Ukkadam STP, Coimbatore Co-treatment Case Study

Contents

List of Tables

List of Figures

A. City Profile

Coimbatore, the second largest city of Tamil Nadu[1], is located on the banks of River Noyyal. The city is a major industrial[2] and educational hub of southern India.

In 2011, the jurisdiction of Coimbatore City Municipal Corporation (CCMC) was expanded to include three Municipalities[3], seven Town Panchayats (TPs)[4] and one Village Panchayat[5], thereby increasing its area from 105.06 km^2 to 257.04 km^2. As per Census 2011, CCMC (post expansion) had a population of 1.61 million. (For details of population of erstwhile CCMC and newly incorporated areas refer Annex 1). As per the City Sanitation Plan (CSP), the city's population is expected to reach 2.15 million in 2025[6].

Access to toilets: As per Census 2011, 87.80 percent of households in Coimbatore had access to Individual Household Latrines (IHHLs) and 9.7 percent were using public toilets[7]. (Figure 1) Approximately 2.5 percent of the households were defecating in the open. (For detailed refer Annex 2)

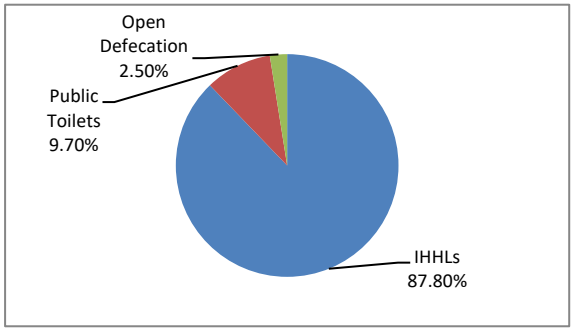


Figure 1: Access to toilets in Coimbatore

Under the Swachh Bharat Mission – Urban (SBM-U) 4,862[8] IHHLs were constructed, taking the proportion of households with IHHLs to 90 percent[9]. In addition 58 public / community toilets (known locally as *Namma* toilets) were constructed, taking the number of public / community toilets to 371[10]. As a result of these initiatives, Coimbatore was declared Open Defecation Free (ODF) in December 2017[11].

Sewage collection, conveyance and treatment systems: Only 37 percent of households with IHHLs were connected to the piped sewer network in 2011[12]. Majority of the households with IHHLs were based on on-site collection systems including septic tanks (57 percent) and pit latrines[13] (5 percent). (For details refer Annex 2)

The CCMC area is only partially covered with Underground Sewerage System (UGSS). As per CCMC only 22 percent (approximately 23 km^2) of the area under erstwhile CCMC[14] is connected to UGSS. The remaining parts of the erstwhile CCMC and recently incorporated areas (3 municipalities, 7 TPs and 1 VP) are not covered by UGSS. Discussions with CCMC officials revealed that work for covering

[1] After Chennai; As per Census 2011 Chennai had a population of 7.1 million.
[2] Key industries contributing to the city's economy are textiles, automotive components, software services, manufacturing, education and healthcare. Coimbatore also houses the country's largest number of hosiery and poultry industries. The city has two special economic zones (SEZ), the Coimbatore Hi-Tech Infrastructure (CHIL) SEZ and Coimbatore TIDEL Park, and at least five more SEZs are proposed.
[3] Kavundampalayam, Kurichi and Kuniamuthur Municipalities
[4] Chinnavedampatti TP, Kalapatti TP, Saravanampatti TP, Vellakinar TP, Thudiyalur TP, Vadavalli TP, and Veerakeralam TP
[5] Vilankurichi Village Panchayat
[6] Source: City Sanitation Plan submitted to Swachh Bharat Mission, GoI.
[7] The city had 313 public toilets
[8] The target under SBM-U was to construct 6056 IHHLs, in FY 2018-19 approximately 1500 IHHLs are planned to be constructed.
[9] Source: CCMC Budget 2018-19
[10] Prior to SBM U there were 313 public toilets. Source: CCMC Budget 2018-19
[11] Source: CCMC
[12] Source: Census 2011
[13] Including pits with slabs / Ventilated Improved Pits (VIPs) and Pit without slab /open pit
[14] The sewer lines extend for 162 km

the entire area of the erstwhile CCMC (105.06 km^2) with UGSS is underway. This will still leave the newly incorporated areas with a population of 0.544 million unserved by UGSS.

CCMC is divided into three zones for sewage collection, conveyance, treatment and disposal. The city has 3 Sewage Treatment Plants (STPs) namely, Ukkadam, Ondipudur[15] and Nanjundapura[16] with total installed capacity of 170 MLD. While the city has three STPs, only one, namely, Ukkadam is currently operational. Thus, at present, the city's wastewater treatment capacity is only 70 MLD. Table 1 summarizes the installed capacities, treatment technology and the current flows received at the STPs.

Table 1: Sewage Treatment Plants (STPs) in Coimbatore[17]

Zone	Location	Capacity [MLD]	Current Waste water Flows (MLD)	Treatment Technology
I	Ukkadam	70	24-30 MLD	Sequential Batch Reactor (SBR)
II	Ondipudur	60	-	SBR
III	Nanjundapura	40	-	SBR
	Total	**170**	**24-30 MLD**	

City's Vision for Sanitation: The CCMC is committed to ensuring universal access to toilets. CCMC constructed 58 public / community toilets under SBM-U, which along with construction of 4,862 IHHLs, has resulted in the city being declared ODF in December 2017.

The CCMC is also committed to providing safe collection and disposal systems for waste water generated in the city. To meet this objective CCMC has adopted a three pronged approach including a) implementation of UGSS in uncovered areas (of erstwhile CCMC and newly incorporated areas); b) septage management / decentralised treatment for uncovered areas; and c) assessing feasibility for reuse of waste water.

The ongoing UGSS project[18] covers an area of 105 km^2 (corresponding to the area of erstwhile CCMC) with laying of sewer lines along 582.88 km[19] and 103,506 household connections. In addition, a Detailed Project Report (DPR) has been prepared for covering the recently added areas (152 km^2) with UGSS. This project is estimated to cost INR 16,310 million and CCMC is exploring funding for the same. Further, a feasibility study for implementing a Tertiary Treatment / Reverse Osmosis facility for reuse and recycling of domestic sewage is also under consideration.

B. Co-treatment – Genesis

Coimbatore initiated co-treatment of septage at Ukkadam STP in 2011, soon after the plant was commissioned in January 2011. The main driver for initiating co-treatment was the fact that majority of the households in the city were connected to on-site sanitation systems and private operators involved in desludging septic tanks were rampantly dumping septage into the city's open areas and

[15] The works at Ondipudur STP were completed in April 2014. However, the plant hasn't been commissioned as yet as work for the collection system and household connections has not been completed as yet.
[16] The work at Nanjudapuram STP has been held up since April 28, 2009 due to public litigation. Consent to establish was obtained by the CCMC from the Tamil Nadu Pollution Control Board (TNPCB) on October 25, 2012. The subject was approved by the city council on March 18, 2013 and forwarded to CMA for getting approval. Meanwhile on April 2, 2013 the National Green Tribunal (NGT), South Zone ordered all work to stop. The argument of the case was concluded in its 9th hearing on January 23, 2014 and the case was dismissed. The judgement was delivered by NGT South Zone on April 24, 2017 and the CCMC was asked to resume work at the STP. Officials at CCMC shared that the process of preparing the revised cost estimates is currently underway.
[17] Source: CMWSSB
[18] For which funding was available under JNNURM
[19] This includes laying sewer lines along 582.88 km and work has been completed for 572.40 km

water bodies. The CCMC wanted to put an end to the unauthorised dumping of septage and the resultant pollution of the city's open areas and water bodies.

The Government of Tamil Nadu in its "Operative Guidelines for Septage Management for Urban and Rural Local Bodies, 2014" (hereafter referred to as Operative Guidelines) has identified STPs in Coimbatore to serve as a regional facility for treating septage of six Town Panchayats[20] and four Panchayat Unions[21] located in its vicinity. However, discussions with CCMC officials revealed that the co-treatment facility at Ukkadam is available only to private desludging operators operating within the area under the jurisdiction of CCMC (i.e., 257.04 km^2). The private desludging operators are required to sign an undertaking with CCMC pledging that they will operate only within the area under the jurisdiction of CCMC and if they are found operating outside, their contract is terminated.

When co-treatment was initiated at Ukkadam in 2011 only 25 private desludging trucks were registered with CCMC[22]. Simultaneous to the initiation of co-treatment facility at Ukkadam, the CCMC undertook drives for enforcement of the environmental protection and pollution control laws. Fines *(challans*), ranging from INR 25,000 to INR 50,000, were imposed by CCMC on desludging trucks found dumping septage in the open environment. In addition, the truck was impounded which was a double blow to the operators as they could not do any business until their vehicle was released. This measure is seen to be the main reason for a steady increase in the number of trucks registered with CCMC. At present, 65 trucks are registered with CCMC, varying in capacity from $3m^3$ – $8m^3$. The officials were of the opinion that all private desludging trucks operating within the jurisdiction of CCMC have been registered.

Contractual arrangements with private desludging operators: As per the Operative Guidelines only certified and licensed septage transporters are authorised to desludge and transport septage to the STP designated for co-treatment. In line with these provisions, all private desludging operators operating in Coimbatore have to register with CCMC after signing a formal agreement. The agreement applies to a single truck, while some operators have more than one truck. The agreement is required to be renewed annually. As a part of this agreement private desludging operators pledge to follow the rules (Table 2) set out by CCMC for co-treatment.

Table 2: List of Rules set by CCMC for private desludging operators partnering in co-treatment at Ukkadam

1	The private desludging operators will discharge the collected septage only at Ukkadam STP and not in the open areas, drains or water bodies anywhere within or outside the city
2	The private desludging operators will not discharge any industrial waste / effluent at the STP
3	The private desludging operators will use the facility only between 6 am and 6 pm
4	The private desludging operators will maintain a queue at the decanting point
5	The private desludging operators will maintain a log of their entry at the decanting point
6	The private desludging operators will paint a large (easy to read) display on their trucks indicating that the truck has been licensed by the CCMC
7	The private desludging operators are required to pay a tipping fee of INR 1,500 per month per truck, to be paid in advance as a quarterly fee of INR 4500
8	The private desludging operators will ensure that the following safety equipment is available on the vehicle and is used by the driver and helper: Gloves 410, Orange jacket 2", Mask Venus V 90 with clip, Safety belt, Helmet, Gumboot, Goggle #M 1621, LED Head Torch, Light and Mask 2m 1200
9	The private desludging operators will get the staff (both driver and helper) insured (INR 10 lakhs per person)

As an annexure to the agreement the operators are required to submit various documents (Table 3) for every truck.

[20] Including Sakar Samakulam, Vedapatty, Perur, Vellalur and Inugur
[21] Periyanaickenpalayam, Sarkarsamakulam, Thodamuthur and Sulur
[22] Source: CCMC

Table 3: List of documents to be submitted by private operators while entering into an agreement with CCMC

1	Registration Certificate (RC) from the Regional Transport Office (RTO)
2	Permit issued as a Medium Goods Vehicle (Form 38) complying with the provisions of Section 56 of the Motor Vehicles Act
3	Dangerous and Offensive (D&O) Trades License (which is issued by CCMC)
4	Pollution Under Control (PUC) Certificate
5	Insurance documents of the vehicle
6	Driver's driving license
7	Certificate that the vehicle has installed an electronic speed limit system
8	Bill as proof of purchase of mandatory safety equipment (including Gloves 410, Orange jacket 2", Mask Venus V 90 with clip, Safety belt, Helmet, Gumboot, Goggle #M 1621, LED Head Torch, Light and Mask 2m 1200
9	Documents of personal insurance policies for both the driver and helper (value of INR 10 lakhs per person)

While there is no registration charge or annual fee, the operators have to pay INR 1,500 as tipping fee per month per truck. This is to be paid in advance on a quarterly basis, amounting to INR 4,500 per quarter.

Truck displaying a sign that it is registered with CCMC

Private desludging operators come together: The private desludging operators have come together in the form of an association, called the "Septage Lorry Association". All private desludging operators who are registered with CCMC are members of this association. Regular meetings are held with CCMC which serve as a medium for operators to share their problems and seek interventions towards their resolution from CCMC.

The formation of the association has enabled operators to negotiate with CCMC regarding the tipping fee. CCMC officials shared that in late 2017 they had proposed raising the tipping fee from INR 1,500 per month to INR 2,500 per month per truck but this move was vehemently opposed by the association citing reasons such as traffic congestion in the city, increase in diesel prices, increase in labour cost, increase in vehicle maintenance costs and their inability to increase the fee for desludging and transporting septage from households[23]. The result was that the tipping fee wasn't increased.

C. Co-Treatment at Ukkadam STP

Plant Background

Ukkadam STP is located in the western part of the city and serves an area of approximately 23 km^2 which is covered with UGSS. The STP is based on "Sequential Batch Reactor" (SBR) technology. The plant has a capacity of 70 MLD while the wastewater flow ranges from 25 to 30 MLD. The presence of spare treatment capacity (of 40 to 45 MLD) enabled implementation of co-treatment of septage at Ukkadam STP.

[23] At present they charge households a fee ranging from INR 800 to 1000 per trip

Half of the treated waste water from Ukkadam STP is supplied (through a pipeline) to the city's Golf Club; the remaining is discharged into Noyyal River. There is neither any charge levied nor any formal agreement for supply of treated wastewater (with water quality specifications) to the Golf Club. The dried sludge (approx. 300-500 kg per month) is given free of charge to the Forest College. For details on the Ukkadam STP refer Annex 3.

Planning and Implementation of Septage Co-treatment

Co-treatment of septage at Ukkadam STP was initiated in early 2011. The un-sewered areas of the erstwhile CCMC (82.06 km^2) and the recently added areas (152 km^2) are served by the co-treatment facility at Ukkadam. Private operators are involved in desludging septic tanks and they charge households a fee, which ranges from INR 800 to 1,000 per trip.

Sixty five private desludging trucks, with capacity ranging from 3 kL to 8 kL are registered with the CCMC for discharging septage at Ukkadam STP. Each truck makes multiple (2 – 3) trips every day and about 130[24] 195[25] truckloads of septage are discharged at Ukkadam on a daily basis. Septage decanting is permitted at only one location in the city, which is an uncovered drain (*Nalla*) located about 500 meters from the STP.

Volume and Quality of Septage

The facility receives about ~16026 truckloads of septage on a daily basis or about 0.88 MLD27 of septage which is blended with ~30 MLD of sewage (therefore septage is ~ 3 percent of the current sewage flows). Due to absence of data, comparison of characteristics of raw sewage and septage is not possible. The city does not undertake quality testing of septage prior to its addition to the raw sewage at the decanting point.

Infrastructure Investments and Operational Changes for Co-treatment

Decanting Station: While the Operative Guidelines issued by GoTN have made it mandatory for STPs undertaking co-treatment to create a dedicated decanting station, there is no such infrastructure which has been created at Ukkadam.

The decanting site is an open drain (*nalla*), located about 500 meters upstream of the STP, which carries sewage to the plant. The decanting point does not have a boundary wall or even a fence. The access to the site is through a dirt path which is not paved or cemented, and the result is that every time a truck drives in / out a thin envelope of dust is created. There is enough space for three trucks to decant septage simultaneously.

While the trucks are permitted entry between 6 am and 6 pm every day, there is no mechanism to control the entry of trucks. Neither does the decanting point have a boundary wall nor is there any supervisor to monitor the entry and exit of trucks. CCMC plans to construct a security room (dimensions 10' x 10') and a store room (dimensions 20' x 10') at the decanting site to enable recording the movement of trucks and to store safety equipment. The CCMC has made a provision of INR 2 million in the budget for FY 2018-19 for the same.

The trucks usually have a driver and a helper on board. The truck arrives and parks at the decanting point following which the helper connects a pipe through which the septage is discharged into the open drain. The entire process takes around five to ten minutes.

[24] Assuming 2 trips are made by every truck each day
[25] Assuming 3 trips are made by every truck each day
[26] Average figure, arrived after adding the total trips assumed at 2 trips per truck (130) and three trips per day (195) per day
[27] Calculated at 160 truckloads with an average capacity of 5.5 KL (average of 3-8 KL)

Staff connecting the pipe to the truck

View of the pipe and the open drain into which septage is decanted

Truck decanting septage

Trucks parked at the decanting site

Retrofits or additions to the treatment process: Discussions with staff at the STP revealed that there have been no retrofits or additions required to the treatment process after mixing of septage with sewage prior to treatment.

Sampling and Monitoring Protocols*:* While the Operative Guidelines require regular testing of input quality of septage in order to identify metals or traces of industrial waste, testing of septage is not being undertaken at present at Ukkadam.

Record Keeping Protocols*:* As per the Operative Guidelines, a supervisor should be appointed at the decanting station / point but no staff has been positioned at the decanting point in Ukkadam. There are thus no records available on the number of trucks using the facility. In the absence of a supervisor the private desludging truckers are expected to maintain a log of their visits to the STP in a log book given to them by CCMC.

Safety protocols*:* As per the agreement with CCMC, private desludging operators are supposed to ensure that the following safety equipment is available on the vehicle and is used by the driver and helper – gloves 410, orange jacket 2", Mask Venus V 90 with clip, Safety belt, Helmet, Gumboot, Goggle #M 1621, Led Head Torch, Light and Mask 2m 1200. During our visit, we did not find staff using any protective gear apart from the orange jacket.

Financial Details

Capital Cost: No additional retrofits or modifications requiring capital investment have been made at the STP to enable co-treatment. CCMC plans to construct a security room (dimensions 10' x 10') and a store room (dimensions 20' x 10') at the decanting site to enable recording the movement of

trucks and to store safety equipment. The CCMC has made a provision of INR 2 million in the budget for FY 2018-19 for the same.

O&M Cost: A comparison of the O&M cost prior and post co-treatment isn't possible as co-treatment was initiated immediately after the plant was commissioned in 2011.

Tipping Fee: Fee of INR 1500 is charged per truck per month (irrespective of the number of trips made) for disposal of septage at Ukkadam. As mentioned earlier, this tipping fee is to be paid in advance per quarter amounting to INR 4,500. The tipping fee collections are approximately INR 1.17 million per annum[28]. (Table 4)

Table 4: Charges for co-treatment – Tipping Fee

Type of charge	Frequency	Rate (in INR)	Total collection in INR (approximate)
Tipping fee	Per truck per month	INR 1500	1.17 million per year

Performance Details

Total Suspended Solids (TSS): As per design parameters of Ukkadam STP, TSS in raw sewage should be between 200 to 400 mg/l. In some months (July 2016; March, April and May 2017) the inlet TSS figures are over 400 mg/l. The treated effluent has TSS figures well within the prescribed level i.e., under 10 mg/l during most of the year except in the months of May and June 2017. (Figure 2)

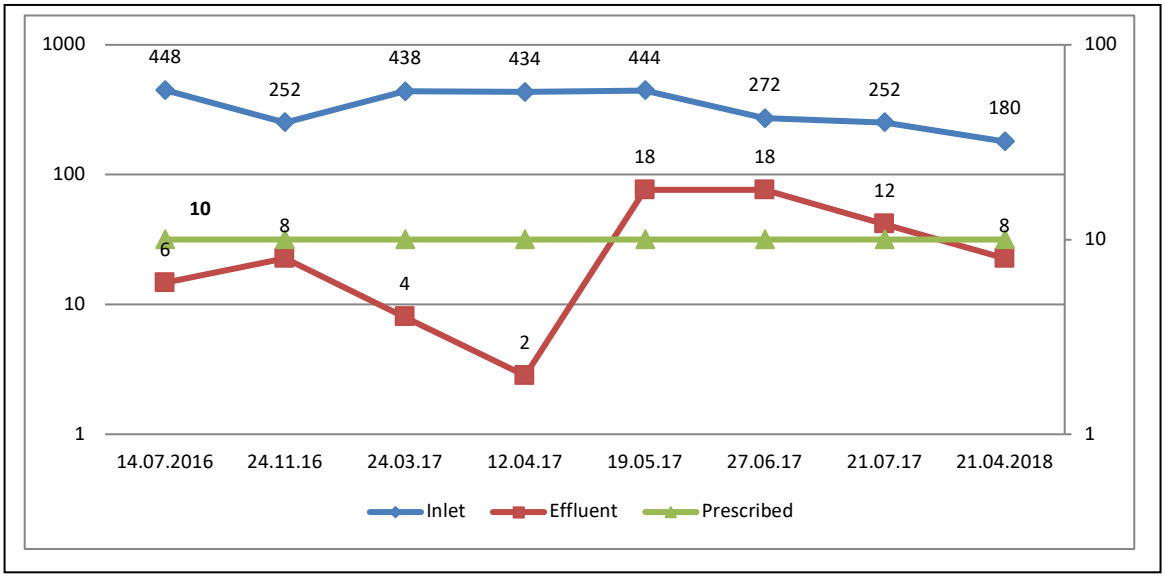


Figure 2: TSS levels (inlet and effluent) mg/l

[28] Based on 65 trucks paying tipping fee of INR 1500 / truck per month.

BOD: The prescribed levels of BOD in raw sewage (as per the plant's design parameters) should be between 200-400 mg/l. In March 2017 the inlet BOD figure was found to be over 400 mg/l. The treated wastewater has BOD well within range of applicable standards of < 10 mg/l in all months except June 2017. (Figure 3)

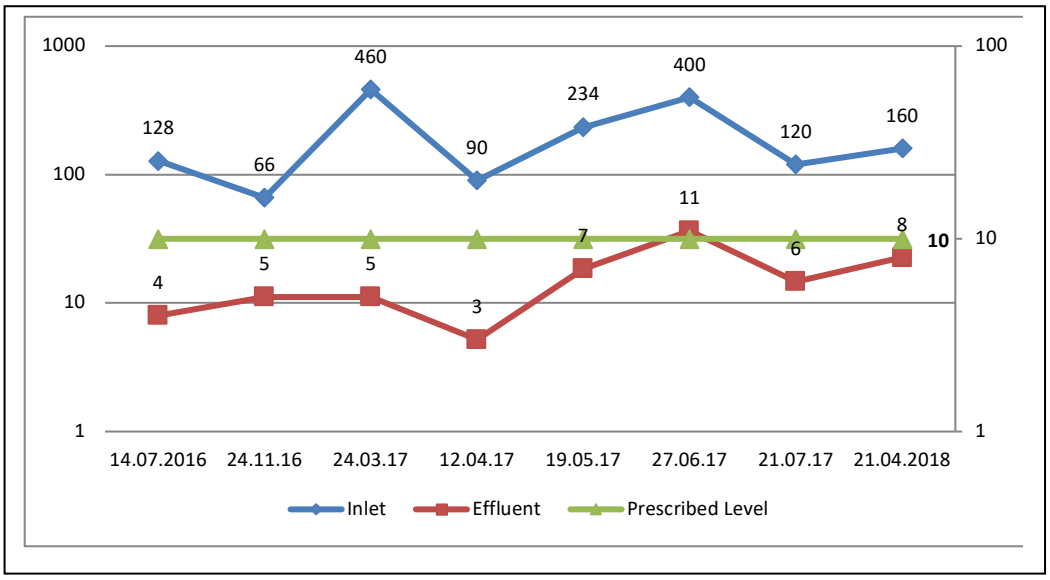


Figure 3: BOD levels (inlet and effluent) mg/l

D. Impact of Co-treatment

City population being served by co-treatment: The initiative has been successful in serving the un-sewered parts of the CCMC. Given that there are approximately 160 trips per day to the Ukkadam STP, it is estimated that the co-treatment facility is able to provide septage treatment solution for between 1.35 to 2.4 Lakh households with septic tanks per year[29].

Regularisation of private desludging operators: The 65 private trucks that are registered with the Ukkadam STP have been provided with a safe and economical option for discharging septage.

Environmental Impact: The initiative has ensured that unauthorised dumping of septage in the city's open areas and water bodies has reduced substantially.

Source of Revenue for the STP: The user charges collected from private desludging operators / trucks is resulting in generating revenue to the tune of about INR 1.17 million per annum.

E. Key lessons and practices

- The sound policy framework put in place by the GoTN in the form of the "Operative Guidelines for Septage Management for Urban and Rural Local Bodies" has laid out the broad contours for co-treatment in the state. While the CCMC has made a provision for co-treatment of septage at Ukkadam, it needs to do a lot more to ensure that it adopts the recommendations of the operative guidelines in their true spirit for safe decanting and conveyance of septage to the STP. This would include expanding the service of co-treatment to the surrounding urban and peri urban settlements; creating a decanting station; putting in place record keeping, testing of septage and safety protocols.

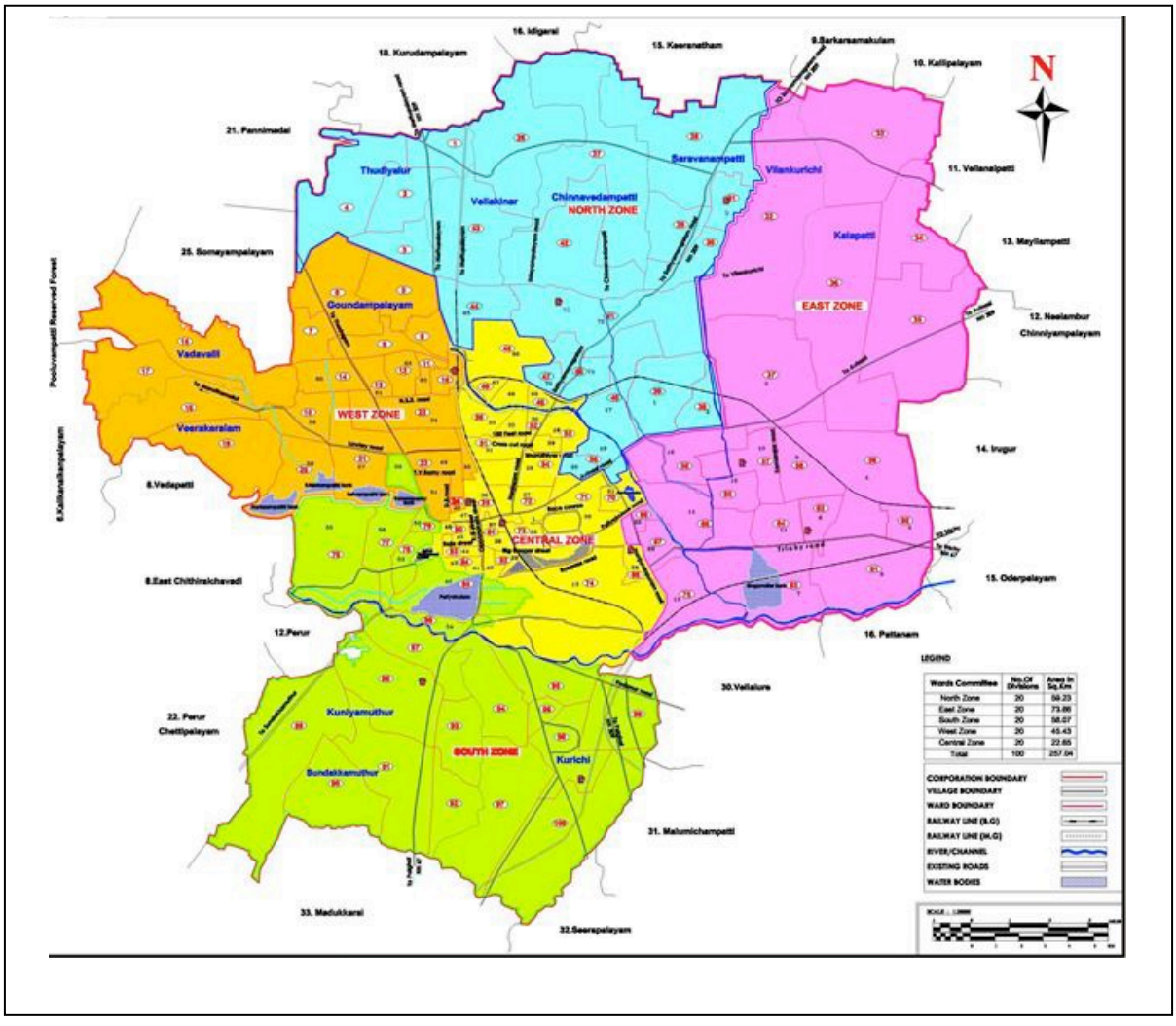
[29] Estimated based on number of households that can be serviced when septic tank sizes varies from 4 to 10 m^3 and when desludging is done once every 3 or 5 years.

- The fact that the CCMC undertook rigorous enforcement of environmental protection and pollution control provisions in tandem with initiation of co-treatment has proved critical to move private desludging operators towards a regulated regime and dissuade illegal dumping of septage.
- The STP at Ukkadam receives a very small amount of septage (about 3 percent by volume of the current flows received at the STP). Data on treated wastewater available for a few months in 2016 and 2017 indicates that there are no significant impacts on the final effluent quality. It seems that the plant is able to handle and treat the additional load from septage without impacting unit operations.
- Record Keeping Protocol needs to be put in place to control and record the movement of trucks in and out of the decanting point.
- Safety protocol needs to be put in place to identify and eliminate industrial waste from being disposed of at co-treatment facilities; this must include random testing of the septage being decanted at the STP.
- Given the large amount of spare capacity at this STP and the success achieved in septage co-treatment, CMC could allow disposal of septage from neighbouring towns and village at this STP. The collaboration between urban and rural areas will not only help in greater amount of septage being co-treated scientifically and safely, but will also add to the revenues of CMC from additional tipping fee.

Annex I: Coimbatore – Population (Census 2011)

A	Erstwhile CMC	1073020
B	**Municipalities added in 2011**	**379130**
	Kavundampalayam	98919
	Kurichi	159523
	Kuniamuthur	120688
C	**Town panchayats (TP)**	**151561**
	Chinnavedampatti TP	13177
	Kalapatti TP	26441
	Saravanampatti TP	21284
	Vellakinar TP	11726
	Thudiyalur TP	25205
	Vadavalli TP	29735
	Veerakeralam TP	23993
D	**Village panchayat**	**14000**
	Vilankurichi village panchayat	14000
	Total	**1617711**

City map of Coimbatore – Zones



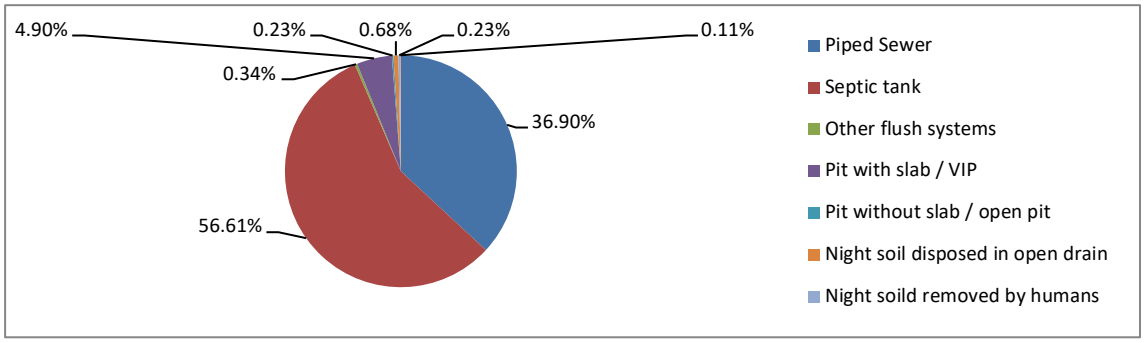
Annex 2: Status of access and collection and conveyance systems in Coimbatore

Table 1: Access to toilet facilities (Census 2011)

Access to Sanitation Facilities	Number of households	%
Individual Toilets	248,332	87.80
Public Toilets	27,435	9.70
Open defecation	7,072	2.50
Total households	**282,839**	**100.00**

Table 2: Collection and Conveyance systems (Census 2011)

	Number of households	%
Piped sewer	91,639	36.90
Septic Tank	140,570	56.61
Other Flush System	848	0.34
Pit with slab / VIP	12,162	4.90
Without slab/ open pit	565	0.23
Night soil disposed into open drain	1,697	0.68
Night soil serviced by human	565	0.23
Night soil serviced by animal	282	0.11
Total	**248,328**	**100.00**



Collection and conveyance mechanism for septage in Coimbatore, Census 2011

Annex 3: Details of Ukkadam STP

Design Capacity	70 MLD
Waste water Flows / Average quantity treated	20-30 MLD
Treatment Technology	Sequential Batch Reactor (SBR) The treatment facility at Ukkadam consists of screen chamber (coarse screen and fine screen), grit chamber, settling tank, sludge digestion tank and sludge drying bed. A typical cycle lasts 4 hours (including 2 hours for filling and aeration, 1 hour for settling and 1 hour for decanting). Six such cycles are run every day. The plant has 8 blowers (capacity of 210 HP) of which ¾ are working at a time. Chlorination is the form for tertiary treatment
Year of commissioning	January 2011
Project under which construction was funded	JNNURM
Cost (In INR)	550 million
Number of Pumping stations	DNA
Areas covered	23 km^2
Area of the STP	DNA
O&M responsibility	Outsourced (M/S Gharebure Engineering Constructions, Pune)
Repair and Maintenance	Outsourced (M/S Gharebure Engineering Constructions, Pune)
Duration of the contract	6.5 years (including 6 months trial run, 1 year performance run and 5 year O&M contract)
Contract Value	INR 70 million
Payment per month	DNA
Treatment cost per ML	DNA
Discharge Point	River Noyyal (50%) Golf Course (50%)
Use of sludge	The dried sludge is given free of charge to the Forest College (approx. 300-500 kg per month)

Design Parameters - Raw sewage and effluent characteristics

	Parameter	Unit	Raw Sewage (value)	Effluent (Value)
A	BOD_5 @20 degree C	mg/l	200-300	10 or less
B	COD	mg/l	400-500	Less than equal to 100
C	Total Suspended Solids	mg/l	200-400	10 or less
D	Kjeldahl Nitrogen	mg/l	15	Less than equal to 10
E	Ammonia Nitrogen	mg/l	10	Less than equal to 2
F	Total Phosphorus	mg/l	5	Less than equal to 2
G	Faecal coliform	No./100 ml	10^6	Less than equal to 200
H	Total coliform	No./100 ml	10^7	Less than equal to 500
I	PH		7-9	7-9
E	Oil and grease	mg/l	15	Less than equal to 5

O&M Costs at the Ukkadam STP

1	Labour cost	5.83 million
2	Chemicals and consumables	2.84 million
3	Civil works	3.83 million
4	Mechanical and Electrical works	8.89 million
	Total	21.34 million

Annex 4: List of officials met at Coimbatore

S. No.	Name, designation, organisation	Mobile	Email
1.	Mr. A Lakshmanan City Engineer, CCMC	9443799211	cityengineer.coimbatore@gmail.com
2.	Mr. Santosh Kumar City Health Officer	9443799202 9444481398	-
3.	Ms. Parvathy Engineer on deputation, CCMC	9443799243	-
4.	Mr. R. Maniraj Staff, Ukkadam STP	9698698719	maniraj4all@gmail.com
5.	Mr. Karthik Assistant Programmer, CCMC	9442501873	