WASTE WATER MANAGEMENT FOR SMALL VILLAGE

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ABSTRACT

One of the most challenging tasks in developing countries is proper management of wastewater. Water is a main source as it is the life of all living things. The large quantity of water is required to fulfill the daily needs of human beings. In many villages the main source of water is the river only due to the fact that in summer they face the water problem. In the village a large amount of wastewater is produced on their daily routine work and they don't have proper arrangement of wastewater management. Globally, over 80 percent of all the waste water is discharged without any treatment.

This study aims to plan the waste water management system in the village areas and treat it, so that villages can fulfill their need of water for the domestic purpose or for agricultural work.

For treating the waste water DEWAT and Root Zone System are used commonly and these techniques are economical and suitable for the village with chambers and soak pits. It is more effective technique for waste water management in the rural areas. This study is more efficient and suitable for small villages. This method will be an alternative technique for waste water management for rural areas.

Keywords: *Waste Water Management, Reuse of waste water, Leach Pit, DEWAT, Root Zone System, Development of Small Village, Economical Waste Water Treatment.*

1. INTRODUCTION

Wastewater is defined as "used water from any combination of residential, commercial, industrial, or agricultural activities, surface runoff or storm water and any sewer inflow or sewer infiltration." Because of this, wastewater is a waste product from home, industrial, commercial, or agricultural activity. Depending on the source, waste water's quality changes. Domestic wastewater from homes, municipal wastewater from communities (often referred to as sewage), and industrial wastewater are among the different types of wastewater. Pollutants in wastewater might be biological, chemical, or physical.

Wastewater is frequently treated on-site by different sanitation systems in developing nations and rural areas with low population densities rather than being transported through sewers. These systems include vermi filtration systems, On-Site Sewage Systems (OSS), and septic tanks connected to drain fields.
Wastewater Types e.g. Black water, Gray water, and Yellow Water are the three basic categories of wastewater.

Presently 70% of India's wastewater is dumped into the environment untreated, contaminating surface and ground water sources and endangering the health of the general population. The policy guidelines for wastewater, effluent, and sewerage treatment are in place, but they need to be implemented better and more successfully on the ground. The accelerated urbanization The main problem is, recycled water can meet most water needs as long as it is sufficiently treated to ensure water quality suitable for use, but in villages there are no treatments and it is circulated openly on the ground, which is more hazardous to health. As a result, we can reuse the water by developing various methods and treatments. The aim of the study is to create waste water management methods through various business chambers for the villages' sustainable growth and the objectives after the study and survey of the village's current waste water route and its results' limitations, create fresh technique for enhancing village sewage, and demonstrate the financial benefits of the created technique.

2. LITERATURE REVIEW

Reviewing and evaluating the current research in order to use recycled waste water involves determining its applicability to any project to go ahead.

The reuse initiatives that have been put into place have typically been done on a modest scale and are typically intended for non-potable uses such landscape irrigation, agricultural or horticultural irrigation, industrial water recycling, residential garden irrigation, and toilet flushing. Only a small number of social studies have been done so far in relation to these reuse programmers.

Findings from literature survey

- With the aid of all the articles in the literature review, we were able to gather the following inputs for our projects.

- The region has a problem with wastewater disposal due to faulty drainage, which leads to accumulation and water logging that put locals at risk for a number of vector-borne diseases.
- This resulted in accumulation and water logging, exposing the locals to a number of vector-borne diseases.
- By creating soak pits that could be constructed with locally available materials and with little assistance.
- The filtering process, which separates solid waste, cleans wastewater, and eventually replenishes the water table with groundwater free of contaminants.
- Rural areas undertake programs for managing wastewater and water used for non-potable purposes.

3. CASE STUDY

The following data was gathered from the Case study Village Grampamchayat shown in Table No. 1:

Table No. 1 Village Data

Sr. No	Census Parameter as per census 2011	Census Data
1.	Total Population	6844
2	Total No of Houses	1346
3.	Female Population%	50.7% (3342)
4.	Total Literacy rate%	76.5% (5046)
5.	Female Literacy rate	36.7%(2422)
6.	Scheduled Tribes Population%	1.1%(72)
7.	Scheduled Caste Population%	7.7%(511)
8.	Working Population%	44.4%
9.	Child (0-6) Population by 2011	728
10.	Girl Child (0-6) Population % by 2011	47.4 %(345)
	Population As per base line survey 2021	7276 souls

3.1 Current Waste Water Management System of the Village

- There are individual septic tanks used.
- Water from septic tanks flows directly into gutters.
- There are no shared wastewater treatment facilities in the community
- The dumping of septic sludge poses serious risks to human health and the environment.

Fig. 1 Waste water at the Gaonthan End

Fig. 2 Village Google Map

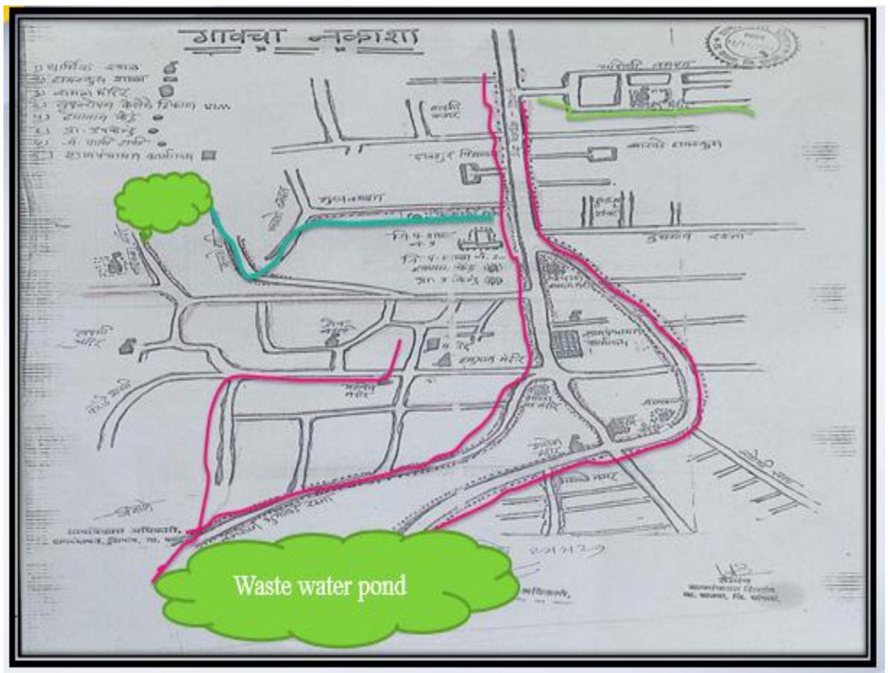

Fig. 3 Village Map

3.2 Present Water Supply Scheme

At present there is one water supply through Dug well at Warana River Bank with daimater 10 m and depth 15 m with Submersible pump - 10 HP. With water storage tank- No of ESR -6 Total Capacity - 275000 Liters, Distribution system – Partially GI Pipe & Partially PVC, GI pipe length -700.00 m PVC pipe length -1000.00 m, Present water supply rate – 40 LPCD, No of hand pumps –in working condition -7Nos.

Table No. 2 Population served and quantity of water supply

Source	Type of supply	Population served	LPCD	Quantity of water supplied (Existing)
Supply Well	Ground Water	7276	40	0.2910 MLD

Table No. 3 Status of toilets

.	**Gaothan Area**	**Vasti**
No. of Toilets	695	250
Septic Tank Toilets	550	150
Soak Pit Toilets	200	95
Public Toilets	12	0

3.3 Limitations in Existing System

- Lack of support from the community,
- A lack of funding for the construction of toilets and soak pits, and
- A lack of government accountability for the project is all factors.

4. DIFFERENT POSSIBLE SOLUTIONS

The following system is established to solve the problem of current village:

1. **STP (Sewage Treatment Plant)**

Wastewater is treated at a sewage treatment plant in three stages: primary (solid removal), secondary (bacterial breakdown), and tertiary (extra filtration).

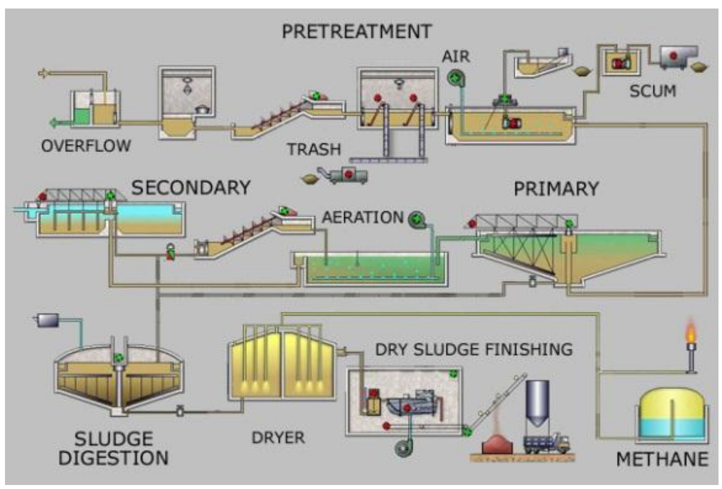

Fig. 4 Layout of Sewage Treatment Plant

Primary Treatment: Sewage is placed in a basin during initial treatment so that solids (sludge) can fall to the bottom and oil and lighter materials can rise to the top. The residual liquid can then be sent for further treatment after these layers have been removed. Sludge digestion is a distinct procedure used to treat sewage sludge

Secondary Treatment: The removal of dissolved and suspended biological materials during secondary treatment frequently involves the use of microbes in a controlled setting. The majority of secondary treatment systems employ aerobic bacteria, which break down the organic sewage components (sugar, fat, and so on). Some systems use fixed film systems, in which the water travels through filters that have bacteria growing on them. In "activated" sludge, which is used in suspended growth systems, decomposing bacteria are introduced right into the sewage. Since bacteria need oxygen to grow, sewage is frequently blended with air to speed up decomposition.

Tertiary Treatment: Water that is being released into a delicate ecology undergoes tertiary treatment, often known as "effluent polishing." Beyond primary and secondary treatment, sewage can be further disinfected using a variety of techniques. Particulate matter can be eliminated via sand filtration, which involves running water through a sand filter. Nutrient concentrations in wastewater, such as nitrogen and phosphorus, may still be high. These have the

potential to upset the nitrogen balance in aquatic habitats, resulting in algal blooms and uncontrollable weed growth.
Sludge Digestion: During initial treatment, sewage sludge that was scraped from the bottom of the settling tank is handled differently from wastewater. Several methods can be used to dispose of sludge. First, it can be broken down by bacteria; occasionally, bacterial digestion will result in methane biogas, which can be utilized to make power. Sludge may also be heated to disinfect it, condensed, or burnt before being recycled as fertilizer.

2. DEWATS (Decentralized Wastewater Treatment Systems)

A multinational network of organizations and specialists developed "Decentralized Wastewater Treatment Systems" (DEWATS). The name DEWATS may be used in this manual to refer to a single particular system, the modular systems approach, or the entire range of systems, depending on the context. The method helps to address the constantly expanding need for on-site wastewater solutions by taking into account the shortcomings of traditional centralized and decentralized wastewater-treatment systems. The following characteristics define DEWATS:

- DEWATS adopt a holistic approach rather than just providing technical hardware, therefore in addition to technical and engineering considerations, the unique economic and social circumstances of the local area are also taken into account.
- DEWATS treats wastewater flows from 1 m^3 to 1000 m^3 per day and unit with close COD/BOD ratios.
- DEWATS can handle both home and commercial wastewater treatment. Wastewater from sanitary facilities, housing colonies, governmental institutions like hospitals, or enterprises, particularly those engaged in food production and processing, can receive primary, secondary, or tertiary treatment from these facilities.
- DEWATS can play a crucial role in all-encompassing wastewater management. The systems ought to be seen as an addition to other centralized and decentralized wastewater-treatment methods. DEWATS can provide a renewable energy source. Depending on the technical layout, biogas supplies energy for cooking, lighting or power generation
- DEWATS are built on a set of layout and design tenets. Longevity, cost effectiveness, toleration of fluctuating inflows, dependability, and, most importantly, minimal control and maintenance requirements

The following technical treatment processes are typically combined in a modular fashion by DEWATS:

- Primary Treatment: in settling ponds, septic tanks, bio-digesters, or sedimentation ponds
- Secondary Treatment - in facultative pond systems, anaerobic filters, or anaerobic baffled reactors
- In horizontal gravel filters, secondary aerobic/facultative treatment
- Post-Treatment – in aerobic polishing ponds.

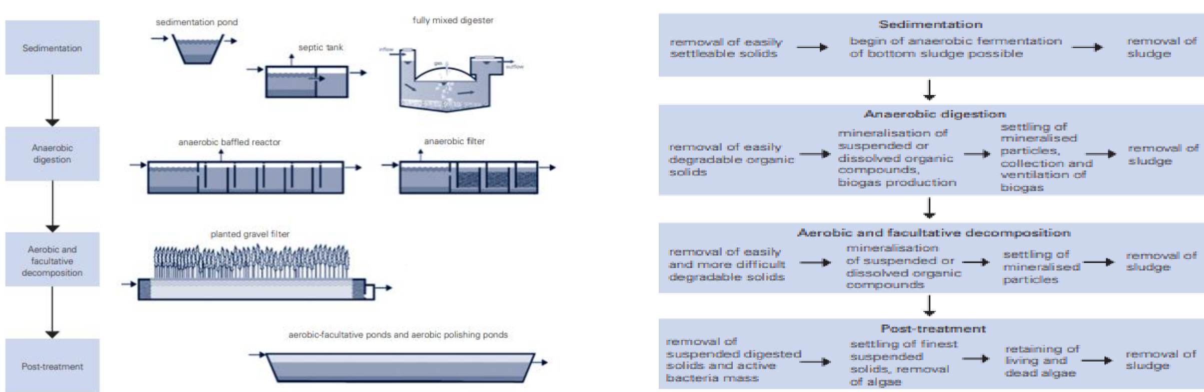

Fig. 5 DEWAT System

3. Root Zone System

The amount of total water on Earth is constant and is regenerated by nature in the oceans, atmosphere, and subsurface regions of the planet. An increase in the number of people, rapid industrialization, and ensuing urbanization has raised the need for water of the necessary quality for various end users.
The over-pollution of water sources is entirely the result of man's negligence of pollution control over a long period of time. Therefore, it is now up to man to take action to address the issue by purifying and recycling water to prevent further contamination of our water sources.
Men made ever-increasing attempts to get the requisite quality and quantity of water by focusing primarily on purification, which further transferred pollutants from one source to another and made the situation worse.

The following are the systems' crucial parts:

(i) The reed type of wetland plants.

(ii) The soil bed.

(iii) Micro-organisms of different type.

Fig. 6 depicts the engineered Root zone bed. The bottom and side bunds of the system are compacted and made impermeable using either plastic liners or specific clays, as can be seen from this picture. The bottom slopes in one direction, varying from 0.5 to 0.2 percent depending on the hydraulic pressure and organic load.

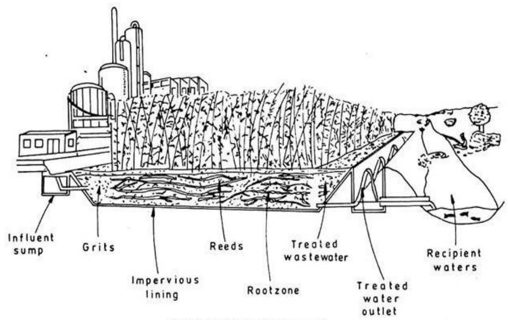

Fig. 6 Root zone System

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The water level in the bed can be adjusted as needed using the under-drain pipe system at the bottom. The soil bed is particularly prepared to achieve both the output quality requirements and the hydraulic permeability needed for a specific effluent. To address the elements in the effluent and, if necessary, to rectify pH, it is decided to add some chemicals in powdered or granular form.

Using the under-drain pipe system at the bottom, the water level in the bed can be changed as necessary. The soil bed has been specially prepared to meet the demands for output quality and the hydraulic permeability required for a certain effluent. It has been chosen to add some chemicals in powdered or granular form in order to address the components in the effluent and, if necessary, to adjust pH.

Due to the fact that it involves specifics of a patented technology. Since there are more than 2500 to 3000 naturally occurring bacterial strains of both the aerobic and anaerobic types, the treatment is comprehensive. The term "Root zone" refers to the space where roots are dispersed. Additionally, there are two types in this zone.

(i) Near the roots and

(ii) Away from the roots.

The water is fed through a canal made of stone aggregate, which usually ensures that the flow is distributed uniformly across the full cross section of the reed bed. The wastewater percolates through the porous soil bed toward the other end because of the slope that was purposefully created in one direction, and it exits through a perforated under-drain pipe system that was installed at the outlet end of the reed bed. The desired level of therapy is accomplished with the appropriate amount of residence time, which can be anywhere from a few hours to a few days.

The naturally occurring plants' unique ability to take oxygen from the air and transfer it to their roots, as effluent percolates through them, provides the soil bed area nearby the roots with the necessary oxygen. The aerobic bacteria use this oxygen to biodegrade the organic materials in the effluent to produce CO2, N2, H2O, and elemental sulphur, leaving almost no sludge behind.

4. Sedimentation Tank

Sedimentation tanks are buildings where wastewater is filled and held for a while in order to remove the suspended particles present in the water.
These particles could collect at the tank's bottom, and scrapers are used to remove them. If the suspended particles have a lower specific gravity than water, they will float to the top of the tank.
Because it allows suspended particles to separate out of water or wastewater as it flows slowly through the tank, a sedimentation tank is a part of a contemporary system for wastewater treatment or water supply and also offers some degree of purification.

Types of Sedimentation Tank

Sedimentation tanks come in a variety of forms, as will be detailed below.

1) Rectangular Tanks
2) Circular Tanks
3) Hopper Bottom Tanks
4) Fill & Drawn Sedimentation Tank
5) Continuous Flow Tank

1. Rectangular Tanks

Rectangular tanks have a rectangular floor shape and are made up of several baffle walls. The baffle wall's purpose is to keep the circuit from short-circuiting and to slow down entering water to extend the particle's effective path of passage.
This sort of sedimentation tank is often provided with channel type inlet and outlet extending the full width, and the floor between two baffles is constructed to look like a hopper sloping towards the center where sludge-pipe is provided. The sludge is removed under hydrostatic pressure through a sludge outlet by opening the gate-valve.

2. Circular Tanks

These are often not utilised in simple sedimentation, but they are frequently employed in sedimentation with coagulation.
There are two types of circular sedimentation tanks based on the water flow;

i. Radial Flow Circular Tank
ii. Circumferential Flow Circular Tank

3. Hopper Bottom Tanks

These are vertical flow tanks, where water flows both upward and downward. These tanks receive water from the top into the deflector box, where it reverses direction and begins to flow upward around the deflector box after first flowing downhill inside it.
When the water changes directions, suspended particles with specific gravities greater than one cannot follow it and instead sink to the bottom, where they are removed through the sludge output pipe by hydrostatic pressure.

4. Fill & Drawn Sedimentation Tank

In this sort of tank, the water from the inflow is held for a period of time, sometimes 24 hours, during which the dispersed particles settle at the bottom of the tank. After 24 hours, the water is released through the outlet.
The settled particles are then removed, which takes 6 to 12 hours, therefore in the case of a fill-and-draw sedimentation tank, one sedimentation activity takes 30 to 40 hours to complete.

5. **Continuous Flow Tank**

In this scenario, the water is not permitted to rest, and flow always occurs at very low speeds. This flow, which may be horizontal or vertical, causes the suspended particles to settle at the tank's bottom.

4.5 Chambers & Soak pit chamber

An enclosed container with porous walls called a soak pit allows water to slowly seep into the soil. Septic tank pre-settled effluent is dumped into an underground chamber, where it seeps into the earth.

The soak pit, which is really just a small pit (often 1 m3), should be between 1.5 and 4 m deep but, as a general rule, should always be at least 2 m above the groundwater table. It must be placed safely away from a source of drinking water (ideally > 30 m).

Soak pits can provide a cost-effective opportunity for a partial treatment of waste- grey- or stormwater from a primary treatment (e.g. septic tank, twin-pits for pour-flush toilets, biogas settler, anaerobic baffled reactor, etc.) and a relatively safe way of discharging it to the environment, thereby recharging groundwater bodies. If there is no intention or need to reuse wastewater, collected stormwater or graywater Small particles are filtered out by the soil matrix as wastewater (after primary treatment, greywater or blackwater) percolates into the soil from the soak pit, and organic materials are broken down by microorganisms.

The soil particles absorb the wastewater effluent, which then permeates the soil pores both horizontally and vertically. Therefore, water permeable sub-soil layers are necessary to prevent rapid saturation. Avoid releasing large amounts of discharged effluents each day (HEEB et al. 2008). Soak pits work well with soil that has high absorptive qualities; rocky, hard-packed, or clayy soil are inappropriate. Leach fields are utilised in the same way as soak pits, however soak pits take up less space and require less upkeep. They may, however, also receive less influent and cause more groundwater pollution than leach fields.

Following a review of the literature, it was determined that **Root Zone System** was the best option for the second observation and that **DEWATS (Decentralized Wastewater Treatment Systems)** was the best option for the first.

Advantages of DEWATS

Decentralized wastewater treatment can give communities a long-lasting and affordable alternative by

- Avoiding high capital expenditures.
- Lowering the price of operation and maintenance
- Promoting commercial and employment possibilities.
- Typically used to rural places.
- Very minimal maintenance and operation costs.
- Depending on the technology used, energy usage is zero or very low.
- Semi-skilled people can use the entire system.

Because it doesn't contain any heavy metals or hazardous substances, sludge can be utilized successfully in agriculture.

Advantages of Root zone treatment System-

- Useful for small towns with lower sullage output
- Extremely cheap implementation and upkeep costs
- Consuming energy is not required.
- The entire system can be used by a semi-skilled person.
- Sullage can be used successfully for gardening or agriculture because it is free of harmful and heavy metals.

5. LIQUID WASTE MANAGEMENT

The biggest issue that exists globally is a lack of water. Even though water makes up two-thirds of the earth's crust, much of it is either present in the form of large salty oceans and seas or is frozen solid, making it unavailable for human consumption and other uses. According to research, 97% of the world's water is salty and unusable by humans or other animals (with the exception of marine life), while the remaining 3% is available as freshwater. Less than 0.01 percent of this three percent is available as fresh water, with more than half of it trapped in glaciers. As a result, there are fewer water resources than there is human demand for it.

Above this, the majority of consumable water is being contaminated by human activity. Numerous water-borne diseases are being caused by this contaminated and untreated water. Then, the world is seeing a significant change in climate, which is making the water issue worse. While some locations are receiving absolutely no rain, others are receiving more than they did previously. Experts even predict that the next World War will be fought over water rather than oil or territory.

The problem of the water crisis, where 884 million people already do not have easy access to safe drinking water, will worsen due to inefficient water consumption and a lack of water treatment. And another 2.5 billion people have limited access to clean water for drinking and sanitation. The natural source of water is being depleted by agriculture's over use and pollution of the groundwater. Water treatment plants will therefore be crucial in this situation.

The need for wastewater treatment prior to discharge back into the environment is clear when taking a closer look at the substance.
There are three basic categories of wastewater: black water, gray water, and yellow water.
Liquid Waste is the collective term for all streams of toilet wastewater produced in homes or commercial facilities. Grey water comes from sinks, showers, baths, and washing machines. Grey water can spread dengue and yellow fever since it has less bacteria than domestic wastewater. Some bacteria, including cholera, can thrive and spread in sullage pools and pose a serious threat to the general public's health. In contrast to sewage, it is often safer to handle, simpler to treat, and can be recycled on site for non-potable purposes like flushing toilets or irrigating plants or crops. One of the main sources of point pollution is sullage (also known as grey water), which is dumped untreated into rivers from residential and commercial areas.
Sullage typically consists of things like oil, food fragments, detergents, mud, etc. Therefore, this cannot be directly recycled, used again, or dumped into the environment. About 30 percent of the waste water produced (sullage and sewage) is black water, and 70 percent is grey water, therefore the contribution of grey water is very substantial. Similar to this, dumping sullage or sewage into natural bodies of water has an impact on the water's quality and contributes to the problem of water pollution. Unhygienic circumstances, a filthy environment, and a higher risk of water-related epidemics result from untreated conditions.
Treatment of sullage must be done before it is released into the environment in order to prevent all these harmful effects on human health and the polluting of water sources. On-site and off-site treatment methods are two types of sullage management solutions that are available. Sullage treatment can be continued either on-site utilising methods that allow sullage to percolate or off-site by collecting and transporting sullage for additional treatment and purification.

Existing Sullage Management System
Currently, RCC closed gutters cover the majority of the Gaothan area, with minor RCC open gutter coverage. The gutter ends are built in U.C.R. masonry after the Gaothan boundary.
The lengths are

- RCC closed gutter 280.90 rmt
- RCC open gutter 2773.85 rmt
- RCC pipe gutter 1004.90 rmt

Two outlets of the Warana River are used to discharge sullage, whilst two outlets release sullage into a public area. The map displays the location's specifics.
Since there are already 7276 people living on the existing drainage system, a total of 291040 liters of water are supplied every day. However, based on the current daily discharge of liquid waste, which is 196342 liters, it can be deduced that 0.765 of the water supply is actually turned into liquid waste.
Villages would receive water at a rate of 55 lpcd after the JAL JEEVAN MISSION water supply project has been completed. By taking into account the aforementioned observation, 0.765 percent of the total water supply is treated as sullage discharge in accordance with this D.P.R. Since there are already 7276 people living on the existing drainage system, a total of 291040 liters of water are supplied every day. However, based on the current daily discharge of liquid waste, which is 196342 liters, it can be deduced that 0.765 of the water supply is actually turned into liquid waste.

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6. DESIGN & ANALYSIS OF SUITABLE TECHNIQUE

To repair the sullage treatment center, the drain network must be connected appropriately while taking into account the network of drains and the land availability. There must be some uncovered areas added to the present. Following a debate on the following problems with locals and G.P. members

- Existing pipe drainage network
- Land availability
- Cost of treatment method

- O&M cost

6.1 Design of Decentralized Wastewater System

Design for Sullage Treatment Center 1

A) For Anaerobic Baffled Reactor

i) Daily Sullage collection Quantity = 141288 liter i.e., 141.288 cum

ii) Detention period –16 hours

iii) Hence volume required for treatment = **94.192 cum**

Hence provide 8 treatment chambers having size 3.00 x 2.10x 2.00 m each.

iv) Volume available for treatment: -

8.00 x 3.00 x 2.10 x 2.00 **= 100.80 cum > 94.192 Cum**

B) For Planted Gravel filter

i) Daily sullage collection quantity= 141288 that is 141.288 cum

ii) Detention period = 11 hrs.

iii) Hence Net volume required for root zone treatment = 64.75 cum

iv) Considering 45% porosity of shrouding material, total volume required for root zone treatment = **143.90 cum**

v) Hence provide 12 treatment chambers having size 4.20 x 3.10 x 1.00 m.

vi) Volume available for treatment 12 x 4.20 x 3.10 x 1.00 hence provide 12 treatment chambers 6 in each row = **156.24 cum> 143.90 cum**

Design for Sullage Treatment Center 2

A) For Anaerobic Baffled Reactor

i) Daily Sullage collection Quantity = 75735 liter i.e.,75.735 cum

ii) Detention period –16 hours

iii) Hence volume required for treatment = **50.49 cum**

iv) Hence provide 4 treatment chambers having size 3.00 x 2.2x 2.00 m each.

v) Volume available for treatment: - 4.0 x 3.00 x 2.20 x 2.00 = **52.80 cum> 50.49 Cum**

B) For Planted gravel filter

i) Daily sullage collection quantity (as per statement) = 75735 that is 75.735cum

ii) Detention period = 12 hrs.

iii) Hence, Net volume required for root zone treatment = 37.87 cum

iv) Considering 45% porosity of shrouding material, total volume required for root zone treatment = **84.15 cum**

v) Hence, provide 6 treatment chambers having size 4.40 x 3.20 x1.0 each

vi) Volume available for treatment 6 x 4.40 x 3.20 x 1.00 hence **84.48 cum > 84.15 cum**

6.2 Design of Root Zone system

Design for Sullage Treatment Center 3 (Root Zone system)

A) Screening Chamber

Provide 1.00 x 1.00 x 1.20 m RCC closed chamber

B) Sedimentation tank

i) Daily sullage collection quantity = 23941 lit /day that is 23.94 cum

ii) Detention period = 8 hrs.

iii) Hence Net volume required for treatment = **7.98 cum**

iv) Hence provide treatment chamber having size 7.00 x 1.00 x 1.20 m each

v) Volume available for treatment **8.40 cum >7.98 cum**, hence sufficient.

C) Root Zone system

i) Daily sullage collection quantity (as per statement) = 23941 lit /daythat is 23.94cum
ii) Detention period = 10 hrs.
iii) Hence Net volume required for treatment = 9.975 cum
iv) Considering45% porosity of shrouding material, total volume required for reed bed system treatment = **22.16 cum**
v) Hence provide channel having size 23.00 x 1.00 x 1.00
vi) Volume available for treatment **23.00 cum>22.16cum,** hence sufficient.

Design for sullage Treatment Center 4 (Root Zone system)

A) Screening Chamber

Provide 1.00 x 1.00 x 1.20 m RCC closed chamber

B) Sedimentation Tank

i) Daily sullage collection quantity = 9551 lit /day thatis 9.55 cum
ii) Detention period = 8 hrs
iii) Hence Net volume required for treatment = 3.18 cum
iv) Hence provide treatment chamber having size 3.00 x 1.00 x 1.20 meach
v) Volume available for treatment **3.6 cum >3.18 cum,** hence sufficient.
vi)

C) Root Zone system

i) Daily sullage collection quantity = 9551 lit /day that is 9.55 cum
ii) Detention period = 10 hrs
iii) Hence Net volume required for treatment = 3.98 cum
iv) Considering 45% porosity of shrouding material, total volume required for reed bed system treatment = **8.84 cum**
v) Hence provide channel having size 9.00 x 1.00 x 1.00
vi) Volume available for treatment **9.00 cum > 8.84 cum**

6.3 Design for sullage Treatment at center 1,2,3,4 For Leach pit

i) Daily Sullage collection Quantity at center 1 = 3450 liter i.e., 3.450 cum.
ii) Daily Sullage collection Quantity at center **2** = 2314 liter i.e., 2.314 cum.
iii) Daily Sullage collection Quantity at center **3**= 3450 liter i.e., 3.45 cum.
iv) Daily Sullage collection Quantity at center **4** = 1893 liter i.e., 1.893 cum.

Because of the low flow, the lack of funds, Department of GR regulations, and instructions from the water and sanitation department, the treatment for these outfalls is a leach pit with a diameter of 2.00 M and a height of 1.85 M.

6.4 Annual Operation & Maintenance: -

- To Clean Screening Chamber (once in the Month) Charges: - 4 X 1 X 12 Labour X 500 = 24000/-
- To Clean The anaerobic sedimentation Tank (thrice in the year)Charges: - 3 X 3 X 3 Labour X 500 = Rs. 13500/-
- To maintenance the root Zone plant.
- Rs. 1,000/- Per year per plant -3 x 1000 =3000
- Testing Samples of Sullage (2 Times in the year)Charges: - 2 X 8 Samples X 1500 = 24000/-
- Sundries:- Rs. 10,000/-

6.5 Total Cost Required

I. Cleaning of Screening Chamber	Rs. 24000/-
II. Cleaning of Anaerobic Sedimentation Chamber	Rs. 13500/-
III. Maintenance of root Zone plant	Rs. 3000/-
IV. Sample Testing	Rs. 24000/-
V. Sundries	Rs. 10000/-

Total: - Rs. 74500/- **Say. 80,000/-**

6.6 Number of Houses in the Villages: 1407

Tax Proposed by government is Rs. 56.85/- per year

Yearly Collection = 56.85 x 1407 = Rs. 79,987.95/- **Say Rs. 80,000**/-

So, the total cost required for the maintenance is Rs. 80,000/-

Which propose Rs 56.85/- as tax, but actualy the amount can be collected Rs. 100/-.

7. TEST & RESULT

Following six different parameters were tested to determining the quality of the water before (Waste water) and after (Purified water) filtration on four different sample collected in four different weeks of a months, called as Sample 1, 2, 3 and 4 respectively.

The tests parameters are: pH, Turbidity, Hardness, Dissolved Oxygen, COD, BOD and the test results are as shown in the tables listed below.

Table No. 4 Test Results for Sample 1

Sr. No.	PARAMETERS	PERMISSIBLE LIMIT	Waste Water				
				Test 1	**Test 2**	**Test 3**	**Avg.**
1	**PH**	6.5-8.5	10.7	6.5	6.3	6.7	6.5
2	**Turbidity**	0-5 N.T.U	197	2	2	2	2
3	**Hardness**	0-150 ppm	244	141	122	137	134
4	**DO**	5-6 ppm	5.9	5	5	5	5
5	**COD**	00 ppm	237	45	47	54	50
6	**BOD**	00 ppm	126	47	46	52	48

Table No. 5 Test Results for Sample 2

Sr. No.	PARAMETERS	PERMISSIBLE LIMIT	Waste Water				
				Test 1	**Test 2**	**Test 3**	**Avg.**
1	**PH**	6.5-8.5	10.3	6.3	6.7	6.5	6.5
2	**Turbidity**	0-5 N.T.U	200	2	2	2	2
3	**Hardness**	0-150 ppm	246	149	106	128	128
4	**DO**	5-6 ppm	5.9	5	5	5	5
5	**COD**	00 ppm	237	47	45	53	48
6	**BOD**	00 ppm	124	46	47	49	47

Table No. 6 Test Results for Sample 3

Sr. No.	PARAMETERS	PERMISSIBLE LIMIT	Waste Water				
				Test 1	**Test 2**	**Test 3**	**Avg.**
1	**PH**	6.5-8.5	10.6	6.8	6.4	6.6	6.6
2	**Turbidity**	0-5 N.T.U	194	2	2	2	2
3	**Hardness**	0-150 ppm	235	149	106	128	128
4	**DO**	5-6 ppm	5.8	5	5	5	5
5	**COD**	00 ppm	234	45	47	51	48
6	**BOD**	00 ppm	127	49	46	49	48

Table No. 7 Test Results for Sample 4

Sr. No.	PARAMETERS	PERMISSIBLE LIMIT	Waste Water				
				Test 1	**Test 2**	**Test 3**	**Avg.**
1	**PH**	6.5-8.5	10.12	6.9	6.2	6.5	6.5
2	**Turbidity**	0-5 N.T.U	198	2	2	2	2
3	**Hardness**	0-150 ppm	239	153	120	138	137
4	**DO**	5-6 ppm	5.6	5	5	5	5
5	**COD**	00 ppm	244	48	51	54	51
6	**BOD**	00 ppm	136	49	47	52	49

Table No. 8 Average Result

Sr. No.	PARAMETERS	PERMISSIBLE LIMIT	PURIFIED WATER for Sample (S)				
			S-1	**S- 2**	**S- 3**	**S-4**	**Avg.**
1	**PH**	6.5-8.5	6.5	6.5	6.6	6.5	6.5
2	**Turbidity**	0-5 N.T.U	2	2	2	2	2
3	**Hardness**	0-150 ppm	134	128	128	137	132.75
4	**DO**	5-6 ppm	5	5	5	5	5
5	**COD**	00 ppm	50	48	48	51	49.25
6	**BOD**	00 ppm	48	47	48	49	48

DEWAT & Root Zone System both traditional and unique method to treat waste water of Shigaon village, all physical and chemical impurities present in wastewater are removed by using this method.

8. COST EFFECTIVE ANALYSIS

The Fig. 8 is the detail drawing of Leach Pit Tank:

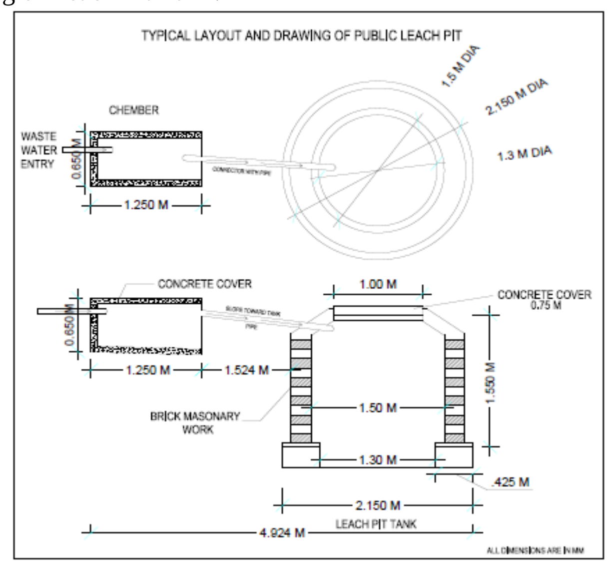

Fig. 7 Leach pit Tank

Table No. 9 Measurement Sheet

Name of Work - Constructing Solid Waste & Waste Water Management at Selected Village							
Sr. No	**Description**	**No**	**L**	**B**	**D**	**Qty**	**Total**
1	Excavation for foundation / pipe trenches in hard murum including removing the excavated material up to distance of 50 m & lifts as below stacking & speeding as directed by Engineering –in charge normal dewatering preparing the bed for foundation& excluding backfilling etc. Complete.						
	Pit	1	2.454	2.45	1.65	7.80	
	Chamber	1	1.250	1.10	0.65	3.00	
					Total (Cum)	**10.80**	Cum
2	Providing & laying in situ / ready mix concrete of M10 proportion with trap / granite / quartzite / gneiss Metal in foundation including form work compacting & curing etc. complete						
	Pit	2	2.150	2.15	0.10	0.36	
	LW	2	1.25	0.30	0.10	0.08	
	Sw	2	0.90	0.30	0.10	0.05	
					Total (Cum)	**0.49**	Cum
3	Providing secondary glass brunt brick masonry with convention / is type bricks in cement mortar 1:6 in plinth as backing in complete masonry including striking joint raking out joints and watering etc. complete						
	Pit	1	3.140	0.39	1.65	2.01	
	LW	2	1.10	0.10	0.65	0.14	
	Sw	2	0.45	0.10	0.65	0.60	
					Total (Cum)	2.21	Cum
4	Providing internal cement plaster 12mm thick in single coating cement mortar 1:3 without neeru finish to concrete or brick surfaces in all position includingscaffolding and curing.						
	Inside LW	2	3.140	0.39	1.65	4.02	
		2		0.90	0.65	1.17	
	SW	2		0.45	0.65	0.59	
					Total (Cum)	**5.78**	Sqm
5	Providing Flush grooved pointing with cement mortar 1: 3for brick work including scaffolding andcuring etc. complete.						
	LW	2		1.10	0.65	1.43	
		2		2.25	0.65	2.93	
	Total (Sqm)					**4.36**	Sqm
	No. of Tank	22					Nos

Table No. 10 Cost Sheet

Name of Work - Constructing Solid Waste & Waste Water Management					
Sr. No	Particulars	Quantity	Rate	Unit	Amount
1	Excavation for foundation / pipe trenches in hardmurum including removing the excavatedmaterial up to distance of 50 m & lifts as below stacking & speeding as directed by Engineering in charge normal dewatering preparing the bed for foundation & excluding backfilling etc. Complete.	1.68	165.00	Cum	277.2
2	Providing & laying in situ / ready mix concrete of M10 proportion with trap / granite / quartzite / gneiss Metal in foundation including form work compacting & curing etc. complete	0.84	4766.00	Cum	3795.96
3	Providing secondary Class brunt brick masonry with convention / is type bricks in cement mortar 1:6 in plinth as backing in complete masonry including striking joint raking out joints and watering etc. complete	4.25	6004.00	Cum	23919
4	Providing internal cement plaster 12mm thick in single coated cement mortar 1:3 without neeru finish to concrete or brick surfaces in all position including scaffolding and curing etc, complete.	4.25	228.00	Cum	23919
5	Providing Flush grooved pointing with cementmorter 1: 3for brick work including scaffolding and curing etc. complete.	36.15	149.00	Sqm	8784.45
		Total Rs			**39776.61**
		Say Rs			**36,777.00**
		No of Tanks=			**22**
		Grand TotalRs			**8,09,094.00**

Payback Period Calculation

(1) Capital Investment cost (I) = Initial cost + annual Installation and maintenance cost

= 8, 09,094+ 74500 = 8, 83,594 /-

(2) Annual Saving (L) = saving from every years expenses

L = 3, 37,900 /-

(3) Annual Expenses for ALMV (E)

(E) = Expenses x 10 year

= 3, 37,900 x 10 = 33, 79,000/-

(4) Saving cost (c) = 10 year expenses cost - annual Installation and maintenance cost

=33, 79,000 - 8, 09,094 + (74500x 9) = 18, 99,406 /-

Total profit in next 10 years 18, 99,406/- = **19, 00,000/-**

This indicates that utilizing this method will only result in less than 2.5 year payback of the initial expenditure.

As a result, it will be advantageous from an economic and environmental standpoint.

CONCLUSION

- The current waste water route in the selected village was investigated, and some treatment limitations were discovered. For example, because the village is divided into three subareas by a state highway, water cannot collect in one location. Instead, it can be easily separated and treated using our method. Soak pits can be used to address all of the fundamental issues with wastewater pounding.
- The methods used for such small villages include soak pits and sedimentation tanks, which take into account the restrictions indicated above.
- Use for gardening or other agricultural activities is permitted within limits. Through this method, water that is suited for agriculture and gardening will be accessible.
- We can save up to 2 lakh rupees annually, after which it would be provided without charge for farming and gardening.
- In terms of both the environment and the economic, it will be advantageous.
- There are both traditional and unique ways to treat waste water, and the method used should depend on things like the characteristics of the wastewater and the physical and chemical qualities of the waste water
- In general, we can increase the amount of water by using building and leach pits.
- We can prevent the adverse consequences of waste water that pollutes the environment by upgrading wastewater processing systems.
- We are here to reduce the impact of sewage by "Constructing soak pits" appropriately.
- After the visit, there was a significant buildup of water in the village, which is detrimental, so it is crucial to work on it and find a solution through practical means.

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