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Analyze and Design of Sewer System in Randal Village as a Case Study

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Abstract- A detailed study on domestic waste water characterization has been performed followed by the design of sewage treatment The present study involves the analysis of pHvalue, total solids, total suspended solids, hardness, acidity, alkalinity chloride, chlorine, BOD,DO and heavy metals such as Iron, Copper, Zinc, Magnesium, Nickel, chromium, Lead, Calcium, Aluminium, Silicon, potassium. A Sewage treatment plant is quite necessary to receive the domestic and commercial wastes and removes the materials which pose harm for general public. Its objective is to produce an environmental safe fluid waste stream and solid waste suitable for disposal or reuse.

The average values of pH, chloride, acidity, turbidity, residual chlorine, alkalinity, DO, Total Solids, BOD, Hardness are found out. A sewage treatment plant has been designed with the treatment units such as bar screen of dimension 1.7m, an aeration tank of dimension 4.5x4.5x3.7m3,a collection pit of diameter 4m and depth 5m.The samplings of the domestic waste from hostel and college have been collected in different times of the day to have an average data of the measured parameters. A sewage treatment plant has been designed with the treatment units, a bar screen of dimension 4.5x4.5x3.7m.

The increasing demand for water in combination with frequent drought periods, even in areas traditionally rich in water resources, puts at risk the sustainability of current living standards. In industrialized countries, widespread shortage of water is caused due to contamination of ground and surface water by industrial effluents, and agricultural chemicals. In many developing countries, industrial pollution is less common, though they are severe near large urban centres. However, untreated or partially-treated sewage poses an acute water pollution problem that causes low water availability.

Global trends such as urbanization and migration have increased the demand for water, food and energy. Development of human societies is heavily dependent upon availability of water with suitable quality and in adequate quantities, for a variety of uses ranging from domestic to industrial supplies and Rapid industrialization is adversely Impacting the environment globally. Pollution by inappropriate management of industrial wastewater is one of the major environmental problems in India as well, especially with small scale industrial sector in the country.

I. INTRODUCTION

A. General

In every villages or city wastes of different types such as spent water from bath room, kitchen, laboratory basins and street washing from various industrial .process, semi-liquid waste and animal excreta, dry refuse of house and street sweeping, Brocken furniture cookery waste from industries etc. are produced daily. If proper arrangement for the collection, treatment and disposal of all the waste produced from the two village are not made, they will go on accumulating & create such foul condition that the safety of the structure such as building, roads will being danger due to accumulation of the spent water in their foundation. In addition of this disease spread & bacteria will breed up in stagnate water & the health of the public will in the danger, all the drinkable water will be polluted. Total insanitary condition will be developed in the village & it will become create difficulties for public to live in villages.

Therefore in the interest of community of the village it is most essential to collect, treat & dispose of all the waste products of village. If domestic sewage is not treated and disposed as it is, then it may lead to following ill effects:- Sewage causes un-sanitary conditions in locality this may also breeds bacteria mosquitoes etc. & cause health hazards. The sewage is generally disposed of in a nearby water coarse or land. This will cause the water to be polluted and cause danger and discomfort to the people living downstream Thus to prevent pollution and to maintain healthy environment and human life, sewage treatment and disposal is essential.

B. Sources on Sanitary Sewage

1) Water supplied to the public for domestics purpose by the local authority.
2) Water supplied to the various industries for various industrial processes by the local authority.

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3) Water drawn from wells by individual houses for their domestic proposes.
4) Water supplied to the local authority to varies publics places such as schools, hotels etc.
5) Unauthorized entrance of rain water in sewer.

C. Factor affecting Sanitary Sewage

1) Rate of water supply
2) Population.
3) Types of area served as residential, industrial, or commercial
4) Ground water infiltration.

D. Aims & Objects Of Project

1) If proper disposal of human excreta to a safe place, before starts decompositions and may cause insanitary conditions in locality.
2) To take out the all kind of waste water from the locality, immediately after its uses so that mosquitoes, fillers, bacteria etc. may not breed in it and cause nuisance.
3) Final disposal of sewage on land or in nearby water course after some treatment so that receiving land or water may not get polluted and unsafe for its further use.
4) As far as possible the fertilizer elements of sewage farming & getting some income in addition to the disposal of sewage
5) If the sewage is disposed off on on the land it should have such a degree of treatment that it may not affect the sub-soil in any way.

D. General Information

The village Rendal is situated at **25** Km to the south of Hatkanangletahsil place S.T. bus service, post office, primary school societies, floor mill, collection centers these facilities are available in this village, main occupation of the villagers is farming and main crop is sugarcane.

E. Configuration

General slope from west to east in Ramnagararea , The difference highest and lowest level is 5 m.

F. Population Forecast

Population of the village as per 2016 census is 2500and prospective population in 2066 is 5150.

G. Rate of Water Supply & Daily Demand

It is proposed to supply 135lit/head/day as per present norms & the daily demand will be 538080 lit/Day including 20% transit losses.

II. STUDY AREA

Rendal is the big village. This is situated near the Hupari.Tal-Hatkangale.Dist-Kolhapur. When we got this project firstly we visited to rendal village and observed all the drainage system in ramnagar area. In that area all the domestic water are carrying though the Bangiol Directly towards the outside area of village.

Ramnagar area is the one of populated area in rendal village. But drainage system is not properly provided in that area. Because the entire domestic water in that area are collected in small drain which is provided at backside of every house. Means one small drain are passing between two houses. And then this waste water are conveying though the small gutter and then joining to the main nallah which is provided along the Ichalkarngi-Kolhapur highway.

A. Population Forecasting

Sr.No	Method	2066	Feasible population

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1	Arithmetical Mean Method	5150	
2	Geometrical Increase Method	5130	
3	Incremental Increase Method	5225	5150

We have preferred 5150population of 2066 as feasible population.

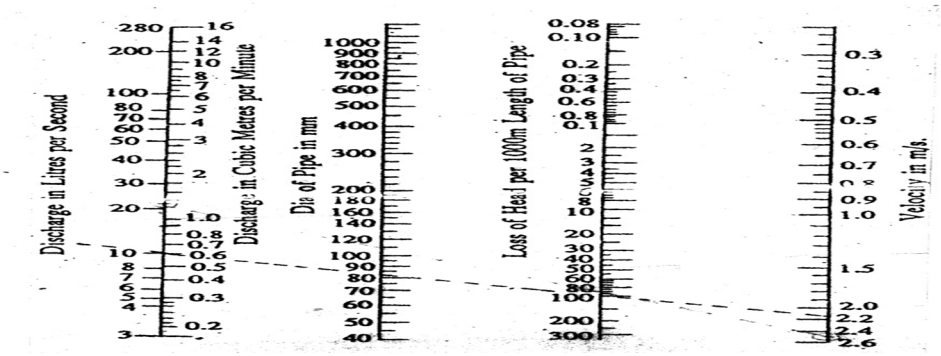
III. DESIGN OF SEWER

Population of village = 5150
Water supply = 135 lit/sec.
Discharge as sewage = 0.85 times of av. Supply
= 0.85 x 135
= 114.75 lit/sec.
Peak factor = 3.5 - (From Table No. 1)
∴ Peak discharge = 115 x 3.5
= 402.5 lit/sec.
Total Peak discharge = 402.5 x5150
= 2072875 lit/day
= 1439.49 lit/minute
= 1.439 m^3/minute
= 23.99 lit/sec.
= 0.024 m^3/sec.

A. Design of Sewer by 'Nomograms'

1) Main Line:

Total peak discharge = 2072875 lit/day
i.e. Total peak discharge = 1.439 m^3/minute
∴ Discharge θ^1 = 1.439m^3/minute
Maximum velocity = 2.5 m/sec. (From Table No. 6)
A.C. pipes are used
Gradient = 1:120
Roughness factor = 0.013 - (From Table No. 2)
By using 'Nomograms'
Dia of pipe = 190 mm
But as per Recommendation public sewer diameter should not be less than 200mm so provide 200 mm dia. pipe.



Nomograms for design of pipes

B. Design of Sewer by Arithmetic Method

1) Population of Village : = 5150

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2) Water Supply: = 135 lit/sec
3) Discharge as Sewage: = 0.85 times av. Supply
= 0.85 x 135
= 114.75 lit/sec.
Say 115 lit/sec.
4) Peak Factor : = 3.5 - (Table No. 1)
∴ Peak discharge = 115 x 3.5
= 402.5 lit/sec.

5) Total Discharge: = 402.5 x 5150
= 2072875 lit/day
= 1439.49 lit/minute
= 23.99 lit/sec.

Q= 0.024 m^3/sec.

C. Sewer Pipe for Main Pipe Line
Now Q = 0.024 m^3/sec.
V = 2.5 m/sec - (From Table No. 6)
Now
Q = A x V
∴ 0.024= A x 2.5
∴ $\frac{0.024}{2.5}$ = A
∴A=9.6x 10^{-3} m^2

But A = $\frac{\pi}{4} D^2$ - for circular sewer
∴9.6 x 10^{-3}= $\frac{\pi}{4}$ x D^2
∴ D^2 = $\frac{9.6 \times 10^{-3} \times 4}{\pi}$
∴ D^2 = 0.0122 m
∴ D = $\sqrt{0.0122}$
∴ D = 0.110 m

∴ D = 110 mm

But as per is provision
Sewerdia. is not less than 200mm so provide **200mm** dia. sewer pipe.

IV. MODEL APPLICATION AND DISCUSSION

In that project we design a Screening, Grit Chamber, Dia.of Sewer and Treatment Plant
A. For design purpose forecasted population is 5150 for the year 2066.

B. Sewer Pipe Design
Velocity- 2.5 m/s
Discharge- 0.024 m^3/sec
Dia. Of sewer – 200mm

C. Grit Chamber Design

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Length = 12 m
Breadth = 0.5 m
Depth = 1.3 m

D. Circular Sedimentation Tank

Dia. D = 10.5 m &
Depth d = 2 m (effective)

E. Sludge Digestion Tank

Circular sedimentation tank having dia.- D = 6 m
Depth d = 6 m.

V. CONCLUSIONS

In every villages or city wastes of different types such as spent water from bath room, kitchen, laboratory basins and street washing from various industrial .process, semi-liquid waste and animal excreta, dry refuse of house and street sweeping, Brocken furniture cookery waste from industries etc. are produced daily.

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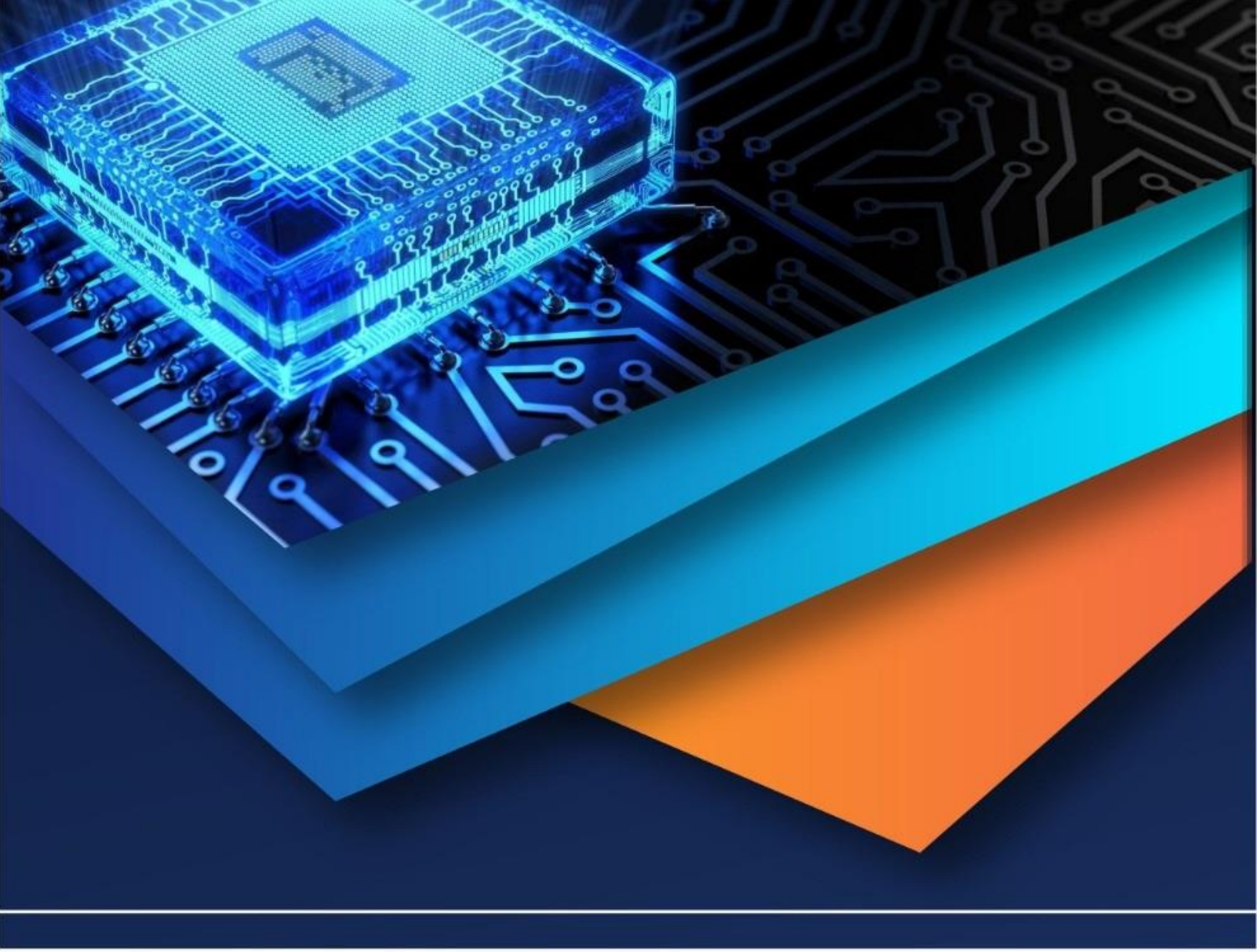

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