory Roller 80-100 kN	hours	6	2,924.90	17,549.40
	Tractor with Rotavator 25 cum per hour	hours	12	456.00	5,472.00
	Water Tanker	hours	3	691.00	2,073.00
	c)Material				
	For well graded granular sub-base materials as per Table 400.1				
	For Grading C Material				
	9.5mm to 4.75mm @ 35%	Cum	134.4	885.20	1,18,970.88
	4.75 mm to 2.36 mm @ 12.5%	Cum	48	875.20	42,009.60
	2.36 mm below @ 52.5%	Cum	201.6	833.20	1,67,973.12
	Water	kl	18	110.00	1,980.00
					3,80,106.00
	Overheads & Contractors Profit		13.62%	3,80,106.00	**51,751.43**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
	Cost for 300 cum = a+b+c+d+e (3 Wheel Roller)				
	Rate per cum = (a+b+c+d+e) /300				
	Cost for 300 cum = a+b+c+d+e (Vibratory Roller)				4,31,857.43
	Rate per 1 cum				**1,439.52**

9	Construction of Unreinforced plain cement concrete pavement M 30 Grade over a prepared sub base, coarse and fine aggregates, confirming to IS 383, Crushed Stone aggregate of 20mm and 10mm size graded granite chips as per table 1500.1, mixed in a concrete mixer of not less than 0.2 Cum capacity and appropriate weigh batcher using approved mix design with minimum cement content of 419Kg/Cum laid in alternate panels with aproved fixed side frame work of Steel Channel, wedges, Steel plates including leveling the form work as per drawing, cleaning the surface wit Air compressor initially and spreadsing the concrete with shovels, rakes, compacted with needle, plate and screed vibrators and finished in continous operation of lines andgade, curing of concrete slab for 14 days including cost and conveyance charges, seigniorage charges of materials, Hire and Operational Charges of all T&P, all taxes., diversion of traffic etc., complete for FInished item of work as per the drawing, as per Technical Specification Clause No 1501 MORD and as directed by the Engineer-In-Charge				
	Unit 1 Cum				
	Taking Output = 75Cum				
	LabourA				
	Mason 1st Class	No	5	550.00	2,750.00
	Mason 2nd Class	No	5	500.00	2,500.00
	Mazdoor Unskilled	No	150	460.00	69,000.00
	Mazdoor Skilled	No	6	523.00	3,138.00
	Surveyor	No	2	850.00	1,700.00
	Mazdoor Semiskilled	No	6	500.00	3,000.00
	MachineryB				
	Concrete Mixer	No	36	566.10	20,379.60
	Needle Vibrator 40 mm	Hr	9	223.00	2,007.00
	Screed Vibrator LMR	Hr	9	100.00	900.00
	Plate Vibrator LMR	Hr	9	150.00	1,350.00
	Water Tanker	KL	5	691.10	3,455.50
	Air Compressor	No	2	576.60	1,153.20
	MaterialC				
	Crushed Stone Aggregate 20m & 10m Blend	Cum	67.5	2,016.80	1,36,134.00
	Sand	Cum	33.75	2,314.99	78,130.91
	Cement @419Kgs /Cum of Concrete	Mt	31.43	7,000.00	2,20,010.00
	Polysheet 125 microns	Sqm	413	15.25	6,298.25

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
	Curing Compound @ 0.33 Lit per Sqm	Lit	131.25	114.00	14,962.50
	Water for curing	KL	18	110.00	1,980.00
	Total (A+B+C)				**5,68,848.96**
	Formwork @ 3% of A+B+C				**17,065.47**
	Add OH&CP		13.62%	5,85,914.43	**79,772.25**
	Total for 75 Cum				6,65,686.68
	Rate for 1 Cum				**8,875.82**

10	Supply and placing seperation membrane of impermiable vergin plastic sheeting 125 Micrins thick uniformly over already laid PCC in single layer without rinkles including cost and conveyance of all material and all labour charges for spreading under Pavements labor as directed by the Engineer-in-charge etc., M- 164 - as per local market rate				
		Sqm	1	20.00	20.00
					20.00

11	Providing and spreading gravel for shoulders with side slopes 2:1 in layers each not exceeding 150mm thick over embankment including sectioning each layer to proper camber, watering, compaction with vibratory roller of 8-10t capacity including cost and conveyance of gravel to site, seigniorage charges, all taxes, labour charges for all operations, hire and operational charges of power roller and other T&P etc., complete for finished item of work.				
	Unit Cum				
	Output 300 Cum				
	Labour				
	Mazdoor Skilled	Day	2.40	500.00	1,200.00
	Mazdoor UnSkilled	Day	8.00	460.00	3,680.00
	Machinery				
	Smooth wheeled Roller 8 T	Hr	6.00	1,421.50	8,529.00
	Water Tanker	Hr	5.00	691.00	3,455.00
	Material				
	Gravel	Cum	384.00	291.50	1,11,936.00
					1,28,800.00
	Add OH&CP		0.14	1,28,800.00	**17,536.12**
	Total for 300 Cum				1,46,336.12
	Total for 1 Cum				**487.79**

ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED					
Developmentof Major Infrastructure and Utilities in APSEZ, Atchuthapuram					
Common Effluent Treatment Plant					
Annexure 1.6: Rate Analysis - CETP Internal Roads					
S.No	**DescriptionofItem**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount in (Rs)**
12	Painting two coats with synthetic enamel paint of approved brand and shade over a primer on plastered surface of Kerb stone after clearing the surface of kerb stone of dirt dust oil grease efflorance and applying Paint including the cost and conveyance of paint & brushes etc., labour charges for all operations all taxes etc., complete as per the MORTH specification No.803.				
	Unit = Sqm				
	Taking output = 40 Sqm				
	Non labour				
	Synthetic enamel Paint grade - I	Lt	6	228.00	1,368.00
	Labour				
	Painter Cl -I	No	2	615.00	1,230.00
	Light Mazdoor	No	1.12	460.00	515.20
					3,113.20
	Add OverHead & Contractor Profit		13.62%	3,113.20	**423.86**
	Rate per 40 Sqm				3,537.06
	Rate Per 1 Sqm				**88.43**

6.7 Annexure 1.7: Lead Statement

Annexure 1.7: LEAD STATEMENT AS PER SSR 2020-2021									
S. No	**Name of Material**	**Source of supply**	**Total Lead in KMs**	**Initial cost**	**Conveyance Charges**	**Blasting**	**Mashing Crushing**	**Total**	**Unit**
1	Sand for mortar	Rajamandry	170.0	605.00	1804.99	0.00	0.00	2409.99	Cum
2	Sand for filling	Rajamandry	170.0	375.00	1804.99	0.00	0.00	2179.99	Cum
3	Sand for Concrete	Rajamandry	170.0	510.00	1804.99	0.00	0.00	2314.99	Cum
4	Gravel/Quarry Spall	Atchutapuram	13.0	113.00	178.50	0.00	0.00	291.50	Cum
5	Aggregate 40-45mm size HBG(IRC & MORTH)	Baguluwada	23.0	870.00	300.20	70.00	147.60	1387.80	Cum
6	Aggregate 19-22mm size HBG(IRC & MORTH)	Baguluwada	23.0	1400.00	300.20	70.00	246.60	2016.80	Cum
7	Aggregate 12-14mm size HBG(IRC & MORTH)	Baguluwada	23.0	1130.00	300.20	70.00	195.60	1695.80	Cum
8	Aggregate 9.5-11.2mm size HBG(IRC & MORTH)	Baguluwada	23.0	965.00	300.20	70.00	164.00	1499.20	Cum
9	Aggregate 5-7mm size HBG(IRC & MORTH)	Baguluwada	23.0	780.00	300.20	0.00	0.00	1080.20	Cum
10	Aggregate 45 mm TO 22.4mm size HBG(IRC & MORTH)	Baguluwada	23.0	1180.00	300.20	0.00	0.00	1480.20	Cum
11	10 to 25mm size HBG (IRC & MORTH) M-046	Baguluwada	23.0	1220.00	300.20	0.00	0.00	1520.20	Cum
12	Aggregate 22.4 mm TO 2.36 mm size HBG(IRC & MORTH) M-031	Baguluwada	23.0	945.00	300.20	0.00	0.00	1245.20	Cum
13	Aggregate 13.2 - 10mm	Baguluwada	23.0	1070.00	300.20	0.00	0.00	1370.20	Cum
14	Aggregate 10 - 5mm	Baguluwada	23.0	903.00	300.20	0.00	0.00	1203.20	Cum
15	Aggregate 9.5-4.75 mm size HBG for GSB M-016	Baguluwada	23.0	585.00	300.20	0.00	0.00	885.20	Cum
16	Aggregates 5mm and below M-030	Baguluwada	23.0	575.00	300.20	0.00	0.00	875.20	Cum
17	Coarse grade metal 2.36mm and below	Baguluwada	23.0	510.00	300.20	0.00	0.00	833.20	Cum
18	SS Revetment work 225mm (RR Masonry Works)	Baguluwada	23.0	171.45	300.20	0.00	0.00	494.65	Cum
19	Selected Earth		5.1	101.00	81.14	22.00	0.00	209.24	Cum
20	Sulphate Resisting cement (SRC)			7000.00					MT
21	Cement (OPC 43/53 grade)			3672.00					MT
22	HYSD steel 415			53000.00					MT
23	HYSD steel 500			55000.00					MT

170 km	Upto 5km			81.14
	5 to 30 km	25	12.17	304.25
	30 to 170	140	10.14	1419.60
				1804.99
5.1km	Upto 5km			81.14
	5 to 13 km	8	12.17	97.36
				178.50
23km	Upto 5km			81.14
	5 to 23 km	18	12.17	219.06
				300.20

6.8 Annexure 2.1 : Detailed Cost Estimate for Electro-Mechanical Equipments

Annexure 2.1:
Detailed Cost Estimate for Electro-Mechanical Items

ANNEXURE 2.1: DETAILED COST ESTIMATION FOR ELECTRO-MECHANICAL EQUIPMENTS OF 5 MLD CETP											
S.No	Description	Qty	Capacity / Unit		Specification	Basic Price	Amount	Transport (3%)	Erection (10%)	Contractors Profit (10%)	Total in (Rs.)
I	**CHROME EFFLUENT TREATMENT**										
1	Bar screen	1	5	m3/hr	Manual with size 600 x 1000mm and SS fabricated	₹ 28,000.00	₹ 28,000.00	₹ 840.00	₹ 2,800.00	₹ 2,800.00	₹ 34,440.00
2	Oil skimmer	1	5	m3/hr	3" belt type oil skimmer of 2 lit/hr removal capacity	₹ 1,11,500.00	₹ 1,11,500.00	₹ 3,345.00	₹ 11,150.00	₹ 11,150.00	₹ 1,37,145.00
3	Effluent Transfer pumps	2	5	m3/hr	Non Clog, Self priming centrifugal pumps with all wetted parts in SS 316 / PP	₹ 33,500.00	₹ 67,000.00	₹ 2,010.00	₹ 6,700.00	₹ 6,700.00	₹ 82,410.00
4	Effluent feed pumps at EQT	2	5	m3/hr	Non Clog, Self priming centrifugal pumps with all wetted parts in SS 316 / PP	₹ 33,500.00	₹ 67,000.00	₹ 2,010.00	₹ 6,700.00	₹ 6,700.00	₹ 82,410.00
5	Stirrer for Reaction tank	1	1	HP	Agitator with Motor & Gear box arrangement, Shaft and paddle in SS 316	₹ 35,000.00	₹ 35,000.00	₹ 1,050.00	₹ 3,500.00	₹ 3,500.00	₹ 43,050.00
6	Stirrer for flocculator	1	1	HP	Agitator with Motor & Gear box arrangement, Shaft and paddle in SS 316	₹ 35,000.00	₹ 35,000.00	₹ 1,050.00	₹ 3,500.00	₹ 3,500.00	₹ 43,050.00
7	Lamella sheets & its arrangement	1	2	HP Drive	Non Clog, Submersible	₹ 2,25,000.00	₹ 2,25,000.00	₹ 6,750.00	₹ 22,500.00	₹ 22,500.00	₹ 2,76,750.00
	DOSING										
8	Stirrers for Chemical preparation tanks	3	0.5	HP	Agitator with Motor & Gear box arrangement, Shaft and paddle in SS 316	₹ 35,000.00	₹ 1,05,000.00	₹ 3,150.00	₹ 10,500.00	₹ 10,500.00	₹ 1,29,150.00
9	Chemical preparation tanks	3	1	m3 each	PP FRP	₹ 30,000.00	₹ 90,000.00	₹ 2,700.00	₹ 9,000.00	₹ 9,000.00	₹ 1,10,700.00
10	H2SO4 dosing pumps	2	0-40	LPH	MOC PP	₹ 27,500.00	₹ 55,000.00	₹ 1,650.00	₹ 5,500.00	₹ 5,500.00	₹ 67,650.00
11	NaHSO3 dosing pumps	2	0-40	LPH	MOC PP	₹ 27,500.00	₹ 55,000.00	₹ 1,650.00	₹ 5,500.00	₹ 5,500.00	₹ 67,650.00
12	Ca(OH)2 dosing pumps	2	0-40	LPH	MOC PP	₹ 27,500.00	₹ 55,000.00	₹ 1,650.00	₹ 5,500.00	₹ 5,500.00	₹ 67,650.00
										SUB-TOTAL	**₹ 11,42,055.00**
II	**CYANIDE EFFLUENT TREATMENT**										
1	Bar screen	1	5	m3/hr	Manual with size 600 x 1000mm and SS fabricated	₹ 28,000.00	₹ 28,000.00	₹ 840.00	₹ 2,800.00	₹ 2,800.00	₹ 34,440.00
2	Oil skimmer	1	5	m3/hr	3" belt type oil skimmer of 2 lit/hr removal capacity	₹ 1,11,500.00	₹ 1,11,500.00	₹ 3,345.00	₹ 11,150.00	₹ 11,150.00	₹ 1,37,145.00
3	Effluent Transfer pumps	2	5	m3/hr	Non Clog, Self priming centrifugal pumps with all wetted parts in SS 316 / PP	₹ 33,500.00	₹ 67,000.00	₹ 2,010.00	₹ 6,700.00	₹ 6,700.00	₹ 82,410.00
4	Effluent feed pumps at EQT	2	5	m3/hr	Non Clog, Self priming centrifugal pumps with all wetted parts in SS 316 / PP	₹ 33,500.00	₹ 67,000.00	₹ 2,010.00	₹ 6,700.00	₹ 6,700.00	₹ 82,410.00
5	Stirrer for Reaction tank	1	1	HP	Agitator with Motor & Gear box arrangement, Shaft and paddle in SS 316	₹ 35,000.00	₹ 35,000.00	₹ 1,050.00	₹ 3,500.00	₹ 3,500.00	₹ 43,050.00
6	Lamella sheets & its arrangement	1	2	HP Drive	Non Clog, Submersible	₹ 2,25,000.00	₹ 2,25,000.00	₹ 6,750.00	₹ 22,500.00	₹ 22,500.00	₹ 2,76,750.00
	DOSING										
7	Stirrers for Chemical preparation tanks	2	0.5	HP	Agitator with Motor & Gear box arrangement, Shaft and paddle in SS 316	₹ 35,000.00	₹ 70,000.00	₹ 2,100.00	₹ 7,000.00	₹ 7,000.00	₹ 86,100.00
8	Chemical preparation tanks	2	1	m3 each	PP FRP	₹ 30,000.00	₹ 60,000.00	₹ 1,800.00	₹ 6,000.00	₹ 6,000.00	₹ 73,800.00
9	NaOH dosing pumps	2	0-40	LPH	MOC PP	₹ 27,500.00	₹ 55,000.00	₹ 1,650.00	₹ 5,500.00	₹ 5,500.00	₹ 67,650.00
10	NaOCL dosing pumps	2	0-40	LPH	MOC PP	₹ 27,500.00	₹ 55,000.00	₹ 1,650.00	₹ 5,500.00	₹ 5,500.00	₹ 67,650.00
										SUB-TOTAL	**₹ 9,51,405.00**
III	**HIGH TDS EFFLUENT- PRIMARY TREATMENT**										
1	Bar screen	1			Mannual Type with SS fabricated	₹ 50,000.00	₹ 50,000.00	₹ 1,500.00	₹ 5,000.00	₹ 5,000.00	₹ 61,500.00

Annexure 2.1:
Detailed Cost Estimate for Electro-Mechanical Items

ANNEXURE 2.1: DETAILED COST ESTIMATION FOR ELECTRO-MECHANICAL EQUIPMENTS OF 5 MLD CETP											
S.No	Description	Qty	Capacity / Unit		Specification	Basic Price	Amount	Transport (3%)	Erection (10%)	Contractors Profit (10%)	Total in (Rs.)
2	Vertex Grit Mechanism	1	100	m3/hr	Grit design load typically < 0.1 m3/MLD and particle removal efficiency of size 150 microns and above. MOC SS316	₹ 35,00,000.00	₹ 35,00,000.00	₹ 1,05,000.00	₹ 3,50,000.00	₹ 3,50,000.00	₹ 43,05,000.00
3	Oil skimmer	3			6" belt type oil skimmer of 10 lit/hr removal capacity	₹ 2,25,000.00	₹ 6,75,000.00	₹ 20,250.00	₹ 67,500.00	₹ 67,500.00	₹ 8,30,250.00
4	Effluent Transfer pumps	4	200	m3/hr	Non Clog, Submersible pumps with all wetted parts in SS 316 / PP	₹ 3,35,000.00	₹ 13,40,000.00	₹ 40,200.00	₹ 1,34,000.00	₹ 1,34,000.00	₹ 16,48,200.00
5	Effluent feed pumps at EQT	2	100	m3/hr	Non Clog, Submersible pumps with all wetted parts in SS 316 / PP	₹ 1,50,000.00	₹ 3,00,000.00	₹ 9,000.00	₹ 30,000.00	₹ 30,000.00	₹ 3,69,000.00
6	Air blowers for Equalization tanks	6	750	m3/hr	Roots blower with required flow at 0.4 kg/sq.m	₹ 2,65,000.00	₹ 15,90,000.00	₹ 47,700.00	₹ 1,59,000.00	₹ 1,59,000.00	₹ 19,55,700.00
7	Air grid for Equalization tanks	1	1	lot	Silicon Coarse bubble diffusers aeration with MOC HDPE with MS header	₹ 15,00,000.00	₹ 15,00,000.00	₹ 45,000.00	₹ 1,50,000.00	₹ 1,50,000.00	₹ 18,45,000.00
8	Air blowers for Neutralization tank	2	50	m3/hr	Roots blower with required flow at 0.4 kg/sq.m	₹ 90,000.00	₹ 1,80,000.00	₹ 5,400.00	₹ 18,000.00	₹ 18,000.00	₹ 2,21,400.00
9	Air grid for neutralization tank	1	1	lot	Silicon Coarse bubble diffusers aeration with MOC HDPE with MS header	₹ 50,000.00	₹ 50,000.00	₹ 1,500.00	₹ 5,000.00	₹ 5,000.00	₹ 61,500.00
10	Stirrer for flash mixer	1		No	To suit size of flash mixing tank and agitator with motor & gear box arrangement	₹ 82,500.00	₹ 82,500.00	₹ 2,475.00	₹ 8,250.00	₹ 8,250.00	₹ 1,01,475.00
11	Stirrer for flocculator	1		No	To suit size of flocculator tank and agitator with motor & gear box arrangement	₹ 82,500.00	₹ 82,500.00	₹ 2,475.00	₹ 8,250.00	₹ 8,250.00	₹ 1,01,475.00
12	Clariflocculator mechanism	1	16m	Dia	Clariflocculator mechanism for 16m dia of tank with 3m height	₹ 8,50,000.00	₹ 8,50,000.00	₹ 25,500.00	₹ 85,000.00	₹ 85,000.00	₹ 10,45,500.00
	DOSING										
13	Stirrers for Chemical preparation tanks	5			Agitators to suit size of tank	₹ 35,000.00	₹ 1,75,000.00	₹ 5,250.00	₹ 17,500.00	₹ 17,500.00	₹ 2,15,250.00
14	Acid/ Alkali dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
15	Alum dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
16	Poly dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
17	Poly dosing pump at Screw Press	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
	SLUDGE HANDLING										
18	Screw Press feed pumps	4	15	m3/hr	Non clog, Centrifugal, Self priming	₹ 1,65,000.00	₹ 6,60,000.00	₹ 19,800.00	₹ 66,000.00	₹ 66,000.00	₹ 8,11,800.00
19	Screw Press	2	15	m3/hr each	Dewatering of primary sludge: operating 12 hrs	₹ 17,50,000.00	₹ 35,00,000.00	₹ 1,05,000.00	₹ 3,50,000.00	₹ 3,50,000.00	₹ 43,05,000.00
										SUB-TOTAL	**₹ 1,87,14,450.00**
IV	**LOW TDS EFFLUENT- PRIMARY TREATMENT**										
1	Bar screen	1		No	Mannual Type with SS fabricated	₹ 50,000.00	₹ 50,000.00	₹ 1,500.00	₹ 5,000.00	₹ 5,000.00	₹ 61,500.00
2	Vertex Grit Mechanism	1	150	m3/hr	Grit design load typically < 0.1 m3/MLD and particle removal efficiency of size 150 microns and above. MOC SS316	₹ 40,00,000.00	₹ 40,00,000.00	₹ 1,20,000.00	₹ 4,00,000.00	₹ 4,00,000.00	₹ 49,20,000.00
3	Oil skimmer	3		No	6" belt type oil skimmer of 10 lit/hr removal capacity	₹ 2,25,000.00	₹ 6,75,000.00	₹ 20,250.00	₹ 67,500.00	₹ 67,500.00	₹ 8,30,250.00

Annexure 2.1:
Detailed Cost Estimate for Electro-Mechanical Items

ANNEXURE 2.1: DETAILED COST ESTIMATION FOR ELECTRO-MECHANICAL EQUIPMENTS OF 5 MLD CETP											
S.No	Description	Qty	Capacity / Unit		Specification	Basic Price	Amount	Transport (3%)	Erection (10%)	Contractors Profit (10%)	Total in (Rs.)
4	Effluent Transfer pumps	4	300	m3/hr	Non Clog, Submersible pumps with wetted parts in SS 316 / PP	₹ 3,90,000.00	₹ 15,60,000.00	₹ 46,800.00	₹ 1,56,000.00	₹ 1,56,000.00	₹ 19,18,800.00
5	Effluent feed pumps at EQT	2	150	m3/hr	Non Clog, Submersible	₹ 1,65,000.00	₹ 3,30,000.00	₹ 9,900.00	₹ 33,000.00	₹ 33,000.00	₹ 4,05,900.00
6	Air blowers for Equalization tanks	4	1000	m3/hr	Roots blower with required flow at 0.4 kg/sq.m	₹ 2,95,000.00	₹ 11,80,000.00	₹ 35,400.00	₹ 1,18,000.00	₹ 1,18,000.00	₹ 14,51,400.00
7	Air grid for Equalization tanks	1	1	lot	Silicon Coarse bubble diffusers aeration with MOC HDPE with MS header	₹ 20,00,000.00	₹ 20,00,000.00	₹ 60,000.00	₹ 2,00,000.00	₹ 2,00,000.00	₹ 24,60,000.00
8	Air blowers for Neutralization tank	2	50	m3/hr	Roots blower with required flow at 0.4 kg/sq.m	₹ 90,000.00	₹ 1,80,000.00	₹ 5,400.00	₹ 18,000.00	₹ 18,000.00	₹ 2,21,400.00
9	Air grid for neutralization tank	1	1	lot	Silicon Coarse bubble diffusers aeration with MOC HDPE with MS header	₹ 50,000.00	₹ 50,000.00	₹ 1,500.00	₹ 5,000.00	₹ 5,000.00	₹ 61,500.00
10	Stirrer for flash mixer	1		No	To suit size of flash mixing tank and agitator with motor & gear box arrangement	₹ 35,000.00	₹ 35,000.00	₹ 1,050.00	₹ 3,500.00	₹ 3,500.00	₹ 43,050.00
11	Stirrer for flocculator	1		No	To suit size of flocculator tank and agitator with motor & gear box arrangement	₹ 35,000.00	₹ 35,000.00	₹ 1,050.00	₹ 3,500.00	₹ 3,500.00	₹ 43,050.00
12	Clariflocculator mechanism	1	13m	Dia	Clariflocculator mechanism for 13m dia of tank with 3m height	₹ 7,50,000.00	₹ 7,50,000.00	₹ 22,500.00	₹ 75,000.00	₹ 75,000.00	₹ 9,22,500.00
	DOSING										
13	Stirrers for Chemical preparation tanks	5		No	Agitators to suit size of tank	₹ 35,000.00	₹ 1,75,000.00	₹ 5,250.00	₹ 17,500.00	₹ 17,500.00	₹ 2,15,250.00
14	Acid/ Alkali dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
15	Alum dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
16	Poly dosing pumps	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
17	Poly dosing pump at Screw Press	2	100	LPH	MOC PP with 4 kg/sq.m	₹ 85,000.00	₹ 1,70,000.00	₹ 5,100.00	₹ 17,000.00	₹ 17,000.00	₹ 2,09,100.00
	SLUDGE HANDLING										
18	Centrifuge feed pumps	2	15	m3/hr	Non clog, Centrifugal, Self priming	₹ 1,65,000.00	₹ 3,30,000.00	₹ 9,900.00	₹ 33,000.00	₹ 33,000.00	₹ 4,05,900.00
19	Centrifuge	1	15	m3/hr	Dewatering of primary sludge: operating 16 hrs	₹ 22,00,000.00	₹ 22,00,000.00	₹ 66,000.00	₹ 2,20,000.00	₹ 2,20,000.00	₹ 27,06,000.00
										SUB-TOTAL	**₹ 1,75,02,900.00**
V	**COMBINED LOW TDS & MEE CONDENSATE EFFLUENT- BIOLOGICAL & TERTIARY TREATMENT**										
1	Aerators for Pre-Aeration tank	11	60	HP	Process Aerator / Mixer with Bridge Mount assembly	₹ 33,71,000.00	₹ 3,70,81,000.00	₹ 11,12,430.00	₹ 37,08,100.00	₹ 37,08,100.00	₹ 4,56,09,630.00
2	Settling media	1	1	lot		₹ 15,00,000.00	₹ 15,00,000.00	₹ 45,000.00	₹ 1,50,000.00	₹ 1,50,000.00	₹ 18,45,000.00
3	Sludge pumps at settling tank	2	40	m3/hr	Non clog, Centrifugal, Self priming	₹ 1,70,000.00	₹ 3,40,000.00	₹ 10,200.00	₹ 34,000.00	₹ 34,000.00	₹ 4,18,200.00
4	Anoxic feed pumps	2	85	m3/hr	Non clog, Centrifugal	₹ 1,40,000.00	₹ 2,80,000.00	₹ 8,400.00	₹ 28,000.00	₹ 28,000.00	₹ 3,44,400.00
5	Mixers for anoxic tank	4	40	HP	Floating mixers	₹ 18,24,000.00	₹ 72,96,000.00	₹ 2,18,880.00	₹ 7,29,600.00	₹ 7,29,600.00	₹ 89,74,080.00
6	Effluent transfer pumps at Buffer storage tank	2	200	m3/hr	Non clog, Centrifugal	₹ 3,35,000.00	₹ 6,70,000.00	₹ 20,100.00	₹ 67,000.00	₹ 67,000.00	₹ 8,24,100.00
7	SBR feed pumps	2	320	m3/hr	Non clog, Centrifugal	₹ 3,90,000.00	₹ 7,80,000.00	₹ 23,400.00	₹ 78,000.00	₹ 78,000.00	₹ 9,59,400.00
8	Floating aerators with blower for SBR-1	35	60	HP	Process Aerator / Mixer with Bridge Mount assembly	₹ 33,71,000.00	₹ 11,79,85,000.00	₹ 35,39,550.00	₹ 1,17,98,500.00	₹ 1,17,98,500.00	₹ 14,51,21,550.00

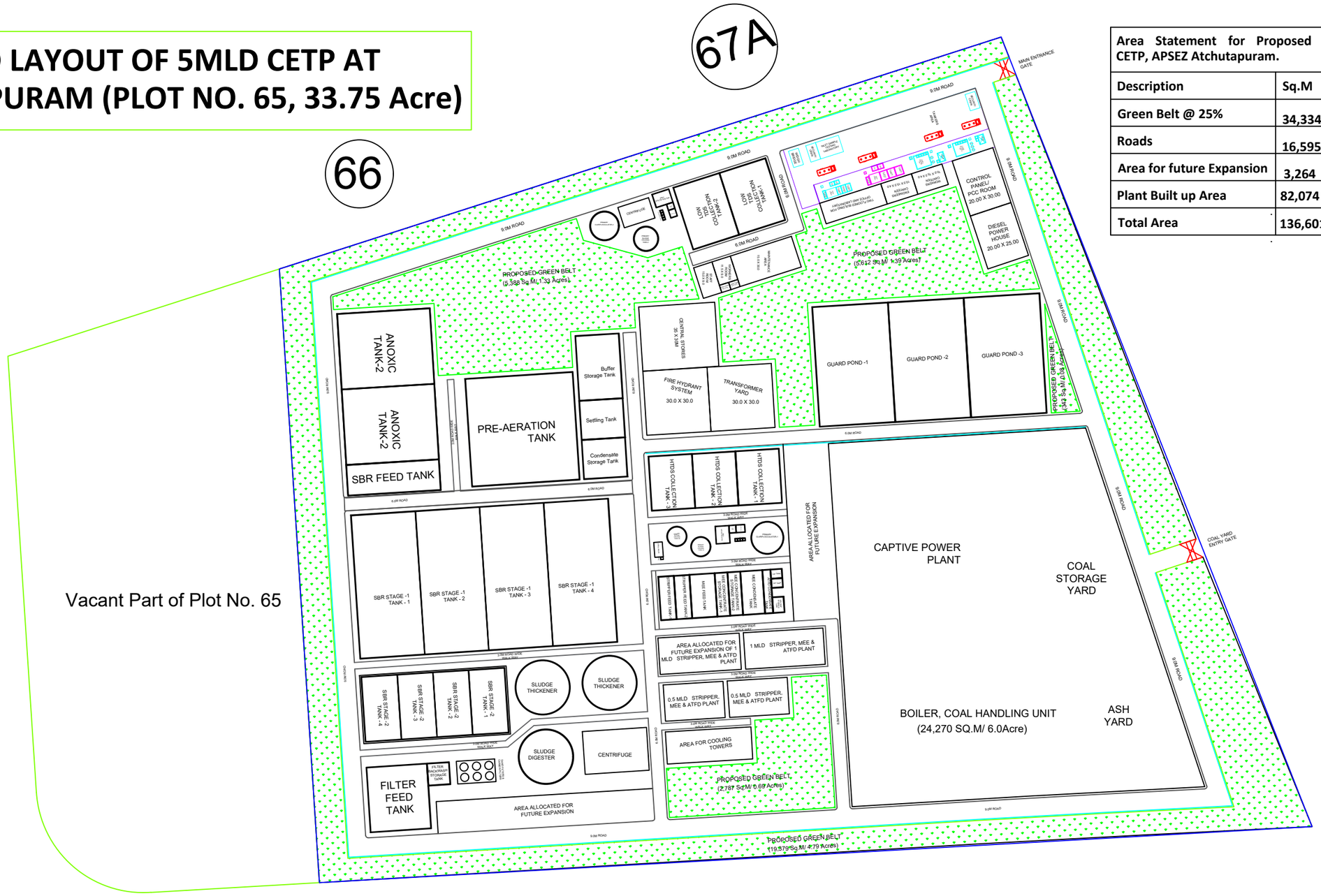
Annexure 2.1:
Detailed Cost Estimate for Electro-Mechanical Items

ANNEXURE 2.1: DETAILED COST ESTIMATION FOR ELECTRO-MECHANICAL EQUIPMENTS OF 5 MLD CETP											
S.No	**Description**	**Qty**	**Capacity / Unit**		**Specification**	**Basic Price**	**Amount**	**Transport (3%)**	**Erection (10%)**	**Contractors Profit (10%)**	**Total in (Rs.)**
9	SBR Decanter mechansim	4	1275	m3/day	Decanter Package SS304, Actuator + Motor, Panel + VFD, with Limit switch and level switch and connected with level transmitter	₹ 37,00,000.00	₹ 1,48,00,000.00	₹ 4,44,000.00	₹ 14,80,000.00	₹ 14,80,000.00	₹ 1,82,04,000.00
10	Floating aerators with blower for SBR-2	11	30	HP	Process Aerator / Mixer with Bridge Mount assembly	₹ 24,00,000.00	₹ 2,64,00,000.00	₹ 7,92,000.00	₹ 26,40,000.00	₹ 26,40,000.00	₹ 3,24,72,000.00
11	SBR Decanter mechansim	4	1275	m3/day	Decanter Package SS304, Actuator + Motor, Panel + VFD, with Limit switch and level switch and connected with level transmitter	₹ 37,00,000.00	₹ 1,48,00,000.00	₹ 4,44,000.00	₹ 14,80,000.00	₹ 14,80,000.00	₹ 1,82,04,000.00
12	RAS pumps (NO3-N)	2	285	m3/hr	Non clog, Centrifugal	₹ 5,00,000.00	₹ 10,00,000.00	₹ 30,000.00	₹ 1,00,000.00	₹ 1,00,000.00	₹ 12,30,000.00
13	RAS pumps at SBR-1	2	80	m3/hr	Non clog, Centrifugal	₹ 1,40,000.00	₹ 2,80,000.00	₹ 8,400.00	₹ 28,000.00	₹ 28,000.00	₹ 3,44,400.00
14	RAS pumps at SBR-2	2	80	m3/hr	Non clog, Centrifugal	₹ 1,40,000.00	₹ 2,80,000.00	₹ 8,400.00	₹ 28,000.00	₹ 28,000.00	₹ 3,44,400.00
15	Feed pumps for ST	2	250	m3/hr	Non clog, Centrifugal	₹ 4,50,000.00	₹ 9,00,000.00	₹ 27,000.00	₹ 90,000.00	₹ 90,000.00	₹ 11,07,000.00
16	Settling media	1	1	lot		₹ 25,00,000.00	₹ 25,00,000.00	₹ 75,000.00	₹ 2,50,000.00	₹ 2,50,000.00	₹ 30,75,000.00
17	Filter feed pumps	2	250	m3/hr	Non clog, Centrifugal	₹ 5,00,000.00	₹ 10,00,000.00	₹ 30,000.00	₹ 1,00,000.00	₹ 1,00,000.00	₹ 12,30,000.00
18	Multigrade sand filter	2	250	m3/hr	Vertical, cylindrical with MOC MS EP, media sand, pebbles gravel	₹ 22,00,000.00	₹ 44,00,000.00	₹ 1,32,000.00	₹ 4,40,000.00	₹ 4,40,000.00	₹ 54,12,000.00
19	Activated carbon filter	2	250	m3/hr	Vertical, cylindrical with MOC MS EP, media pebbles activated carbon	₹ 28,00,000.00	₹ 56,00,000.00	₹ 1,68,000.00	₹ 5,60,000.00	₹ 5,60,000.00	₹ 68,88,000.00
20	Filter backwash pumps	2	300	m3/hr	Non clog, Centrifugal	₹ 5,50,000.00	₹ 11,00,000.00	₹ 33,000.00	₹ 1,10,000.00	₹ 1,10,000.00	₹ 13,53,000.00
	SLUDGE HANDLING										
21	Stirrers for Chemical preparation tanks	2		Nos	Agitators to suit size of tank	₹ 35,000.00	₹ 70,000.00	₹ 2,100.00	₹ 7,000.00	₹ 7,000.00	₹ 86,100.00
22	Poly dosing pumps	4	100	LPH	MOC PP with 4 kg/sq.m	₹ 55,000.00	₹ 2,20,000.00	₹ 6,600.00	₹ 22,000.00	₹ 22,000.00	₹ 2,70,600.00
23	Thickener mechanism	2		No		₹ 17,00,000.00	₹ 34,00,000.00	₹ 1,02,000.00	₹ 3,40,000.00	₹ 3,40,000.00	₹ 41,82,000.00
24	Centrifuge feed pumps	4	15	m3/hr	Non clog, Centrifugal, Self priming	₹ 1,65,000.00	₹ 6,60,000.00	₹ 19,800.00	₹ 66,000.00	₹ 66,000.00	₹ 8,11,800.00
25	Centrifuge for sludge dewatering	2	15	m3/hr	Dewatering of primary sludge: operating 16 hrs	₹ 22,00,000.00	₹ 44,00,000.00	₹ 1,32,000.00	₹ 4,40,000.00	₹ 4,40,000.00	₹ 54,12,000.00
										SUB-TOTAL	**₹ 30,47,22,660.00**
	SUMMARY										
I	**CHROME EFFLUENT TREATMENT**										₹ 11,42,055.00
II	**CYANIDE EFFLUENT TREATMENT**										₹ 9,51,405.00
III	**HIGH TDS EFFLUENT- PRIMARY TREATMENT**										₹ 1,87,14,450.00
IV	**LOW TDS EFFLUENT- PRIMARY TREATMENT**										₹ 1,75,02,900.00
V	**COMBINED LOW TDS & MEE CONDENSATE EFFLUENT- BIOLOGICAL & TERTIARY TREATMENT**										₹ 30,47,22,660.00
										SUB-TOTAL	**₹ 34,30,33,470.00**
1	Interconnecting Piping & Fittings @ 15%										₹ 5,14,55,020.50
2	Automation @ 15%										₹ 5,14,55,020.50
3	Electrical panel @ 10%										₹ 3,43,03,347.00
4	Electrical works @ 15%										₹ 5,14,55,020.50
5	Stripper, MEE & ATFD System										₹ 56,15,00,000.00
										TOTAL	**₹ 1,09,32,01,878.50**
1	Commissioning of Equipments @ 5% (I to V and Item 5)										₹ 4,52,26,673.50
	TOTAL									**GRAND TOTAL**	**₹ 1,13,84,28,552.00**

6.9 Drawing No. 101 : Layout Plan of 5 MLD CETP

PROPOSED LAYOUT OF 5MLD CETP AT ATCHUTAPURAM (PLOT NO. 65, 33.75 Acre)

Area Statement for Proposed 5MLD CETP, APSEZ Atchutapuram.		
Description	**Sq.M**	**Acre**
Green Belt @ 25%	34,334	8.48
Roads	16,595	4.10
Area for future Expansion	3,264	0.81
Plant Built up Area	82,074	20.28
Total Area	136,601	33.75



NOTE :-

1. All dimensions are in Meter unless otherwise specifically mentioned.
2. All levels are in meters and are with respect to mean sea level.
3. The arrangement and sizing have been arrived on the design requirements and will be confirmed during detailed design.
4. The dimensions and arrangements shown in this drawing are tentative only.
5. In general all sizes & dimensions are indicative and could vary during detailed design.
6. The geotechnical details are taken from isopachs provided by client.

N W E S

QUALITY ASSURANCE

Verification of accuracy, correctness and completeness in respect of design analysis and drawings are assured by respective design consultant.

Name				
Date				
Signature				
	Designed By	Drawn By	Checked By	Approved By

CLIENT:

M/s ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED
Vijaywada, Andhra Pradesh

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TECHNICAL CONSULTANTS:

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Project Title
DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

Drawing Title: LAYOUT PLAN OF 5MLD CETP

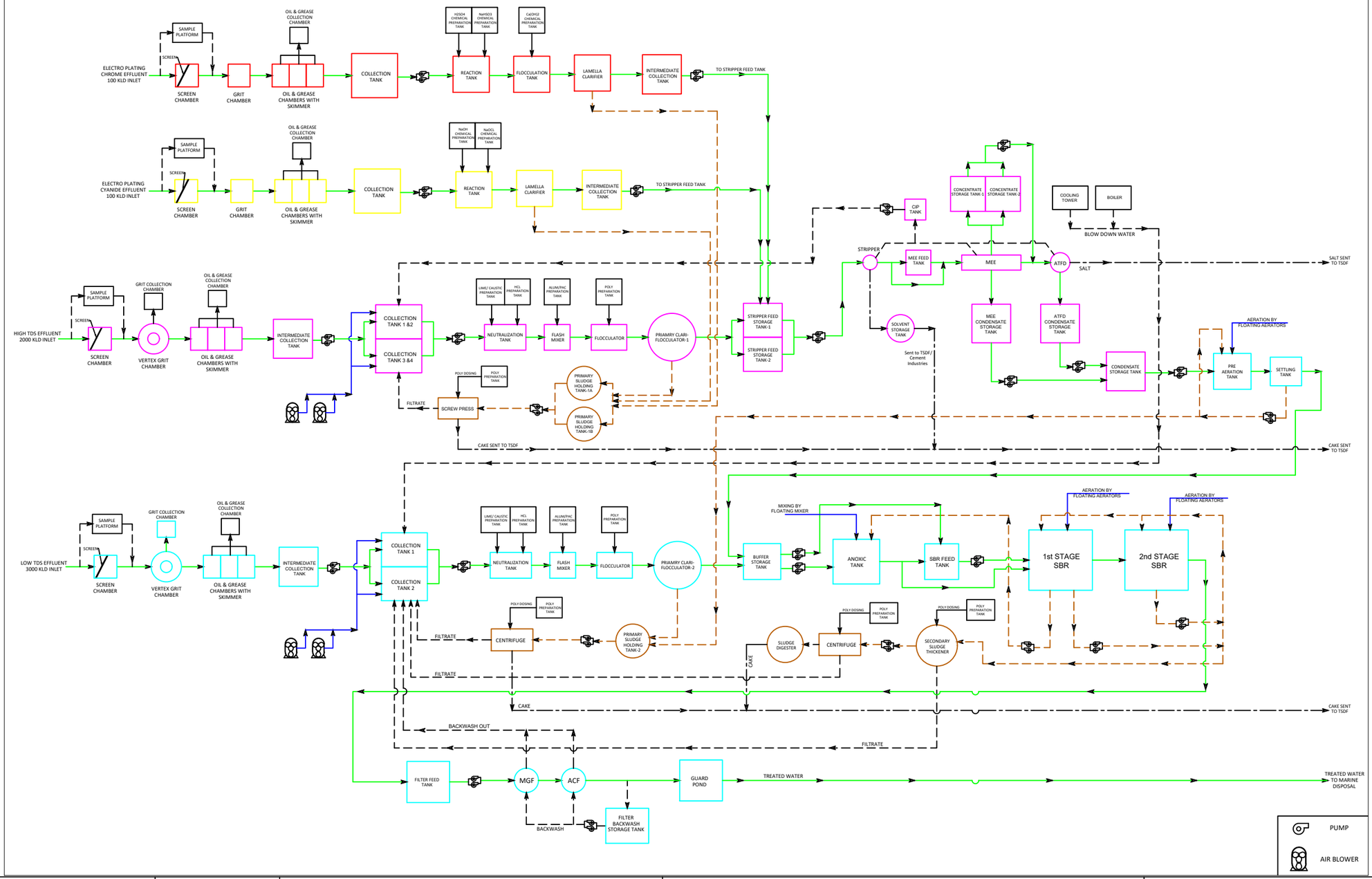
Revision Note :-

Drawing No.: 101

Date	Sheet No.	Scale	Sheet Size	Rev.
07-06-2021	1 of 1	1:2000	A3	1.0

6.10 Drawing No. 201 : Process Diagram of Proposed 5 MLD CETP

PROCESS FLOW DRAWING OF 5MLD COMMON EFFLUENT TREATMENT PLANT



Note :-

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Drawing Title
PROCESS FLOW DIAGRAM

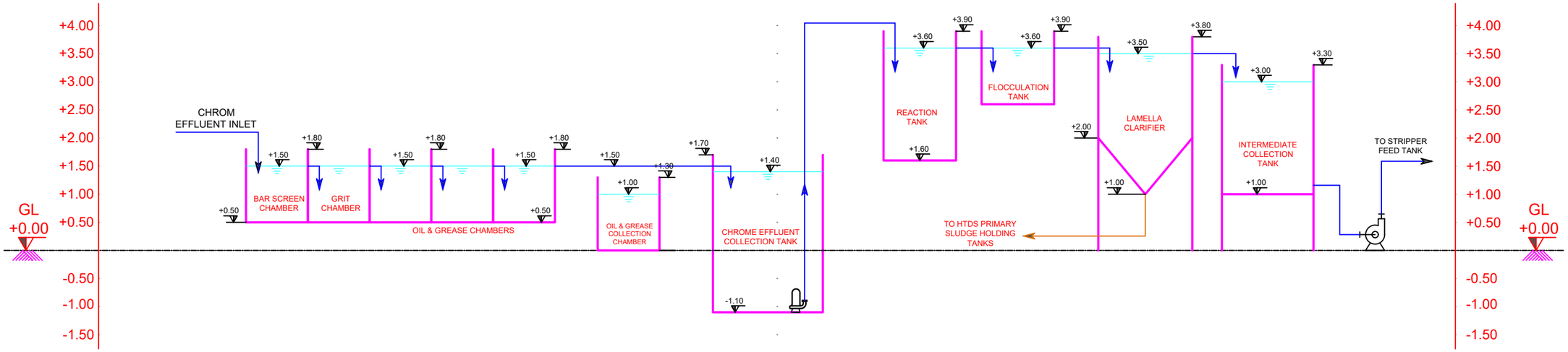
Revision Note :-

Drawing No.
201

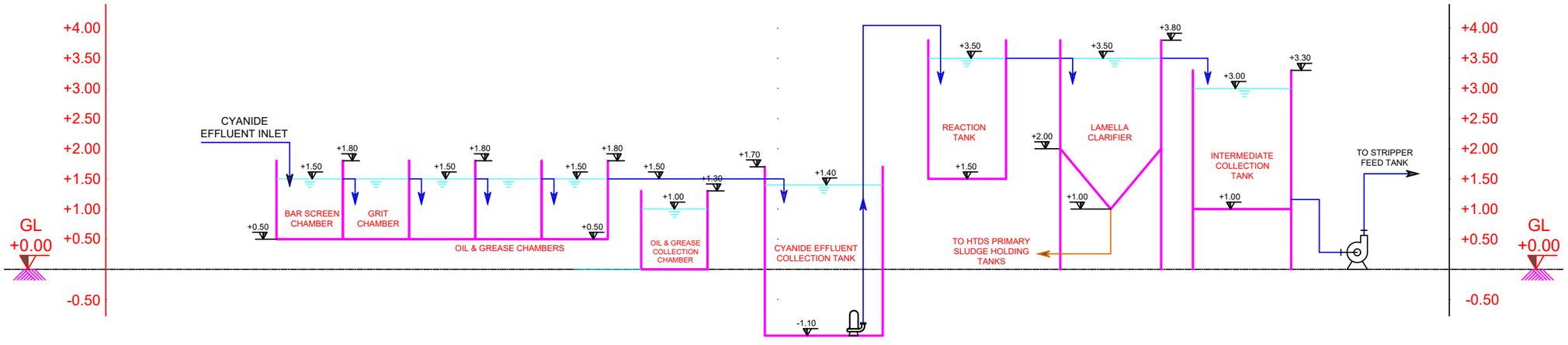
Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	1 of 1	NTS	A3	1.0

6.11 Drawing No. 301 to 304 : Hydraulic Flow Diagram of Proposed 5 MLD CETP

HYDRAULIC FLOW DRAWING FOR CHROME EFFLUENT



HYDRAULIC FLOW DRAWING FOR CYANIDE EFFLUENT



Note :-

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Project Title

DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

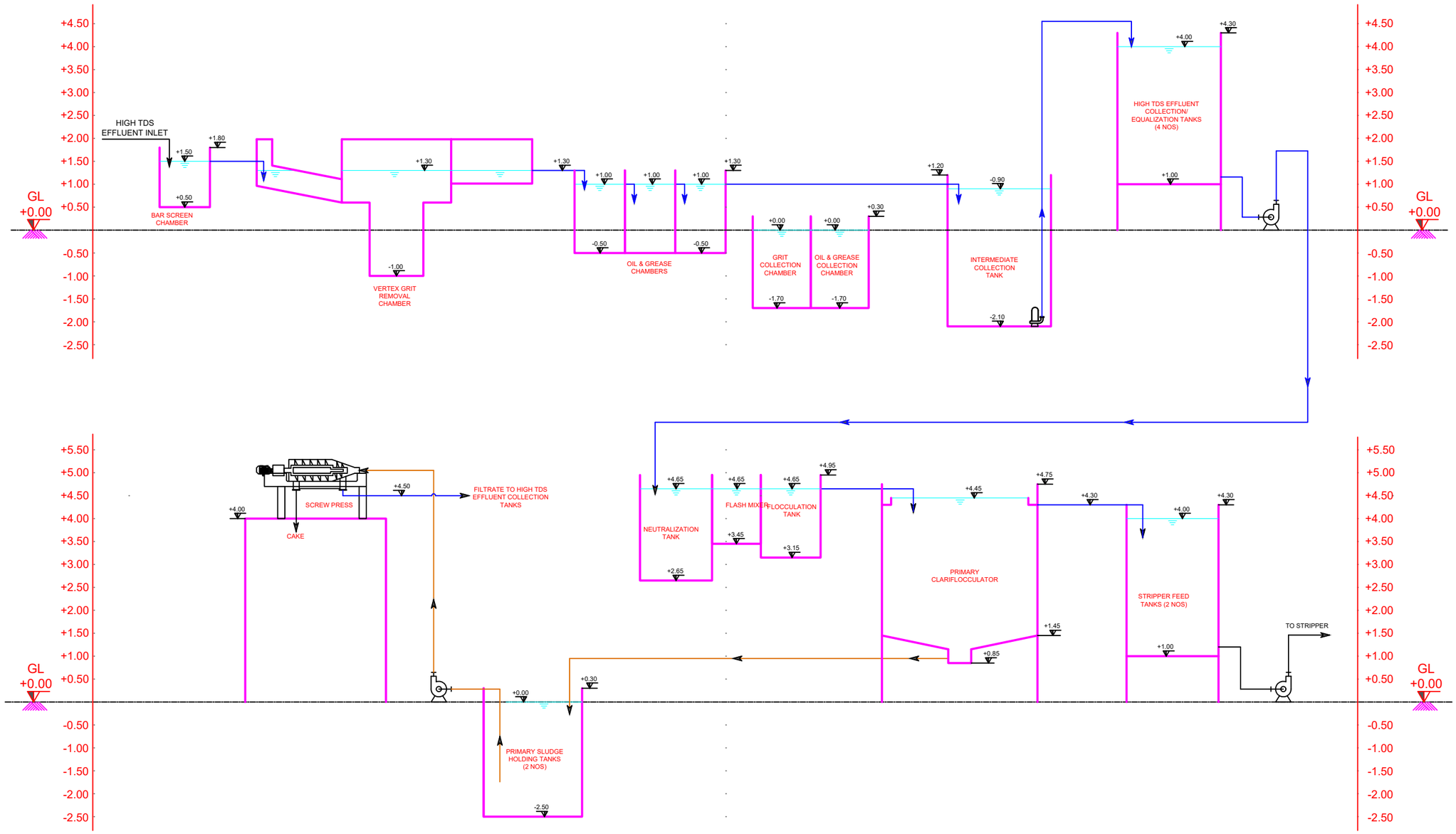
Drawing Title: HFD

Revision Note :-

Drawing No.: 301

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	1 of 4	NTS	A3	1.0

HYDRAULIC FLOW DRAWING FOR HIGH TDS EFFLUENT - PRIMARY TREATMENT



Note :-

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Date				
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	Designed By	Drawn By	Checked By	Approved By

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DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

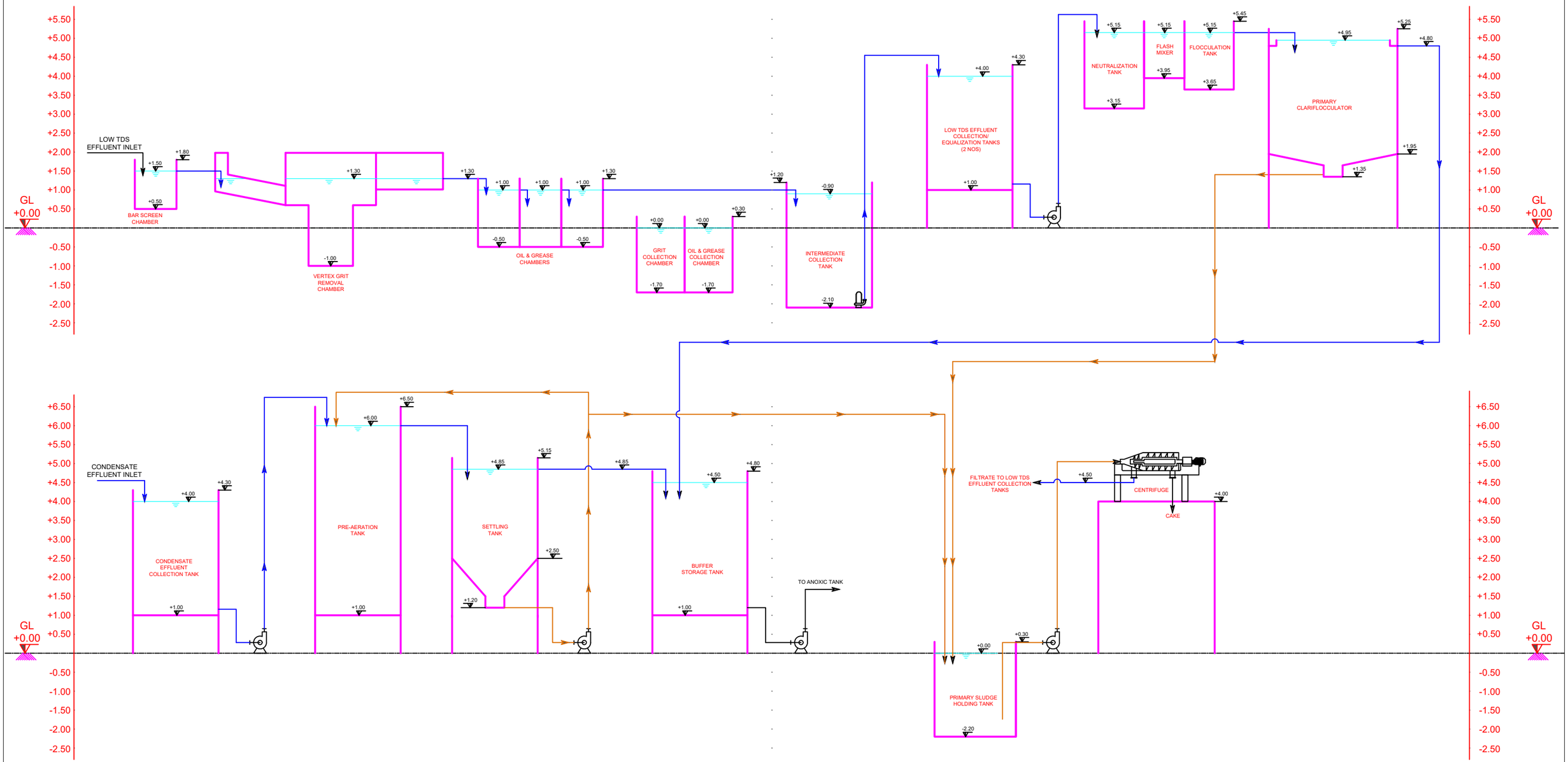
Drawing Title: HFD

Revision Note :-

Drawing No.: 302

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	2 of 4	NTS	A3	1.0

HYDRAULIC FLOW DRAWING FOR LOW TDS EFFLUENT - PRIMARY TREATMENT



Note :-

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Project Title: DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

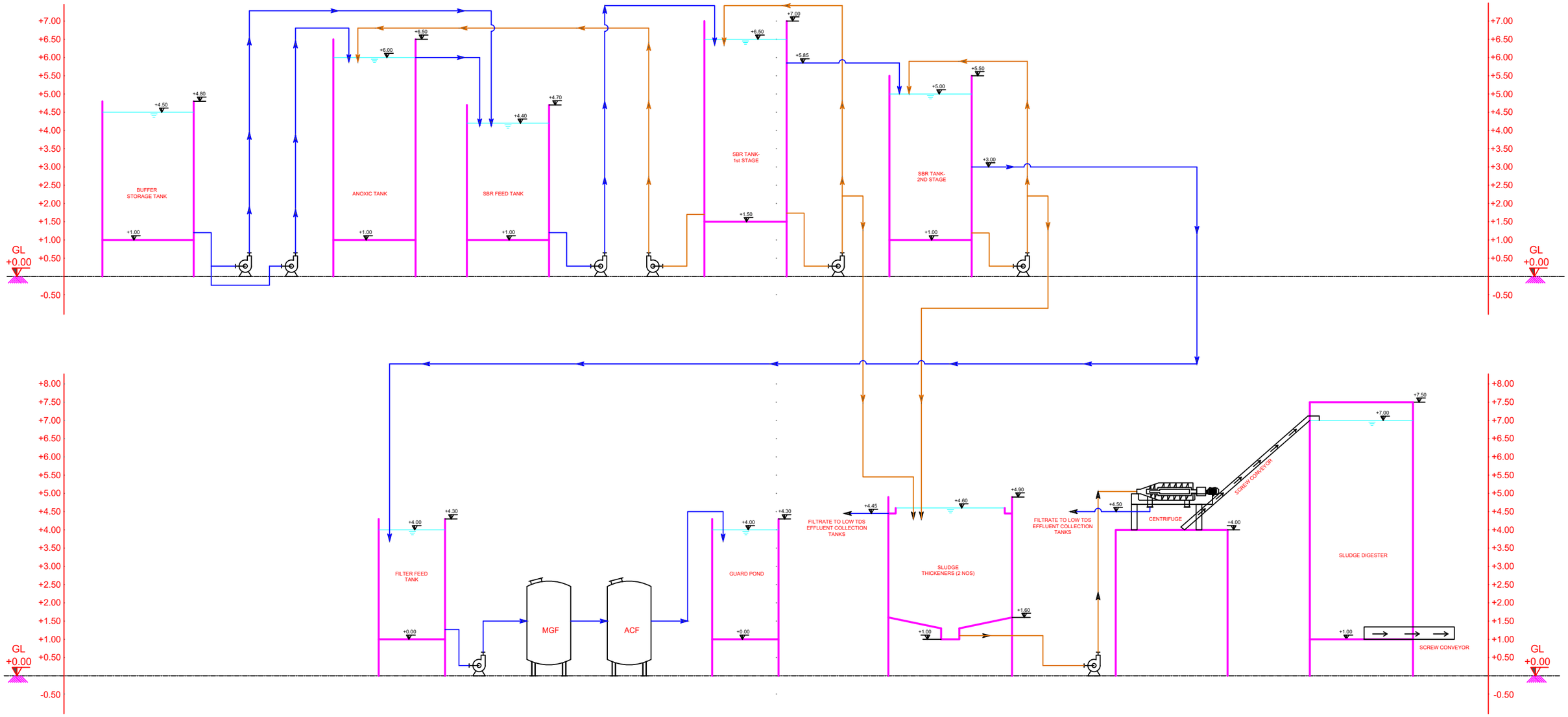
Drawing Title: HFD

Revision Note :-

Drawing No.: 303

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	3 of 4	NTS	A3	1.0

HYDRAULIC FLOW DRAWING FOR LOW TDS EFFLUENT - SECONDARY & TERTIARY TREATMENT



Note :-

All levels are in Meters.

N W E S

QUALITY ASSURANCE

Verification of accuracy, correctness and completeness in respect of design analysis and drawings are assured by respective design consultant.

Name				
Date				
Signature				
	Designed By	Drawn By	Checked By	Approved By

CLIENT:

M/s ANDHRA PRADESH INDUSTRIAL INFRASTRUCTURE CORPORATION LIMITED
Vijaywada, Andhra Pradesh

TECHNICAL CONSULTANTS:

INDO-GERMAN INSTITUTE OF ADVANCED TECHNOLOGY (IGIAT)
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Project Title

DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

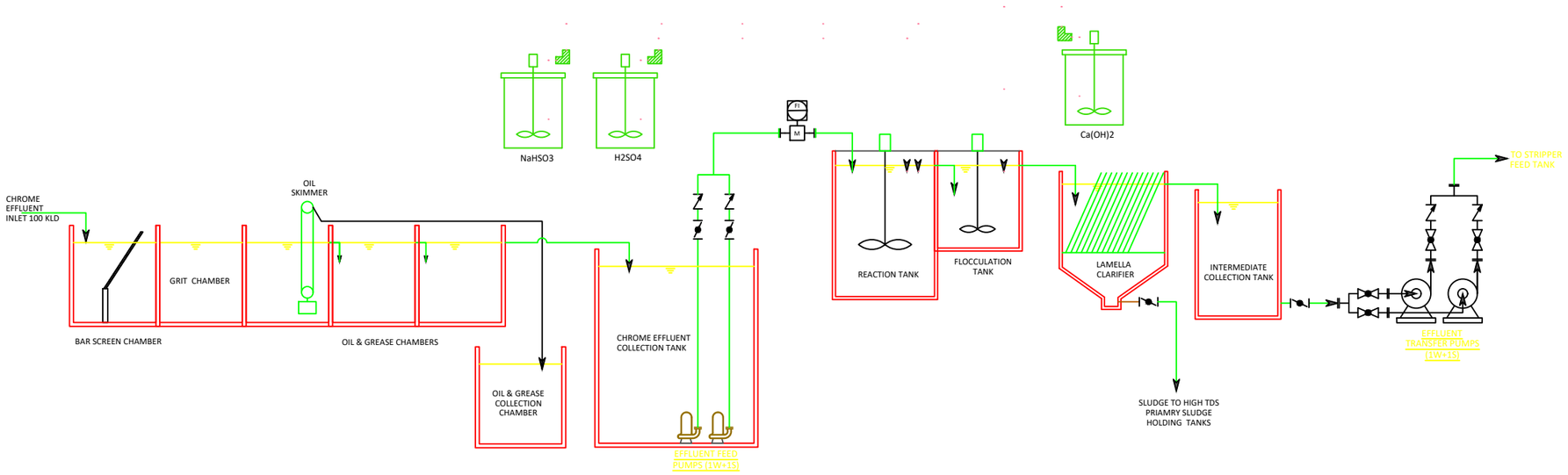
Drawing Title	Revision Note :-
HFD	

Drawing No. 304

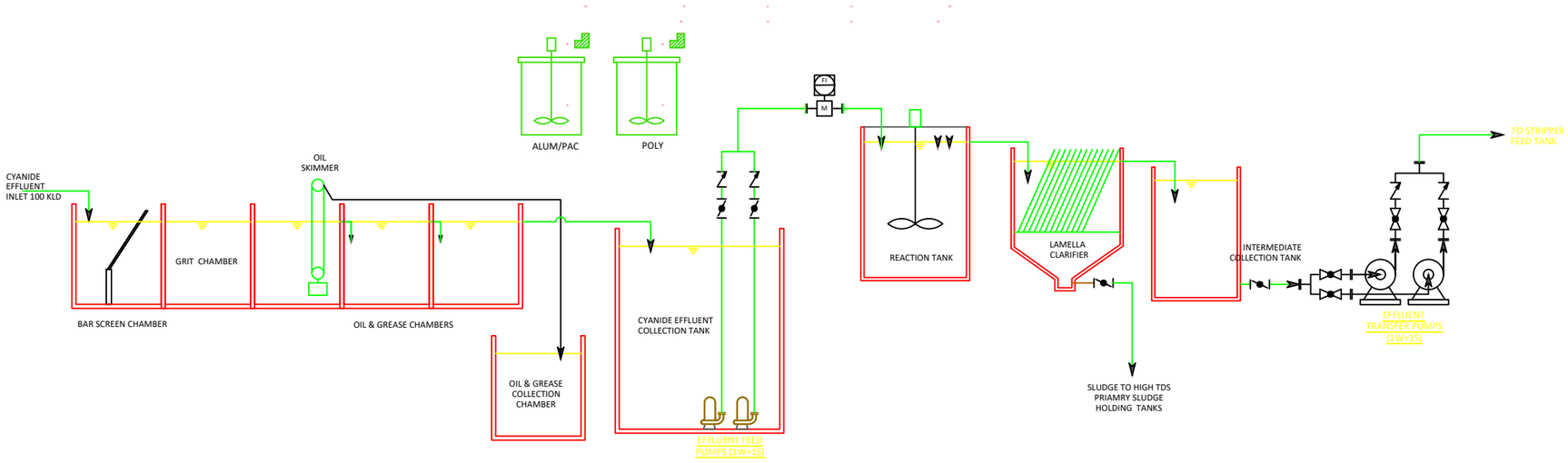
Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	4 of 4	NTS	A3	1.0

6.12 Drawing No. 401 to 404 : P & ID Diagram of Proposed 5 MLD CETP

P & I DRAWING FOR 100KLD CHROME EFFLUENT



P & I DRAWING FOR 100KLD CYANIDE EFFLUENT



Note :-

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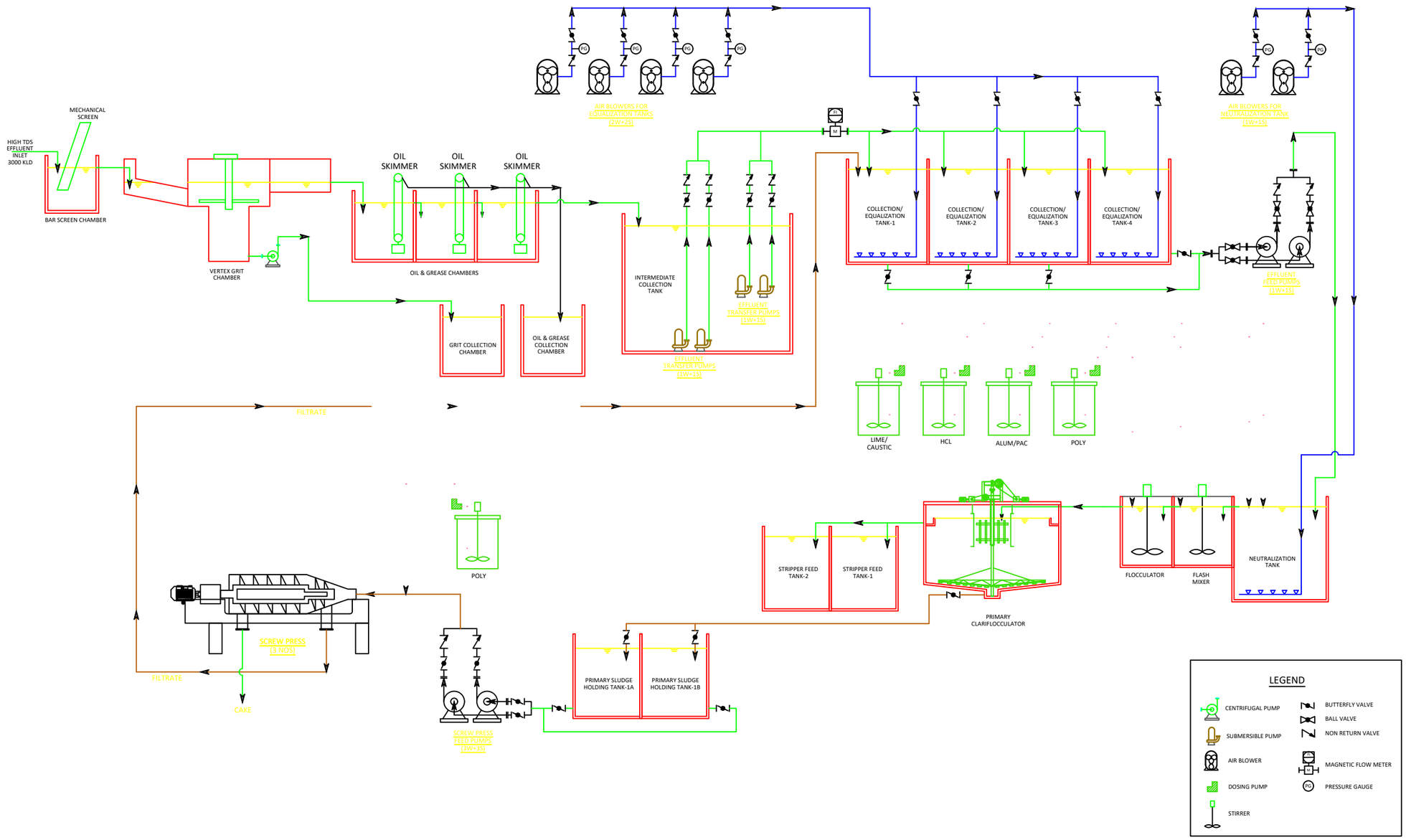
Drawing Title: P & ID

Revision Note :-

Drawing No.: 401

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	1 of 4	NTS	A3	1.0

P & I DRAWING FOR 3000KLD HIGH TDS EFFLUENT- PRIMARY TREATMENT



Note :-

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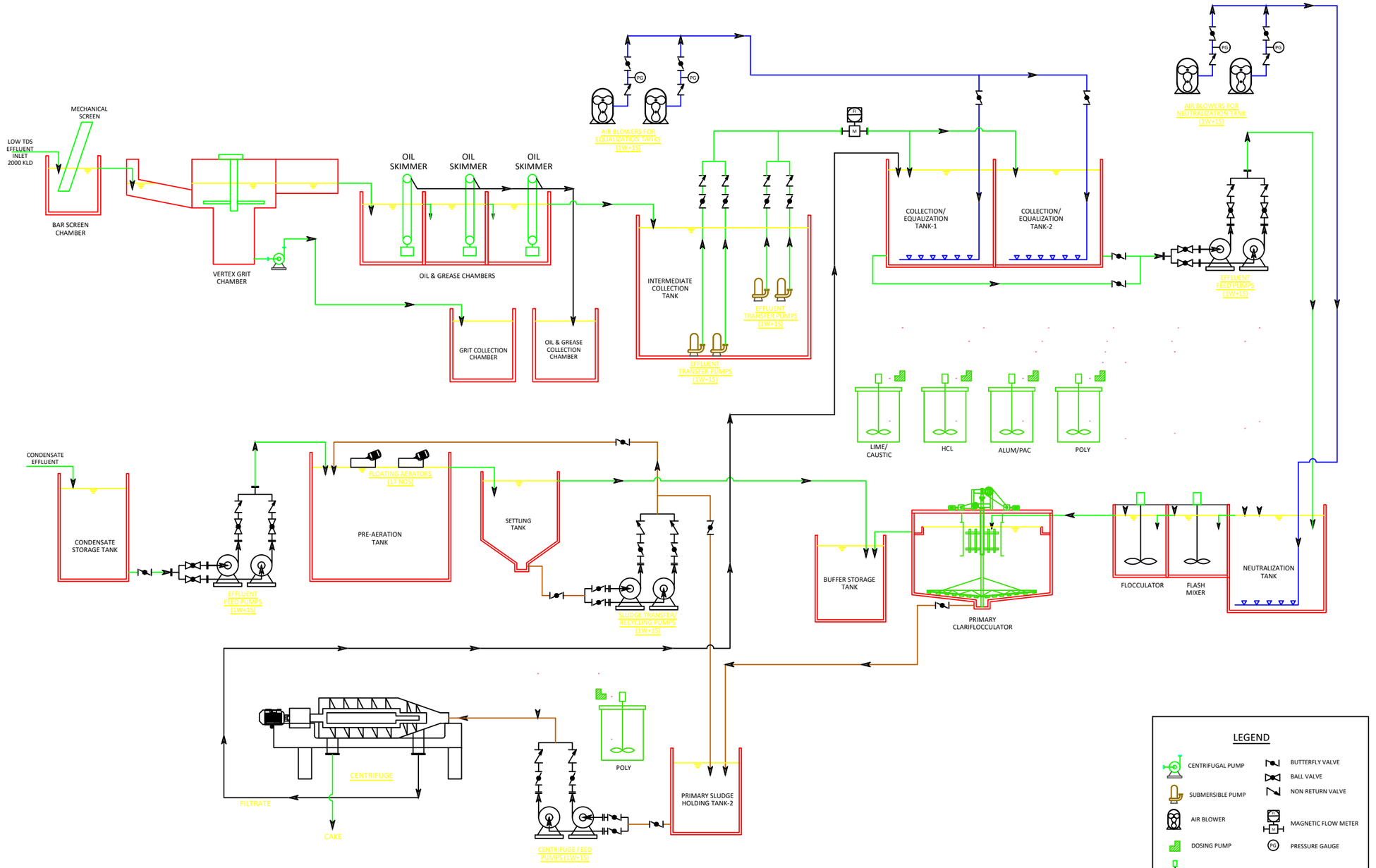
Drawing Title: P & ID

Revision Note :-

Drawing No.: 402

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	2 of 4	NTS	A3	1.0

P & I DRAWING FOR 5000KLD LOW TDS & CONDENSATE EFFLUENT- PRIMARY TREATMENT



LEGEND

- CENTRIFUGAL PUMP
- SUBMERSIBLE PUMP
- AIR BLOWER
- DOSING PUMP
- STIRRER
- BUTTERFLY VALVE
- BALL VALVE
- NON RETURN VALVE
- MAGNETIC FLOW METER
- PRESSURE GAUGE

Note :-

N W E S

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Date				
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DETAILED PROJECT REPORT ON ESTABLISHMENT OF 5 MLD COMMON EFFLUENT TREATMENT PLANT (CETP) AT APSEZ, ATCHUTHAPURAM, VISAKHAPATNAM DISTRICT, ANDHRA PRADESH

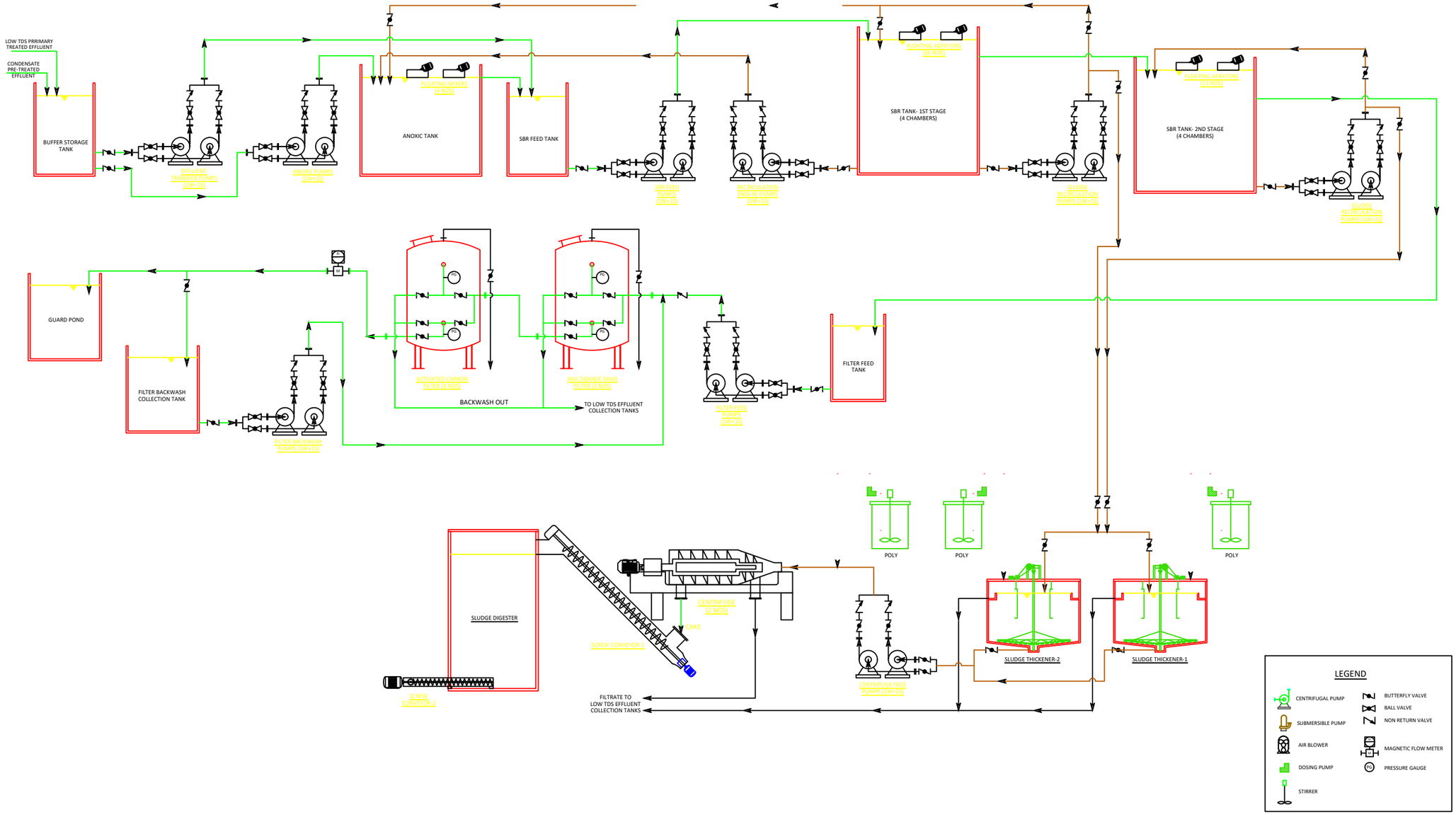
Drawing Title: P & ID

Revision Note :-

Drawing No.: 403

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	3 of 4	NTS	A3	1.0

P & I DRAWING FOR 5000KLD LOW TDS & CONDENSATE EFFLUENT- SECONDARY & TERTIARY TREATMENT



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Drawing Title
P & ID

Revision Note :-

Drawing No.
404

Date	Sheet No.	Scale	Sheet Size	Rev.
22-05-2021	4 of 4	NTS	A3	1.0