A Small Scale waste Water Treatment Plant and Proposal for its Establishment over Raipur Institute of Technology Premises

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***Abstract*: Water is one of the world‟s most valuable resources, yet it is under constant threat due to climate change and resulting drought, explosive population growth, and waste. One of the most promising efforts to stem the global water crisis is industrial and municipal water reclamation and reuse. The WateReuse Association defines reused, recycled, or reclaimed water as "water that is used more than one time before it passes back into the natural water cycle." Thus, water recycling is the reuse of treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, toilet flushing, or replenishing a groundwater basin (referred to as groundwater recharge). Water reuse allows communities to become less dependent on groundwater and surface water sources and can decrease the diversion of water from sensitive ecosystems. Additionally, water reuse may reduce the nutrient loads from wastewater discharges into waterways, thereby reducing and preventing pollution. This „new‟ water source may also be used to replenish overdrawn water sources and rejuvenate or re-establish those previously destroyed. The objective of this project is to give insight into the appropriate technology for treatment of wastewater. This project covers and discusses the sustainable wastewater treatment system targeting the small community such as Colleges, School, Commercial complex etc. where a small Wastewater Treatment Plant can be established with the optimum effluent standards and cost.**

Keyword – water treatment, cost of work, different units in water treatment plant.

Introduction

Over the last few decades, India has witnessed a rapid increase in the urban population. It is estimated that 50% of the population in India will be in urban centres by the year 2050. The growing population invariably exerts tremendous pressure on the existing natural resources. In fact, a glance at the statistics provided in the „Global Environment Outlook‟, Report reflects on the grim future of India in term of its natural resources. „Water Resources‟ is one of the major future concerns for India as per the report and several other research papers. The major issues concerning „Water Resources‟ in India can be broadly classified into issues of water quantity (availability) and quality, for use in the domestic, industrial and service sectors. A look at the present scenario, with respect to these two aspects, gives an overview of the existing problems and provides a platform for improvement in terms of strategic point of view. As per the 9th Plan Working Group document, the coverage of urban population for drinking water and sanitation could not be raised as planned due to a rapid rise in urban population and inadequate plan outlay, besides the marked shift in the priority from urban to rural sector. The issue of adequate quantity, quality and the distance of the nearest available source is emerging to be the most contentious issue with regard to urban water supply. Per capita water supply grossly varies from 40 litres per capita per day (lpcd) to 200 lpcd.

Necessity of the Project

This project was studied and performed under 5 divisions:

1. Study of the need arouse for the treatment of waste water.
2. Study for the basics of waste water treatment plant along with the standard criterions.
3. Conducting survey over the area where plant can be established.
4. Collection of waste water sample at regular interval of days.
5. Performing tests over the collected samples and analysing the results.
6. Calculation were performed to compute the technical specifications and the space requirement for each unit was calculated.
7. Cost analysis was done for each unit and the base of pricing was referred from the quotations being requested to the leading vendors in this field.

Methodology

The methodology adopted for designing of Wastewater treatment plant needs a systematic approach which includes collection and study of various data‟s.

The various steps involved for designing the Wastewater Treatment plant should be under following heads:

1. Study and analysis for the requirement of wastewater treatment plant.
2. Estimation of total wastewater generated.
3. Analysis of conveyance system and other treatment process already present in the premises.

4. Calculation of daily load and peak load for the premises.
5. Detailed Study of the basic processes necessary for the treatment of waste water.
6. Collection and testing of the Wastewater sample from the premises.
7. Deciding the effluent standards desired after the treatment process as per its use and within the CPCB limits. 8. Designing different units for the treatment process. 9. Computing the area required for each unit.
10. Studying the contour values and elevations for the premises and deciding appropriate location for the establishment of Wastewater plant.
11. Drawing schematic diagrams for the designed treatment plant.
12. Performing cost analysis for the project.
13. Analysing and suggesting for any future expansion of the project.

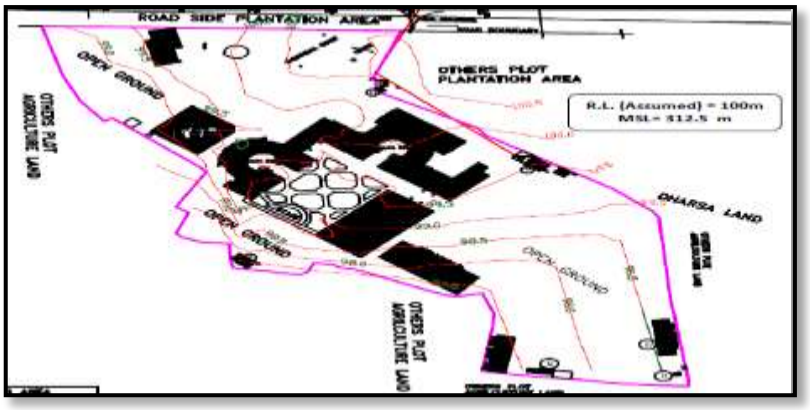

Figure:1 Contour Plan of RITEE Premises (Red Lines)

Parameters	**Standard Parameter IS 10500-1991**	**RITEE Waste Water** Discharge
pH	5.5-9.0	6.94
BOD (mg/L)	100	230.7
Turbidity (NTU)	50-60 NTU	167.7
COD (mg/L)	250	354.3
Oil and grease (mg/L)	10	1.22
Total Suspended Solids (mg/L)	200	213.3

Table no 1Wastewater Parameters Value

Waste Water from RITEE Building
Total Number of persons = 1500

As per standards laid down by the CPHEEO (Central Public Health Environmental & Engineering Organisation), the fresh water consumption per day per person for educational building should be between 70 litres per day. It is officially expressed as "litres per capita daily" (lpcd). By and large public water supply and sewerage bodies/authorities all across the country use the former figure to work out probable water consumption. When water is consumed by people living in a particular complex without access to an underground sewerage/drainage system. The amount consumed is estimated to be **70 lpcd** . The total quantity of waste water reaching the plant would be **75%** of the supplied water (i.e. No. of residents x 70 litres x 0.75) comes into a sewage treatment plant(STP), and , this total volume has to be treated by the STP. Waste Water generated from RITEE building: 1500 x 70 x 0.75 lpcd = **78,750 lt/day**

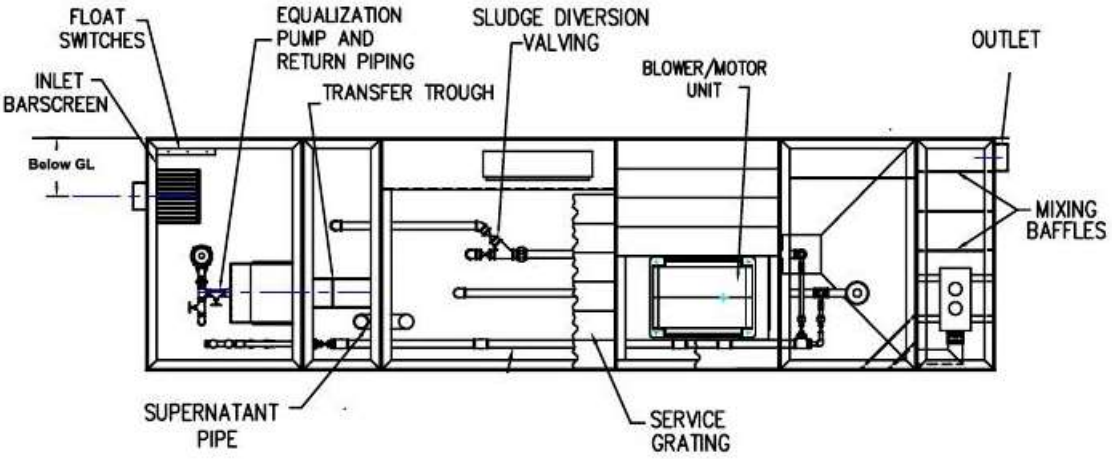

Figure:2 Top View of plant

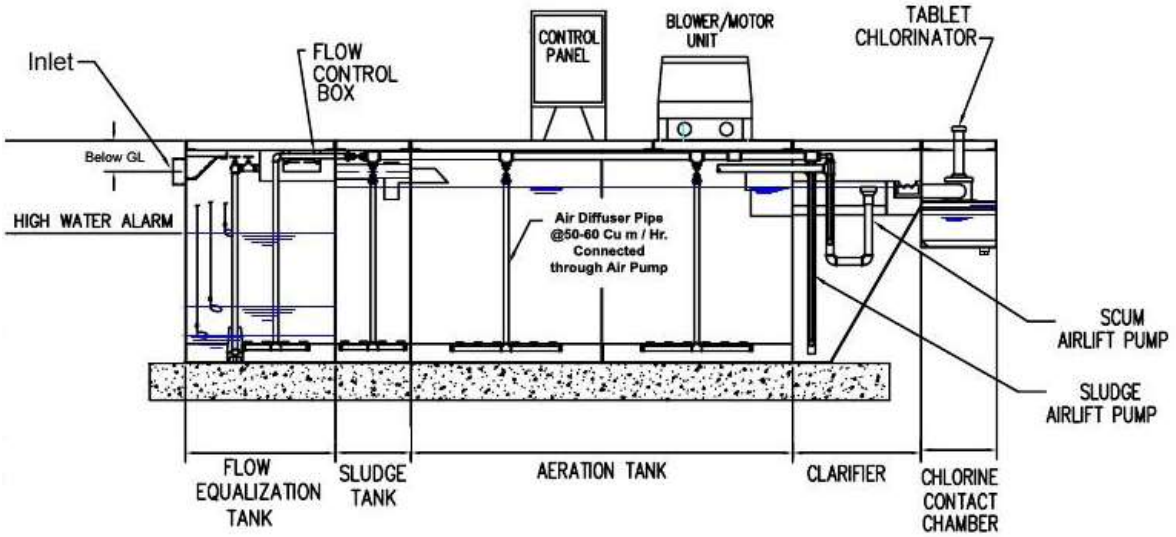

Figure:3 Side view of plant

Table no 2 Different unit size and capacity

Model Number	Plant Capacity	Screen Size	Aeration Tank Volume	Equalization Tank Volme	Clarifier Volume	Total Area Required (Approx)	Filters	
							PSF	ACF
RITEE-1	120 KLD	10mm	86 Cu. m	30 Cu. m	22.5 Cu. m	60-65 Sq. m	0.75 Cu. m	0.75 Cu. n

Table:3 Design Summary of Wastewater Treatment Plant

Parameter	**Designed Values**
1. Plant Capacity	120 KLD
2. Installation Units	1
3. Screens	1. Coarse Screen: 16mm Bar@80 mm c/c 2. Fine Screen: 10 mm Bar@20mm c/c 3. Size= 0.1m x 0.1m
4. Equalization Tank	1. Area=15m2 (5m x 3m) 2. Depth=3.5m
5. Pump	Capacity= 6m3/hr
6. Aeration Tank	1. BOD Load/day= 30 kg/day 2. Air Requirement=95m3/hr 3. F/M=0.12 4. Area= 30 m2 (10m x 3m) 5. Depth=3.6m
7. Clarifier Tank	1. SLR= 2.33 kg/m2 2. Volume= 22.5 m3(5m x 3m x 1.5m) 3. HRT= 4.5 Hrs
8. Pressure Sand Filter	1. Filtration Rate= 6 m3/hr 2. Diameter(min)= 0.8 m 3. Height=1.5-1.8 m 4. Depth of Sand Layer= 0.6-0.75 m
9. Activated Carbon Filter	1. Filtration Rate= 6 m3/hr 2. Diameter(min)= 0.9 m 3. Height=1.5-1.8m 4. Depth of Carbon Layer= 0.6-0.75m
10. Sodium Hypo Dosing System	1. Chlorine Dose/day=0.6 kg 2. Hypo Dose/day (10% Strength)=6 kg/day 3. Volume= 50 Litres
11. Sludge Dewatering System	1. BOD Removal= 30 kg/day 2. Volume= 0.42m x 0.42m x 0.02m
Total Area Required= 60 to 65m2	

Table:4 Showing Cost of Each Unit of Wastewater Treatment Plant from Vendors

Units	Vendor-1 (INR)
Screening Chamber	90,000
Oil and Grease Trap	65,000
Equalization Tank	4,30,000
Raw Sewage Lift Pumps	2,80,000
Aeration Tank	4,40,200
Secondary Clarifier/ Settling Tank	1,00,000
Sludge Recirculation	1,10,000
Pressure Sand Filter (PSF)	80,000
Activated Carbon Filter (ACF)	NA
Disinfection Of Treated Water	1,73,000
Electroplating System	NA
Total Cost (INR)	**17,68,200/-**

Table No 5 Cost Vs Output Parameters

Parameters	**Standard Parameter IS 10500-1991**	**RITEE Waste Water** Discharge	**Vendor-1 Output Discharge** 17,68,200 INR
pH	5.5-9.0	6.94	6.0-8.0
BOD (mg/L)	100	230.7	< 30 mg/L
Turbidity (NTU)	50-60 NTU	167.7	50-60 NTU
COD (mg/L)	250	354.3	<120 mg/L
Oil and grease (mg/L)	10	1.22	< 1 mg/L
Total Suspended Solids (mg/L)	200	213.3	< 30 mg/L

Conclusion

The conclusion drawn from the project is:

The total area required for the establishment of 120 KLD plant over the RITEE premises serving the population of 1500 would be around 60-65 m2.

Minimum Cost of Establishment of Wastewater plant as per the requested quotation is 15,75,000/- whose effluents are within the standard limits as per laid by Central Pollution Control Board and is appropriate for the gardening and horticulture purpose.

Since the slope of RITEE ground surface is towards the backside of the college, therefore the proposed location for establishing the Wastewater treatment plant should be at the back side of the college.

Large volume of water can be saved by the establishment of Wastewater plant which can be used during dry season to nourish the greenery of the premises.

The treatment of waste water plant over the RITEE premises can save more than 3 Crore 65 Lakh litres of water in a year which is enough to serve more than 2 Lakh 70 thousand of the population in a day.

By establishing Wastewater treatment plant load over the tube wells or bore holes can be reduced to large extent which in turn increases the ground water level and also increases the specific yield of the ground surface.

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