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REPORT

SCALING-UP IMPROVEMENTS TO COMMUNITY TOILETS: A PILOT DEMONSTRATION AT RMS COLONY, TIRUCHIRAPPALLI

October 2022

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Abbreviations

BOD	Biochemical Oxygen Demand
CBO	Community Based Organisation
CMA	Commissionerate of Municipal Administration
COD	Chemical Oxygen
CT	Community Toilet
FOL	Flush-Out Latrines
GoI	Government of India
GoTN	Government of Tamil Nadu
IHHL	Individual Household Latrine
ISC	Integrated Sanitary Complex
L	Litres
MAWS	Municipal Administration and Water Supply
No.	Number
O&M	Operation & Maintenance
PT	Public Toilet
SBM-U	Swachh Bharat Mission – Urban
SHE	Sanitation & Hygiene Education
SHGs	Self-Help Groups
TCC	Tiruchirappalli City Municipal Corporation
TNPCB	Tamil Nadu Pollution Control Board
TNUDP	Tamil Nadu Urban Development Programme
TNUSSP	Tamil Nadu Urban Sanitation Support Programme
ULB	Urban Local Body

Executive Summary

Executive Summary

There has been an increased interest in establishing treatment systems for community toilets (CT) and public toilets (PT) in recent years. However, the geographical characteristics and the community where the CT/PT is located pose limitations in providing appropriate treatment systems. Such limitations could be overcome by identifying low-cost treatment options based on the location and community development.

City-Wide Inclusive Sanitation (CWIS) is an initiative by the Bill and Melinda Gates Foundation (BMGF), globally supported by multiple agencies and organisations. Tiruchirappalli is one of the eight global cities selected under the CWIS initiative. CWIS cities are expected to move towards achieving the Sustainable Development Goal (SDG) for sanitation to ensure safe, inclusive, and financially sustainable sanitation services and serve as global benchmarks. The Tiruchirappalli CWIS programme is guided by the Tiruchirappalli City Corporation (TCC) and delivered by a consortium of partners led by the Indian Institute for Human Settlements (IIHS).

While the project aims to improve the overall sanitation outcomes in Tiruchirappalli across the full cycle of sanitation, it also focuses on improving service delivery to the urban poor. The project attempts to mainstream sanitation into existing initiatives, showcase innovations and systematically document and share learnings, to enable scaling up.

Tiruchirappalli city has more than 400 CT/PTs within the city limits, maintained by self-help groups (SHG) or by Tiruchirappalli City Corporation (TCC). Out of these, 124 toilets depend on onsite sanitation systems (OSS). An assessment of CT/PTs carried out by the CWIS team in 2020 revealed that more than 30 toilets were de-sludged frequently, about two to eight times a month, which caused an additional financial burden to the ULB and communities and led to the frequent suspension of CT/PT operations, interrupting access to toilets (CWIS: CT/PT Assessment, 2020).

TCC has been implementing multiple initiatives such as improving the CT/PTs and household latrine and toilet facilities, periodic de-sludging and phase-wise UGD coverage to ensure safe management of fecal sludge and improve the sanitation value chain.

As part of the efforts to demonstrate improvements to community toilets, the CWIS programme initiated a demonstration project at the community toilet at RMS Colony in Tiruchirappalli. The RMS Colony community toilet was selected based on the frequency of de-sludging, which was every two days.

The objective of the demonstration was to achieve the following:

1. Enable safe treatment and disposal through improved septic tank and disposal arrangement; and

2. Reduce the frequency and cost of de-sludging.
3. Establish inclusive facilities to benefit differently abled people, children, and pregnant women.

This report portrays the containment improvements of RMS Colony community toilet, Tiruchirappalli which resulted in the reduction of environmental impacts which cause public health crisis and can reduce the burden of de-sludging costs for the ULBs.

1 Background

1. Background

1.1. City-Wide Inclusive Sanitation

Tiruchirappalli, the fourth largest municipal corporation in the state of Tamil Nadu. Tiruchirappalli is one of the eight global cities and one of four in India selected under the City-Wide Inclusive Sanitation (CWIS) initiative by the Bill and Melinda Gates Foundation (BMGF). CWIS cities are expected to move towards achieving the Sustainable Development Goal (SDG) for sanitation to ensure safe, inclusive, and financially sustainable sanitation services and serve as global benchmarks. The Tiruchirappalli CWIS project is guided by the Tiruchirappalli City Corporation (TCC) and delivered by a consortium of partners led by the Indian Institute for Human Settlements (IIHS).

The expected outcomes of the CWIS programme in Tiruchirappalli are:

1. At least 70 per cent of fecal sludge (FS) is safely managed and treated.
2. Safe and hygienic access to the toilet and reduced resource usage.
3. Improved and inclusive sanitation facilities in community and public toilets.

1.2. Catchment Area Selection for the Project Demonstration

Tiruchirappalli is a partially sewered city which has more than 400 CT/PTs within the city limits, maintained by self-help groups (SHG) or by Tiruchirappalli City Corporation (TCC). Out of these, 124 toilets depend on onsite sanitation systems (OSS).

Figure 1.1: Location Map of RMS Colony

Source: RMS colony needs assessment, CWIS, 2020.

From among the 294 slums located within Tiruchirappalli city, RMS Colony (Edamalaipatti pudhur) was chosen for a detailed needs assessment. The earlier survey had observed issues in the containment system of this CT, which served the urban poor and slum dwellers. The population in the settlement is around 400 and the residents rely on the community toilet for their sanitation needs.

Figure 1.2: Septic Tank	Figure 1.3: Overflow of Septage from Septic Tank Accumulated Near to Inlet Side
	
Source: Containment improvement – RMS colony, CWIS,2020.	*Source*: Containment improvement – RMS colony, CWIS,2020.

The containment system of the community toilet at RMS Colony was lacking disposal arrangements, had leaks and damage in the access cover(manhole). The lack of disposal arrangements caused the septic tank to overflow, which led to frequent closures of the CT. To control overflow from the septic tank, TCC de-sludged the containment once in two days.TCC's indirect costs to de-sludge the CT were Rs. 1.08 lakhs per year.

The assessment found that the toilet infrastructure, such as toilet pans, light fixtures, walls, and doors were damaged. Due to the poor condition of the CT, the community dwellers were reluctant to use the toilet, thus increasing the chances of open defecation.

1.3. Objectives

The prime objectives of the project demonstration are:

1. Enable safe treatment and disposal through the containment improvement and proper disposal arrangement
2. Reduce the frequency and cost of desludging.
3. Establish inclusive facilities on the super structure to benefit differently abled people, children, and pregnant women.
4. To prevent the Open Defecation (OD) in the community.

2

Project Planning

2. Project Planning

2.1. Assessment and Data Collection

The implementation team conducted a sanitation needs assessment at RMS Colony in January 2020, which included the following activities:

1. A social mapping exercise where residents participated and provided their views about the sanitation conditions in the settlement.
2. Transect walk across the community/slum.
3. Focus Group Discussion (FGD) with residents of different age groups and gender.

The catchment area was selected based on the following criteria:

a. Neighbourhood with high dependence on community toilets or high prevalence of open defecation.
b. High frequency of desludging.
c. Community Toilets requires infrastructure improvement.
d. Community Toilets located in one of the model slums under Tiruchirappalli CWIS programme.

Figure 2.1: Toilet Dependency at the Settlement

Source: Sanitation needs assessment, CWIS, 2019.

The catchment of RMS Colony in Anna Nagar (Arunthathiyar Street) was selected for the demonstration as it met the criteria mentioned above. RMS Colony was also a model slum under the CWIS programme and has one community toilet to meet the community's sanitation needs. Out of the 84 households in RMS Colony, 16 households had individual household latrines (IHHL), while the remaining 68 households relied on the community toilet. The sanitation needs assessment at RMS Colony showed that nearly 75 per cent of the slum dwellers relied on the community toilet. The assessment also helped the implementation team identify three open defecation spots. Even though TCC was working towards making the city open defecation-free (ODF), the practice was prevalent among the residents of RMS Colony due to the lack of accessibility of the community toilet.

The containment of the community toilet at RMS Colony was de-sludged frequently due to the overflow, which was confirmed based on the movement of the de-sludging vehicles fitted with GPS tracking devices by the implementation team.

The findings of the sanitation need assessment (Table 3.**1**) was used to analyse the gaps in the toilet infrastructure according to the standards specified by the MoHUA.

The demonstration project was planned to be conducted in two phases. The activities under each phase are listed below.

Phase I:

1. Identification of gaps in the community toilet infrastructure according to the MoHUA standards
2. Demonstration of improvements in the community toilet

Phase II:

1. Monitoring the performance of the system
2. Maintenance of the improved superstructure through Sanitation Hygiene Education (SHE) teams maintaining other community toilets in the city
3. City and state-level scaling up.

Figure 2.2 explains the process flow and action plan of the demonstration.

Figure 2.2: Action Plan for the Demonstration

Source: CWIS,2020

3

Findings

3. Findings

3.1. Sanitation Conditions of the Community Toilet:

The sanitation conditions of the community toilet, such as the location, toilet usage pattern and infrastructure are provided in Table 3.1.

Table 3.1: Sanitation Conditions of the Community Toilet in RMS Colony		
Sl. No.	**Description**	**Details**
1	Name of the settlement	RMS Colony, Anna Nagar, Arunthathiyar Street
2	Latitude	10°46'12.79"N
3	Longitude	78°40'24.11"E
4	Population	400 people
5	Open defecation spots	3
6	No. of toilets for men and boys	7
7	No. of toilets for women and girls	7
8	Condition of doors	Broken
9	Condition of pans	Stained and broken
10	Condition of water tank	Leakage
11	Condition of septic tank	Overflow and leakage
12	Condition of soak pit	Not available
13	Source of water supply to the community toilet	Borewell water supplied through overhead tank
14	Area available for the treatment system	Nearly 100 square metres
Source: RMS Colony needs assessment, CWIS 2020.		

3.2. Identification of Gaps in Infrastructure

The assessment found that the community toilet required improvement in both the containment system and the superstructure. The issues identified in the infrastructure are presented below.

3.2.1. Containment:

The implementation team observed the following issues in the containment.

a) Leakage in the septic tank.

b) Blockage in disposal pipe arrangement.

c) Damage in septic tank access cover, i.e., maintenance hole.

d) Frequent overflow from the inlet chamber of the septic tank, which led to the closure of the CT until the de-sludging vehicle arrived.

e) **Higher resource utilisation due to de-sludging:** TCC's de-sludging vehicle was called once every two days to de-sludge the septic tank (verified with GPS tracking). The cost of de-sludging per trip was INR. 750/-. TCC was spending INR. 1,08,000 a year for the de-sludging of RMS Colony containment.

f) The septage was taken from the chamber located in the outlet end of the septic tank by the TCC's de-sludging operators. The first chamber of the septic was filled with sludge accumulated from the beginning (and never desludged), which affected the performance of the containment system.

3.2.2. Superstructure:

The assessment found that the provision of sanitation features in the toilet infrastructure was not as per the MoHUA standards. Other issues identified in the superstructure are below.

a) Toilet units were not provided as per the MoHUA requirements with respect to the population.
b) There were no inclusive provisions such as ramps, handrails, and separate toilet units for differently abled people.
c) Heavy leakage was found in the RCC water storage tank.
d) Toilet doors were broken and rusted.
e) Toilet pans were broken and stained.
f) Pipes and taps were leaking and worn out.
g) Cracks were found on walls and roof.
h) Electrical fittings and switches were damaged. Lighting was poor inside the toilet.
i) Walls were dirty.

3.2.3. Assessment of Wastewater Quantity

The wastewater generated in the community toilet per day is arrived based on the total no. of users using the facility every day. The breakup of total wastewater quantity is provided below.

Table 3.2: Waste Water Quantity

Toilet	2124	Litre Per day Qty
Bathing	3725	Litre Per day Qty
Cloth washing	1142	Litre Per day Qty
Total	6991	LPD

The wastewater quantity is arrived based on the calculation below,

Table 3.3: Wastewater Volume Calculation			
Usage description	**Total number of usages**	**Water use litre/usage**	**WW generation in litres**
Men's toilet	151	5	754
Women's toilet	137	5	685
Children's toilet (boys)	30	5	148
Children's toilet (girls)	30	5	148
Physically challenged (Men)	10	10	103
Physically challenged (Women)	10	10	103
Wash basin (Men including kids and elders)	191	0.5	96
Wash basin (Women including kids and elders))	176	0.5	88
Bathroom (Men)	57	30	1713
Bathroom (Women)	57	30	1713
Cloth-washing (men)	6	50	285
Cloth-washing (women)	17	50	856
Cleaning Toilet and other facilities	3	100	300
Total estimated volume of WW generated (litre) per day			6,991

4

Proposed Model for Containment Improvement

4. Proposed Model for Containment Improvement

RMS colony Community Toilet needed both superstructure and containment improvement. The following improvements were suggested for the RMS colony community toilet.

4.1. Superstructure Improvement

The following provisions were proposed for the superstructure improvement:

a. A ramp with a slope of not more than 1:10 (height: length) to enable ease of access for the elderly and the differently abled.
b. Medium-sized toilet pans for the benefit of the elderly, differently abled people, and pregnant women.
c. Handrail and washbasin.
d. Sliding doors.
e. High-contrast lights and LED light strips on the walls for the benefit of the visually challenged.
f. Differently abled people can utilise a ring bell supplied as part of the toilet facilities to request assistance or support from others if necessary.
g. Precast compound wall.
h. Child-friendly features and hand-washing facilities.

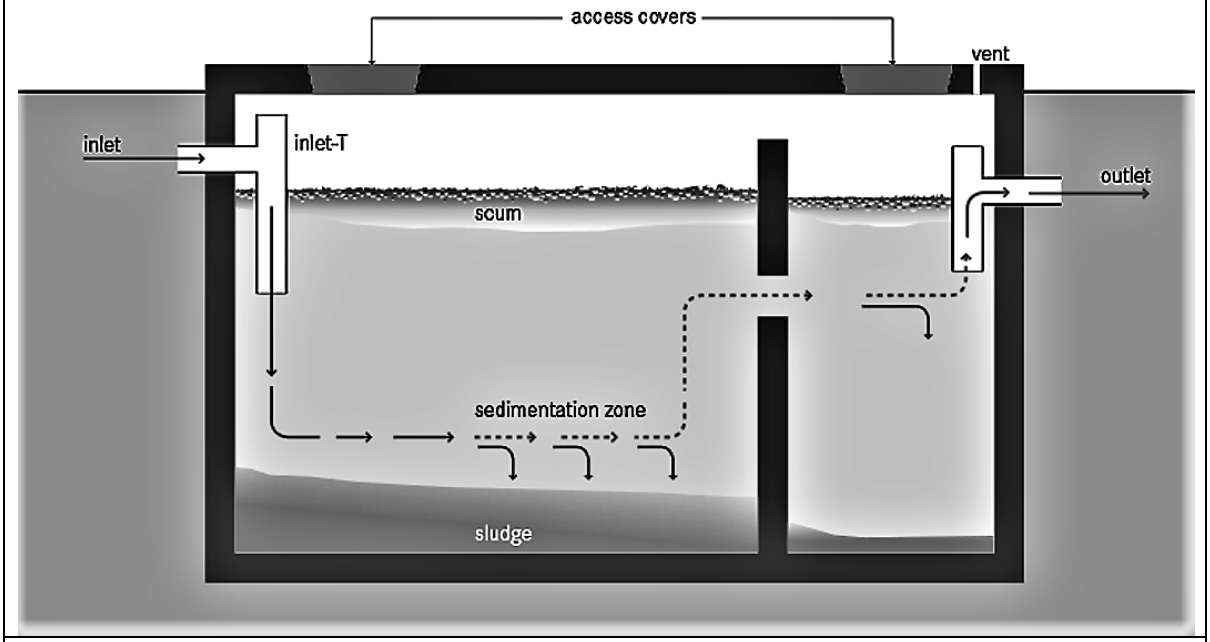
4.2. Containment Improvement

Based on the available area as well as its low operation and maintenance requirements, it is proposed to modify the existing septic tank into an improved septic tank and install a new primary settling tank (settler) while converting the septic tank into an anaerobic baffled reactor integrated with filter chambers. The proposed improved septic tank would have the capacity to treat 7 KLD.

4.2.1. Primary Settler:

As part of the containment improvement, a new primary settler (Figure 4.1) is planned at RMS Colony community toilet, which digests fresh fecal sludge from the toilet and releases gas through the vent pipe. It is a sub-soil tank with one baffle wall and two chambers. After the digestion stage, the effluent enters the secondary treatment process. The hydraulic retention time is 24 hours, and the average reduction of BOD is 20-30 per cent. The recommended period of de-sludging is once in every 24 months or can be extended up to a maximum of 36 months when the sludge accumulation is very low. The sludge level in the settler will be monitored and the tank should be de-sludged when the sludge level reaches 75 per cent of its total capacity, even if it is earlier than the specified time. The sludge level can be calculated based on the BOD loading rate in the treatment system, which is 600 mg/litre.

Figure 4.1: Primary Settler



Source: Containment improvement, RMS colony, CWIS – Tiruchirappalli, 2020.

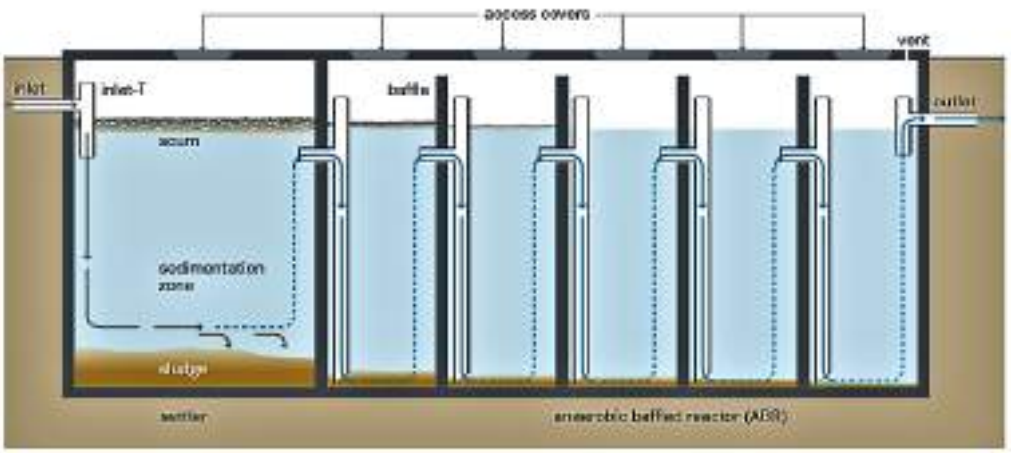
4.2.2. Improved Septic Tank:

The improved septic tank is a refurbished structure with three-chambered anaerobic baffled reactor and two-chambered anaerobic filter. Both the treatment units are provided with a HRT of one day. The recommended de-sludging frequency is 36 months.

4.2.3. Anaerobic Baffled Reactor:

The Anaerobic Baffle Reactor (ABR) is the secondary treatment unit where processes such as solid-liquid separation and biological digestion of organic matter by microorganisms take place. The ABR installed at RMS Colony consists of a series of baffles that compartmentalise the reactor tank into three chambers. Treatment of the wastewater takes place as it is forced to flow upward through the chambers, where the pollutants get biologically degraded in an active sludge layer retained at the bottom of each chamber. The wastewater is forced to pass through this active sludge layer during input flow, where anaerobic bacteria are present and break down the contaminants, thereby the organics in the subsequent chambers experience progressive degradation. The treatment of wastewater by ABR ensures a reduction in BOD by 65 to 90 per cent The ABR treatment unit is provided with a one-day hydraulic retention time and a recommended de-sludging frequency of 36 months (Figure 4.2).

Figure 4.2: Schematic Diagram of Anaerobic Baffled Reactor

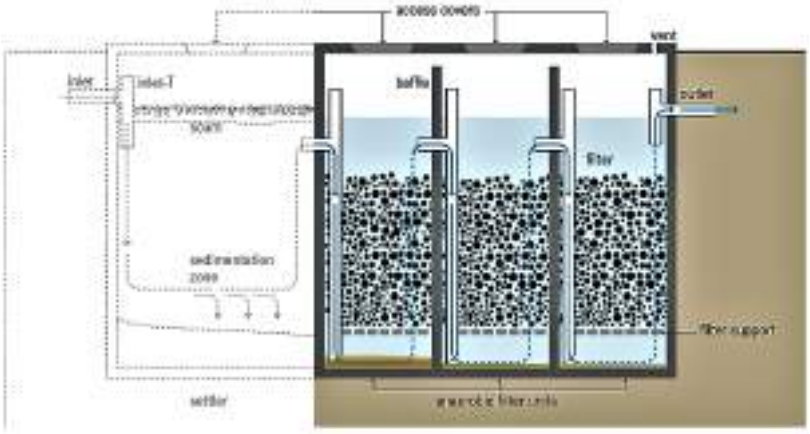


Source: Containment improvement, RMS colony, CWIS – Tiruchirappalli, 2020.

4.2.4. Anaerobic Filter Reactor:

The Anaerobic Filters (AF) are the treatment units, where escaped pollutants from the ABR are treated by further anaerobic degradation. It is a fixed bed biological reactor, where the extensive contact between the wastewater and the microbial biomass that develops on the filter media is facilitated, allowing faster digestion of organic matter. Special filter media of plastic, having large surface area is used to fill Anaerobic Filter, and microorganisms get attached to this filter material. Even distribution of effluent over the filter media is an important design criterion for AF and the equal distribution is provided by appropriate freeboard before the filter and the same space before the outflow pipe. The treatment of wastewater by AF ensures a reduction in BOD by 65 to 85 per cent. The hydraulic retention time provided for this treatment unit is one day and a desludging period of 36 months is recommended. (Figure 4.3)

Figure 4.3: Schematic Diagram of Anaerobic Filter Reactor



Source: Containment improvement, RMS colony, CWIS – Tiruchirappalli, 2020.

4.2.5. Dispersion Trenches:

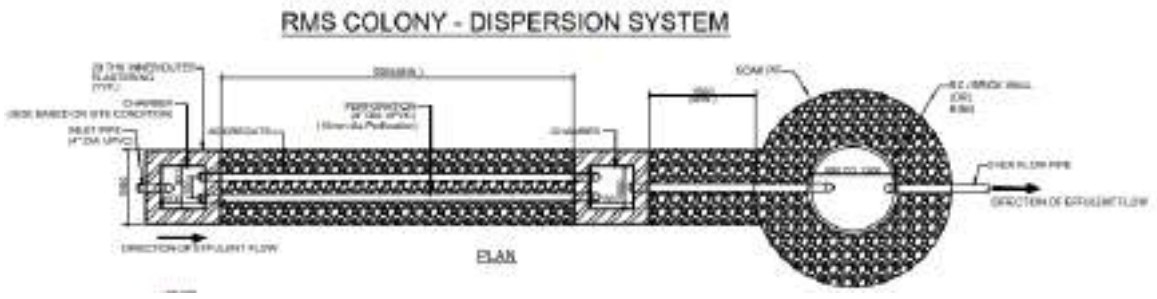
Dispersion trenches are 1 m in depth and 0.3 to 1 m in width. These trenches are excavated to a slight gradient of about 0.25 per cent along their length. To disperse the treated wastewater, open joined earthenware, or concrete pipes of diameter 8 to 10 cm are laid inside the trenches over a bed of 15 cm to 25 cm of washed gravel or crushed stone. The top portion of the trench should be filled with coarse gravel and crushed stones to a minimum depth of 15 cm such that the pipes are covered. To avoid the immediate flooding of the trench when it rains, the rest of the trench should be filled with excavated dirt and finished with a mound above ground level. The septic tank effluent is discharged into a small distribution box from which several trenches could radiate out. Each distribution box should be provided with three to four trenches (Refer Figure 4.4). The number of trenches is calculated based on a maximum length of 30 m for each trench and a minimum 2 m spacing (CPHEEO, 2013).

4.2.6. Dispersion Pits:

Dispersion pits or soak pits are extensively used treatment systems as the cost for construction is very less compared to other systems. The pits can be any regular shape, although the most common are circular and square. When the depth below the invert level or the inflow pipe is at 1 m, the minimum horizontal dimension of the soak pit should be 1 m. These dispersion pits are typically preferred when the water table is sufficiently below ground level, there is limited land available, or a porous layer underlying an impervious layer at the top, which allows for easier vertical downward flow than horizontal flow, as in the case of dispersion trenches (Figure 4.4). To avoid flooding damage, the top portion of the soak pit should be raised above the adjacent ground and covered. (CPHEEO, 2013).

The schematic diagram of the proposed treatment system is provided below.

Figure 4.4: Schematic Diagram of Dispersion Trench and Pit



Source: Containment improvement, RMS colony, CWIS – Tiruchirappalli, 2020.

5 Finance and Budgeting

5. Finance and Budgeting

5.1. Project Cost

A total of 9.98 lakhs has been spent on the improvement of RMS colony community toilet improvements. Rs.4.38 Lakhs spent on containment improvement and Rs. 5.5 Lakhs on the superstructure and other site-based requirements. A beak-up of the expenditure is given below.

Table 5.1: Expenditure

Sl. No	Descriptions	Expenditure made. (INR. Lakh)
1.	Primary settler with 7 KLD capacity	1.69
2.	Improved septic tank (consist of Anaerobic baffle reactor and Anaerobic filters) with	1.99
3.	Disposal arrangement	0.70
4.	Superstructure retrofitting	5.50
	Total Expenditure	**9.88**

Source: CWIS 2020.

6 Implementation of the Proposed Model

6. Implementation of the Proposed Model

6.1. Design Basis

Treatment Capacity : 7KLD
Operating hours : 24

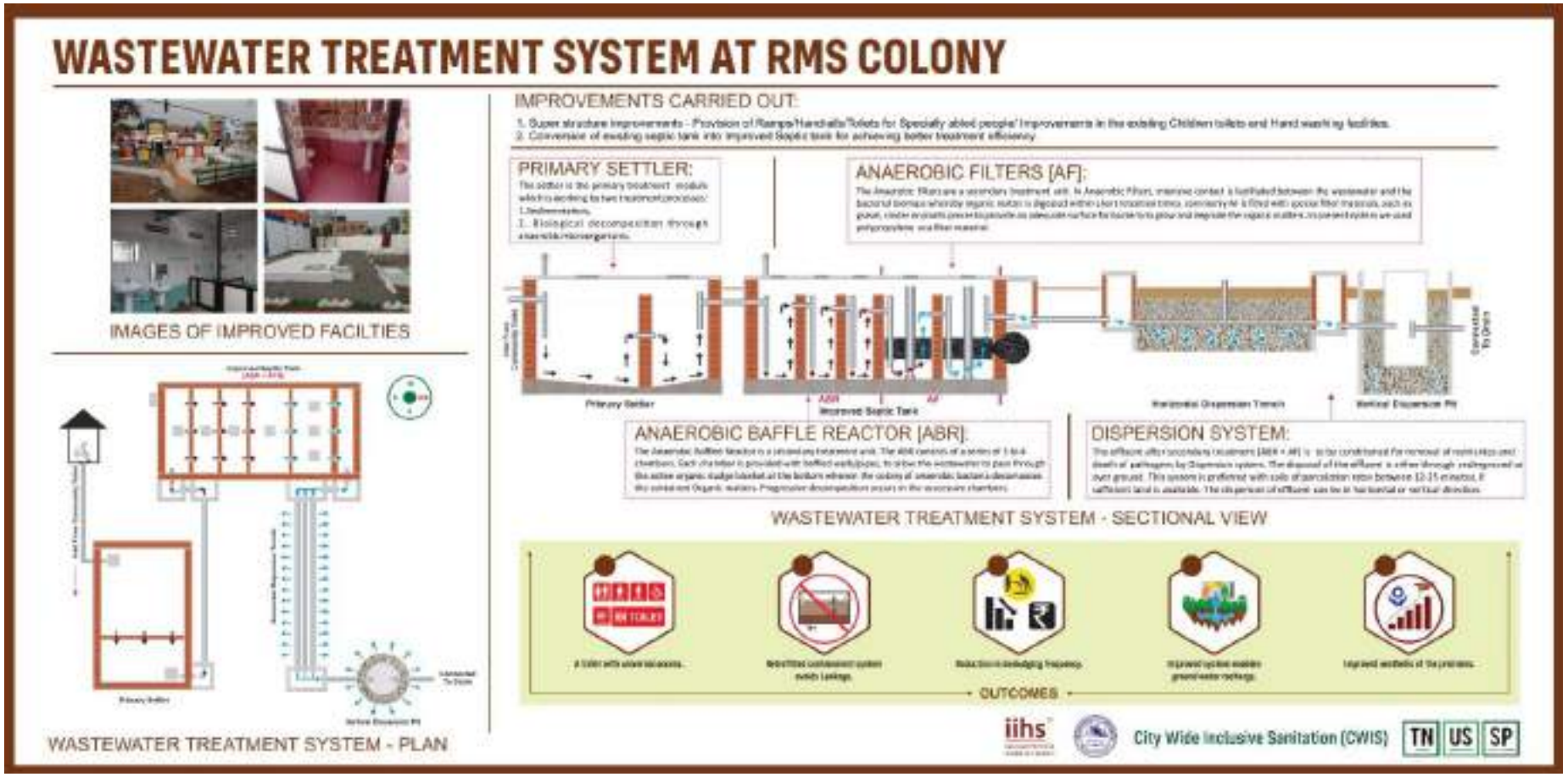
Table 6.1: Design Criteria for Key Parameters					
Sl. No	**Description**	**Unit**	**Inlet**	**Outlet**	**TNPCB Standard**
1	pH		7.0 – 8.0	7.0 – 8.0	6.5 – 9.0
2	Bio-Chemical Oxygen Demand (BOD)	Mg/l	1500 - 2500	<30	30
3	Total Suspended Solids (TSS)	Mg/l	1500 - 3000	<30	30
4	Chemical Oxygen Demand (COD)	Mg/l	3500 - 6000	<100	100
5	Nitrogen – Total	Mg/l	250 - 500	<15	15
6	Fecal Coliform (FC)	MPN/ 100ml	-	<1000	<1000

6.2. Design Consideration

Table 6.2: Design Consideration		
Design consideration for the CT Usage	250 Persons per day	As per the assessment conducted on 19.03.2020. Refer the Annexure 07.
Design Wastewater Quantity	7 KLD	As per the Calculation sheet (19.03.2020). Refer the **Annexure 5**
Existing containment system	Septic tank without soak pit (24000 L tank capacity)	As per field assessment
BOD (Initial)	600 mg/litre	Assumed
COD (Initial)	1200 mg/litre	Assumed

6.3. Schematic Diagram of the Treatment System

Figure 6.1: Schematic Diagram of RMS Colony Wastewater Treatment System



Source: Containment improvement, RMS colony, CWIS – Tiruchirappalli, 2020.

6.4. Process Description

6.4.1. Primary Settler:

The construction of the primary settler started with measuring and marking the level and layout. Safety measures were followed during the construction work. Following the excavation process, the Plain Cement Concrete (PCC) applied and after construction of bottom floor with Reinforced Cement Concrete (RCC), outer wall, baffle wall, and plastering inside the tank works were completed. Once the roof slab was constructed, a hydrostatic test was conducted. The primary settler was used as the temporary containment system until the septic tank was refurbished. The septic tank was opened and de-sludged after diverting the wastewater to the primary settler. As a precautionary measure, the sides of the septic tank were excavated to a depth of 1 m before de-sludging to prevent earth pressure.

The tank was kept open for 24 hours after de-sludging to let the accumulated gases escape. The top slab was removed the next day and kept open for 12 hours to avoid further accumulation of gases. Then it was cleaned with fresh water and chlorine powder and de-sludged again. Construction workers were allowed to enter the tank only after the tank dried and gas concentration was measured using a gas monitor.

Figure 6.2: Primary Settler After Construction

Source: RMS colony containment improvement, January 2021.

6.4.2. Improved Septic Tank

The existing septic tank is converted into an improved septic tank. Since the septic tank had leakages, it was continuously dewatered until masonry work was completed. Two baffle walls (Figure 6.3) were constructed along with the existing two baffle walls and a filter bed (perforated RCC slab) was provided to place the filter media. T-pipes were placed at the inlet of each chamber to prevent scum from passing between chambers and extended up to the bottom of the tank to increase the digestion process and reduce the velocity of flow. The existing septic tank is converted into improved septic tank (Figure 6.4) which consists of the following units.

1. Anaerobic baffle rector
2. Anaerobic Filter

The support walls and pre-cast perforated slabs were used as a platform for the filter media. Effluent from this anaerobic filter was sent to the dispersion trench. Following a hydrostatic test, the system was commissioned (Figure 6.5), and the temporary provision was discontinued.

Figure 6.3: Construction of Baffle Wall Inside the Existing Septic Tank	**Figure 6.4: RCC for Roof Slab – Improved Septic Tank**
	
Source: Containment improvement – RMS colony, CWIS, 2020.	*Source*: Containment improvement – RMS colony, CWIS, 2020.

Figure 6.5: Improved Septic Tank After Construction

Source: RMS colony containment improvement, January 2021.

6.4.3. Dispersion Trench:

The dispersion system was provided as per **IS 2470, part 2**. The disposal arrangement may vary according to the groundwater table condition and percolation rate at the site.

This is a horizontal dispersion trench with three perforated pipes with a cleaning arrangement by provision of “T” Pipe in the middle of the trench and chambers at the end of the trench. In this unit, the pipes were laid above 1 m of aggregates of size 70 mm, and a minimum slope was provided to allow water to percolate into the earth. The effluent from dispersion trench reaches the dispersion pit and discharge into the nearest storm water drain when the ground water table raises during the rainy seasons. The composition of the dispersion trench is as follows:

1. Bottom boulders of medium size aggregates of 50 to 70 mm.
2. Middle layer with a small size aggregate of 12 to 20 mm.
3. Top layer with a small size aggregate of 6 to 10 mm.
4. Above this layer, a 500-micron polythene sheet is placed to prevent rainwater from entering the system, and the sides of the polythene sheets were extended to 300 mm on both sides of the aggregate layer. Earth was filled above the polythene sheet layer.

6.4.4 Dispersion Pit:

The dispersion pit was constructed along with the primary settler for use as a temporary disposal arrangement during the execution period. The dispersion pit was made of RCC rings with perforated holes and provided with 750 mm of aggregate filling around the pit. The bottom of the pit was plastered. The pit was regularly de-sludged during the construction. After completion of the construction, the pit was de-sludged, disinfected, and then connected to the outlet of the dispersion trench. The community toilet usage and effluent discharge were observed for seven days. An improvement in the usage is expected after a behaviour change communication (BCC) intervention in the settlement.

7 Results and Outcomes

7. Results and Outcomes

7.1. Treatment System

The improved containment treatment system was operational since February 2021. The outcome of the improvement is as follows:

a. The maintenance is very less including the primary settler.
b. The anaerobic baffled reactor and anaerobic filter are functioning well, and the sludge level monitoring is carried out once in every six months. Because of the low sludge level, the containment has not yet been desludged.
c. The OD practice is considerably reduced, and the users of community toilet increased after the retrofit.
d. The frequency of de-sludging reduced from every two days to three years. The cost savings to the ULB is INR. 11,250 per month. Since the improvement of the containment system, the containment has not been desludged for approximately 20 months, saving Tiruchirappalli City Corporation (TCC) Rs. 2,25,000/- in direct costs.

7.2. Treated Quality of the Wastewater

The quality of the treated water in the containment is monitored from February 2021 to February 2022. The results of the organic pollutant load in the treatment system shows the biological treatment of the improvemed septic tank is effective. The high concentration of COD and BOD in the Primary digester significantly reduced after the biological treatment process in the Anaerobic baffled reactor and Anaerobic Filter.

Figure 7.1: RMS Colony Containment System Treatment Performance -COD

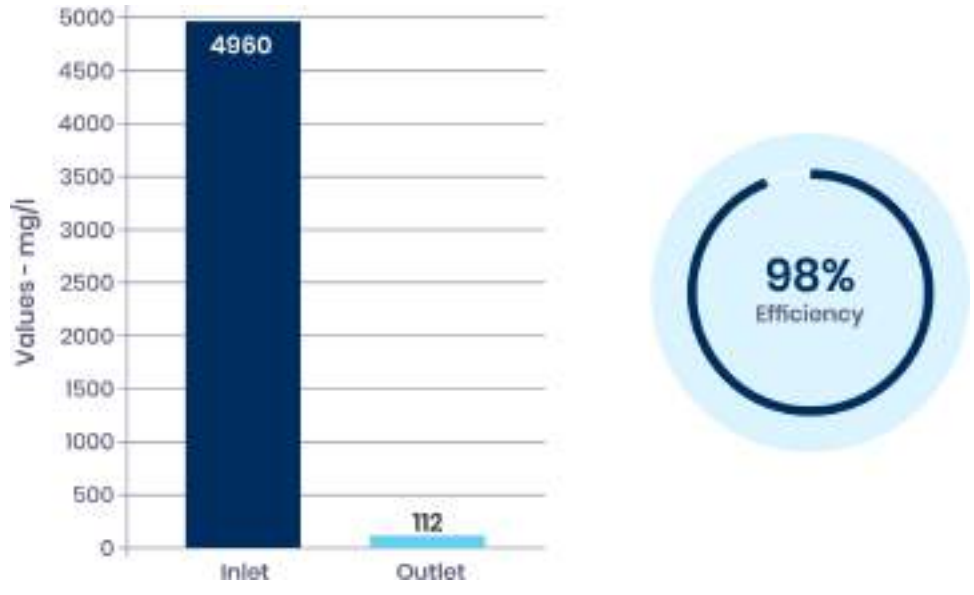
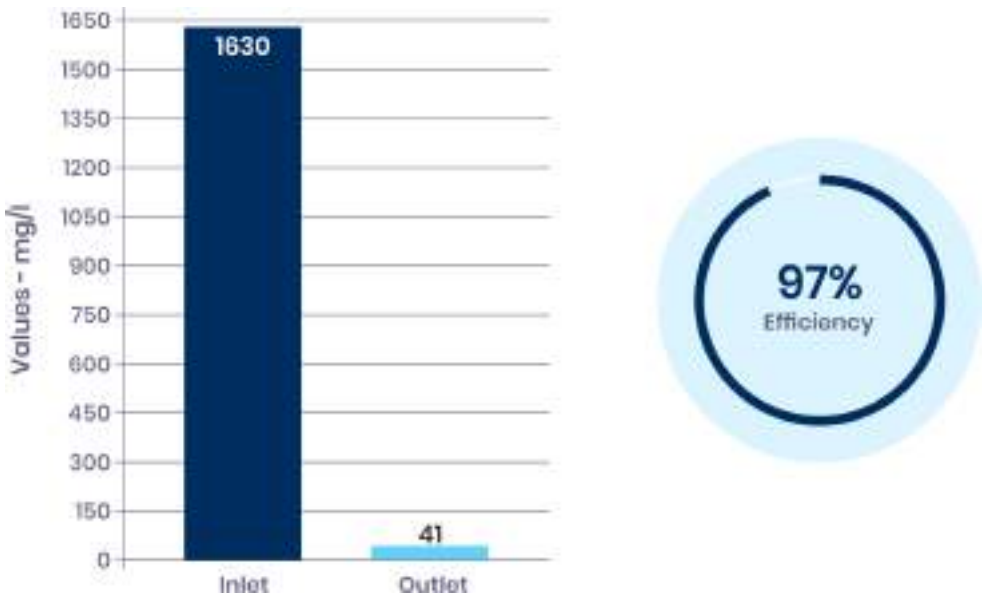


Figure 7.2: RMS Colony Containment System Treatment Performance - BOD



7.3. Superstructure Improvement

1. Inclusive features such as a ramp, separate rest rooms for differently abled people, and child-friendly toilets benefit the community.
2. The accessible and user-friendly upgrade to the community toilet has improved the hygiene and aesthetics in the area, preventing the community dwellers from dumping solid waste around the premises of community toilet.

7.4. Daily Operations and Maintenance

A caretaker from Self Help Group (SHG) manages the daily operations of the community toilet, including the maintenance of the superstructure, surroundings, and the treatment facility. An information board with the operations and maintenance schedule, as shown in Figure 7.3, is updated every day. The SHG members also maintain a record of daily financial transactions in the community toilet. In addition, a caretaker will monitor the improved treatment system's performance as and when required.

Figure 7.3: Information Board for Operations

8 Challenges and Limitations

8. Challenges and Limitations

Implementing improvements to the existing containment or superstructure is a challenging task. The challenges faced by the team during execution are,

a. Renovation of old containment structure
b. Arresting leakage in the septic tank
c. Temporary disposal arrangement
d. Desludging old sludge
e. Renovation during the operation hours of CT
f. Availability of special components for the people of differently abled
g. Community behaviour change

9 Way Forward

9. Way Forward

The sanitation improvements at RMS Colony community toilet are a cost-effective, viable model with a potential for replication. The demonstrated improvements – superstructure and containment – strengthened the sanitation coverage in the community, favouring eradication of open defecation, no major operation cost involved and reduction of resource utilisation for de-sludging the containment units.

Even though there are many mechanised STPs available in the market, this simple gravity-based anaerobic treatment system is most suitable for community toilet containment improvement if adequate area is available for the treatment systems.

Action items to scale up the containment improvements are listed below.

1. Identifying the list of toilets with containment issues, and without adequate inclusion facilities in the superstructure.
2. Identifying a suitable solution for containment improvement.
3. Replicating and scaling up containment improvement in other parts of the city.
4. Documenting the lessons learnt and provide support to other ULBs to replicate this model.
5. Developing a strategy to run the toilets without hindrance and implanting a monitoring system.

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Annexures

Annexure I – Users and Water Usage Data

Table A1.1: Users and Water Usage Data of CT, RMS Colony			
S. No	**Description**	**Quantity (Nos)**	**Remarks**
A	**Toilet Users calculation - Existing Condition**		
1	Total No. of HH in the beneficiary community	84	As per needs assessment
2	Total Number of Population in the community	400	As per needs assessment
3	Average household population	4	As per the survey.
4	Number of HH having Individual Household Latrine (IHHL)	16	
5	Total number of users of IHHL	64	
6	Number of usages of CT as per monitoring	81	The number of users is less than usage number due to multiple usage by single user.
7	Number of **users** based on the Usage number	121	It is considered as each user may use 1.5 times the facility during the day
9	Additional users of toilet from the nearby Anganwadi school	20	
10	Total estimated number of users of CT-Toilet (I)	**141**	From the community and nearby Anganwadi
B	**Toilet Users calculation - Future growth consideration**		
1	People practicing Open defecation	215	Estimated based on IHHL user and CT user
2	50% of people practicing OD may use to CT after retrofit (II)	**108**	Remaining 50% of OD may convert to IHHL
C	**Total number of users of CT based on existing and future users(I)+(II)**	249	As per the Design backup
	Final No. of Users considered for using CT	**250**	

Annexure II: Wastewater Quantification

Table A2.1: Wastewater Volume Calculation			
Usage description	**Total number of usages**	**Water use litre/usage**	**WW generation in litres**
Men's toilet	151	5	754
Women's toilet	137	5	685
Men's urinal	-	-	0
Women's urinal	-	-	0
Children's toilet (boys)	30	5	148
Children's toilet (girls)	30	5	148
Physically challenged (Men)	10	10	103
Physically challenged (Women)	10	10	103
Wash basin (Men including kids and elders)	191	0.5	96
Wash basin (Women including kids and elders)	176	0.5	88
Bathroom (Men)	57	30	1713
Bathroom (Women)	57	30	1713
Cloth-washing (men)	6	50	285
Cloth-washing (women)	17	50	856
Cleaning Toilet and other facilities	3	100	300
Total estimated volume of WW generated (litre) per day			**6,991**

Annexure III: Users and usage of CT

Table A3. 1: Users and Usage of CT				
Sl. No	**Description**	**Unit**	**Quantity**	**Remarks**
A	**Toilet Users calculation - Existing Condition**			
	Total No. of HH in the beneficiary community	Nos	84	Nos
	Total Number of Population in the community	Nos	400	As per PRA report
	Average household population	Nos	4	As per the survey. Few houses have more than 4
	Number of HH with IHHL	Nos	16	
	Total number of users of IHHL	Nos	64	
	Number of usages of CT as per monitoring		181	The number of users is less than user number due to multiple usage by single user
	Number of users of CT as per PRA survey		120	Not considered for the calculation
	Number of users calculated based on Usage number		121	It is considered as each user may sue 1.5 times the facility during the day
	Additional users of toilet from the nearby Anganwadi school		20	
	Total estimated number of users of CT-Toilet - Existing		**141**	**From the community and nearby Anganwadi**
B	**Toilet Users calculation - Future growth consideration**			
	People practicing Open defecation		215	Estimated based on IHHL user and CT user
	50% of OD may convert to CT		108	balance 50% of OD may convert to IHHL
C	**Total number of users of CT based on existing and future users**		**248**	
	Rounded figure		**250**	
D	**Per day usage of Toilet in CT**			
	Total number of usages based on the total number of existing users from the community		181	Based on the site usage monitoring

Table A3. 1: Users and Usage of CT				
Sl. No	**Description**	**Unit**	**Quantity**	**Remarks**
	Total number of usages based on the total number of future users from the community		162	OD conversion to CT and usage considered 1.5 time by the users
	Total number of usages based on the total number of users from the Anganwadi		25	
	Total usage of Toilet estimated per day		**368**	
E	**Bifurcation of users of CT from the community**			
	Total Men Users	%	44	as per the monitoring at site
	Total Women Users	%	40	as per the monitoring at site
	Total old people	%	6	as per the monitoring at site
	Total Child Users	%	10	as per the monitoring at site
F	**Total usage of CT toilet**			
	Total usage of CT toilet per day from the community		343	
	Total Men Users		151	
	Total Women Users		137	
	Total old people		21	
	Total Child Users		34	
	Additional 20 Children's		25	From nearby Anganwadi school
	Total usage of CT toilet per day		**368**	
G	**Total number of users/usages of Bathroom in the CT from the community**			
	Total number of usages based on the total number of existing users from the community		60	50% of the users
	Total number of usages based on the total number of future users from the community		54	50% of the users
	Total number of users of Bathroom		**114**	
H	**Total user of CT Bathroom**			

Table A3. 1: Users and Usage of CT				
Sl. No	**Description**	**Unit**	**Quantity**	**Remarks**
	Total usage of CT Bathroom per day from the community		114	
	Total Men Users		57	50% of men
	Total Women Users		57	50% women
I	**Total number of users of cloth wash**			
	Total number of users/usages of cloth wash from the community		23	10% of CT users
	Total Men Users		6	25% for women
	Total Women Users		17	75% for women
J	**Total number of usages of Wash basin**			
	Total number of usages of Wash basin		368	
	Total Men Users with kids and elders		191	Calculated based on the bifurcation mentioned above. 50% of kids and elders
	Total Women Users with kids and elders		176	Calculated based on the bifurcation mentioned above. 50% of kids and elders

TN US SP

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