



# **SFD Lite Report**

## **Kanchipuram**

### **India**

This SFD Lite Report was prepared by CSE  
Date of production/ last update: 08/10/2021

# 1 The SFD Graphic

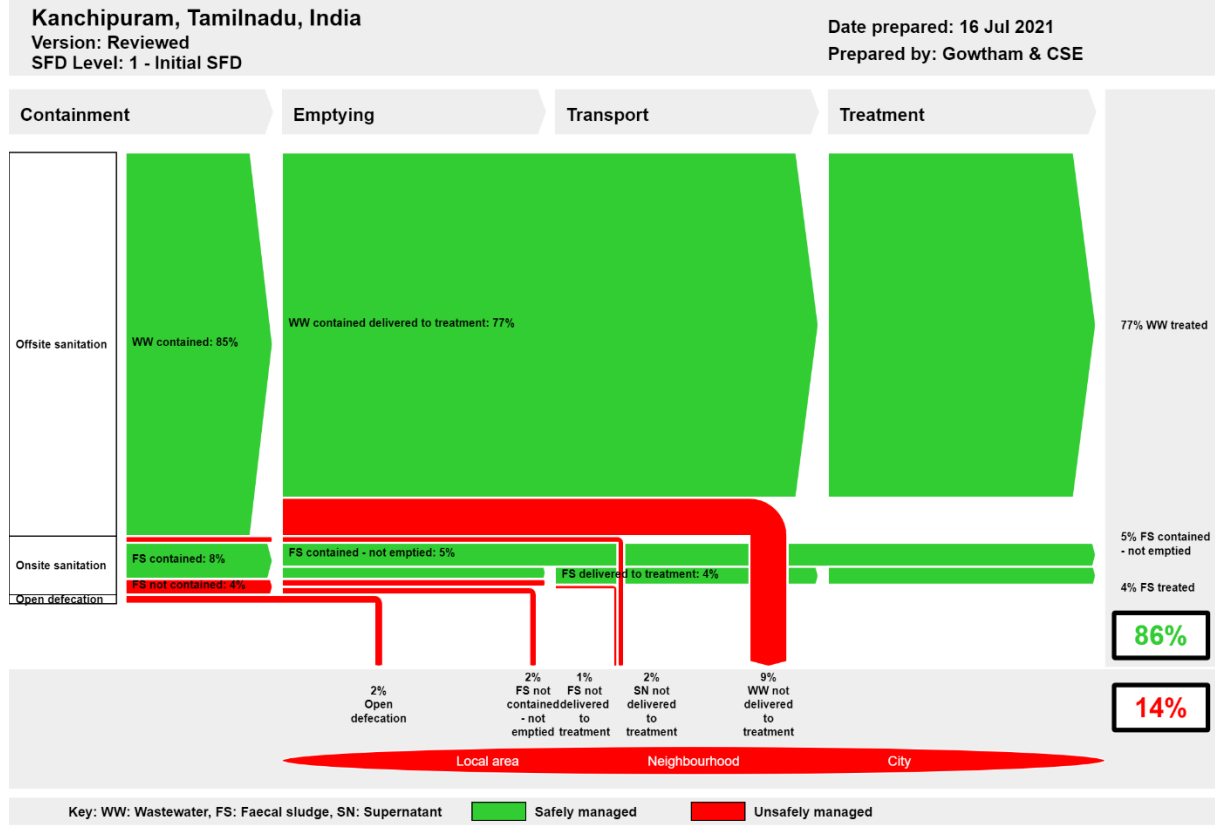


Figure 1: SFD Graphic for Kanchipuram (Source: Gowtham/CSE)

## 2 SFD Lite information

**Produced by:**

- Centre for Science and Environment, New Delhi.
- This report is compiled as part of the SFD Promotion Initiative project funded by the Bill and Melinda Gates Foundation (BMGF). We would like to thank Mrs. Maheshwari, Municipality Commissioner; Mr. Royappan, the Health department supervisor, for being supportive of data collection and introducing various stakeholders involved in SFD.
- Special thanks to Mr. Dhruv Pasricha, Programme Officer, CSE, Mr. Harsh Yadava, Senior Research Associate, CSE, and Mr. Sachin Sahani, Consultant, CSE for their valuable inputs

**Collaborating partners:**

- Kanchipuram Municipality

**Date of production:** 08/10/2021

### 3 General city information

Kanchipuram Municipality is comprised of 51 wards with a total population of 2,32,816. The total area is 36.14 Square kilometers. The city is on the northeast side of Tamilnadu and is located 76 km away from the state capital Chennai (see Figure 2). It's a Municipality administration city. The city is located in the banks of the river Vegavathi. Kanchipuram is considered one of the ancient cities in India<sup>1</sup>. It's considered a minimum of 2000 years old. The city was mentioned in the Sangam literature called "PERUMBANATRUPADAI" which was written between the 6<sup>th</sup> century BCE to 3<sup>rd</sup> century CE. The city is called a Land of thousands of temples. The great Indian poet Kalidasa praised the city as "Nagareshu Kanchi". And it's also considered the birthplace of Dravidian architecture. And also the city is famous for its silk sarees. According to legends in Hindu mythology, Kanchi silk weavers are the descendants of Sage Markandeya, the master weaver of Gods. The skilled artisans weave them on handlooms, creating a unique handmade work of art in each saree. People from all over south India visits, especially for these Kanchipuram sarees<sup>2</sup>.

Table 1: Decadal population growth. (Source: ULB, Kanchipuram, 2011)

Year	Population
1991	144955
2001	153140
2011	232816

Kanchipuram city is at an elevation of 83.2 m above sea level. Latitude and longitude coordinates are 12.834174, 79.703644. The surrounding area of the city is flat and slopes towards the south and east. Types of soil found in the city are red loam, lateritic soil, black soil, red sandy soil. Clay, with some loam, clay, and sand, are suitable for use in construction. These soil types are described to be inferior due to the mixture of stone and gravel and the region is highly prone to earthquakes due to its location in seismic zone II. Agriculture is the prevalent occupation in the surrounding villages of the city. Generally, the city experiences a hot and humid climate throughout the year with heavy to moderate rainfall during the monsoon seasons. The normal monsoon pertains to around 1200 mm rainfall in Kanchipuram with the highest amount of rainfall in October and November. Agriculture mainly depends on the monsoon. During the summer season, the maximum temperature is 37.6 °C and the minimum is 20.1°C. During the winters, the maximum and minimum temperature is 28<sup>3</sup>.

<sup>1</sup> FGD-1, 2021: Kanchipuram municipality public health section Employees.

<sup>2</sup> <https://www.nsoj.in/stories/the-weavers-of-kanchipuram>

<sup>3</sup> <https://www.kancheepuramonline.in/city-guide/geography-of-kancheepuram>

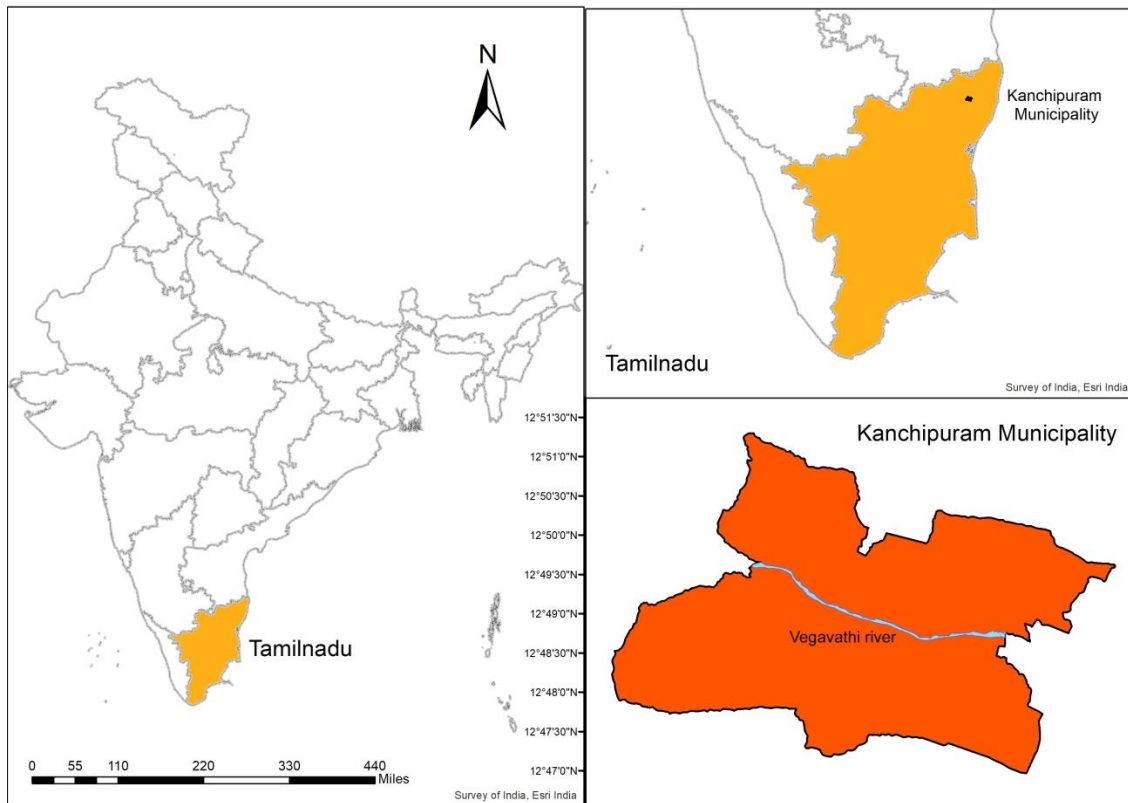


Figure 2: Kanchipuram map (Source: Gowtham/CSE/2021)

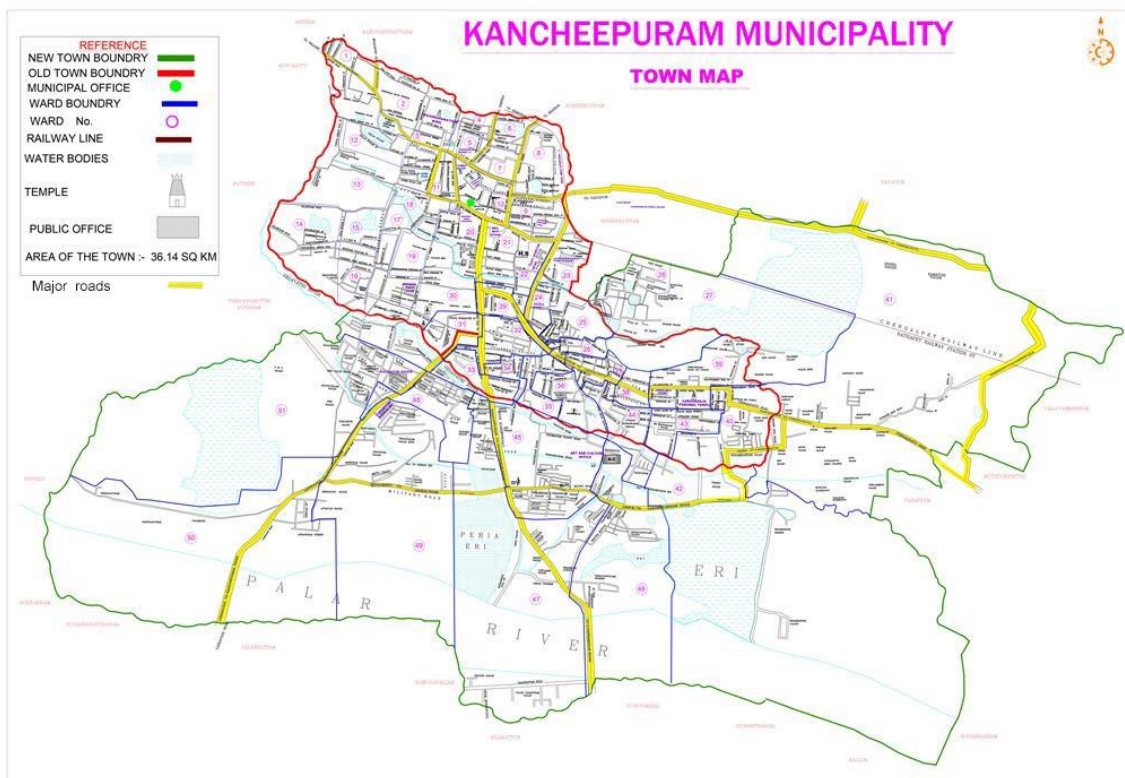


Figure 3: Ward map (Source: ULB, Kanchipuram, 2016)

## 4 Service outcomes

Table 2: SFD matrix Kanchipuram Municipality (Source: CSE)

Kanchipuram, Tamilnadu, India, 16 Jul 2021. SFD Level: 1 - Initial SFD

Population: 232816

Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 100%

System label	Pop	W4a	W5a	F3	F4	F5	S4e	S5e
System description	Proportion of population using this type of system	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
<b>T1A1C1</b> User interface discharges directly to a centralised combined sewer	85.0	90.0	100.0					
<b>T1A2C5</b> Septic tank connected to soak pit	1.0			70.0	90.0	100.0		
<b>T1A2C6</b> Septic tank connected to open drain or storm sewer	3.0			70.0	90.0	100.0	0.0	0.0
<b>T1A2C8</b> Septic tank connected to open ground	2.0			70.0	90.0	100.0		
<b>T1A4C10</b> Lined tank with impermeable walls and open bottom, no outlet or overflow	4.0			40.0	90.0	100.0		
<b>T1A5C10</b> Lined pit with semi-permeable walls and open bottom, no outlet or overflow	3.0			25.0	90.0	100.0		
<b>T1B11 C7 TO C9</b> Open defecation	2.0							

The outcome of the SFD report for Kanchipuram city tells 86 percent of excreta is safely managed and 14 percent of excreta is not safely managed (Figure 1). Safely managed excreta (86%) is combined such as 77% of Wastewater (WW) is treated, 5% of faecal sludge (FS) contained- not emptied and 4% of faecal sludge is treated. Unsafely managed excreta (14%) originate from 2% of open defecation, 2% of faecal sludge not contained, 1% of faecal sludge not delivered to treatment, 2% of supernatant (SN) not delivered to treatment, and 8% of Wastewater not delivered to a treatment plant.

Overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

### 4.1 Offsite sanitation system

The City is having a UGSS (Underground sewage system). In the city 45 wards with a population of 197520 (85%), connected with UGSS<sup>4</sup> out of 51 wards with an overall population of 232816<sup>5</sup>. For a new drainage connection, 13,618<sup>6</sup> (182 USD) rupees have been charged as a one-time connection fee. Monthly 50 (0.6 USD) rupees are charged. The population dependent on the offsite sanitation system (T1A1C1) is 85 percent. According to

<sup>4</sup> FGD-2, 2021: Kanchipuram municipality Engineering section Employees

<sup>5</sup> Census India 2011

<sup>6</sup> 1 USD = 75 Rupees

the FGD-1, 90 LPCD (Litre per capita per day) is delivered to the Kanchipuram people by the municipality. And the wastewater generation of offsite sanitation is 14.71 MLD<sup>7</sup> (Million liters per day). In the city, there are 10 stations are located to pump the Sewage from House service Connection (HSC) to the treatment facility. High-tension station -2, Low-tension station – 2, lifting station – 6. The Underground sewage system of the city is working satisfactorily<sup>8</sup> which is why wastewater transported to treatment is estimated at 90%.

Vegavathi River is important to drain the rainwater, which is flowing in the middle of the city. According to the journal, presently 4000 houses have encroached in the flood plain of Vegavathi River (Jayavel, 2017)<sup>9</sup> (T1A2C6, 3%) and most of them discharge sewage in the river. After the 26 km run, Vegavathi is merging with the Palar River. Another important open drain in the city is the branch river of Vegavathi called Manjal Neer channel which is ends in Nathapettai Lake. According to the municipality data, 450 houses discharging sewage in that channel and notices have been issued



Figure 3: Drainage manhole cover in ward 21 (Source: Gowtham/CSE/2021)

A consultant under TWIC (Tamilnadu Water Investment Company) was appointed to survey the 18 inlet channels that lead to the manjal Neer channel to identify the discharge of sewage. 450 notices have been issued to houses (0.7% of T1A2C6) from December 2020 to February 2021 to stop the sewage discharge<sup>10</sup>. The Vegavathi River and Manjal Neer channel water are not treated by the water treatment facility<sup>11</sup>.



Figure 4: Effluent discharge pipe in manjal neer canal (Source: Gowtham/CSE/2021)



Figure 5: Sewer line in Kanchipuram Bus stand (Source: Gowtham/CSE/2021)

<sup>7</sup> FGD-2, 2021: Kanchipuram municipality Engineering section Employees

<sup>8</sup> , KII- 3, 2021, Mr. Sujai, Working at Nathapettai STP

<sup>9</sup> Journal about vegavathi Kanchipuram river encroachment

<sup>10</sup> Report submitted by Kanchipuram municipality commissioner to National green tribunal, 2020

<sup>11</sup> KII- 3, 2021, Mr. Sujai, Working at Nathapettai STP

#### 4.2 Onsite sanitation system (OSS)

Out of 51 wards, 6 wards with a Population of 30266 are fully dependent on OSS due to the unavailability of the underground sewage system<sup>12</sup>. Based on the FGD, KII with the relevant stakeholders and household survey 13 percent of the city population is dependent on onsite sanitation and types of containment systems such as Septic tank connected to open drain (T1A2C6, 3%), Septic tank connected to open ground (T1A2C8, 2%), Septic tank connected to soak pit (T1A2C5, 1%), Lined tank impermeable wall with an open bottom, no outlet (T1A4C10, 4%) and Lined pit with semipermeable wall and open bottom, no outlet (T1A5C10, 3%)<sup>13</sup>.

*Containments:* Septic tanks are found to be with one or two chambers, the most common being with one chamber. The Tank sizes do not adhere to the BIS (Bureau of Indian standards). Septic tanks are constructed by local masons and engineers, considering the space availability and number of people in the house. Septic tank capacity varies from 2 m<sup>3</sup> to 6 m<sup>3</sup> with Septic tank outlet is connected to Open ground (T1A2C8, 2%), Open drain (T1A2C6, 3%) and soak pit (T1A2C5, 1%) to discharge the effluent (Supernatant) when the tank is full<sup>14</sup>.

Using the Soak pit (T1A2C5, 1%) for effluent discharge (Supernatant) may bring the risk of groundwater pollution, but as explained below the groundwater risk assessment ran as part of the preparation of this report concluded that the risk was low.



**Figure 6: Septic tank outlet connected to open drain**  
(Source: Gowtham/CSE/2021)



**Figure 7: Septic tank outlet connected to soak pit**  
(Source: Gowtham/CSE/2021)

A lined tank with Impermeable wall containment is plastered on all four sides of the wall with an open bottom (T1A4C10, 4%). Fully lined tanks are majorly used in onsite sanitation. It's usually constructed with a single chamber. This containment is common in lower-middle-

<sup>12</sup> FDG – 2, 2021: Kanchipuram Municipality Public health section Employees

<sup>13</sup> Field observation, July 2021

<sup>14</sup> Household surveys, July 2021

class income groups<sup>15</sup>. A lined pit with a semipermeable wall and open bottom (T1A5C10, 3%) containment system is mostly used in a government-supported scheme such as the SBM (Swachh Bharat mission). According to KII, 6900 individual household toilets are constructed under the SBM<sup>16</sup>. This containment system built by precast concrete rings of 1 meter to 1.5-meter diameter with 30 to 40 centimeters of depth is placed one by one in the pit 2 meters deep (Figure 6). Rings are not plastered in between, so the effluent can leach through the crack and the bottom is open. Both T1A4C10 & T1A5C10 containment system is common in low-income groups because these types of containments are mostly not overflowing so doesn't have any outlet<sup>17</sup>



Figure 8: Lined pit semipermeable wall and open bottom  
(Source: Gowtham/CSE/2021)



Figure 9: Fully lined tank with open bottom/no outlet connected  
(Source: Gowtham/CSE/2021)

*Community Toilets/ Public Toilets:* There are 57 Community Toilets (CT) and 13 Public Toilets (PT) are in Kanchipuram city. All 51 wards are divided into 7 divisions and each division is governed by an individual Health sub-inspector. Under the Sub inspectors, animators are supervising the CT & PT and its working condition<sup>18</sup>. Public toilets are located in the place where the floating population is more such place as Bus stand, Market, Temple, etc. CT & PT sewage disposal is based on the availability of UGSS. 25 % of CTs are located in the city where the UGSS is not available. In those areas, sewage is contained by a septic tank connected to a soak pit on which 1% of the overall population is dependent (T1A2C5, 1%) and it is emptied once in six month<sup>19</sup>.

<sup>15</sup> Household survey, July 2021

<sup>16</sup>, <sup>16</sup> KII- 1, 2021, Interview with Mr. Royappan, Health department supervisor

<sup>17</sup> KII- 6, 2021, Mr. T.V.Senthilkumar, Civil engineer, G.P.R Construction, Kanchipuram.

<sup>18</sup> KII- 1, 2021, Interview with Mr. Royappan, Health department supervisor

<sup>19</sup> KII- 2, 2021, Mr. Kamaraj, Contractor of Public toilet in Kanchipuram Bus stand





Figure 10: Public toilet in Kanchipuram bus stand

(Source: Gowtham/CSE/2021)

**Emptying:** For emptying fecal sludge, the city is depending on Private and municipality government desludging operators. There are 3 municipality-owned desludging vehicles are available in the city<sup>20</sup>. There are four groups of private emptier are available in the city covering the urban village and rural village in the outskirts of the city. The capacity of vehicles varies from 8000 liters to 12000 liters. Emptier are provided with proper safety precautions such as Hand gloves and Face masks. The cost of emptying fecal sludge varies from 1100 – 2500 Rupees (14 – 33 USD)<sup>21</sup>. The frequency of emptying the septic tank varies from 3 months to 2 years depends upon the number of households connected with the Septic tank. The mechanical desludging is usually carried out by two people (One driver & a cleaner). The emptying process is fully mechanical meaning there is no direct contact with fecal sludge. According to key informants, there is currently no manual scavengers for desludging<sup>22</sup>.

**Transport:** Desludging vehicles are assembled on the Mini lorry and Lorry. The pump and Storage tank is assembled in the backside of the cabin of the vehicle. Pump capacity varies from 10 Hp to 12 Hp. Tank capacity varies from 8000 liters to 12000 liters. Each truck taking one to three trips per day. For each trip, it takes 20 km to empty and discharge the Sludge in the Treatment plant. Since there is no separate treatment facility for the fecal sludge it is transported to the Municipality treatment facility located in Nathapettai<sup>23</sup>.



Figure 11 Private emptier advertisement notice  
(Source: Gunasekaran/KII-4/2021)



Figure 12: Private emptier vehicles parking place at Pillayar palayam  
(Source: Gowtham/CSE/2021)

<sup>20</sup> FDG – 2, 2021: Kanchipuram Municipality public health section Employees.

<sup>21</sup> 1 USD = 75 Rupees

<sup>22</sup> KII- 4, 2021, Mr. Gunasekaran, Owner of Srisairam Waste water vehicles.

<sup>23</sup> KII- 5, 2021, Mrs. Latha, Owner of Sriram emptiers

*Treatment/ Disposal:* The collected sewage is treated at the sewage treatment plant (STP) in Nathapettai which is commanded by Kanchipuram Municipality. STP capacity is 14.5 MLD (Million liter per day), Using the Waste stabilization pond (WSP) method. Three large stabilization ponds are constructed for treatment. The treated water is discharged into Nathapettai Lake through the manjal Neer canal, which is then used for agriculture purposes<sup>24</sup>. The septage trucks operating in the Kanchipuram municipality have all been issued warnings to refrain from dumping the collected septage into the lakes and the open areas. Any trucks found dumping the septage in the lake or other open areas are levied penalties and the operators have been warned of a penalty of Rupees 25,000 since there has been no incident of dumping of sewage into the open areas and lake<sup>25</sup>



**Figure 13: Nathapettai lake**  
(Source: Gowtham/CSE/2021)



**Figure 14: Sewage overflow pipe**  
(Source: Gowtham/CSE/2021)

The treatment system has been functioning since the year 1978. A DPR (Detailed Project Report) has also been prepared for renovating the STP by changing the treatment methodology to Activated Sludge Process (ASP). As of date the existing STP using the WSP (Water stabilization Pond) technology is functioning properly at its full capacity of 14.5MLD. And the test reports of discharge water are taken periodically to ensure the discharge meets the surface water standards<sup>26</sup> which is why the wastewater and faecal sludge delivered to treatment that is treated is assumed to be 100%.



**Figure 15: Water stabilization pond in Nathapettai STP**  
(Source: Gowtham/CSE/2021)



**Figure 16: KII interview with Mr. Royappan**  
(Source: Gowtham/CSE/2021)

<sup>24</sup> KII- 3, 2021, Mr. Sujai, Working at Nathapettai STP

<sup>25</sup> Report submitted by Kanchipuram municipality commissioner to National green tribunal

<sup>26</sup> Report submitted by Kanchipuram municipality commissioner to National green tribunal

### 4.3 Open defecation

People from the outskirts of the city area such as Thennambakkam, Sadhavaram<sup>27</sup>, Mettu colony<sup>28</sup> are practicing open defecation ((T1B11C7 to C9), 2%). These particular areas are majorly filled with low-income households. Due to unavailability of toilet facility and community toilet facility leaving people no choice other than open defecate<sup>29</sup>. During the nightfall or early morning near vacant/ Agriculture land is used for a nature call.

### 4.4 Groundwater contamination risk

Groundwater table levels varies from 12m to 45m<sup>30</sup> and more than 25 percent of drinking water is extracted from a protected dug well located in the middle of Palar river which is more than 10m away from any sanitation facilities. So according to the groundwater risk assessment by SFD concludes overall risk is Low.

## 5 Data and assumption

Population data is collected from Census India 2011. And the data for all sanitation chains and containments were updated based on field observation, key informant interviews, focus group discussion, and household surveys, all led in July 2021. Secondary data was collected from authorized websites and relevant stakeholders. Selection of houses for household survey based on types of houses such as Pakka, Kutcha, Semi-pakka, and the number of houses in each category depends upon the majority housing type in a particular ward.

- Government scheme subsidy for the Individual household toilets is constructed mostly with a lined pit with a semipermeable wall and open bottom (T1A5C10, 3%) containment system where there is no centralized sewage connection. So it's assumed all the SBM-supported household toilets are having a lined pit with a semipermeable wall and open bottom (T1A5C10, 3%) system. Another reason for this assumption is, it costs less compared to other containments. Data insufficiency & non-availability: Present population data and data on households depend on onsite sanitation systems and different types of containment systems. 80 percentage of the water volume supplied is assumed as wastewater volume. As per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website, it is assumed that 50% of the contents of septic tanks and fully lined tanks are FS. The FS in lined tanks with impermeable walls and the open bottom was selected as 100%.
- The proportion of Septic tank (T1A2C5), (T1A2C6), (T1A2C8) emptied is considered as 70%, A lined tank with an open bottom (T1A4C10) emptied assumed as 40% and a lined pit with a semipermeable wall and open bottom (T1A5C10) emptied considered as 25%, assuming 10 years as the threshold, based on the size of the tank and no. of people dependent on that system. So, households getting their systems emptied in less than 10 years are considered to be using their system with

<sup>27</sup> KII- 1, 2021, Interview with Mr. Royappan, Health department supervisor.

<sup>28</sup> Household survey, July 2021

<sup>29</sup> Field observation, July 2021

<sup>30</sup> KII- 6, 2021, Mr. T.V.Senthilkumar, Civil engineer, G.P.R Construction, Kanchipuram.

emptying and those who are taking more than 10 years are considered as not emptying their systems.

- The proportion of FS delivered to the treatment facility from all the onsite containments was assumed to be 90% (Variable F4) .

## 6 Context-adapted SFD Graphic

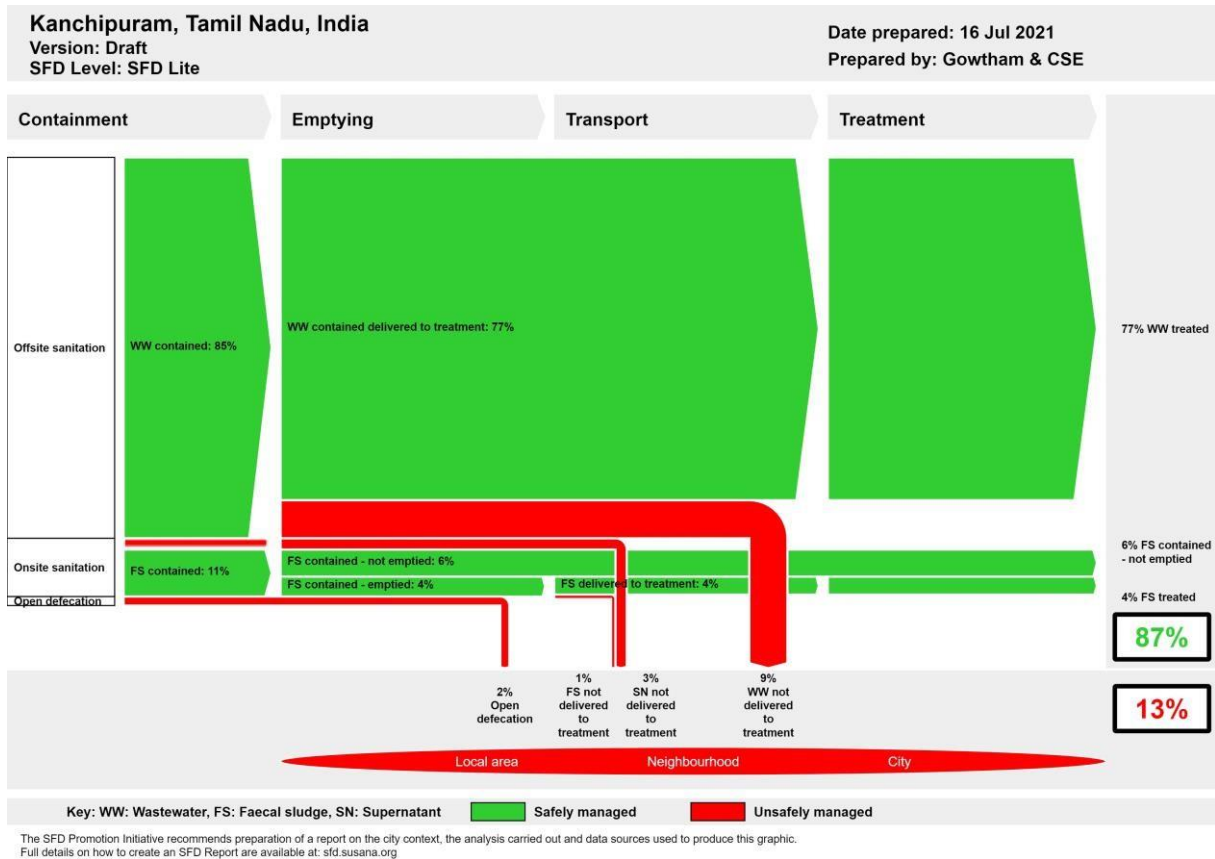


Figure 17: Context-adapted SFD graphics for Kanchipuram (Source: Gowtham/CSE/2021)

The only difference suggested in the context-adapted SFD is at the containment stage for correctly designed septic tanks, though connected to open drains and open ground. Based on the assumptions, 50% of the proportion of the content of the septic tank is solid FS, which is generated and collected inside the septic tanks and the remaining 50% of the content is supernatant. The solid FS collected in the septic tank is considered to be contained at the containment stage and hence 11% of FS is contained (represented green colour at containment stage) followed by this, 6% is FS remaining in the tank which is contained and never emptied and 4% of faecal sludge is emptied and treated in Nathapettai STP. The supernatant generated from the septic tank connected to the open drain and open ground is not contained and hence is considered to be unsafely managed (represented in red). Overall, the excreta of 13% of the population is not safely managed according to the context-adapted SFD graphic (Figure 17).

## 7 List of data sources

### 7.1 Reports and literature

1. Census 2011
2. Kanchipuram municipality website  
<https://www.tnurbantree.tn.gov.in/Kancheepuram/about-us/>
3. Report submitted by Kanchipuram municipality commissioner to National green tribunal
4. Journal about vegavathi Kanchipuram river encroachment  
<https://www.vikatan.com/literature/environment/101721-political-reasons-behind-thevegavathi-river-renovation-work>
5. <https://www.kancheepuramonline.in/city-guide/geography-of-kancheepuram>
6. <https://www.nsoj.in/stories/the-weavers-of-kanchipuram>

### 7.2 Field Observation on July 2021

1. STP at nathapettai and Nathapettai lake
2. Visited approximately 50 households spread throughout the city
3. Vegavathi river and Manjal Neer channel
4. Public toilet located in Kanchipuram bus stand

### 7.3 Focus group Discussion on July 2021

1. FGD-1, 2021: Kanchipuram municipality public health section Employees
2. FDG – 2, 2021: Kanchipuram Municipality Engineering section Employees

### 7.4 Key informant interviews

1. KII- 1, July 2021, Interview with Mr. Royappan, Health department supervisor.
2. KII- 2, July 2021, Mr. Kamaraj, Contractor of Public toilet in Kanchipuram Bus stand
3. KII- 3, July, 2021, Mr. Sujai, Working at Nathapettai STP
4. KII- 4, July 2021, Mr. Gunasekaran, Owner of Srisairam Wastewater vehicles.
5. KII- 5, July 2021, Mrs. Latha, Owner of Sriram emptiers.
6. KII- 6, July 2021, Mr. T.V.Senthilkumar, Civil engineer, G.P.R Construction, Kanchipuram.

Kanchipuram, India, 2021

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