

OPTIMAL DESIGN OF OPEN DRAINS AND SEWAGE TREATMENT PLANT IN VIZIANAGARAM MARKET AREA

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ABSTRACT

The world is in such a condition that global warming is increasing and rainfall is decreasing. Due to the low rainfall, water scarcity is attacking the people day by day mostly in urban areas. Vizianagaram is one of such areas where water scarcity is more and no proper drainage system is available to collect the rain water. Also the environment is unhygienic at the city centre, where 500cusec of sewage water is filled in the peddha tank near the clock tower. This project attempts to design the efficient and economic drainage system for market area as well as sewage treatment plant to reduce the sewage and to develop the Vizianagaram city centre. Storm & waste water collected into the drains is connected to the sewer pipe at sewage treatment plant. Manning's equation computes channel velocity, rational method is used to compute the discharge of the drain. Arithmetic increase method is used to calculate the population which is used for sewage generation for design of STP.

KEYWORDS: *Manning's equation, most economical drain, open drains, rational method, and Sewage treatment plant.*

I.INTRODUCTION

The practice of storm water management and sewage water management has evolved significantly over the last twenty years. A good and efficient storm water management is badly required at the moment all over the universe especially in developing countries like India. The idea of efficient storm water & sewage water management is based on the requirement to protect the health of the public, welfare and safety of the public, conservation of water, need to strive for sustainable etc., Generally storm water drains are designed to carry the maximum storm runoff that is likely to be produced by the contributing catchment area from a rain of designed frequency and of duration equal to the time of concentration.

Sewage implies the collecting of waste water from occupied area and conveying them to some point of disposal. The liquid wastes will require treatment before they are discharged into the water body or otherwise disposed of without endangering the public health or causing offensive conditions.

Sewage treatment is the process of removing the contaminants from waste water and household sewage, both runoff (effluents) and domestic. It includes physical, chemical and biological process to remove physical, chemical and biological contaminants. Its objective is to produce a treated effluent and a solid waste or sludge suitable for discharge or reuse back.

II.OBJECTIVE OF THE STUDY

Considering the above facts the present study has been planned with the following objectives.

1. To provide economical and efficient open drains to Vizianagaram market area and also sewage treatment plant to reduce the sewage and to develop Vizianagaram city center.
2. To calculate the rainfall intensity by past 20 years rainfall data.
3. To calculate discharge by rational method to design the drain cross section.
4. To estimate the volume of sewage water generated during the different periods from Vizianagaram rural and urban areas.
5. To estimate the volume of sewage water to be generated during the next 30 years from Vizianagaram rural and urban areas.
6. To design the primary sewage treatment units for the estimated sewage discharge and to reuse the water for irrigation purpose and sludge as fertilizer.



Fig.1 present condition of Peddha tank

III. TESTS CONDUCTED TO THE SEWAGE WATER:

- Determination of PH value
- Determination of total solids
- Determination of total dissolved solids
- Determination of biochemical oxygen demand
- Determination of chemical oxygen demand
- Determination of nitrates
- Determination of nitrites.

Water coming from the Railway station area Peddha tank water: (conducted in college laboratory)

TABLE:1

S.NO	PARAMETER	RESULT
1.	PH	8.5
2.	Total dissolved solids	960ppm
3.	Total suspended solids	40ppm
4.	B.O.D	86.25mg/l

TABLE:2

S.NO	PARAMETER	RESULT
1.	PH	8.35
2.	Total dissolved solids	560ppm
3.	Total suspended solids	20ppm
4.	B.O.D	67.25mg/l

TESTS CONDUCTED IN LOTUS GRANGES (INDIA) Ltd. RECOGNISED BY GOVT. OF INDIA & MINISTRY OF ENVIRONMENTAL & FOREST MOEF (Notification No: S.02728(E)) An ISO 9001:2008, OSHAS 180001:2007 & CENTRAL DRUGS STANDARD CONTROL ORGANISATION & DRUG CONTROL OF A.P APPROVED LABORATORY.

TABLE.3 Sample-1: For peddha tank water

S. NO	Parameter	Unit	Method	Result
1	Ph	H+ Conc	IS 3025:P-11	8.25
2	Nitrates	Ppm	EPA	38
3	Total dissolved solids	Ppm	IS 3025:P-16	980
4	Total suspended solids	Ppm	IS 3025:P-17	35

5	BOD	mg/l	IS 3025:P-44	80
6	COD	mg/l	ASTM D 1252	150
7	Nitrites	Ppm	IS 3025:P-34	0.02

TABLE.4 Sampe-2: Water from

railway area

S. NO	Parameter	Unit	Method	Result
1	Ph	H+ Conc	IS 3025:P-11	8.10
2	Nitrates	Ppm	EPA	25
3	Total dissolved solids	Ppm	IS 3025:P-16	580
4	Total suspended solids	Ppm	IS 3025:P-17	25
5	BOD	mg/l	IS 3025:P-44	60
6	COD	mg/l	ASTM D 1252	130
7	Nitrites	Ppm	IS 3025:P-34	0.05

IV.SEWAGE TREATMENT

Sewage treatment is the process of removing contaminants from wastewater and household sewage, both runoff (effluents) and domestic. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce a treated effluent and a solid waste or sludge suitable for discharge or reuse back into the environment.

The treatment of sewage consists of many complex functions. The degree of treatment depends upon the characteristics of the raw inlet sewage as well as the required effluent characteristics.

Treatment processes are often classified as:

- (i) Preliminary treatment
- (ii) Primary treatment
- (iii) Secondary treatment
- (iv) Tertiary treatment.

V.CALCULATION OF SEWAGE GENERATION

Vizianagaram population in 2011 = 55,255

TABLE.5 Present and after 30 years' population calculations

Year	% increase per 10years	Population
2017	2.5	56700
2021	3.05	58400
2031	4.05	60800
2041	5.10	63910
2047	5.70	67600

Sewage treatment plant designed for 30years.

TABLE.6 Designed population = 70000

S.No (col.1)	Population (col.2)	Per capita demand in liter/day/person (col.3)	Per capita sewage production in liter/day/person (80% of col.3)
1	Less than 20000	110	90
2	20000-50000	110-150	90-120
3	50000-2 lakhs	150-180	120-150
4	2 lakhs-5 lakhs	180-210	150-170
5	5 lakhs- 10 lakhs	210-240	170-190
6	Over 10 lakhs	240-270	190-200

Per capita water demand = 180 liter/day/person

Per capita sewage production = 150 liter/day/person

Designed population = 70000

Total sewage generated per day = $150 \times 70000 = 10.5$ MLD

DESIGN OF RECEIVING CHAMBER:Receiving chamber is astructure to receive the sewage collected through underground sewage system.it is a rectangular shaped tank constructed at the entrance of the sewage treatment plant. The main sewer pipe is directly connected with this tank.

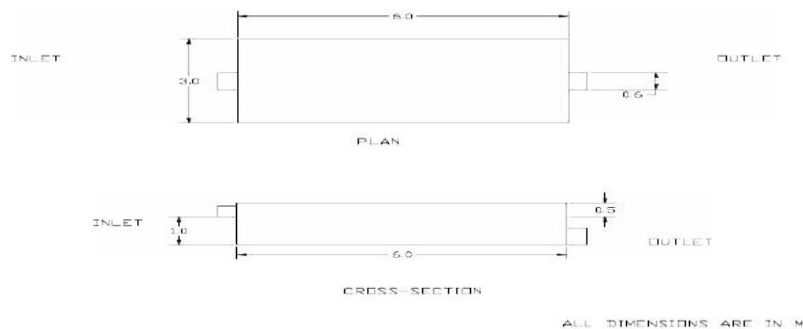


Fig.2 Receiving chamber

For a discharge of 10.5 MLD Provide receiving chamber 6m x 3m x1.5m

DESIGN OF SCREENS: Sewage contains suspended and floating matter in it. The suspended matters are of large size such as tree leaves papers, gravel, timber pieces etc as well as small size such as sand and silt etc. the large size suspended and floating matter such as oils greese etc are removed through screens

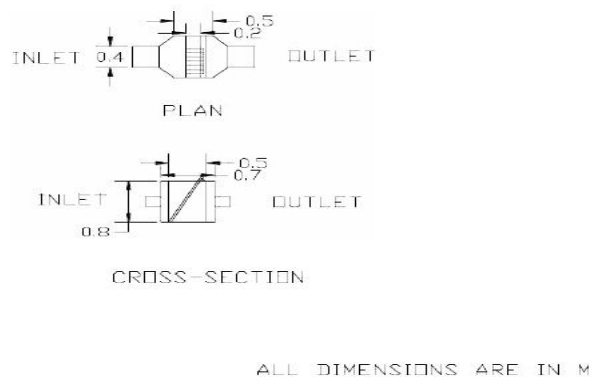


Fig.3 Screens

For a discharge of 10.5 MLD Provide Bar screens of 10mmX50mm of clear spacing 50mm with an inclination of 60°

DESIGN OF GRIT CHAMBER: The sewage contains large amount of gritty substance in addition to other matter. The main source of grit are industrial wastes, kitchen, storm water runoff pumping from excavation and ground water seepage. Grit must be removed before pumping of sewage to the other treatment units otherwise it will cause an obstruction to the flow.

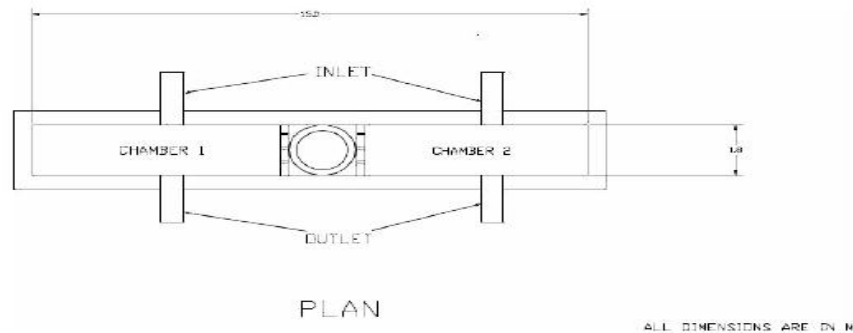


Fig.4 Grit chamber

For a discharge of 10.5 MLD Provide grit chamber 15m x 1.8m x1.3m with free board

DESIGN OF SKIMMING TANK: These tanks are used for removing oil, grease and fats of sewage. When compressed air is circulated, the oily matter rise upward and are collected in the side where they are removed.

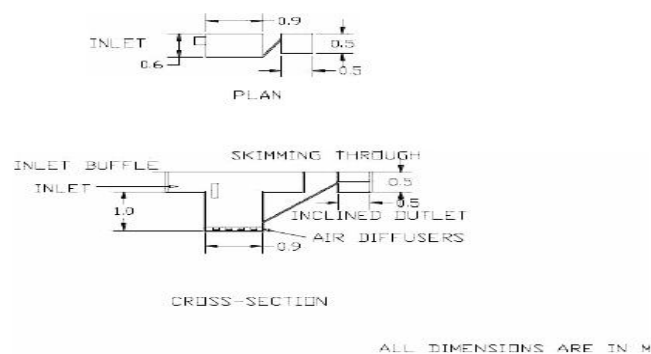


Fig5. Skimming tank

For a discharge of 10.5 MLD Provide skimming tank 0.9m x 0.6m x1.0m with free board

DESIGN OF PRIMARY SEDIMENTATION TANK: The primary sedimentations are located after the screens and grit chambers. The sewage is passed through the primary sedimentation before the biological treatment in order to separate the settable solids.

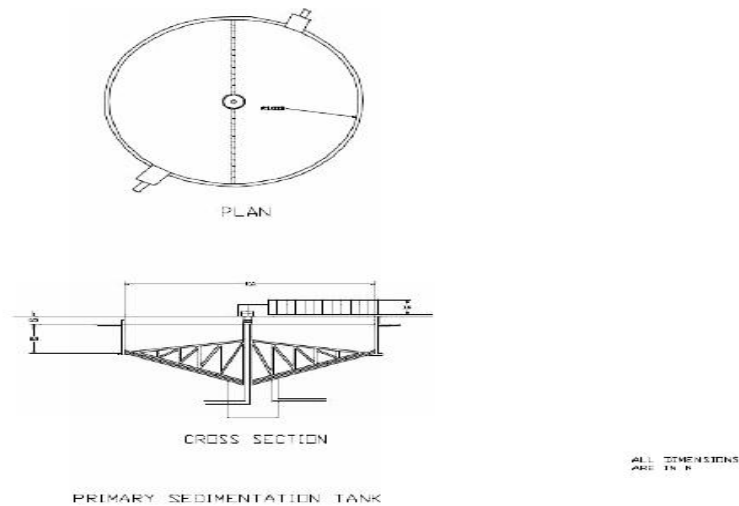


Fig.6 Primary sedimentation tank

For a discharge of 10.5 MLD Provide primary sedimentation tank 11m diameter and 2.5m depth with free board

DESIGN OF AERATION TANK: It is the process of bringing water in intimate contact with air, while doing so the water absorbs oxygen from the air. The carbon dioxide gas is also removed upto 70% and upto certain extent, bacteria is also killed. Iron, manganese and H₂S gas are also removed upto certain extent from the water.

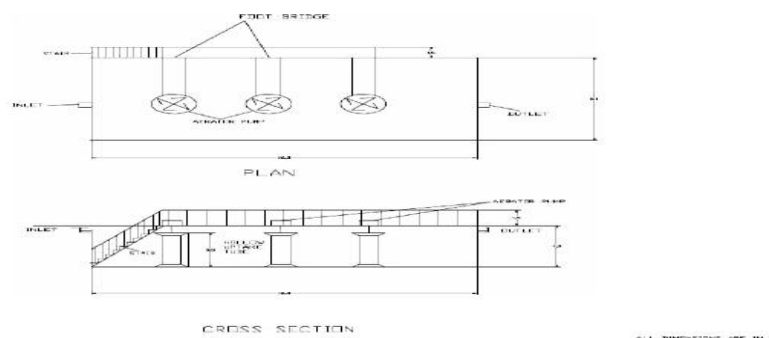


Fig.7 Aeration tank

For a discharge of 10.5 MLD Provide aeration tank of 15mx8m x 4m with free board

DESIGN OF SECONDARY SEDIMENTATION TANK: The effluent from the primary sedimentation tank contains about 60 to 80% of the unstable organic matter originally present in sewage. This colloidal organic

matter, passes the primary clarifiers without settling there, has to be removed by secondary sedimentation tank, is carried out by changing the character of the organic matter, thus converting it into stable form like nitrates, sulphates etc.. Secondary sedimentation tanks are designed to work on aerobic bacterial decomposition for discharge of 10.5MLD, provide secondary sedimentation tank of 25m diameter and 3m depth with free board.

DESIGN OF SLUDGE DIGESTION TANK: The sludge digestion wears the organic matter of the sludge into liquid and simple compounds which are stable and unfoul in nature. A portion of the solids is converted into liquid and gasses due to which the volume of the sludge is reduced by 60-75%. The moisture content of the sludge cannot be reduced, but after its digestion it can be removed without any difficulty.

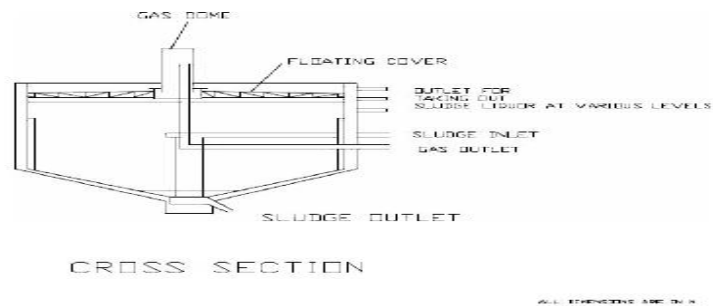


Fig.8 Sludge digestion tank

For a discharge of 10.5 MLD Provide sludge digestion tank of 11m diameter and 6m depth with free board.

OPEN DRAINS: The drains are used for conveying less foul water from kitchens, bathrooms, rain water from washing places, roofs, etc., except the foul discharge from water closets. The surface drains will provide cheap arrangement for collecting sullage and storm water. These are less hygienic.

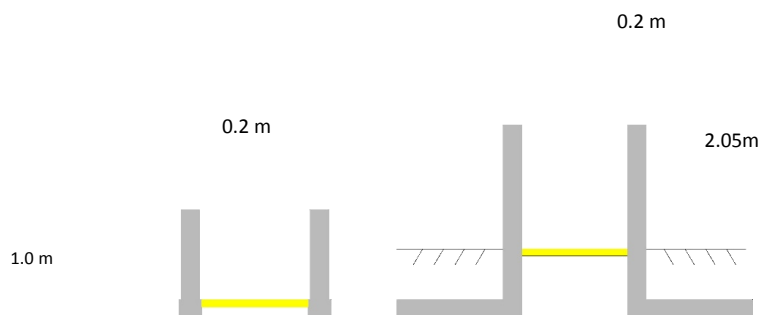


Fig.9 C/s of Sub drain Fig.10 c/s of main drain

VII.CONCLUSION

Storm water from the market area is collected into the drains and then it is transferred to sewer which is connected to treatment plant. After the treatment process, water from the peddha cheruvu is diverted to the agriculture land. From the outlet also the surrounding area of peddha cheruvu is used for recreational purpose.

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