TN TAMIL NADU | US URBAN SANITATION | SP SUPPORT PROGRAMME

REPORT

# BASELINE STUDIES:
# TIRUCHIRAPPALLI, PERIYANAICKEN-PALAYAM, NARASIMHANAICKEN-PALAYAM

*December 2016*

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TN US SP
TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

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INDIAN INSTITUTE FOR HUMAN SETTLEMENTS

In Association With:

Consortium for DEWATS Dissemination Society

Gramalaya

Keystone

# Baseline Studies: Tiruchirappalli, Periyanaicken-Palayam, Narasimhanaicken-Palayam

*December 2016*

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# Abbreviations

| | |
|---|---|
| **BC** | Backward Caste |
| **BMGF** | Bill and Melinda Gates Foundation |
| **BPL** | Below Poverty Line |
| **CPCB** | Central Pollution Control Board |
| **CPHEEO** | Central Public Health and Environmental Engineering Organisation |
| **CTE** | Consent to Establish |
| **CT/PT** | Community toilet/Public Toilet |
| **DEWATS** | Decentralised Wastewater Treatment System |
| **FSTP** | Fecal Sludge Treatment Plant |
| **GoTN** | Government of Tamil Nadu |
| **IHHL** | Individual Household Latrine |
| **ISDA** | Infrastructure Services Deficiency Analysis |
| **MAWS** | Municipal Administration and Water Supply |
| **MBC** | Most Backward Caste |
| **NNP** | Narasimhanaicken-palayam |
| **OSS** | On-site Sanitation Systems |
| **PPI** | Progress out of Poverty Index |
| **PWD** | Public Works Department |
| **SBM** | Swacch Bharat Mission |
| **SC** | Scheduled Caste |
| **SES** | Socio-economic Category |
| **SHE** | Sanitation and Hygiene Education |
| **STP** | Sewage Treatment Plant |
| **TNUSSP** | Tamil Nadu Urban Sanitation Support Programme |
| **TP** | Town Panchayat |
| **TSU** | Tehcnical Support Unit |
| **UGD** | Underground |
| **ULB** | Urban Local Body |
| **WHO** | World Health Organisation |

# Executive Summary

# Executive Summary

## E1. Background

About half the population of Tamil Nadu reside in urban areas as on 2011, according to Census 2011. Urban settlements in India presently face multiple challenges across the full sanitation chain from access to treatment and disposal. In Tamil Nadu, there continues to be deficits in access to individual household toilets with 75 percent of urban households have toilets within their premises, 9 percent use public toilets, and 16 percent resort to open defecation (Census 2011). About 27 percent of the household toilets are connected to the sewer system and 38 percent to septic tanks (Census 2011). Thus, a high proportion of households depend on on-site systems (OSS) including septic tanks and pits, with variations in the type of structures and their cleaning. There is also a shortage of treatment systems to receive and treat human excreta properly.

The Bill and Melinda Gates Foundation (BMGF) is supporting the Government of Tamil Nadu (GoTN) to achieve the Sanitation Mission of Tamil Nadu by helping set up a Technical Support Unit (TSU) within the Municipal Administration and Water Supply (MAWS). The Tamil Nadu Urban Support Programme (TNUSSP) aims at helping Tamil Nadu improving urban sanitation and demonstrating innovations along the entire sanitation chain in two selected model urban locations - Tiruchirappalli (Trichy), and the two Town Panchayats (TPs) of Periyanaicken-Palayam (PNP) and Narasimhanaicken-Palayam (NNP) in the Coimbatore district.

## E2. Sampling

Under the TNUSSP, baseline surveys of the two selected sites were carried out to understand their current status along the full sanitation chain. Household surveys were carried out in Tiruchirappalli, PNP and NNP. The attempt was not merely to cover households and establishments using a random sampling approach, but to understand the neighbourhood conditions and environmental services that characterised different parts of the city. Hence, the sampling methodology involved selection of spatial clusters that were representative of different typologies of settlements in these urban locations. For this, the Infrastructure Services Deficiency Analysis (ISDA) framework was adapted and applied in these locations. The survey included water quality testing, transect mapping, and study of sanitation systems across the sanitation chain.

Further, to understand the perspectives of the range of stakeholders involved in the sanitation chain, interviews and group discussions were conducted with stakeholders including community/public toilet facility users, ULB officials and workers, and farmers. Simultaneously, participatory exercises were done in these two urban locations to understand the disposition, needs and preferences of the urban poor communities residing in slum areas.

This report summarises the findings of all the surveys (quantitative and qualitative), water quality testing, and the participatory exercises to present a consolidated perspective of the sanitation situation in these two urban sites.

## E3. Key Findings: Tiruchirappalli

In Tiruchirappalli, 1,969 households were surveyed of which 60 per cent were located in non-slum areas. Seventy per cent of the respondents were women. In slum areas, casual labour was the most common form of employment (about 42 per cent households), followed by self-employment or private employment. In non-slum areas, respondents reported diversified sources of income.

Gas was the main source of energy for cooking across slum and non-slum areas. Bank accounts were held by 87 per cent of the non-slum and 77 per cent of the slum households, and 18 per cent of the non-slum and 12 per cent of the slum households reported having outstanding loans.

### E3.1. Access to toilets

In Tiruchirappalli, 85 per cent of non-slum households and 64 per cent of slum households reported having individual or shared toilets. Use of community toilets and open defecation practices were higher in slum areas, with 26 per cent households using community toilets and 11 per cent practicing open defecation, compared 11 per cent using community toilets and 4 per cent practicing open defecation in non-slum areas. While the advantages of individual toilets were acknowledged, people mentioned several constraints to individual toilet construction including lack of space, cost of toilet construction, cost of connecting to underground sewerage network, cost of building and de-sludging septic tanks. With respect to current sanitation arrangement, 40 per cent of the slum and non-slum households reported to be satisfied with their current situation of not having individual toilet access.

While community toilets provide access to toilets and sometimes bathing facilities to households, their maintenance significantly varies based on the type of management. In general, the community toilets visited in Tiruchirappalli had a better user satisfaction report than the toilets visited in PNP and NNP, but there was scope for further improvement. Besides poor maintenance, the key issue with community toilets was overcrowding during peak hours. The users follow a time-slot based usage driven by their working hours. Improvements were also required in terms of, number of toilets, accessible toilets for children and people with disabilities, and increased plinth area for users.

Of the 4 per cent non-slum households and 11 per cent slum households which report open-defecation, (some members of these households practice open defecation this despite access to individual toilets). The reasons for open defecation include a mix of factors including cultural habits, overcrowded and poorly maintained community toilets and lack of access to water.

### E3.2. Containment Structures

In Tiruchirappalli, 34 per cent of non-slum households and 44 per cent of slum households have access to the underground (UGD) sewer network. About six to eight per cent of the households in neighbourhoods with sewers reported that they did not make the connection on account of cost of connection, lack of access from households, unwillingness to pay municipal taxes, or administrative delays. Around 54 percent households reported on-site systems in non-slum areas, of which majority were septic tanks (94 per cent), 3 per cent were single pits and 3 per cent did not know the type of system. For slum households, around 40 per cent reported on-site systems of which 85 per cent reported to have septic tanks, 10 per cent were single pits and 3 per cent were twin pits.

Although this was data reported by households, according to the World Health Organisation (WHO), septic tanks are defined as watertight chambers with at least two compartments which receive human excreta and flush water from toilets. On using the WHO criteria, only 32 per cent of the non-slum households and 16 per cent of the slum households can actually be considered septic tanks, while the rest remain variations of a pit.
Engineers and masons are the primary persons responsible for construction of on-site systems. Engineers and masons reported that they advised their clients on the right kind of containment structures to build, but clients mainly used budgetary constraints to decide the kind of containment structure— while poorer households opted for a single pit, better-off households built septic tanks with chambers and soak pits.

In the sample surveyed, over half of all households (60 per cent non-slum households and 55 per cent slum households) have no outlet for their on-site sanitation systems, and 13 per cent non-slum and 17 per cent slum households reported connecting the on-site sanitation system outlet to open drains. Kitchen and bathroom waste was found to be directly discharged into open drains in over half the slum and non-slum households, and was connected to the sewer system in only a fifth of the cases.

## E3.3. Collection, Conveyance and Disposal

A majority of the sanitation systems across slum and non-slum households were located on roads wide enough for desludging vehicles to access them. However, there was still poor access to the system itself, as most structures did not have an easily removable cover. Around half of the households (56 per cent of the non-slum households and 44 per cent of the slum households) with on-site systems reported having a fixed cover on top of the on-site system. In 10 per cent non-slum households and 12 per cent slum households, partial or full manual entry is still reported although manual scavenging is banned by law. While households are keen on getting the fecal sludge cleaned, they are not aware of where it is disposed.

## E3.4. Water supply and quality

Public tap water is the dominant source of water with nearly 50 per cent of the households across settlements reporting the same, while other sources include street connection, piped water into dwelling, bottled water in non-slum areas and hand pump in slum area. For washing and cattle rearing, 43 per cent of the non-slum households and 26 per cent of the slum households report using different water source. Primary reasons for this choice is because drinking water is of better quality and hence more expensive and also farther away from the house.

Water quality samples from various settings in Tiruchirappalli showed widespread deterioration in water quality. Household and groundwater samples of 31 of the 33 households tested were F.Coli positive, when none are to test positive, and the levels were much higher in areas with visual exfiltration. In 10 samples, the levels were greater than 20 MPN/100 ml, with one household reporting as high 70 MPN/100 ml.

### E3.5. Solid waste management

Door to door waste collection was reported by 69 per cent of the non-slum households and 57 per cent of the slum households, and in eight of the ten cases across settlements it is reported to be done on a daily basis and on a bi-weekly basis in the rest of the cases. About ten per cent of the non-slum households and seven per cent of the slum households report segregating waste.

About 70 per cent of the women from non-slum area and 59 per cent of the women from slum report using sanitary napkins. Napkins were disposed-off along with solid waste by about 70 per cent of the non-slum women and 60 per cent of the slum women. One out of every sixth respondent burns it, while 11 per cent of the non-slum women and 17 per cent of the slum women dispose it in a separate designated place.

### E3.6. Establishments surveyed

In 16 of 29 establishments sampled, toilets were connected to on-site systems while in seven establishments it is connected to the UGD network. Out of the 20 septic tanks, 17 were reported as being watertight while nine had one or more partition walls. Applying the WHO criteria of septic tanks as 'watertight structures with partition walls', only nine of the on-site systems can be considered septic tanks while six remain variations of a pit.

Of eight schools sampled, four schools reported that the toilets are connected to the UGD network while in the other four, connections to on-site systems were reported. Of these, only two of the four on-site systems fit the WHO criteria of septic tanks.

## E4. Key Findings: Town Panchayats of Periyanaicken-Palayam and Narasimhanaicken-Palayam

For this survey, a total of 405 households were sampled in NNP, of which 77 per cent were in non-slum areas and the rest in slum areas. In PNP, a total of 604 households were surveyed, with 79 per cent were in non-slum areas and rest in slum areas.

In both NNP and PNP, in non-slum settlements, about half the households were engaged with the private sector for their livelihood, followed by self-employment and labour work. In slum areas, the dominant source of income was labour work, followed by employment in private sector. About 90 per cent of the non-slum households and 80 per cent of the slum households in PNP and NNP reported access to banking services, and an average 15 per cent of the non-slum and 25 per cent of the slum households had outstanding loans.

### E4.1. Access to toilets

Individual or shared toilets were being used by 93 per cent non-slum households in NNP, and 97 per cent in PNP. Among slum households, individual toilets were used by 54 per cent households in NNP and 64 per cent in PNP, but use of community toilets and open defecation was also common with 24 per cent households in PNP and 18 per cent in NNP. Despite the growing demand, the quality of community toilets and maintenance is insufficient. The common complaints were insufficient toilet numbers to serve the total user population, resulting in long queues in the morning. Overcrowding of community toilets is generally exacerbated in towns where people with individual toilets also use community toilets, for reasons such as saving expenses for cleaning septic tanks.

A third of the slum households in NNP and 16 per cent in PNP reported open defecation. The three most common reasons for continued open defecation were that community/public toilets were dirty; toilets weren't always free; and that children were unable to use the toilets.

## E4.2. Containment Structures

There is no underground sewer network in both PNP and NNP. Over three fourths of slum and non-slum households in PNP report having a septic tank, and about 10-14 per cent reported single pits. In NNP, eighty one per cent of the non-slum households report having a septic tank and eight per cent report having single pits. In slum households of NNP, 63 per cent report having have septic tanks and 24 per cent report having single pits.

However, on using the WHO criterion of defining a septic tank as watertight compartment with chambers, only 8 non-slum and 6 slum households in PNP, and 2 slum households in NNP actually have what can be considered septic tanks, while all the remaining households in PNP and NNP have only variations of pits.

In slum areas of PNP, in 59 per cent of households, the on-site sanitation systems did not have outlets, while one-fifth said they were not aware of the mechanisms of disposal. In non-slum areas, 34 per cent of households do not have an outlet for their on-site systems, and 38 per cent allow for percolation into the ground. In NNP, in 40-48 per cent of the slum and non slum households, the on-site systems did not have an outlet and in 15-18 per cent households reported percolation into the ground.

However, interactions with different stakeholders presented a different picture with regard to the disposal of wastewater. According to builders, the most commonly constructed containment structures here were 'basalt septic tanks', 'brick septic tanks', and 'pit-ring models'. Basalt septic tanks are just variations of pit-ring systems, because the base of the structure allows for wastewater to percolate and hence on-site systems where the wastewater percolates into the ground is likely to be higher.

Grey water from kitchens is mainly disposed of into open drains directly across both slums and non-slums in NNP and PNP. In the slums in NNP however, it is also used in kitchen gardens (16 per cent) or sent to a separate soak pit (14 per cent).

## E4.3. Collection Conveyance and Disposal

Road access to on-site systems was a particular problem in the slums of NNP, with a third of the household reporting road width less than 5 feet. In both PNP and NNP, only half of the slum and non-slum households reporting having ever opened on their on-site systems, which means that the structure has to be broken open for de-sludging. Although use of vacuum trucks is the most common method of emptying on-site systems, manual entry was being done in half or more of the households across locations, a clear violation of the manual scavenging law. Households largely seem to be unaware about where the fecal sludge is disposed once it has been removed from their on-site systems.

### E4.4. Water supply and quality

In non-slum areas, piped water into the dwelling is the main water source for a majority of the households. In slum households, although piped water is the main source for a large number of households - 57 per cent in NNP and 69 per cent in PNP, it is augmented by public tap water in about 30 per cent of the households.

In the two town panchayats, none of the ground water samples tested positive for E.Coli or F.Coli, but seven of the 26 household water samples tested positive for F. Coli (Maximum FC 34 MPN/100 ml Expand). Three of the 26 household samples also tested positive for E.Coli. There were more positive results for E.Coli and F.Coli among transects where there was visual exfiltration from on-site systems.

### E4.5. Solid waste management

An overwhelming majority (over 95 per cent) of the slum and non-slum households across both places report door to door collection of solid waste, except in slum households in NNP where 70 per cent of the households report the same. Door to door collection is mainly done on a daily basis (in nearly 90 per cent of the cases) and in a small fraction of the cases on bi-weekly basis. As regards waste segregation, around 10 per cent of the households in NNP report segregating in both slum and non-slum areas. In PNP however, about 54 per cent of the non-slum households and 41 per cent of the slum households report segregating.

Over 90 per cent of all non-slum and slum households report using sanitary napkins, except in slum areas of PNP where 83 per cent households report using sanitary napkin and the rest use cotton or cloth. Across locations two ways for disposing sanitary napkins were disposal along with solid waste (41 per cent to 66 per cent) or burning the napkins (24 per cent to 52 per cent).

### E4.6. Establishments surveyed

Toilets in all the 23 establishments surveyed were reported as being connected to on-site systems. These establishments had a total of 41 containment structures which were reported to be ‘septic tanks’. However, when the WHO criteria was applied just 7 of the on-site systems are septic tanks and the rest are some variations of a pit. While a majority of the on-site systems are easily accessible by de-sludging trucks, the entire process of emptying the systems can be quite laborious since in half of the cases the covers of the on-site systems are sealed.

In the schools surveyed, all the 16 on-site systems for which data collected were reported as being septic tanks. Since details of the on-site system are limited it was not possible to confirm if the on-site system are actually septic tanks.

## E5. Conclusions

Results from the baseline survey in both Tiruchirappalli and PNP and NNP indicate deficits across the entire sanitation chain and highlight the need to address gaps.

## E5.1. Access

Community toilet maintenance and management needs to improve across all three locations and address issues lack of cleanliness, long queue during peak hours, poor repair and maintenance, and lack of water.

Households should be encouraged to avail fund available through SBM and build individual toilets.

Behavioral aspects of continued open defecation despite toilet access need to be addressed through a communication strategy which highlights the ill effects of open defecation and its impact on environment and health.

## E5.2. Containment, Collection, Conveyance and Disposal

The issue of non-compliance to CPHEEO norms during construction of containment structures needs to be addressed through training for stakeholders including masons, engineers, and ULB officers.

Further, awareness needs to be built among households on the importance of regular desludging, to ensure both individual protection while also making the process of desludging safe for operators. Households also need to be sensitised on the need for regular septic tank cleaning.

Appropriate treatment structures to facilitate safe disposal and reuse of fecal sludge need to be developed.

A review of existing options for personal protection equipments/ gear exclusively for desludging workers needs to be undertaken to understand their issues and needs and address them through improved design.

# 1

# Background

# 1. Background

Tamil Nadu is the most urbanised state amongst the large states in India, with half the population residing in urban areas. The urban population is spatially dispersed and there are variations in urbanisation levels across districts and regions of the state. Urban settlements are facing multiple challenges across the full sanitation chain, including deficits in access to individual household toilets, mixed status of community and public toilets—limited coverage of sewerage or underground drainage network and that too in larger cities, high proportion of households dependant on on-site systems (septic tanks and pits) with variable record of type of structures and cleaning, and a shortage of treatment systems to receive and treat all of human excreta successfully.

According to the Census 2011, about 75 percent of urban Tamil Nadu households had toilets within their premises, 9 percent use public toilets, and 16 percent resorted to open defecation. About 27 percent of the household toilets were connected to the sewer system and 38 percent to septic tanks (Census of India, 2011a). In urban Tamil Nadu, 1,129 MLD of sewage treatment capacity existed with another 151 MLD under construction; however, the actual utilisation was reported to be lower at 394 MLD (CPCB, 2013). With the construction of individual toilets by households themselves, as well under the Swachh Bharat Mission Urban (SBM-U), as well as increased access to community and public toilets, the number of households practicing open defecation is likely to have reduced considerably especially in the larger urban areas. The number of households connected to sewerage has also registered an increase with the implementation of sewerage schemes in selected cities.

However, on-site systems remain the dominant household arrangements across the State. Taking cognisance of the predominance of on-site sanitation systems in the State, the Government of Tamil Nadu (GoTN) issued the Operative Guidelines for Septage Management across the State in September, 2014. These guidelines underlined the importance of standardising the design and construction of septic tanks, instituting standard operating procedures for collection and transportation of septage, and implementing possible co-treatment options at the existing under-utilised sewage treatment plants, apart from creating new infrastructure and systems for comprehensive septage management.

The Bill and Melinda Gates Foundation (BMGF) is supporting the GoTN to achieve the Sanitation Mission of Tamil Nadu by helping set up a Technical Support Unit (TSU) within the Municipal Administration and Water Supply (MAWS). The Tamil Nadu Urban Support Programme is aimed at helping Tamil Nadu improving urban sanitation and demonstrating innovations along the entire sanitation chain in two selected model urban locations—Tiruchirappalli (Trichy), and the two Town Panchayats (TPs) of Periyanaicken-Palayam (PNP) and Narasimhanaicken-Palayam (NNP) in Coimbatore district.

Under the TNUSSP, Baseline Surveys of the two selected sites was carried out to understand their current status along the full sanitation chain and included water quality testing, transect mapping and study of sanitation systems across the sanitation chain. Simultaneously, participatory exercises were done in these two urban locations, to understand the special disposition, needs and preferences of the urban poor communities residing in slum areas. This report summarises the findings of all the surveys (quantitative and qualitative), water quality testing, and the participatory exercises to present a consolidated perspective of sanitation situation in the two selected urban sites.

This report is organised in four parts: Part 1 is the introduction of which this text is a part and Part 2 presents the study methodology, including criteria for urban model site selection and the different component of the Studies. Part 3 presents the consolidated findings from all the surveys and participatory exercises and Part 4 focusses on discussions and key insights.

# 2

# Study Methods

# 2. Study Methods

The Baseline studies comprised the following elements in the two locations of Trichy and PNP-NNP TP cluster:

1. Household baseline surveys
2. Qualitative Interactions with different stakeholder groups across the sanitation chain
3. Participatory exercises with urban poor household's resident in slum communities
4. Water quality Testing

Each of the above elements is summarised in the sections below.

## 2.1 Baseline Household Survey

Household baseline surveys using semi-structured survey instruments, were administered to households in selected clusters using an Infrastructure Services Deficiency Analysis framework. About 1,969 and 1,009 households respectively were covered in Trichy and PNP-NNP TPs. In addition, the survey also covered establishments in the two locations, including shops, offices, factories, etc.

Table 2.1 presents the detailed break-down of the sample households and establishments covered under the Baseline Survey.

**Table 2.1:** Quantitative Research Sample: Questionnaire-based Interviews

| **Respondent** | **Tiruchirappalli** | **PNP and NNP** *(Two TPs in Coimbatore)* |
|---|---|---|
| Households | 1,969 | 1,009 |
| Establishments, of which | 35 | 25 |
| Factories | 5 | 5 |
| Shops | 10 | 5 |
| Government Offices | 5 | 5 |
| Hospitals and Nursing Homes | 5 | 5 |
| Other Establishments | 10 | 5 |

*Source:* TNUSSP Baseline Studies, 2016

The attempt was not merely to cover households and establishments using a random sampling approach, but to understand the neighbourhood conditions with respect to environmental services that characterised different parts of the city. Hence, the sampling methodology involved selection of spatial clusters that were representative of different typologies of settlements in these urban locations. For this, the Infrastructure Services Deficiency Analysis (ISDA) framework was adapted and applied in these locations. The key features of the ISDA approach are summarised below.

### 2.1.1 Infrastructure Services Deficiency Analysis

In developing countries today, there are wide variations in the physical infrastructure that exists and the actual services that these provide. Existence of piped water supply for instance is no indication of hours of supply, quality, etc. While some of the infrastructure and services are provided by the government or the local body, there are several informal or private providers who bridge the last mile in service delivery by making the services available. Households themselves invest in a variety of arrangements and

coping strategies to deal with deficits in their homes. These can vary a lot depending on the socio-economic status as well as the location or neighbourhood and settlement type in which these households are located. Such spatial types, self-provision and the services provided by informal providers are not accounted for during large data collection exercises such as the Census or a city-level mapping that focusses on the physical infrastructure. In order to capture the specificities of the existing infrastructure and services available in the selected sites, an Infrastructure Services Deficiency Analysis (ISDA) was chosen as an assessment methodology.

The ISDA is a useful tool that provides descriptive information on the current level of physical infrastructure, service levels, spatial details and a socio-economic classification of households. The ISDA has been used previously in selected locations in India and elsewhere. One of the earliest analysis was done in Battambang in Cambodia that provided a simple six- typology classification of settlements, and their location along with a general description of settlement pattern for the city. A detailed general description of the infrastructure arrangements, service levels and household response to deficiency were also presented. The major limitation in this report was also its apparent strength—general description and evidently simple recommendations for each typology.

The ISDA that presented service deficiency in considerable detail, was the service deficiency analysis for Lucknow (Environmental Services Master Plan, TARU, 1996). This report differed significantly from the Cambodian report in that it took city drainage catchments as the primary unit of analysis. The area based analysis was undertaken rapidly with limited personnel and relatively low coverage. The sample base on which the deficiency analysis was drawn was adequate to make general comments, but was somewhat inadequate to formulate detailed recommendations and derive cost-estimates. The report also lacked detailed linkage between service levels and the dynamics of 'operations and maintenance'.As a result, many of the options that were presented, would have to be modified considerably when implemented on ground. However, this made fairly detailed recommendations for improvement in the short and long run. Further, the ISDA has been modified and used by practitioners and consultants in other locations, notably the Gangtok and Bangalore Environmental Services Master Plan, where standards and indices to measure urban services have been suitably modified to suit the local conditions (TARU 1996, 2000). These were then used for pilot projects for improved water and sanitation services in selected slums that were implemented successfully and posed as a model for scaling up by the Bangalore Water Supply and Sewerage Board (BWSSB, AusAID Masterplan, 2000). Further, the analyses fed into the development of different detailed plans for the Water and Environmental Services Master Plan for Bangalore, implemented by BWSSB.

The core principles of the ISDA methodology—delineation of settlement typologies and documenting environmental services in general—were supplemented with the specificities of sanitation systems in particular at the household and neighbourhood levels in the baseline studies in Trichy and the two TPs.

**ISDA Methodology adopted in Baseline Studies**

In the two sites selected for this baseline survey, a step-by step process was followed to capture spatially explicit information on household arrangements for housing, water and sanitation services, including select socio-economic data; and service delivery arrangements in the identified settlement/habitat focussed on water supply and sanitation including environmental sanitation (solid waste and liquid waste streams). This served to understand the commonalities and variations that existed with regard to infrastructure (household and neighbourhood) and access to services.

Secondary Analysis

A preliminary secondary analysis was undertaken using census (Census, 2011) and other published sources of data, including data from the Tiruchirappalli City Corporation and the Town Panchayats.

Where available, maps were also used including Survey of India Topographic sheets, urban growth trend maps for the two sites, to understand the spatial construct, drainage and other physical features and expansion trajectories. This preliminary analysis was used to primarily decide the site level numbers for sampling different stakeholder categories—households, establishments, institutions, etc., and served to inform the reconnaissance team of spatial specifics that needed to be verified/validated.

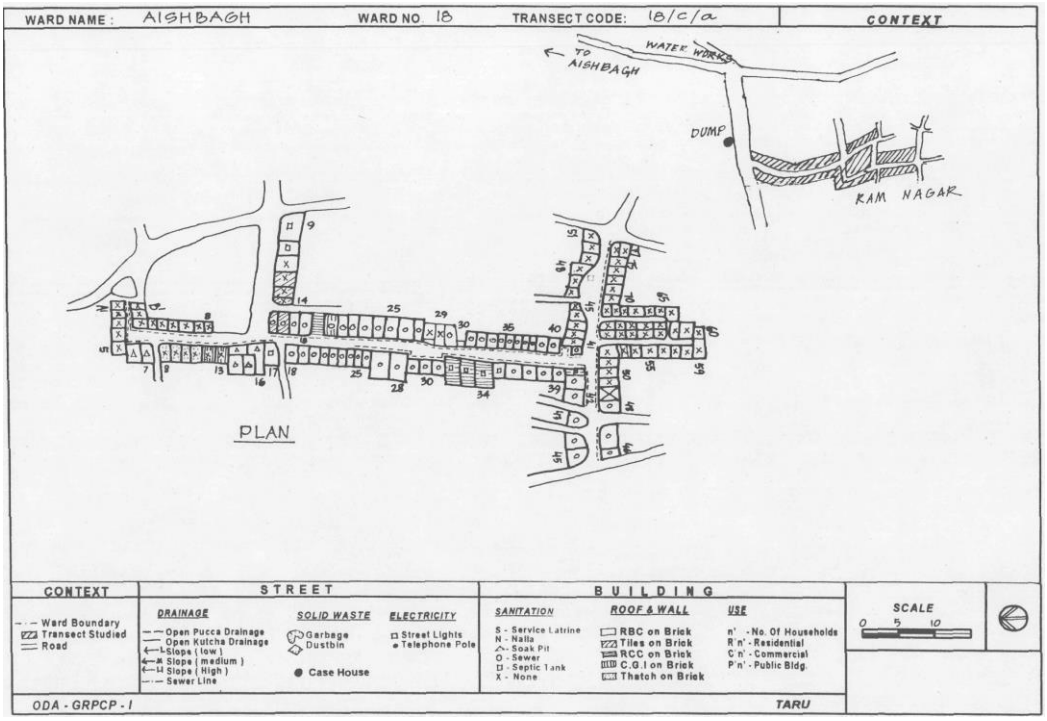
Reconnaissance leading to identification of key typologies

The second step involved a reconnaissance of the whole site (two sites) to identify the various settlement typologies that existed in the city/town panchayats. Care was taken to include specific differentials identified in the secondary analysis—core and periphery, slums and non-slum areas, etc. Broadly the different typologies were identified based on physical planning parameters, i.e., population density, building type, land-use and socio-economic class of residents (through visible proxy of building type) in these settlements. The identified typologies were listed and characterised for homogeneity (or heterogeneity) to generate a weightage matrix that would enable aggregation of sample survey data to site-wide (City or the Town Panchayat) scale.

Transects

Popularly used in ecology, a transect (transversal section) is a line or a path through part of the environment which shows a range of different habitats (Center for Applied Transect Studies www.transecet.org).Transects are effectively applied in urban planning to create different zones that allows for clear demarcation of land use, mobility planning, zoning, etc.

**Figure 2.1:** Sample representation of a transect




*Source*: TNUSSP Baseline Studies, 2016

Within the different typologies, transects were identified to represent the typology. A higher number of transects were selected for typologies that displayed heterogeneity and a smaller number of transects selected for typologies that have low variations (or displayed more homogeneity). The size of each

transect was kept to about 100 to 120 houses, with larger size transects being marked in transects for heterogeneous typologies and smaller transects being defined in homogenous typologies.

This was done to capture the heterogeneity from the various settlements and to collect robust information. A detailed house-listing in the transect including water and sanitation infrastructure, socio-economic category (SEC) proxy indicators (building type) was undertaken and supplemented with reported transect-level service levels.

Following the house-to-house listing, sample households were selected for detailed household interviews, using (stratified) random sampling within the transects, with adequate provisions for managing no-response or absent households. The team conducting the transect studies were multi-disciplinary and comprised of mapping personnel and socio-economic researchers, who recorded (on Google Maps using GPS-enabled tablets).

Transect-level data: included the street length and location, paving type and condition, drainage type, sewerage where available, solid waste collection arrangements apart from other key infrastructure related features.

Household Data: included building type, use, number of floors, water supply type, timings and quality, sanitation arrangements, condition and quality of containment structures, solid waste disposal arrangements, interface with ULB, costs and transactions required for services related to sanitation, etc.

The transect level baseline survey consisted of structured data collection through interviews of households, supplemented by a limited sample of establishments and institutions.

## 2.2 Qualitative Research and Group Discussions

In addition, qualitative interactions (case studies, group discussions) were carried out with identified stakeholders such as Community/Public Toilet Facility Users (PT/CT), ULB officials and workers, Farmers who receive septage and masons/builders. Details of the types of stakeholders and number of group discussions are presented in Table 2.2.

**Table 2.2:** Qualitative Research Sample: Interviews and Group Discussions

| Stakeholders | Tiruchirappalli | Coimbatore |
|---|---|---|
| Households | 8 | 8 |
| Masons and plumbers | 4 | 4 |
| Public facility admin and women federations | 4 | 3 |
| Builder | 4 | 4 |
| Licensed Architects/Engineers | 4 | 2 |
| Manufacturers/Sanitary Fittings Dealers | 2 | 2 |
| Pit Ring Manufacturers | 2 | 2 |

| **Table 2.2:** Qualitative Research Sample: Interviews and Group Discussions | | |
|---|---|---|
| **Stakeholders** | **Tiruchirappalli** | **Coimbatore** |
| Cess pool truck manufacturers/builders | 1 | 1 |
| Wholesalers and Retailers of Sanitary Products | 4 | 4 |
| De-sludging services proprietors | 2 | 2 |
| De-sludging services workmen and drivers | 2 | 2 |
| Sanitary workmen/Individuals engaged in manual scavenging | 4 | 4 |
| Farmers receiving/buying sludge | 4 | 2 |
| Water purifier retailers | 2 | 2 |
| Local Bottled Water Manufacturers | 1 | 1 |
| RMPs and Pharmacists | 2 | 2 |
| *Source*: TNUSSP Baseline Studies, 2016 | | |

## 2.3 Participatory Exercises and Group Discussions with Urban Poor Communities

Participatory exercises were conducted with urban poor community groups in the two locations. The objectives of these exercises were to:

1. Understand arrangements for water and sanitation at households and community
2. Understand sanitation practices
3. Map Identity inks/importance of sanitation to life, livelihood of the community
4. Map service providers (who) and means of access (how) and constraints (why) in connection with access of services
5. Capture ideal/improved conception based on the actual/current access to ULB for services
6. Understanding preferences of the communities regarding service providers and services across public, private, mix of service providers, etc.

The study looked at the current sanitation practices; issues related to sanitation and linkages to people's day-to-day life situations like employment, children's education and others, and their perspectives toward clean environment and health. The study was carried out in two parts—a detailed quantitative study to bring out data points about access to sanitation, number of toilets, cost of access and, a qualitative study that studied specific household cases, identified stakeholders and problems faced by the community and coping mechanisms employed by them among other things.

Participatory exercises were facilitated among groups of women, men, boys and girls separately in the selected locations. The study employed a community-learning process by using the following participatory tools such as mapping of the service providers, force field analysis and prioritisation methods. Techniques of Focus Group Discussion and Key Informant Interview were applied as overarching methods while facilitating specific participatory tools and interacting with the community and key stakeholders in groups and individuals.

Mapping of service providers helped to identify key stakeholders such as Sanitation and Hygiene Education (SHE) committees, SHGs, sanitation workers both male and female, ward councillors, private service providers who provide service to empty septic tanks, civil society organisations, Town Panchayats, Municipal Corporation, etc., and their geographical coverage. Mapping also covered roles and responsibilities and constraints/difficulties faced by the above stakeholders. Moreover, this tool also helped to capture various arrangements for sanitation and water in the community and households in each location.

Force field analysis helped to understand favourable/positive and unfavourable/limiting factors of various service providers, services, structures and practices in the existing situation of water and sanitation. The community's perception and experience on how important is water and sanitation services for their life, health, status and livelihoods also collected.

Prioritisation methods explored community viewpoints based on quality of services by various service provides, characteristics of good and bad services and priority of the community in terms of services and service providers. This method also helped to understand community priorities of various facilities, institutional arrangements and services attached to sanitation.

Focus group discussions and key informant interviews were also conducted throughout the process to generate in depth knowledge based on each of the objectives. Specific checklists were prepared based on the pilot visits and visible participatory pictorial tools were also used while facilitating discussions, which has encouraged the participants who were illiterate, elders and children, to share their experiences and perceptions.

The sample locations the participatory exercises were selected based on the fact that they needed to cover slums where community toilets exist, practice of open defecation is predominant, individual household latrines existed; locations where toilets are connected to UGD, septic tank, and open drainage; locations situated at the core and periphery of the municipal corporation; authorised and unauthorised slums and locations where no quantitative study was conducted.

Based on this, 10 locations in Trichy municipal corporation area; and two locations each from PNP and NNP TPs in Coimbatore were selected. Table 2.3 summarises the key features of the settlements in which the participatory exercises were conducted.

| **Table 2.3:** Participatory exercises in Urban Poor Communities and their characteristics | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Location/Slum (Baseline zone)** | **CT** | **OD** | **IIHL** | **UGD cover** | **Septic Tank** | **Core** | **Periphery** | **Authorise** | **Unauthorised** | **Quantitative Study** |
| **Trichy** | | | | | | | | | | |
| MelaEda Street) | | | 20 HH | | | | | | | |
| Panchapur | | | | | | | | | | |
| Ramachandranagar | | | 25 HH | Proposed | | | | | | |
| Neduntheru | | | Few HH | Laid but no connection | | | | | | |
| Milaguaparai | | | | Partial | | | | | | |
| Uyakondanthirumalai | | Partial | A few | | | | | | | |
| Sengulam Colony | | Partial | | Full coverage | | | | | | |
| Pookkollai | | | | Full coverage | | | | | | |
| Moolathoppu | | | Few HH | Laid but no connection | | | | | | |
| Pilliarkoil Street | | | Few HH | Full coverage | | | | | | |
| **Coimbatore ( Periyanaickenpalayam andNarasimhanaickenpalayam Town Panchayats)** | | | | | | | | | | |
| Vivekanandapuram/ PN Palayam | | | | | | | | | | |
| Anna Nagar/ PN Palayam | | | | | | | | | | |
| OmShakthi Nagar/ NSN Palayam | | | | | | | | | | |
| Chennamanaickenur/ NSN Palayama | | | | | | | | | | |
| *Source*: TNUSSP Baseline Studies, 2016 | | | | | | | | | | |

## 2.4 Water Quality Testing

As a part of Baseline Studies, water quality from drinking water and ambient water sources, was also tested for key parameters to set out a baseline against which progress could be measured over a period of time, especially in respect of interventions that may be implemented in different parts of the two urban locations.

a. The parameters tested included:
b. Coliform and E. Coli
c. Nitrates
d. BOD
e. COD
f. Conductivity

Samples were selected from transects based on:

- Groundwater depth (reported by the residents and borewell contractors)

Categorised into high and low based on depth to groundwater
Trichy: ≤ 40 feet, PNP, NNP: ≤ 90 feet (low)

- Type of human excreta disposal arrangement

UGD, On-site Sanitation System (OSS) without visible exfiltration, OSS with visible exfiltration
The water quality sampling locations in the two urban locations are presented in Tables (2.4) and (2.5).

**Table 2.4:** Water Quality Sample Sources: Trichy

| **Sample Source / Transect Type** | | **Groundwater** | **Water used in Households** | **Open Drain** | **Water Body** | **Grand Total** |
|---|---|---|---|---|---|---|
| OSS with visual exfiltration: high G/water area | | 3 | 2 | 4 | 1 | 10 |
| OSS with visual exfiltration: Low G/water area | | 3 | 6 | 4 | 2 | 15 |
| OSS without visual exfiltration: high G/water | | 4 | 3 | 4 | 1 | 12 |
| | OSS without visual exfiltration: Low G/water area | | | 2 | 1 | 3 |
| Proposed UGD-High G/water area | | 3 | 3 | 4 | 1 | 11 |
| UGD-High G/water area | | 2 | 4 | 4 | 2 | 12 |
| | UGD-Low G/water area | | | 4 | | 4 |
| Total | | 15 | 18 | 26 | 8 | 67 |

*Source*: TNUSSP Baseline Studies, 2016

| **Table 2.5:** Water Quality Sample Sources: PNP and NNP | | | | |
|---|---|---|---|---|
| **Sample Source/Transect Type** | **Groundwater** | **Water used in Households** | **Open Drain** | **Grand Total** |
| OSS with visual exfiltration: high G/water area | 1 | 9 | 7 | 17 |
| OSS with visual exfiltration: Low G/water area | 2 | 5 | 5 | 12 |
| OSS without visual exfiltration: high G/water | 2 | 6 | 3 | 11 |
| OSS without visual exfiltration: Low G/water area | | 3 | 3 | 6 |
| Proposed UGD-High G/water area | 1 | 3 | 4 | 8 |
| Total | 6 | 26 | 21 | 54 |
| *Source*: TNUSSP Baseline Studies, 2016 | | | | |

# 3 Key Findings: Tiruchirapalli

# 3. Key Findings: Tiruchirappalli

This chapter presents the key findings from the baseline study in the city of Tiruchirappalli, also referred to as Trichy. First part details household survey results and second part details findings from establishment and school survey. Insights from key Informant interviews, participatory community engagement, water quality assessment and technical assessment are all included under relevant sections.

## 3.1 Profile of Households

In Tiruchirappalli, 1,969 households were surveyed of which 60 per cent (n=1,180) are located in non-slum areas. Across slums and non-slum areas, about 70 per cent of the respondents were women. Across both sample populations, nearly 6 out of every 10 households are affiliated to the Backward Class (BC) social category (Table 3.1).

**Table 3.1:** Profile of Households in Tiruchirappalli (% of households)

| | **Non slum ( n= 1,180)[1]** | **Slum (N=789)** |
|---|---|---|
| Female respondents | 69 | 73 |
| Educational attainments | | |
| NO schooling | 7 | 15 |
| Grade 1-4 | 4 | 8 |
| Grade 5-8 | 21 | 30 |
| Grade 9-12 | 34 | 35 |
| Graduate | 25 | 9 |
| Post Graduate | 9 | 3 |
| Social category break up | | |
| Scheduled caste (SC) | 14 | 29 |
| Backward class (BC) | 62 | 55 |
| Most backward caste (MBC) | 10 | 7 |
| Scheduled tribe (ST) | 1 | 1 |
| Employment category | | |
| Labour | 20 | 42 |
| Self employed | 22 | 22 |
| Government | 14 | 4 |
| Private | 28 | 25 |
| Pension | 14 | 6 |
| Access to ration card | | |
| No | 4 | 5 |
| Yes, of which | 93 | 91 |
| Below Poverty Line Cards (BPL) | 82 | 93 |
| Above Poverty Line Cards (APL) | 15 | 6 |

*Source:* TNUSSP Baseline Studies, 2016

[1] Numbers indicated in the bracket throughout this report refers to number of households/ schools/ establishment or responses as the case may be.

In slum areas, about 42 per cent of the households earn their income as casual labours, followed by self-employment or private employment. In the non-slum areas, sources of income of households are more uniformly distributed across various income categories.

The Progress out of Poverty Index (PPI) is a 10 question index which has been developed by the Grameen Foundation and customised for 45 countries including India. A PPI scores indicates the likelihood of a household to be below the poverty line. Based on their PPI scores, households were classified into categories of 'low probability' with a PPI score of 33 or below or 'moderate probability' with a PPI score greater than 33 and less than 66. There were no households which had a PPI score greater than 66 which would have meant that they have a high probability of being below the poverty line. Results indicate that 99 per cent of the sample households fall into category of low probability of being below the poverty line. However, majority (over 90 per cent) of the households have access to ration cards, mainly Below Poverty Line (BPL) cards, which gives them access to basic food provisions and other essentials at subsidised rates.

**Table 3.2:** Household Characteristics in Tiruchirappalli (% of households)

| | **Non slum ( n= 1,180)** | **Slum (N=789)** |
|---|---|---|
| Source of energy for cooking | | |
| Gas | 91 | 78 |
| Kerosene | 4 | 9 |
| Firewood | 4 | 11 |
| Access to electricity | 98 | 99 |
| Asset Ownership | | |
| TV | 98 | 96 |
| Mobile Phone | 92 | 88 |
| Bicycle | 42 | 40 |
| Motorbike | 67 | 46 |
| Car/jeep | 13 | 3 |
| Access to Individual/shared toilet | 85 | 64 |

*Source*: TNUSSP Baseline Studies, 2016

Across both slum and non-slum areas, gas is the main source of energy for cooking and the rest of the households rely either on kerosene or firewood (Table 3.2). Nearly all households have access to electricity across both settlements. In terms of assets, across both slum and non-slum areas, 9 out of 10 households have access to television and mobile phones. However, only 85 per cent of the non-slum households and 64 per cent of the slum households have access to individual household toilets.

Access to bank account is seen as a key aspect of financial inclusion, especially for poor households, where in they stand to receive direct government transfers. Bank account access is reported by 87 per cent of the non-slum and 77 per cent of the slum households. As regards loan taken, 18 per cent of the non-slum and 12 per cent of the slum households report having current loan outstanding primarily towards house construction (22 per cent to 32 per cent), for business (23 per cent), education (16 per cent to 19 per cent and asset purchase (15 per cent to 21 per cent).

Across both slum and non-slum areas, about 60 per cent of the households live in their own premises (Table 3.3). Further, 66 per cent of households in non-slum areas and 74 per cent of households in slum areas are individual houses, while 23 per cent and 13 per cent respectively are a single building

with less than 4 floors. Majority of the houses have proper construction with walls made of brick/stone or cement.

| **Table 3.3:**Characteristics of dwelling unit in Tiruchirappalli (% of households) | | |
|---|---|---|
| | **Non slum ( n= 1180)** | **Slum (N=789)** |
| Households occupied by tenants | 40 | 30 |
| **Type of premises** | | |
| Own house | 59 | 63 |
| Rented | 36 | 37 |
| **Kind of premises** | | |
| Individual house | 66 | 74 |
| Single building with < 4 floors | 23 | 13 |
| Wall of the house – brick/stone/concrete | 98 | 95 |
| **Floor of the house** | | |
| Cement | 41 | 64 |
| Mosaic/marble/ceramic | 58 | 35 |
| *Source:* TNUSSP Baseline Survey, 2016 | | |

## 3.2 Access

To understand the defecation patterns across the different areas in the city, all households were asked to share their place of defecation.

| **Table 3.4:** Defecation pattern in Tiruchirappalli (% of households) | | |
|---|---|---|
| | **Non slum ( n= 1180)** | **Slum (N=789)** |
| Individual/Shared Toilets | 85 | 64 |
| Community Toilets | 11 | 26 |
| Open Defecation | 4 | 11 |
| Sum may not add up to 100 as multiple forms of defecation may be practised by one household | | |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

### 3.2.1 Household Toilets

Many households in both slum and non-slum areas use individual or shared toilets (Table 3.4). Use of community toilets and the prevalence of open defecation is higher in slum areas in comparison to non-slum areas. However, in a few household's access to toilets does not necessarily translate into usage. There are some households where some members of family use a toilet (individual/ shared/ community/ public), and others engage in open defecation.

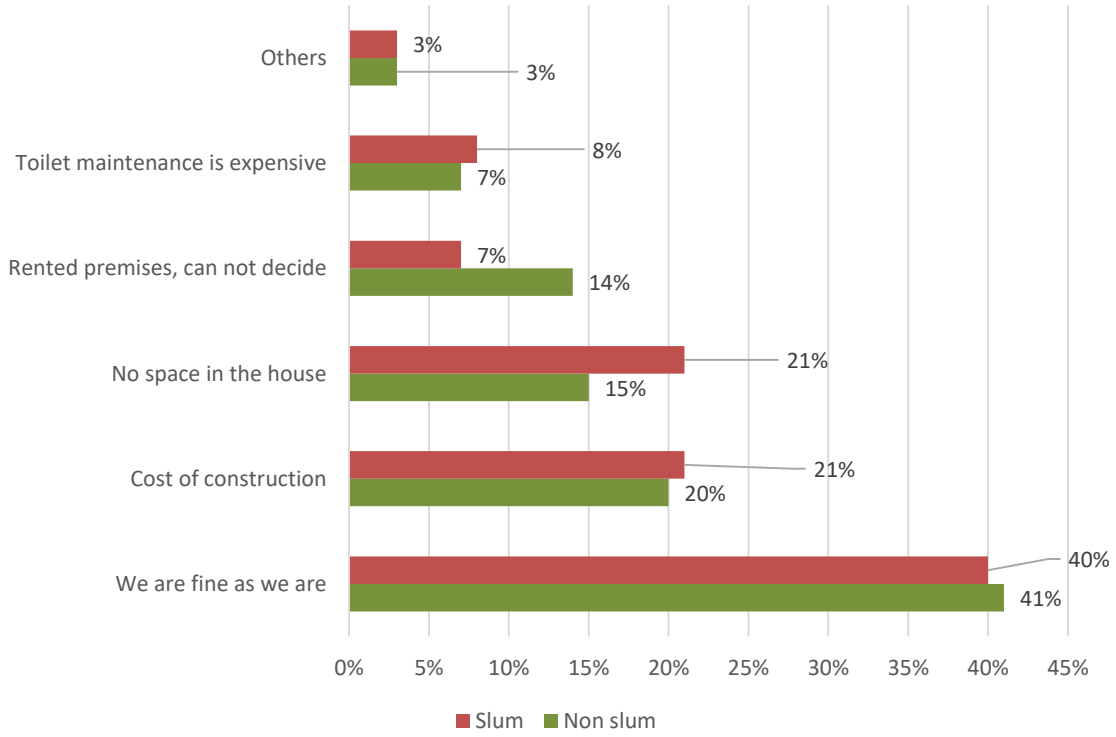
A household toilet can either be exclusively used by one household (individual household latrine, IHHL) or can be shared by multiple households (shared toilets). Just 3 per cent of the non-slum households share their toilets compared to 11 per cent in slum areas. Sharing typically occurs with at least 2 to 4 households (could go up to 8 households in non-slum areas and 14 in slum areas). Problems faced by

households sharing their toilets include long waiting hours, non-availability of water, sharing of maintenance expenses and cleaning responsibilities.

> *In the past, the people used to practice open defecation. At some point they started building toilets near their house or within the compound. The initial hesitation has been overcome and now everyone likes to build attached toilets. While most people prefer swatting pan, families with senior citizens or younger generation are switching to the western commodes – Sanitary Ware Wholesaler, Thirunagar*

Main reason for not having an individual toilet is the 'comfort with current situation' which reported by 40 per cent of the households across slum and non-slum areas (Figure 3.1). This is followed by 'high cost of construction' (20 per cent) and 'lack of space for toilet construction (15 per cent to 20 per cent).

**Figure 3.1:** Reasons for not having an individual household toilet in Tiruchirappalli (% of reasons)




*Source*: TNUSSP Baseline Studies, 2016

While the advantages of a fully functional toilet are understood by community members, they highlight some operational constraints which deter construction of toilet which includes costs of toilet construction and connection to underground network (Table 3.5).

| **Table 3.5:** Community perception on strengths and limitations of an individual toilet | |
|---|---|
| **Strengths** | **Limitations/constraints** |
| • Easier to keep it clean and neat<br>• Saves walking and queuing time<br>• Convenient for children, sick and elderly persons<br>• Safe for women to access anytime of the day<br>• Helps live a healthier life<br>• Relief from using ill maintained community toilet | • High cost of construction<br>• Lack of space in the house<br>• Absence of underground network in the area<br>• High cost of connection to underground<br>• Small septic tanks fill quickly and start leaking if it is not emptied at regular intervals<br>• High cost for emptying the septic tanks |
| *Source:* TNUSSP Baseline Studies, 2016 | |

### 3.2.2 Community Toilets and Public Toilets (CT/PTs)

In slum areas, 26 per cent of the household's report utilisation levels of Community Toilets and Public Toilets (CT/PTs) compared to non-slum areas 11 per cent. Among these households, 60 per cent of non-slum and 70 per cent of the slum households report paying for usage, largely on a per use basis (typically ₹1 per use for toilets). One quarter of the community toilet users faced problems in sharing toilets and a third aspired to change their toilet to individual toilets connected either to sewer system or septic tank.

Visits to four different types of operational community toilets, one each run by private, municipal corporation, Women's Federation (WAVES, non-slum), and one run by an NGO (non-slum), revealed varied levels of maintenance and user satisfaction with CT/PTs. All CTPTs employ a minimum of 2 people to run each facility—one attendant who is also responsible for managing the facility and one cleaner. The WAVES toilet was the only exception where 2 cleaners are hired—one to clean toilets for men and another for women.

**Figure 3.2:** Community toilets in Tiruchirappalli

*Source*: TNUSSP Baseline Studies, 2016

The number of toilets across CT/PTS ranges from 5 to 10 with same number of toilet rooms for women and men. CT/PTs run by Corporation and WAVES had separate toilet rooms for the differently-abled (with only the latter offering ramp access to disabled persons) and CT/PTs run by Corporation and private organisations offer bathing facility also. Every day on an average 250 men and 180 women use CT/PTs, across corporation, WAVES, and NGO run CT/PTs. Private CTPT, report 250 men and 50 women using their toilets on a daily basis.

**Figure 3.3:** Community toilet showing small plinth area

*Source*: TNUSSP Baseline Studies, 2016

The number of toilets across CT/PTS ranges from 5 to 10 with same number of toilet rooms for women and men. CT/PTs run by Corporation and WAVES had separate toilet rooms for the differently-abled (with only the latter offering ramp access to disabled persons) and CT/PTs run by Corporation and private organisations offer bathing facility also. Every day on an average 250 men and 180 women use CT/PTs, across corporation, WAVES, and NGO run CT/PTs. Private CTPT, report 250 men and 50 women using their toilets on a daily basis.

Toilet usage is charged on a per use basis, with private and corporation CT/PTs charging ₹2 and the WAVES and NGO run CTPT charging ₹1. Corporation run CT/PT offers more flexibility through monthly and group payment options. All the toilets in private, corporation, and NGO run CT/PTs were connected to the sewer system, while in WAVES run CT/PT, toilets are connected to a septic tank which is then linked to a biogas plant.

*One of the reasons for community toilets not being successful is that, squatting pans should be 20-inch-wide to ensure comfort to the users. In public toilets, most of squatting pans are not of standard size so it is uncomfortable for the users – Thirunagar, Sanitary Ware Wholesaler.*

All operators except the NGO operated CT/PT spend about ₹5,000–7,000 in monthly maintenance of the toilet, and their overall user experience is satisfactory. However, in NGO run CT/PT, expenses towards monthly maintenance is as low as ₹570 and not surprisingly user satisfaction rating is very low. Three out of the five users mentioned that these toilets are not easy to use primarily because of lack of cleanliness, bad odour, small size and

*'Many households in the locality are still waiting for a UGD connection and do not have the space to construct a septic tank. Hence, they have to resort to using community and public toilets' – Pit ring manufacturer from Selva Nagar.*

mosquito problem. Two of the users reported unsatisfactory cleanliness levels in the toilet including blocked toilets and lack of water.

*Most of the public toilets that are constructed do not adhere to any standards. For instance, to cut down on costs, builders use low quality material and incorrect products. They do not take into consideration outlet pipe size. Further, collection junction needs to be set separately for bathroom and toilet to avoid blockage. Masons often build the collection junction in the ground with the help of bricks and cement and when it gets blocked, it is difficult to clear it. However, now readymade collection junctions are available in the market to reduce these issues. This readymade junction is very helpful for apartments, and public toilets – Mudukupatti slum, Sanitary Ware Wholesaler.*

**Table 3.6:** Usage timing of community toilets based on community responses

| **Community members** |  **Toddlers** |  **Girls** |  **Boys** |  **Working Women** |  **Working Men** |  **House-wives** |  **Old/ Disabled** |
|---|---|---|---|---|---|---|---|
| Community Toilet (4.30 am – 10.00 pm) | Don't use | 5–8 AM | 5–8 AM | 5–9 AM | 5–9 AM | After 10 AM | After 10 AM |
| Community toilet (SHE Team) (4.30 am – 8.30 pm) | Don't use | 5–8 AM | 5–8 AM | 6–8 AM | 6–8 AM | 11 AM–5 PM | After 10 AM |
| Open defecation (OD)* | Anytime OD | 5–6 AM | 7–9 AM | 5–6 AM & 7–9 PM | 5–9 AM & 7–9 PM | 5–6 AM & 7–9 PM | Any time |
| *OD among men and women prevalent in Moolathoppu, Panjapur & Uyyakkondanthirumalai in Tiruchirappalli | | | | | | | |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | | | | |

With community toilets being in high demand, members have evolved their timing arrangements based on livelihoods, school and other chores (Table 3.6). Among the 10 locations in Tiruchirappalli with community toilets, working men, women and the school going children used the toilets from 5–9 a.m. In Moolathoppu and Pookkollai in Tiruchirappalli, the old and chronically ill tend to practice open defecationduring the rush hours if they are in urgent need to defecate. Toddlers and young children below 5 years across all locations, also defecate in open spaces outside their home. In a few locations toddlers defecate by spreading paper and disposing the waste in drains or else by directly defecating in the open drains.

Other models of CT/PT management operational in Tiruchirappalli include those managed by Sanitation, Health and Hygiene (SHE) committees led by women's self-help group or Toilet

Management Committees. These have created space for community members to be involved in operations of toilets thereby giving them greater ownership. Further, operating community toilets on a pay and use basis allows them to cover for costs involved in managing toilets and thereby ensure sustainability. While community led model does build ownership among members and has advantages, communities are well aware of limitations of such a model (Table3. 7).

*In my opinion, although community/public toilets are well constructed, they are still unable to meet the requirements of the households. This is because the toilet facility is not well maintained and there is no manager for these toilets – Sanitary Fittings retailer from Jagannathapuram.*

**Table 3.7:** Community perception of community toilet management

| Advantages | Limitations |
|---|---|
| **Managed by Corporation(in Tiruchirappalli and two Town Panchayats)** | |
| • Less burden on the community<br>• Sufficient fund for construction and renovation<br>• Provide technical support during issues faced by the public toilets irrespective of its management<br>• No user fee collected by corporation<br>• 24X7 access to the toilet | • Delay in repair and maintenance<br>• Difficulty to get the services on time<br>• Cleanliness of the toilet is not assured always<br>• Poor maintenance of corporation run toilets (non-availability of buckets/mugs, etc.)<br>• Limited accountability by attender<br>• Limited number of sanitation workers |
| **Managed by SHE Committee or SHG (only in Tiruchirappalli)** | |
| • Timely repair of even minor maintenance issues<br>• Feeling of ownership and participation by the community<br>• Better accountability to the community<br>• Democratic decision making on user fee and timing<br>• Better Community contribution<br>• Toilets always clean and hygienic<br>• Build awareness on sanitation and health<br>• Address the sanitation issues of local area.<br>• Provided work opportunity for local persons (at least 2 persons)<br>• Resource mobilisation<br>• Negotiate with respective Municipal ward members regarding major repairs | • Difficulty in mobilising large quantity of money, if major repair work is needed<br>• Technically qualified people are not available at all places<br>• Dependent on corporation for major repair and renovation<br>• Dependent on corporation sanitation workers for water clogging, blockage in the toilet and septic tank emptying |

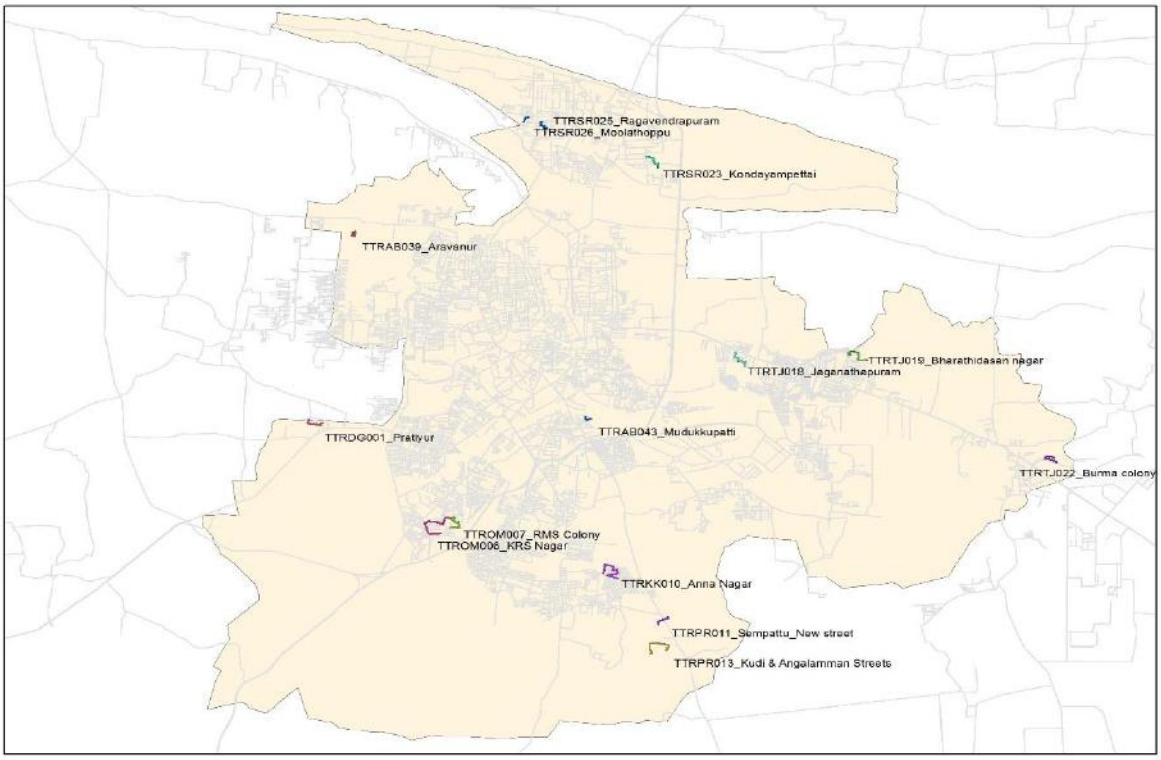
*Source:* TNUSSP Baseline Studies, 2016

### 3.2.3 Open Defecation

Out of the 133 households- 48 non-slum and 85 slum households, had some or all members engaging in open defecation. Of these, a group of 37 households engage in open defecation despite having access to toilets, 26 from slums and 11 non-slum areas. Among the commonly reported reasons for this behaviour are that members are used to going out, non-usability of toilets due to water shortage, and poor maintenance of community toilets. Hence, it appears to be a combination of habit along with

poor quality of toilets that is leading to continuation of open defecation despite toilet access. Four non-slum transects and 10 slum transects in the sample report having designated open defecation sites which are largely on the outskirts of the city (Map1). Distance to these sites varies between 1 and 30 minutes depending upon where the household is in that area.

**Figure 3.4:** Transects in Tiruchirappalli which have open defecation sites




*Source*: TNUSSP Baseline Studies, 2016

Members in only 7 households had different defecation pattern for dry and wet season and the remaining households follow the same defecation pattern in both seasons across age and gender. It is important to understand the social context in which sanitation practices have emerged. Basic amenities such as electricity, water, toilets and drainage have been slow to come by for slum settlements. Slums in Tiruchirappalli which were established as early as 1915, have community toilets almost a century later in 2014 (Table 3.8). Thus, those households which do not have access to toilets have been historically defecating in the open and this is socially accepted until recently. Thus, the migration to exclusive toilet use—individual, shared or community toilets will take time.

*'According to me open defecation is the best thing except for three months in the year when it rains. In open defecation, the sludge dries up and gets decomposed in a couple of days. That will not be a problem for the environment. But sometimes in the case of septic tank, the sludge germs will multiply within the septic tank. And when it is poured on to open land, it will be a huge threat to the environment, as there will be air pollution as well as soil contamination' – Sanitary Fittings Retailer*

| **Table 3.8:** Timeline of key infrastructure in slums in Tiruchirappalli | | | | | |
|---|---|---|---|---|---|
| **Location / Slum** | **Year of Establishment** | **Year in which services were made available** | | | |
| | | **Electricity** | **Community Toilet** | **Water** | **Drainage** |
| Mela Eda Street | 1915 | 1980 | 2014 | 1968 | Open drainage since 1998 |
| Neduntheru | 1945 | 1955 | 2005 | 2000 | UGD constructed not functional |
| Milaguaparai | 1950 | 1975 | 1975 | 1975 | UGD since 2010 |
| Pookkollai | 1955 | 1980 | 1990 | 2005 | UGD constructed in 2005; not connected |
| Panchapur | 1960-65 | 1980-85 | 2003 | 1980-85 | No UGD or open drainage |
| Pilliarkoil Street | 1965 | 1975 | 1975 | 1975 | 2010 partial UGD |
| Moolathoppu | 1969 | 1969 | Nil | 1969 | Open drainage 1995 onwards |
| Sengulam Colony | 1970 | 1988 | 2003 | 1970 | UGD since 2005 |
| Ramachandra Nagar | 1976 | 1986 | 2003 | 2001 | Partial open drainage since 1990 |
| Uyakondanthiru-malai | 1990 | 1984 | 2000 | 1984 | UGD open drainage 1990 partial |
| *Source:* IIHS Baseline Survey, 2016 | | | | | |

Of the 101 households with no access to toilets, about 60 per cent hoped to have one in the future. They want an individual toilet for various reasons including saving time, convenience of use during day and night, safety for women and children, privacy, disease prevention, comfort of seat position, escape from odour, protection from animals and environmental safety (Table 3.9).

| **Table 3.9:** Community response on factors which promote and discourage open defecation | |
|---|---|
| **Factors which promote** | **Factors which discourage** |
| • Saves money<br>• Water requirement is less<br>• No need of cleaning and maintenance<br>• Lack of space for construction of attached toilets<br>• Poverty and lack of money to invest in construction of toilet<br>• Closed toilets are claustrophobic | • Only usable during dark despite needingit<br>• Defecation sites are far from the settlement<br>• Increasing restrictions from the authorities<br>• Threat to women and girls from strangers and animals<br>• Difficult to use for menstruating women<br>• Lack of privacy<br>• Difficult to use for aged and sick persons |

| **Table 3.9:** Community response on factors which promote and discourage open defecation | |
|---|---|
| **Factors which promote** | **Factors which discourage** |
| • Open defecation is an old custom/habit | • Aids spread of infectious disease<br>• Difficult to use during monsoons |
| *Source:* TNUSSP Baseline Studies, 2016 | |

## 3.3 Containment

All the households that use an individual toilet, either shared or an IHHL, were asked about their toilet outlets. Hence, the recall based responses given below are based on the awareness of the respondent.

| **Table 3.10:** Wastewater outlets from toilets in Tiruchirappalli (% of household) | | |
|---|---|---|
| | **Non-Slum (%) (n=1006)** | **Slum (%) (n=504)** |
| Sewer system or underground | 34% | 44% |
| On-site systems | 54% | 40% |
| Direct discharge to drain | 8% | 10% |
| Open areas | 0.1% | 1% |
| Water bodies (Canal, Pond, Lake, River etc) | 0.1% | 1% |
| Don't know | 5% | 4% |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

In the non-slum areas, 54 per cent of the households are connected to on-site systems and 34 per cent are connected to the underground network. In slum areas, 44 per cent of the households are connected to the underground network and 40 per cent to on-site systems (Table 3.10). In both categories of settlements, around 8 per cent to 10 per cent of the households have toilets where fecal is being directly discharged into the open environment.

*Some households connect their toilets directly into surface drains, even though a UGD network is present in the locality, because these households do not have sufficient funds to connect to the UGD.-Plumber from Mudukkupatti*

Cost saving is among the main advantage of connecting to a sewer system, as all members in households with toilets use them, instead of trying to save cost of cleaning or reduce frequency of cleaning with a certain extent of open defecation. Underground sewer systems also allow for both septage and sullage water to the sewer, besides keeping sludge out of sight and making toilets odour free.

However, a sewer system, wherever available in seen as panacea by some respondents. High cost of connecting to underground at which ranges between ₹2000 and ₹25,000 was mentioned as a barrier to access. Water scarcity has often led to clogging of networks, which gets multiplied by poor waste disposal practices. For example, dumping of solid wastes such as plastics, bottles, napkins, cloths, etc.,

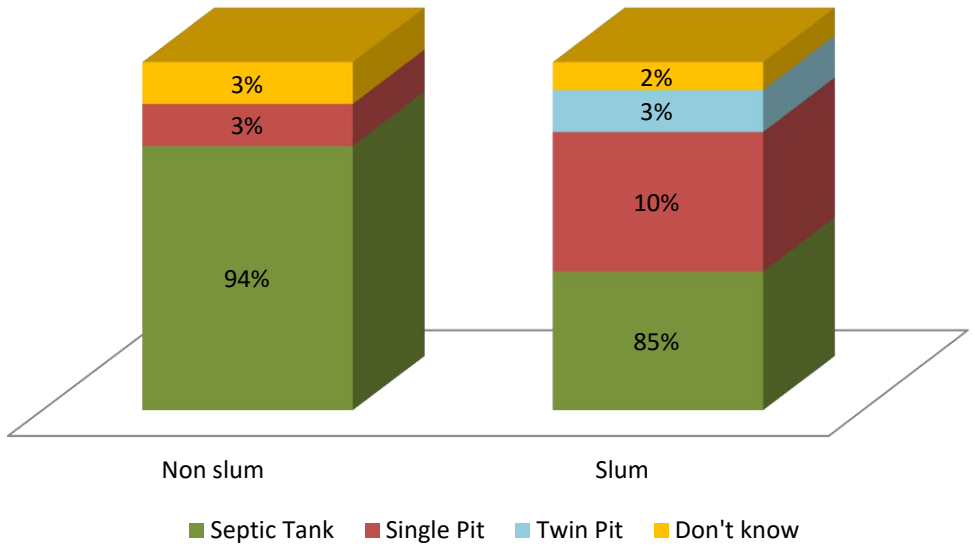
*The most regular buyers of pit rings for pit construction are low income households. We advise the clients on the basis of budget, size of the toilet, and total number of members of the household– Pit ring manufacturer.*

aggravates the problem and inconveniences large number of households. For instance, in Nelson Road in Tiruchirappalli, underground network is available and people have no choice but to connect to it. However, pipeline has not been maintained creating frequent problems.

Thus, it is not surprising to find households not connected to sewer system even when available. About 8 per cent of the non-slum and 6 per cent of the slum households could not connect to UGD network. Among the multiple reasons, 10 per cent was because households had applied for connection and were awaiting the same and rest included following reasons—ineffective sewer systems, inability to make connection to the toilet, unwillingness to connect and pay extra taxes, and not mandatory to do so. Hence, a combination of quality issues, physical constraints, lack of awareness, and administrative delays contribute towards households not being able to access the UGD networks.

*The quality of underground sewer is very poor and combined with poor maintenance; it means that sewer gets blocked frequently, fixing of which also takes a long time' – Mason from Keerakollai*

**Figure 3.5:** Type of Onsite Systems in Tiruchirappalli



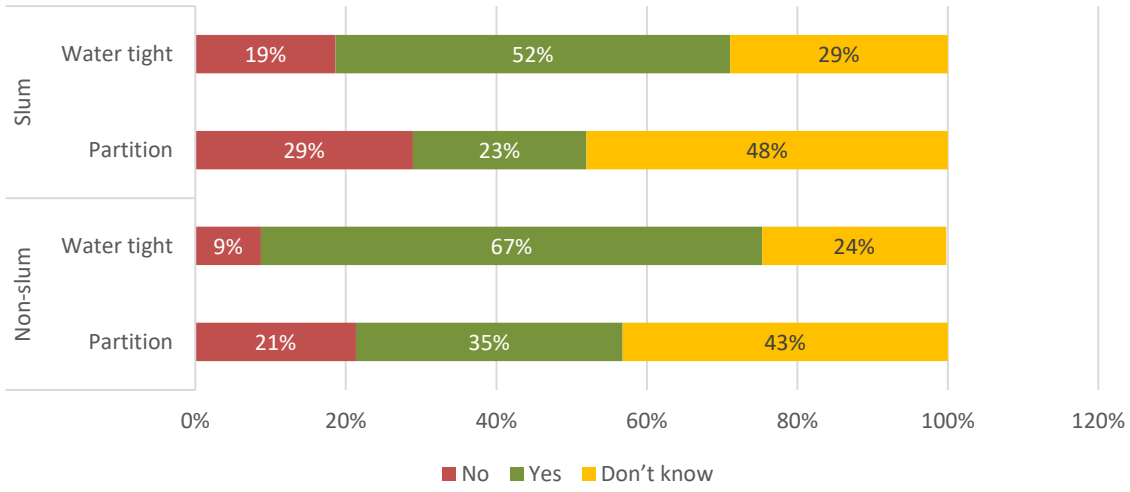

*Source*: TNUSSP Baseline Studies, 2016

Details on the type of on-site systems reported by 54 per cent of the non-slum households (n- 539), indicates that 94 per cent are septic tanks, 3 per cent as single pits, 3 per cent did not know the type of system (Figure 3.5). Similarly, of the 40 per cent of the slum households (n= 204), which report on-site systems, 85 per cent report to have septic tanks, 10 per cent have single pits, 3 per cent have twin pits and 2% do not know. This corroborates with the information provided by masons, engineers and builders, who report septic tanks and single pits as the commonly constructed structures. A third of the non-slum households with septic tanks and 28 per cent of the slum households with septic tank report sharing the same with one to ten households.

The World Health Organisation[2] defines Septic tanks as *'Watertight chambers sited below ground level which receive excreta and flush water from flush toilets and other domestic sullage (collectively known as wastewater). It is best to build a septic tank with two compartments, the first compartment being twice the size of the second'*. Hence, as per the WHO standards, it is necessary for a septic tank to be watertight and it should ideally have at the least one partition wall so as to meet the two chamber criteria.

Further analysis of septic tank specifications were undertaken to check if they fulfil the two essential criteria—presence of at least one partition and if they are watertight (Figure 3.6). Only 67 per cent of non-slum households have septic tanks with water-tight systems and 35 per cent with partition. Similarly, in slum areas, only 52 per cent septic tanks have water-tight systems and 23 per cent have a partition. Using the twin WHO criteria of water tight systems and OS with partition, 32 per cent of the non-slum and 16 per cent of the slum households have septic tank and rest are variations of a pit. The difference between reported type of on-site system and actual system is explained by the fact that a large section of the households assume that on-site systems are septic tanks when they are actually pits. Such a belief largely arises from the perception that any on-site system which is square or rectangular in shape is a septic tank.

**Figure 3.6**: Characteristics of Septic Tanks in Tiruchirappalli

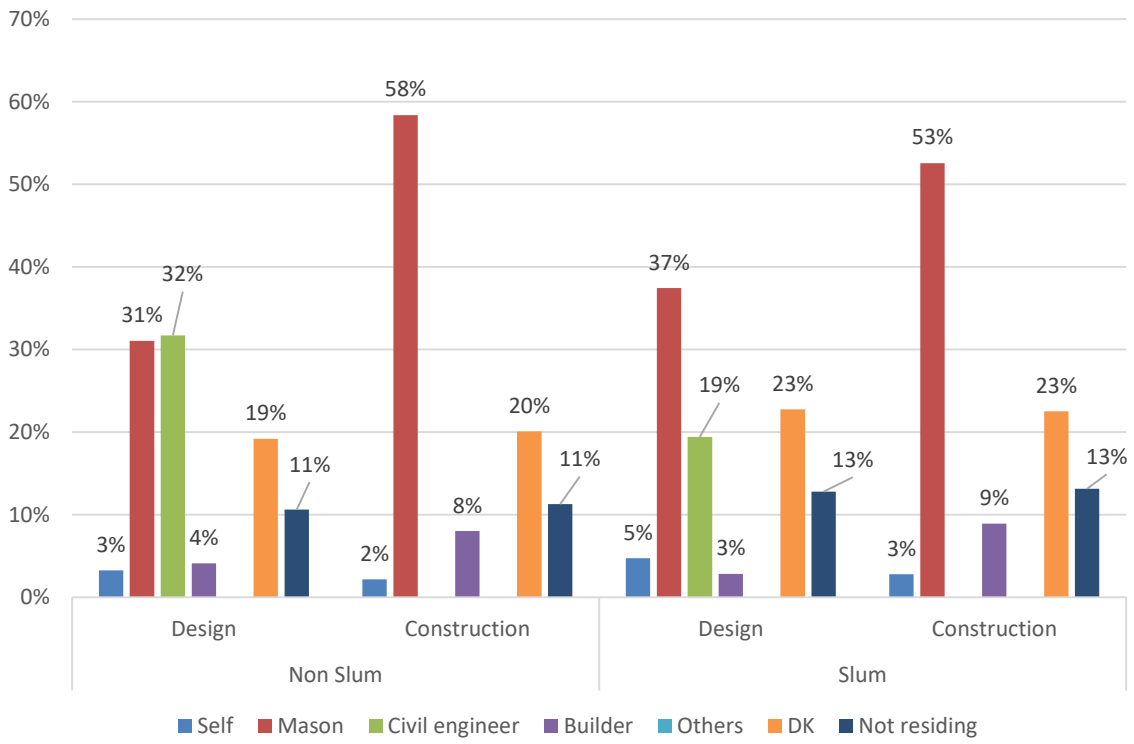



*Source*: TNUSSP Baseline Studies, 2016

On-site systems are designed by masons in 31 per cent of the non-slum and 37 per cent of the slum households (Figure 3.7). Furthermore, engineers design on-site systems in 32 per cent of the non-slum and 19 per cent of the slum households. In more than half the households in both settlements, mason builds the on-site Systems and in more than a third of the households across settlements, information was either not known or currents residents were not present at the time of construction. Interviews with builders, engineers, masons, and pit ring manufacturers undertaken to understand construction practices in designing and building waste disposal systems, revealed varying levels of awareness. Both masons from Tiruchirappalli who participated in the study, were aware of the basic design of a septic tanks as a structure with partition and where water drains out through the outlet in to a soak pit.

[2]http://www.who.int/water_sanitation_health/hygiene/emergencies/fs3_9.pdf

**Figure 3.7**: Construction and Design of Onsite systems in Tiruchirappalli




*Source*: TNUSSP Baseline Studies, 2016

The two builders mentioned not being aware of any external standards that they have to adhere to and are dependent on their engineers, who were aware about such specifications.

> *'Our company provides a special design where separate pipes are provided for both bathroom waste and toilet waste and the containment structure is sealed tight. When the households use this structure, they need not worry about bad smell' Builder from KK Nagar*

Engineers mentioned following the Tamil Nadu Public Works Department (PWD) standards and are aware about the importance of certain structural specifications in on-site systems. Engineers view direct connection of toilet waste to a soak pit as the worst containment practice, as in a pit without any partition walls, wastewater does not undergo any purification process and contributes directly to contamination of ground water. Further, they mentioned that soil test is needed before construction commences to ascertain the right type of containment structure. Clay soil and rocky areas not good for construction of containment structures.

Typically, a square or a rectangular structure is popularly seen as a septic tank in the local context. 'People are not aware of how to dispose fecal sludge and everyone in our locality uses the septic tank. Government should take action or the environmental condition will worsen and eventually collapse. We build only septic tank with partition walls and soak pits' Engineer from KK Nagar.

*'A septic tank with partition along with a soak pit is the best containment structure. When the client's budget is lower than the estimated cost by mason/engineer, that containment structure will be the worst structure, as then a pit ring with no soak pit will be built. Client's choice is based on their budget and not on the quality of soil* – Mason from Keerakollai.

Although engineers are aware of government specifications and have the knowledge to choose the right type based on soil conditions, they are unable to adhere to the norms as the client's budgetary constraint overrides all these aspects.

'Clients only want to dispose the waste from their houses and do not opt for containment structures based on quality. They merely need a containment structure that fits within their budget. If the builder can build it within their budget, they go ahead with it, else they seek another engineer. It is for this very reason that we are not able to maintain basic standards as the client's insistence on low budget takes precedence. Only the government can educate the people about sanitation' Engineer from Lingam Nagar.

Masons also appear to have picked up some critical learnings while working with Engineers and face similar problems while building a containment structure for their clients. 'Pit rings are bad for the land, especially if they are constructed near a bore well. However, low income households continue to use them because they are the cheapest option. There should be no bore well within 20 to 30 feet of a soak pit' says the mason from Aravanur.

Two masons related similar experiences that they do try to advise their clients on right type of containment structure, but the clients hardly listen to them. If they are unable to do the work within the client's budget, the clients usually seek someone else out. Besides, space scarcity also is an overarching constraint urban poor have to live with.

However, there are others who do not compromise on the quality standards. '*If the client is very conscious about their budget and want to reduce it, we warn them that it will create problems for them in the future. If the client does not understand, we drop the project. However, clients generally tend to understand the importance of building the right type of containment structures*' says the engineer from Uraiyur.

*'We follow the PWD norms. For example, we need to account for 100 liters per person and for residences, the minimum size of a septic tank should be 5x8 feet. The PWD also has certain regulations for commercial buildings'* – Engineer, TNHB Uraiyur.

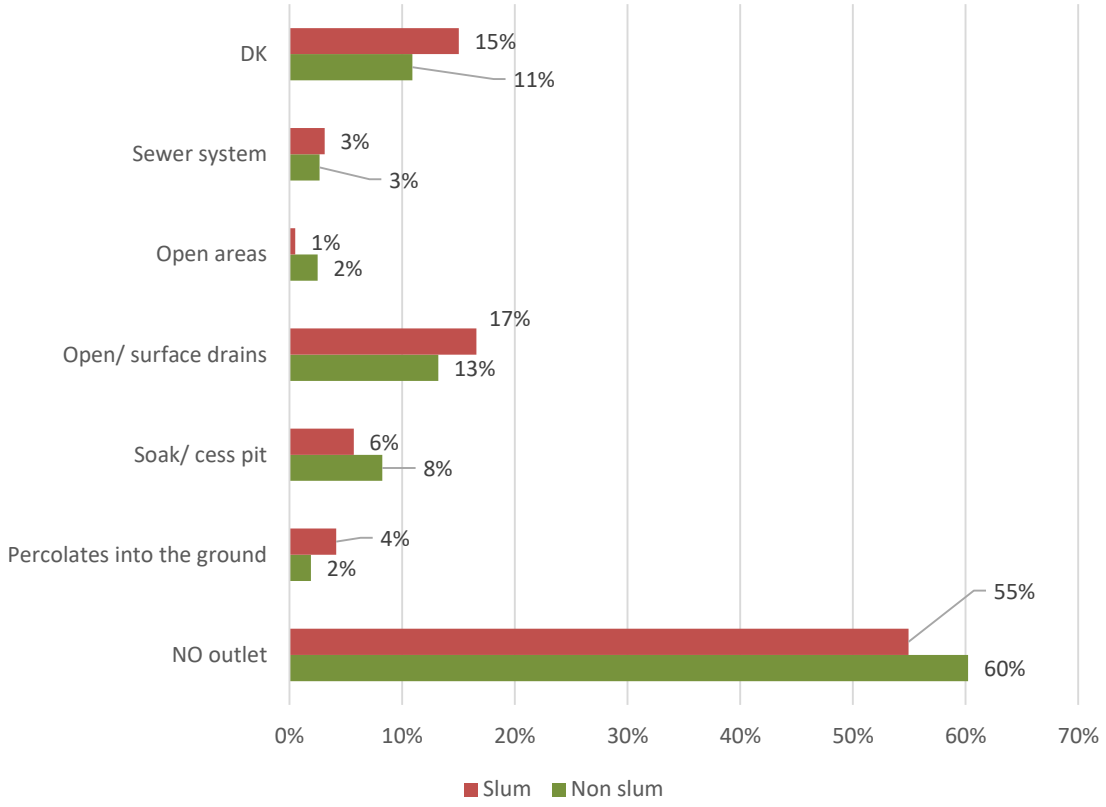
While plumbers are not directly involved in the construction of containment structures, they do provide support services to ensure that the entire disposal mechanism is functioning properly. Discussions with two plumbers revealed a basic understanding of underground network and on-site systems. While discussing any standards or norms that they might follow, the importance of setting up an air manual to prevent blockages in the pipe was highlighted by both of them.

In terms of awareness levels of new technology, both builders emphasised on the importance of recycling wastewater. 'Every household should have a treatment plant. They can recycle the water and use it for gardening. Only the government can help in this by creating awareness. If each household has a treatment plant, the groundwater level will increase. Such systems are however not feasible as clients are not aware of them and they are very expensive' says a builder from KK Nagar.
Among engineers, Decentralised Wastewater Treatment (DEWATS) is seen as being good for the environment but its high price is the primary reason for its limited usage. Another suggestion was to

improve the current system by decentralising septic tanks, especially in areas where there is no underground system and increasing the number of tanks. This would improve maintenance and waste water can be properly treated and re-used for all purposes except drinking. Towards improving current systems, both builders preferred treatment plants but there again cost considerations were primary. '*Some of the builders do not construct treatment plants. They only construct septic tanks and soak pits. As building promoters, they should start building treatment plants but everyone is money minded and wants to build on minimum budget. They do not care about environmental issues and here Government has a role to play in making people aware. Isha Homes is the only apartment complex in Tiruchirappalli where treatment plant is built*' says a builder from J B Nagar.

Disposal of wastewater from on-site system also forms an integral component of safe disposal of fecal sludge since the liquid effluent also contains harmful bacteria. Usually wastewater is transferred to a soak/cess pit, underground network or allowed to infiltrate into the ground if the soil is not very permeable. Households with on-site systems that are not twin pits[3] were asked where the wastewater from their systems goes to (Figure 3.8).

**Figure 3.8**: Disposal of wastewater from septic tanks and single pits in Tiruchirappalli




*Source*: TNUSSP Baseline Studies, 2016

[3]This includes households that said that their on-site systems are single pits or septic tanks and also those households which do not know what type of OS system they have

In a miniscule 6 per cent of the slum households and 8 per cent of the non-slum households, wastewater drains into soak pit or cess pit, while 55 per cent to 60 per cent of the on-site systems across settlements do not have any water outlets. Bound by cost and space constraints, households choose smaller septic tanks, which get filled every 6 to 9 months. This is particularly so because, if the septic tanks receive waste water from toilets and also from bathing and washing.Over time, the tank becomes weak and starts leaking and generates a foul odour in and around the house.

Community members reported not being able to afford emptying septic tank as it wouldcost them around ₹.2000 every 6 to 9 months. It is pertinent to note that 22 per cent of the non-slum households and 19 per cent of the slum households report getting permission to build the current pit or septic tank.

**Figure 3.9**: Open drains

*Source*: TNUSSP Baseline Studies, 2016

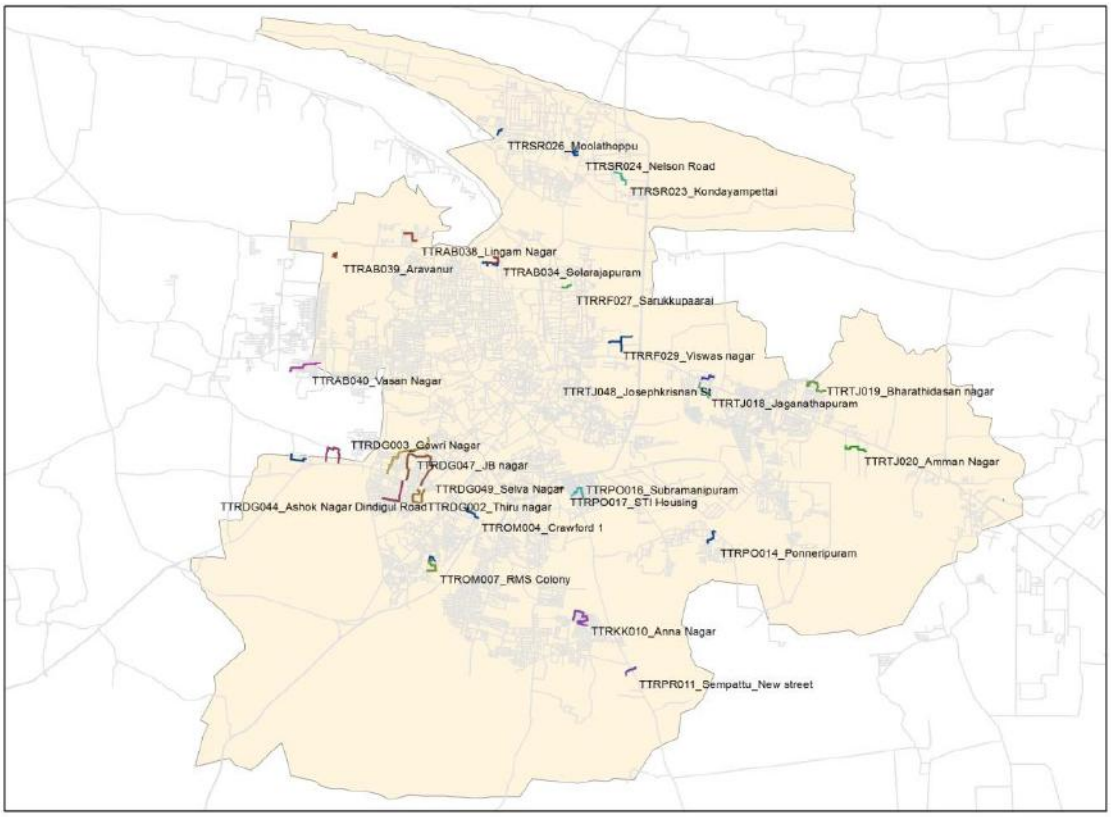
Furthermore, 13 per cent to 17 per cent of the household's wastewater drains out into open/surface drains and open areas. An engineer from Lingam Nagar mentioned that most of the septic tanks in his locality have outlets that drain out into open drains, and in some cases, open yards. Hence, the presence of on-site systems clearly does not necessitate the safe containment of fecal sludge.

*'Best containment structure is one that removes the filtered waste water immediately. Example would be a pipeline from the containment structure to an open drainage system. The waste water should not be stored; it should go outside so that sludge will remain and can be cleaned every five years. There is no use in building a tank if there is no option for removing water from containment structure'* – Mason from Tiruchirappalli.

However, community members are aware of the negative consequences of draining water from onsite systems in to open drains. For one, it promotes defecation of toddlers in open drain, which then increases their chances of coming in contact with fecal sludge and increases bad odour. Further, since the drains are constructed without considering topographical slope, water does not flow properly. The situation is further compounded by improper waste disposal into the drain.With infrequent drain cleaning and de-silting, drains get blocked and facilitate mosquito breeding. Even when garbage is cleared from drains, it is kept aside and not cleared immediately.

'*Household waste is collected from each house in a push cart. Still solid waste is dumped in an empty space next to a graveyard by the people or in the in the open drain in front of their house which leads to blockage in the drainage. We remove it on a daily basis and transfer to the Ariyamangalam compost yard in a truck. Waste usually collected comprises of mud, household garbage, plastics, and sewer blockage*' – Cleaner, Viragupettai

**Figure 3.10**: Transects in Tiruchirappalli where waste water from households drains into open drains




*Source*: TNUSSP Baseline Studies, 2016

## 3.4 Collection, Conveyance, and Disposal

For safe removal of fecal sludge from on-site systems and disposal, measures need to ensure that any form of human contact along this segment of the sanitation chain is avoided. As per law[4], manual cleaning or emptying of pits and septic tanks is prohibited. All urban law bodies (ULB) are required to adopt mechanical processes for cleaning of pits and septic tank.

Accessibility to on-site systems plays a critical role in determining the ease with which de-sludging service providers can clean the on-site systems. Three important components of accessibility are accessibility to onsite system, width of the road to accommodate de-sludging vehicles, and if onsite system can be opened. In a majority of the households, in slum and non-slum areas, the on-site systems are located around (in front, behind or on the side) of the household premises (Table 3.11). Furthermore, 88 per cent of the on-site systems in non-slum households and 84 per cent in slum households have an approach road which is 5 feet wider or more.

[4] Prohibition of Employment as Manual Scavengers (and their rehabilitation) Act, 2013

| **Table 3.11:**: Accessibility of On-site systems in Tiruchirappalli (percentage of households) | | |
|---|---|---|
| **Location of OS system** | **Non-Slum (n=538)** | **Slum (n=204)** |
| **Location of onsite systems** | | |
| In front of the building | 23 | 26 |
| Behind the building | 31 | 35 |
| On one side of the building | 41 | 30 |
| Below the pan/platform (below the building) | 4 | 7 |
| Don't Know | 1 | 1 |
| **Distance from the nearest access road to OS systems** | | |
| Less than 5 feet | 12 | 15 |
| 5–10 feet | 57 | 51 |
| Greater than 10 feet | 31 | 33 |
| **Is there an opening on top of the OS system?** | | |
| Yes | 56 | 44 |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

Since all on-site systems that are not twin pits would have to be emptied, respondents were asked to share if their on-site systems are accessible by a cess-pool machine hose pipe. In just about 56 per cent of the non-slum households and 44 per cent of the slum households, the onsite systems provide for an opening, while in the remaining cases, top has to be broken to access the systems. Therefore, while most of non-slum and slum households in Tiruchirappalli can be easily accessed by de-sludging trucks, cleaning them can be quite laborious since a large proportion of the on-site systems, particularly in slum areas do not have covers which can be easily removed.

'*We avoid cleaning systems at night because snakes, scorpions, and insects live in the tank and come out when the cover is removed. Workers do face problem of odour, vomiting and skin allergies as protection gear are not used because they are expensive. Workers cannot work without touching the matter and sometimes they have to get into the tank and put the hose in a proper position before they can run the air compressor*' - De-sludging service operator, Subramaniapuram.

As per CPHEEO norms septic tanks need to be cleaned periodically at an interval of 2–3 years. Across settlements, 56 per cent of the non-slum households (n=296) and 55 per cent of the slum households (n=112) reported having emptied or cleaned on-site systems since they started living in the current premises. Of these households, 77 per cent of non-slum households and 53 per cent of the slum households cleaned in the last five years paying anywhere between ₹500 and₹5,000 per visit based on the size of the tank and quantity de-sludged. Foul odour and back flow into the toilet were among the commonly cited reasons for desludging.

Nine out of ten households across settlements reported calling private service providers to clean on-site systems and the rest of the households mentioned availing the services of the municipality. The most common method for cleaning/emptying on-site systems is using vacuum suction trucks without manual entry.

*'Our services are called for when the tank overflows, when there is odour and when there are pipeline blockages. Also, during rainy season when the absorption capacity of the soil goes down, we are usually busy. The problems we face are that onsite systems tend to be covered in concrete, which has to be broken at the time of cleaning and can damage the septic tank. Sometimes access to the on-site system is through a narrow path, in which case using a truck can be quite difficult'* - De-sludging service worker, Subramaniapuram.

**Box 3.1:** Technical Study of Sanitation Services in Tiruchirappalli

Average volume of septic tank in Trichy is 7.5 M3 with 70 per cent of the septic tank built as per CPHEEO standards and 93 per cent of the septic tank lined at the bottom. Of the surveyed households, 17 households had de-sludged with 40 per cent reporting de-sludging within the last 5 years. Typically, sludge in Trichy is thin compared to the two town panchayats in Periyanaikenpalayam and Narasimhanaikenpalayam.

Most containment units observed were septic tanks with provision for access. Operators had to break open the manhole with crowbar and improvised tools such as drilling machines. Tankers used for de-sludging were professionally designed, with ladder, storage space for pipes and tools. Tank capacity ranges from 4,000 to 10,000 litres and are rubber lined for long life. Suction piper are up to 100 feet in length, with operator using couplers for joints. Many operators work bare chested.

While registered operators dump in designated sites at a fee of Rs. 30 per trip, others dispose in farms. Typically, most trucks cater up to a radii of 50 kilometers for collection and for disposal, larger trucks travel to 15 kilometers while smaller trucks go no further than 4 to 5 kilometers.

Source: Tamil Nadu State Baseline Study: Technical Assessment of Sanitation Chain, TNUSSP, 2017

About half the households across settlements report using suction truck without any manual entry (Table 3.12). However, in six per cent to eight per cent of the cases, manual entry into on-site systems is reported despite using suction trucks. It is also important to note that 13 non-slum households and four slum households mentioned manual cleaning of on-site systems. An attempt was made during the study to meet these manual cleaners but nobody was willing to come forth out of fear of legal penalties being imposed on them as it is banned by law.

**Table 3.12:** Methods used for cleaning on-site systems in Tiruchirappalli (% of households)

| | Non-slum (n=296) | Slum (n=112) |
|---|---|---|
| Manually cleared and emptied into nearby drain | 3 | 4 |
| Manually cleared, carted and emptied nearby | 1 | |

| **Table 3.13:** Methods used for cleaning on-site systems in Tiruchirappalli (% of households) | | |
|---|---|---|
| | **Non-slum (n=296)** | **Slum (n=112)** |
| Removed by suction truck with manual entry into pit | 6 | 8 |
| Removed by suction truck without any manual entry into pit | 55 | 51 |
| Don't know | 34 | 38 |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

'*Before the onset of vacuum motor technology, oil pump motors and generators were used for cleaning tanks. These oil motors would only remove the wastewater, and not the sludge. So, manual cleaning was required at that time. However, the current vacuum technology removes the sludge as well as any other waste materials present in the tank. Hence, manual cleaning is no longer required*' -De-sludging service worker, Subramainapuram.

**Figure 3.11**: Collection and disposal of fecal sludge from households in Tiruchirappalli

*Source*: TNUSSP Baseline Studies, 2016

Households largely seem to be unaware about where the fecal sludge is disposed once it has been removed from their on-site systems. Only nine households knew where the fecal sludge is emptied in the river or stream (4), buried on land (1) and dumped in farms (4).

Two de-sludging proprietors report transporting matter via tankers to the Sewage Treatment Plants (STPs) and neither of them mentioned facing any problems. Both proprietors report to operate well maintained tankers which are leak proof. They dispose the fecal sludge at the STPs as that is the prescribed site by the law. Both drivers reported using the Punjapur STP and also mentioned the existence of a second STP (one driver recalled that it was located at Jamamal College and the other, at Anna Stadium). Secondary research indicates that these are actually two decanting sites which are run by the Corporation for the collection of fecal sludge in case of Punjapur STP is not accessible. This narrative is however, not consistent with observations from other stakeholders.

'A treatment plant should be built. We can recycle the water and use it for washing purposes. There is a problem in the Panjapur treatment plant. The cable wires were stolen, so now the treatment plant is not running. Steps should be taken to maintain it properly. Truck operators are now dumping waste in to Kaveri River' says an engineer from Nelson Road.

Community responses reveal that until two years, most of the sludge cleaners (both private and public) disposed sludge it the outskirts of the city in the water bodies, paddy fields, wasteland, plots adjacent to forest areas and other agricultural fields. But strict action against the violators such as seizing the vehicle and fines have completely stopped such illegal disposal practices and now waste is dumped in Panjapur treatment plant.

**Table 3.14:** Water quality results from various sources based on certain transect characteristics in Tiruchirappalli

| Transect characteristics | Ground water | HH Water | OD | WB | Total |
|---|---|---|---|---|---|
| **Sample size** | **15** | **18** | **26** | **8** | **67** |
| OSS with visual exfiltration- high G/water area | 3 | 2 | 4 | 1 | 10 |
| OSS with visual exfiltration- Low G/water area | 3 | 6 | 4 | 2 | 15 |
| OSS without visual exfiltration- high G/water | 4 | 3 | 4 | 1 | 12 |
| OSS without visual exfiltration- Low G/water area | | | 2 | 1 | 3 |
| Proposed UGD-High G/water area | 3 | 3 | 4 | 1 | 11 |
| UGD-High G/water area | 2 | 4 | 4 | 2 | 12 |
| UGD-Low G/water area | | | 4 | | 4 |
| Total | 15 | 18 | 26 | 8 | 67 |

**Table 3.14:** Water quality results from various sources based on certain transect characteristics in Tiruchirappalli

| Transect characteristics | Ground water | HH Water | OD | WB | Total |
|---|---|---|---|---|---|
| **Samples tested positive for F.Coli / total number of samples** | | | | | |
| OSS with visual exfiltration- high G/water area | 3/3 | 2/2 | 4/4 | 1/1 | 10/10 |
| OSS with visual exfiltration- Low G/water area | 3/3 | 6/6 | 4/4 | 2/2 | 15/15 |
| OSS without visual exfiltration- high G/water | 3/4 | 2/3 | 4/4 | 1/1 | 10/12 |
| OSS without visual exfiltration- Low G/water area | | | 2/2 | 1/1 | 3/3 |
| Proposed UGD-High G/water area | 3/3 | 3/3 | 4/4 | 1/1 | 11/11 |
| UGD-High G/water area | 2/2 | 4/4 | 4/4 | 2/2 | 12/12 |
| UGD-Low G/water area | | | 4/4 | | 4/4 |
| Total | 14/15 | 17/18 | 26/26 | 8/8 | 65/67 |
| **Samples tested positive for E.Coli/total number of samples** | | | | | |
| OSS with visual exfiltration- high G/water area | 2/3 | 2/2 | 4/4 | 1/1 | 9/10 |
| OSS with visual exfiltration- Low G/water area | 3/3 | 6/6 | 4/4 | 2/2 | 15/15 |
| OSS without visual exfiltration- high G/water | 1/4 | | 4/4 | 1/1 | 6/12 |
| OSS without visual exfiltration- Low G/water area | | | 2/2 | 1/1 | 3/3 |
| Proposed UGD-High G/water area | 3/3 | 3/3 | 4/4 | 1/1 | 11/11 |
| UGD-High G/water area | 2/2 | 2/4 | 4/4 | 2/2 | 12/12 |
| UGD-Low G/water area | | | 4/4 | | 4/4 |
| Total | 11/15 | 13/18 | 26/26 | 8/8 | 58/67 |

In Tiruchirappalli water samples were collected across four different types of water sources – ground water, household water, open drains (OD) and water bodies (WB) across different transect types. All samples from open drains and water bodies tested positive for F.Coli and E.Coli. In 6 of the 26 samples F.Coli levels were as high as 1600 MPN/100 ml. Drains in areas with underground sewerage also showed high values which could be explained by upstream contribution and also partial coverage of UGD network. Of the eight waterbodies sampled, all tested positive for F.coli.
Household and groundwater samples from 31 of the 33 households were F.Coli positive with levels from areas with visual exfiltration being much higher. In 10 samples it greater than 20 MPN/100 ml with one household reporting as high 70 MPN/100 ml.

*Source:* TNUSSP Baseline Studies, 2016

## 3.5 Engagement with ULBs

With a majority of the household's dependent on private service providers, utilisation of municipal de-sludging services is negligible. There are reports from 22 per cent of the non-slum and 19 per cent of the slum households seeking permission from local authorities to build the current containment structure. About a third of non-slum households and slum households report paying deposit and fee to

municipality for water and sanitation. Despite paying taxes, just 4 per cent of the households have sought assistance from municipality for resolving issues of blocked drains and irregular water supply. Of these, nearly half the households felt that officials had responded in a timely fashion and even fewer (43 per cent) felt that the officials had been able to resolve their problems.

## 3.6 Handwashing and Menstrual Hygiene Management

Besides access to safe sanitation, hand washing is most important behaviour required to prevent the spread of diseases and diseases. About 69 per cent of the non-slum households and 44 per cent of the slum households report having a designated place within the house for hand washing. One fifth of the non-slum houses and 40 per cent of the slum houses have a designated place outside the households for handwashing. About 90 per cent of the slum and non-slum households report using a bar soap or a liquid soap for handwashing and 5–10 per cent use a detergent for the same.

Over 95 per cent of households across settlements reported handwashing after eating and using a toilet (Table 3.14). Although just 20 per cent of non-slum households and 25 per cent of slum households report cleaning hands before preparing food, nearly 70 per cent of household's report cleaning hands before eating. Furthermore, just about 7 per cent to 8 per cent of the household's report handwashing in the previous week after cleaning a child.

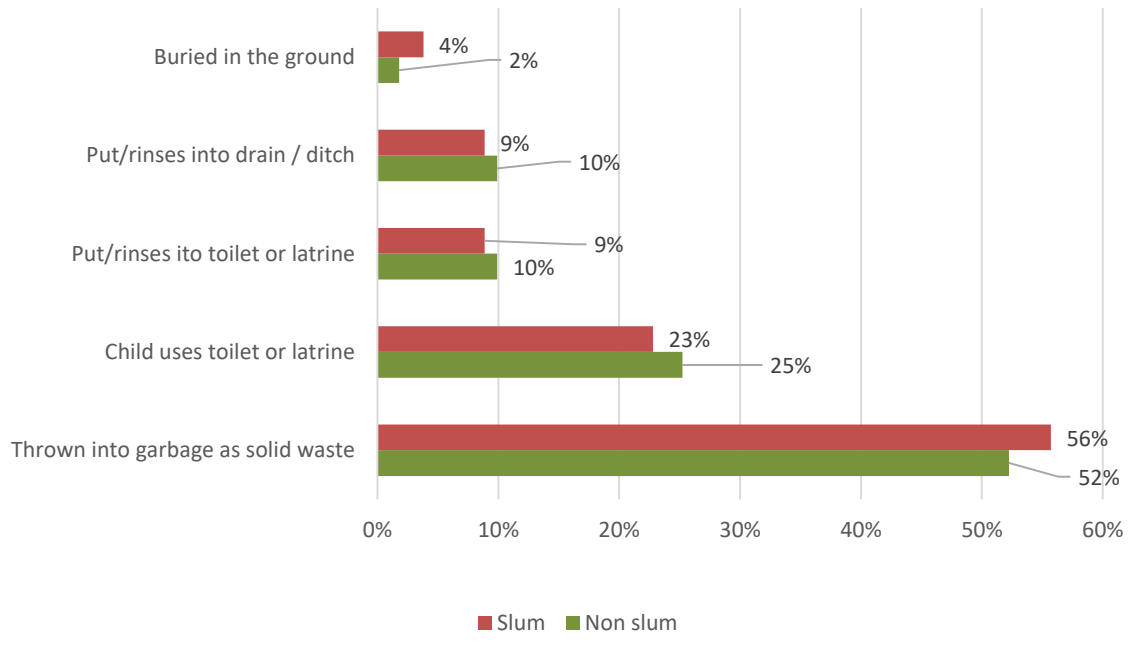
**Table 3.15:** Events which triggered hand washing in the last week in Tiruchirappalli ( % of households)

| | **Non slum (n= 1,180)** | **Slum (n= 789)** |
|---|---|---|
| Before eating | 72 | 69 |
| After eating | 98 | 98 |
| After going to the toilet | 95 | 95 |
| Before preparing food | 20 | 25 |
| Before feeding a child | 85 | 88 |
| After cleaning a child who has defecated | 8 | 7 |
| After touching animals | 7 | 4 |
| After using pesticides | 3 | 2 |

*Source:* TNUSSP Baseline Studies, 2016

In the sample a total of 190 households—111 from non-slums and 79 from slums—responded to questions on child faeces disposal. Over 50 per cent of household's report throwing child faeces in the garbage as solid waste, while a fourth of the households across both settlements report that the child uses toilet. About 10 per cent of the households either empty child's fecal matter into the toilet and an equal per cent empties it into the drain (Figure 3.12).

**Figure 3.12:** Disposal sites of child faeces in Tiruchirappalli (% of households)




*Source*: TNUSSP Baseline Studies, 2016

In terms of menstrual practices, women in 776 households from non-slum areas and 539 slum households responded to questions on menstrual hygiene. About 70 per cent of the women from non-slum area and 59 per cent of the women from slum report using sanitary napkins. Napkins were disposed-off along with solid waste by about 70 per cent of the non-slum women and 60 per cent of the slum women. One out of every sixth respondent burns it, while 11 per cent of the non-slum women and 17 per cent of the slum women dispose it in a separate designated place (Table 3.15). A total of six to seven per cent of women from each settlement reported using cotton or cloth and they are predominantly thrown with rest of the solid waste and in a few cases burnt.

**Table 3.16**: Disposal methods of sanitary napkins in Tiruchirappalli (Percent of households)

| | **Non Slum (n=776)** | **Slum (n=539)** |
|---|---|---|
| Throw with rest of the solid waste | 69% | 59% |
| Throw in separate designated place | 11% | 17% |
| Burn it | 17% | 18% |
| Bury it | 2% | 3% |
| Throw it in toilet | 1% | 2% |

*Source:* TNUSSP Baseline Studies, 2016

While most community toilets in Tiruchirappalli had a provision for common waste bins for sanitary napkins, women shared that often these plastic bins were toppled by dogs and napkins strewn all over the street making it awkward and embarrassing for them. Importantly, there is no space to place bins

in each toilet for disposal as the toilets have small plinth area. Women complained that despite several instructions, most users of community toilets either throw the napkins into the toilet, thereby clogging the drain or wrap it in paper and stuff it in the window sill, with a risk of it falling on the next user. Further, sanitary workers refuse to collect bins with sanitary napkins, thereby leaving them no choice but to burn them.

## 3.7 Water Supply

Access to safe drinking water near the household was assessed and information on each source of water was collected. Public tap water is the dominant source of water with nearly 50 per cent of the households across settlements reporting the same (Table 3.16). Other commonly accessed sources include street connection, piped water into dwelling, bottled water in non-slum areas and hand pump in slum areas. In terms of time taken to get water, in 72 per cent of the cases, water is available at home and in 24 per cent of the cases it takes less than 30 minutes.

**Table 3.17**: Main sources of drinking water for the household in Tiruchirappalli (Percent of reported sources)

| | Non slum n=1,309 | Slum n=845 |
|---|---|---|
| Public tap water | 48 | 53 |
| Street Connection (Dedicated Connection for HH but on the street) | 19 | 19 |
| Piped water into dwelling/yard | 12 | 10 |
| Bottled water | 12 | 4 |
| Own hand pump/own tube well | 7 | 10 |
| Tanker/truck | 1 | 3 |
| Own well, protected | 1 | 1 |
| Public open well | 1 | 0 |
| Public hand pump/tube well | 0 | 1 |

*Source:* TNUSSP Baseline Studies, 2016

Households make payment for about half of their water sources and these mainly include public tap water, street connection dedicated to the house, piped water in to the dwelling yard, with payment made mainly to Municipal Corporation. In case of bottled water payment is made to the private supplier with a majority of users paying less than ₹200. Water is typically stored in pots or buckets, roof tank, basement tank or drum inside the house. While a majority of households do not report having problems, about 11 per cent of the non-slum households and 16 per cent of the slum households report facing multiple problems in varying frequencies—erratic water supply, poor quality of water, water sources being controlled by some groups, irregular timing of water supply and poor maintenance of source. Payment for water sources is made to town panchayat, and in case of bottled water it is made to private supplier. Contamination of water supply with sewage also found mention in discussions with retailers of bottled water and water purifiers.

'*Water from the Corporation supply is often dark in colour and has a pH level of 6.5 due to the sewage waste that gets dumped into the river from nearby industries and households. Contamination is greater during the rainy reasons because the supply pipes often break, allowing for more effluents to enter the water source. While all households use this water, households from economically weaker backgrounds are more adversely affected. This is because the richer households are able to purchase water purifiers/reverse osmosis systems or buy bottled water, while the lower income households either only boil the water or filter it by using a white cloth before consumption. Such contaminated water results in diseases such as viral fever, vomiting, and diarrhoea*' - Manufacturer of bottled water in Geetha Nagar

Bore well water tastes better and is of better quality than corporation water, and so people don't fall sick according to water purifier retailer in Kondayampettai. Among the non-slum households, 45 per cent report treating water before consumption as compared to 34 per cent slum households, with boiling water being the most common method. The next sought after option is to treat with electronic treatment device.

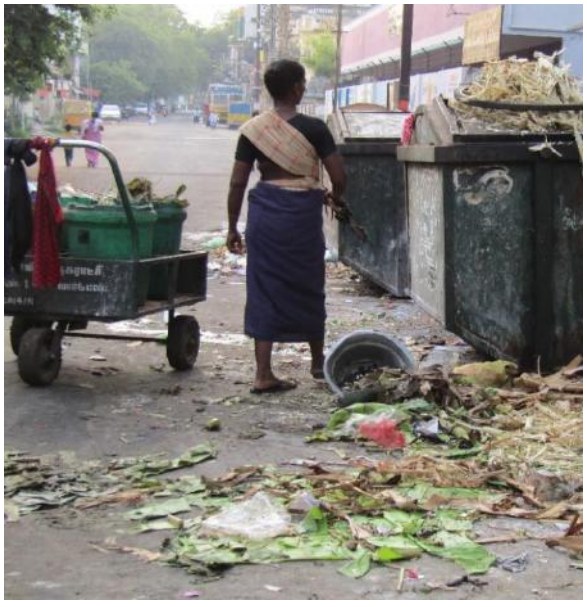
### 3.7.1 Non potable water

For washing and cattle rearing, 43 per cent of the non-slum households and 26 per cent of the slum households report using different water source. Primary reasons for this choice is because drinking water is of better quality and hence more expensive and also farther away from the house. About 25 per cent of the non-slum households and 30 per cent of the slum households report paying to access non potable water.

## 3.8 Solid Waste Management and Drainage

Door to door waste collection was reported by 69 per cent of the non-slum households and 57 per cent of the slum households, and in eight of the ten cases across settlements it is reported to be done on a daily basis and on a bi-weekly basis in the rest of the cases. Just about two per cent to three per cent of the slum and non-slum households report paying the municipal corporation for waste collection services. If waste is not collected, it is either dropped in community dustbins, empty vacant land or designated areas by majority of the households.

**Figure 3.13**: Waste collection by a sanitation worker

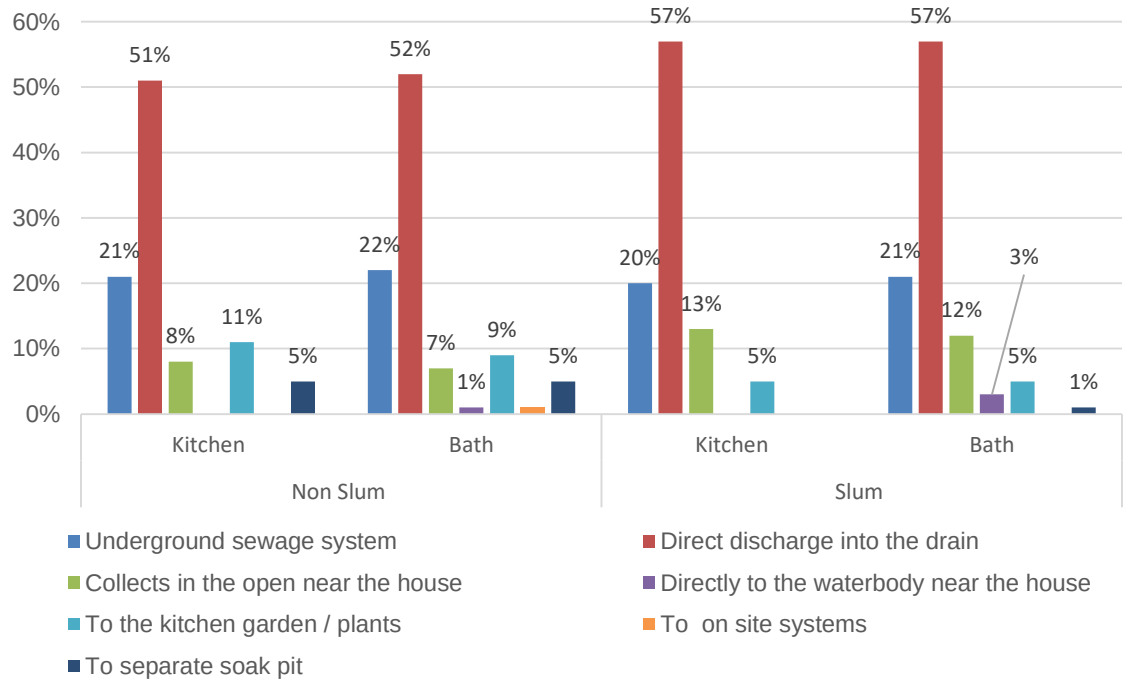


*Source*: TNUSSP Baseline Studies, 2016

As regards segregation, about ten per cent of the non-slum households and 7 per cent of the slum households report segregating waste. Recyclable waste such as old newspaper, metals and plastics are treated on a case to case basis. Wherever possible and needed they reuse it, failing which they sell it to the person who buys recyclable waste, dump it in community bin or throw it in designated area nearby. As regards kitchen and bathroom waste, in little over half the slum and non-slum households,

it is directly discharged in to the drain, and in a fifth of the cases it is connected to the sewer system (Figure 3.14). Similar pattern is witnessed in case of disposal of bathroom waste.

**Figure 3.14:** Disposal site for kitchen and bathroom waste in Tiruchirappalli




*Source*: TNUSSP Baseline Studies, 2016

## 3.9 Establishments

### 3.9.1 Profile of Establishments

To further understand the waste management practices of institutions, a total of 29 establishments were covered in Tiruchirappalli, 20 in the non-slum area and 9 in the slum area. Of these 29 establishments, in a majority of the cases, premises are owned (21) or rented (7) and toilets therein are used exclusively by the owners (Table 3.17).

**Table 3.18**: Number of Establishments visited by type

| Type of Establishment | Non slum | Slum | Total |
|---|---|---|---|
| Factory | 1 | 3 | 4 |
| Government Office | 2 | 1 | 3 |
| Hospital | 2 | | 2 |
| Hotel | 2 | | 2 |
| Nursing home | | 1 | 1 |
| Private Office | 3 | | 3 |
| Restaurant | 2 | 1 | 3 |

| **Table 3.18**: Number of Establishments visited by type | | | |
|---|---|---|---|
| **Type of Establishment** | **Non slum** | **Slum** | **Total** |
| Shop | 8 | 3 | 11 |
| **Total** | **20** | **9** | **29** |
| *Source:* TNUSSP Baseline Studies, 2016 | | | |

### 3.9.2 Access

None of these 29 establishments reported that their employees defecate in the open and in only one establishment in Tiruchirappalli was the use of CT/PTs reported, for the reason that the establishment does not have a toilet. Further 82 per cent of the factories/shops reported the presence of dedicated toilets for their employees, while all offices, hospitals, nursing homes, hotels, and restaurants had the same present within their premises. The most common reason for not having a dedicated toilet facility in the establishment is that it is a rented premise so they cannot make decisions regarding construction of toilets. Other reasons cited were that there is no space in or near the premises, and there is a public or community toilet close by.

| **Table 3.19**: Usage levels of establishment toilets in Tiruchirappalli | | | | | |
|---|---|---|---|---|---|
| **Type of establishment** | **N** | **Percentage of establishments with dedicated toilet for employees** | **Average number of dedicated toilets per establishment** | **Average number of employees per toilet** | **Average number of visitors per toilet** |
| Factory/shop | 10 | 67% | 7.9 | 18.2 | 410.6 |
| Government/Private Office | 6 | 100% | 4.8 | 21.0 | 2.1 |
| Hospital/Nursing home | 3 | 100% | 14.7 | 7.9 | 13.2 |
| Hotel/restaurant | 5 | 100% | 3.8 | 3.7 | 500.0 |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | | |

On an average, factories/shops have about one toilet for every 18 employees and 411 visitors (Table 3.18). Similarly, for hotels/restaurants, while the average number of people per toilet is 4, the average number of visitors using one toilet is approximately 500. Hence, the per toilet usage levels by employees is highest for factories/shops and offices whereas hotels/restaurants have the highest number of visitors per toilet.

### 3.9.3 Containment

In a majority of the establishments (16) toilets are connected to on-site systems while in 7 establishments it is connected to the UGD network. One establishment reported that the outlet of their toilets directly discharges into an open/surface drain. The remaining six respondents were not aware of the disposal arrangements for their establishment (Table 3.19).

| **Table 3.20**: Outlets for waste water from toilets in Tiruchirappalli (no of establishments) | | | |
|---|---|---|---|
| **Type of containment structure** | **Non slum** | **Slum** | **Total** |
| Sewage system (UGD) | 6 | 1 | 7 |
| On-site systems (pit or septic tank) | 11 | 5 | 16 |
| Drain (direct discharge) | 1 | | 1 |
| Don't know | 1 | | 6 |
| *Source:* TNUSSP Baseline Studies, 2016 | | | |

Three establishments did not connect their toilets to underground system despite availability because they thought it was not mandatory to connect to the network as per the Corporation or Municipality regulations.

Sixteen establishments that have toilets connected to on-site systems have a total of 20 on-site systems and all of them are reported to be septic tanks. On-site systems, for the purpose of this study, refer to single pits, twin pits, and septic tanks. However, as was seen in the case of households, pits are often mistaken for septic tanks. As per the WHO standards, it is necessary for a septic tank to be watertight and it should ideally have at the least one partition wall so as to meet the two chamber criteria. Out of the 20 septic tanks, 17 were reported as being water-tight while nine had one or more partition walls. In light of these findings, it would be more appropriate to state that nine of the on-site systems (45 per cent) are septic tanks and six (30 per cent) are some variation of a pit. In about half the establishments, the on-site was reported to be designed by the mason, with two each reported to be designed by the engineer and builder. In terms of construction of the on-site systems, in 5 of the 20 cases, it was built by the builder, and in 9 instances it was built by others. In 19 of the 20 establishments with on-site systems reported that wastewater from their systems has no outlet and in one case it was reported to drain out and percolate into the ground.

### 3.9.4 Collection, Conveyance, and Disposal

Accessibility to on-site systems plays a critical role in determining the ease with which de-sludging service providers can clean the on-site systems. All the on-site systems are located in and around the establishment premises and hence, likely to be easily accessible (Table 3.20). Furthermore, for 85 per cent of the OS systems, the width of the access road was reported as being greater than 10 feet while for the remainder it is 5–10 feet, thus allowing de-sludging truck easy access to OS systems. Lastly, for 75 per cent (n=15) of the on-site systems it was reported that the structure is accessible by hose pipe of the cess-pool machine since it has covers which can be removed.

| **Table 3.21**: Location of on-site systems in Establishments in Tiruchirappalli (number of establishments) | |
|---|---|
| **Location of OS system** | **no** |
| In front of the building | 3 |
| Behind the building | 15 |
| On the side of the building | 2 |
| Total | 20 |

| **Table 3.21**: Location of on-site systems in Establishments in Tiruchirappalli (number of establishments) | |
|---|---|
| **Location of OS system** | **no** |
| *Source*: TNUSSP Baseline Studies, 2016 | |

During the survey, it was confirmed that 14 out of the 20 on-site systems have been cleaned during the time the respondent has been working in the current premises. Of these 14, 13 were last emptied less than a year ago. The primary reasons reported for undertaking de-sludging of these systems was because it was 'long since OS was last cleaned', bad smell and overflow from the on-site system, and backflow in the toilets.

Out of the 14 on-site systems that were de-sludged, 12 were cleaned by a private cess-pool vehicle while the other two had availed services from a municipal cess-pool vehicle. Data on the methods employed by the vehicles indicates that in 13 cases manual entry into the system was not required while for one OS system manual entry was reported. Furthermore, only for 3 out of the 14 systems did the respondents report to being aware about where the cess-pool vehicles dispose the fecal sludge—all three mentioned that the sludge is disposed-off at the Government STP.

Decisions on up gradation is mainly taken by the management or senior staff of the establishment with due permission from authorities. Of the 25 respondents, 21 felt that there was no need to upgrade the current toilet facilities, as they happy with the current set up, while one each of the establishment could not upgrade on account of one of the following reasons - high cost of construction, high cost of maintenance or lack of space.

| **Table 3.22**: Types of Waste generated ( no of establishments) | | |
|---|---|---|
| | **Non slum** | **Slum** |
| Solid waste | 16 | 7 |
| Organic waste | 4 | 1 |
| Offal waste | 1 | |
| Infected waste | 3 | 1 |
| Others | | 1 |
| Total | 24 | 9 |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

Majority of the establishments report generating solid waste (23) and organic waste (5). Just 4 of the 29 respondents report segregating waste, and just 7 of the 29 establishments report daily waste collection. In the event waste is not collected daily, it is thrown in the community waste bin (10) or thrown in the designated area in the community (4). Offal waste in one establishment is reported to be thrown in community bins. Of the four establishments which handle infected waste, one reports that private agency collects it; two report corporation/town panchayat handling it and one reports disposing it along with solid waste to garbage collector (Table 3.21).

In terms of bath water disposal, of the 23 establishments which responded, 12 do not have bathing area (Table 3.22). Bath water was connected to sewer system (5), into on-site systems (4) or in to drain/open areas (2).

| **Table 3.23**: Disposal sites for bath water ( no of establishments) | | |
|---|---|---|
| | Non slum | Slum |
| No bathing | 6 | 6 |
| In to sewerage system | 5 | |
| Direct discharge into drain | 1 | |
| Collects in the open near establishment | 1 | |
| To on-site systems | 3 | 1 |
| Total | 16 | 7 |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

## 3.10 Schools

A total of 8 schools were covered in Tiruchirappalli; one from a slum area and the other 7 from non-slum areas.

### 3.10.1 Access

None of the schools in Tiruchirappalli reported that their students, teachers or staff defecate in the open or use CT/PTs. On average, there are 197 girls and 208 boys studying in these 8 schools and average 26 staff members per school—5 males and 21 females. The Table 3.23 presents the average burden on toilets in these schools. On an average, one toilet serves 99 girls, 110 boys, and 14 staff members each.

| **Table 3.24**: Usage of toilets in school, Tiruchirappalli | |
|---|---|
| Average number of common facilities for girls | 3.25 |
| Average number of common facilities for boys | 1.9 |
| Average number of common facilities for Staff only | 5.8 |
| Mean number of girls per toilet | 116 |
| Mean number of boys per toilet | 117 |
| Mean staff members per toilet | 18 |
| *Source*: TNUSSP Baseline Studies, 2016 | |

Just three of the eight schools in Tiruchirappalli report having a dedicated space for hand wash for each toilet facility. Others do not have a dedicated had wash for each toilet facility for various reasons—there a common hand wash (3), hands can be washed anywhere (2) and cost of construction is high (1).

### 3.10.2 Containment

Half the schools reported that the toilets are connected to the UGD network while in the other four, connections to on-site systems were reported. Each school that reported connections to on-site systems had all its toilets linked to one on-site system. One school, which had UGD network in its neighbourhood, did not connect to it because of lack of proper access.

All on-site systems were also evaluated against the WHO standards of being watertight and having at the least one partition wall—three facilities report watertight OS systems and two report having a partition wall. Only two of the four on-site systems were 'watertight and have partition walls' thus fitting WHO criteria of septic tanks. As regards wastewater disposal from schools with on-site systems that are not twin pits[5], the responses were one each from the following category—no outlet, discharged into the sewer system, drains into a soak/cess pit, and no information. OS systems are reported to be built by civil engineer in one case, by builder in other and in two cases information is not known.

### 3.10.3 Collection, Conveyance, and Disposal

Accessibility to on-site systems plays a critical role in determining the ease with which de-sludging service providers can clean the on-site systems. In two schools, the on-site system is located behind the building while in the other two is right next to the building. Similarly, access to two on-site systems is through a road which is wider than 10 feet while the width of the access road to the other two on-site systems is 5 to 10 feet. Lastly, three out of the four systems have covers which can be removed so that the hose from cess-pool vehicles can be inserted. Hence, the on-site systems in the schools of Tiruchirappalli are easily accessible by vacuum trucks.

All four on-site systems have been cleaned during the time the respondent has been working in the current premises of the establishment. Furthermore, all four were reported to have been cleaned in the past one year. All respondents said that the reason for de-sludging the on-site system was that enough years had passed and it was felt that it was time to clean it. Two of the systems were cleaned by a private cess pool vehicle while the other two were cleaned with the help of a Municipal cess pool vehicle. Out of these four, three confirmed that the cleaning was done without any manual entry into pit. The fourth respondent was not aware of how the on-site system had been cleaned. Only one respondent was aware about where the vacuum trucks dispose the fecal sludge which was reported to be the government STP.

### 3.10.4 Water Supply

Of the eight schools, four report having piped water in their compound, three have 'hand pump/bore well' and one school reports using bottled water. Three schools report making payments for water, two of which is to municipality and in one case to private bottled water supplier. While one school reports of having access to running water, all others report storing water in various containers. Five of the eight schools report treating water using electronic methods.

[5]This includes households that said that their on-site systems are single pits or septic tanks and also those households which do not know what type of OS system they have

# 4

# Key Findings: PNP & NNP

# 4. Key Findings: PNP and NNP

This section of the report looks at the key findings from the baseline assessment in PNP and NNP. First the findings from the household survey are presented while the second half looks at the findings from the Establishment and School Survey.

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## 4.1 Profile of Households

In NNP, a total of 405 households were sampled, of which 77 per cent are in non-slum areas and the rest in slum areas. Out of 10 respondents, 6 are female across both slum and non-slum areas (Table 4.1). A majority of the households in NNP report affiliation to BC category (67 per cent), followed by the MBC category (20 per cent) in the non-slum areas. In slum areas, a large section of respondents belonged to MBC (44 per cent) followed by BC (33 per cent).

**Table 4.1**: Profile of Households in TPs (percentage of households)

| | NNP | | PNP | |
|---|---|---|---|---|
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Female respondents | 61 | 59 | 63 | 60 |
| **Educational attainments** | | | | |
| No schooling | 13 | 27 | 10 | 19 |
| Grade 1–4 | 3 | 7 | 4 | 5 |
| Grade 5–8 | 19 | 36 | 25 | 23 |
| Grade 9–12 | 40 | 22 | 35 | 39 |
| Graduate | 21 | 6 | 23 | 13 |
| Post Graduate | 4 | 1 | 3 | 1 |
| Social category break up | | | | |
| Scheduled caste (SC) | 6 | 18 | 4 | 38 |
| Backward class (BC) | 67 | 33 | 63 | 33 |
| Most backward caste (MBC) | 20 | 44 | 24 | 26 |
| Scheduled tribe (ST) | 1 | | | |
| **Employment category** | | | | |
| Labour | 20 | 50 | 17 | 50 |
| Self employed | 15 | 10 | 18 | 7 |
| Government | 3 | 1 | 5 | 2 |
| Private | 55 | 36 | 47 | 28 |
| Pension | 6 | 3 | 9 | 11 |
| Access to ration card | | | | |
| No | 19 | 12 | 10 | 13 |
| **Yes, of which** | | | | |

| **Table 4.1**: Profile of Households in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Below Poverty Line Cards (BPL) | 75 | 86 | 76 | 80 |
| Above Poverty Line Cards (APL) | 6 | | 13 | 7 |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | |

In PNP, a total of 604 households were randomly selected, of which 79 per cent are in non-slum areas and rest in slum areas. Furthermore, about 60 per cent of the respondents are female across both settlements. A majority of the households in PNP reported affiliation to the BC category (63 per cent), followed by the MBC category (24 per cent) in the non-slum areas, where as in slum areas, about a third of the respondents were each BC and SC, and 26 per cent belonged to MBC.

In both NNP and PNP, in the non-slum settlements, about half the households engaged with the private sector for their livelihood, followed by self-employment and labour work. Dominant source of income in the slum areas, was labour work, followed by employment in private sector.
Results indicate that more than 99 per cent of the sample households in PNP and NNP fall into category of low probability of being below the poverty line. However, about 75–80 per cent of the households hold below poverty line cards, which gives them access to basic food items at lower prices. An overwhelming majority of the households in NNP and PNP have electricity and use gas for cooking (Table 4.2). The only exception is slum households in NNP, where besides gas, firewood and kerosene is used. Over 90 per cent of households in the non-slums areas of PNP and NNP, have access to TV, mobile phone and toilets (shared or individual). In the slum households in both PNP and NNP, TV ownership and mobile ownership is nearly 90 per cent, while just 54 per cent of NNP and 64 per cent of the PNP slum households report access to toilet—individual or shared.

| **Table 4.2**: Household Characteristics in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Source of energy for cooking | | | | |
| Gas | 97 | 84 | 97 | 97 |
| Kerosene | | 5 | 1 | |
| Firewood | | 11 | | |
| Access to electricity | 99 | 95 | 99 | 99 |
| Asset Ownership | | | | |
| TV | 98 | 96 | 99 | 97 |

| **Table 4.2**: Household Characteristics in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Mobile Phone | 92 | 89 | 91 | 88 |
| Bicycle | 29 | 43 | 25 | 37 |
| Motorbike | 72 | 55 | 70 | 54 |
| Car/jeep | 8 | 3 | 12 | 7 |
| Access to individual/shared toilet | 93 | 54 | 99 | 64 |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | |

A large per cent of the sample household in PNP and NNP live in individual houses in non-gated communities (60 per cent), and the rest mainly live in single floor buildings (Table 4.3). In NNP, besides individual houses, single floor buildings are equally popular. In non-slum households, cement is the commonly used material for floor, while in non-slum houses, mosaic, marble or ceramic is widely used.

Access to banking services is a key indicator of financial inclusion. About 90 per cent of the non-slum households and 80 per cent of the slum households in Coimbatore report access to banking services. An average of 15 per cent of the non-slum and 25 per cent of the slum households have a current outstanding loan, which are primarily taken for one of the following four purposes—house construction, purchase of an item, education or business.

| **Table 4.3**: Characteristics of dwelling unit in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Households occupied by tenants | | | | |
| **Type of premises** | | | | |
| Own house | 47 | 83 | 65 | 67 |
| Rented | 53 | 17 | 35 | 31 |
| **Kind of premises** | | | | |
| Individual house, non-gated community | 63 | 43 | 60 | 67 |
| Single building with < 4 floors | 11 | | 10 | |
| Single floor building, multiple houses | 23 | 33 | 27 | 22 |

| **Table 4.3**: Characteristics of dwelling unit in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Individual house in a community | | 22 | | |
| Wall of the house: brick/stone/concrete | 94 | 96 | 81 | 84 |
| Floor of the house | | | | |
| Cement | 26 | 62 | 36 | 54 |
| Mosaic/marble/ceramic | 72 | 31 | 63 | 38 |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | |

## 4.2 Access

### 4.2.1 Household Toilets

Individual or shared toilet is used by 93 per cent and 97 per cent of the non-slum households non-slum areas in NNP and PNP respectively. In the slum areas, although individual toilet use is the dominant defecation patter—54 per cent in NNP and 64 per cent in PNP, community toilets and open defecation is also practised (Table 4.4). An overwhelming majority of household's report using toilets on an individual basis and about 10 per cent across NNP and PNP report sharing toilets. Among main problems in sharing mentioned by a total of 20 households was the long waiting time, non-availability of water, sharing of cleaning and maintenance expenses. In the remaining households in PNP and NNP, use of one IHHL is available for every 4 four household members—in slum and non-slum areas—across both the TPs. The type/availability and condition of household was a key decision variable in selecting the house as reported mainly in 60 per cent of non-slum households and an average 40 per cent of the slum households in NNP and PNP.

| **Table 4.4**: Defecation pattern in TPs (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non slum ( n= 311)** | **Slum (n= 94)** | **Non slum ( n= 475)** | **Slum (n=129)** |
| Individual/Shared Toilets | 93% | 54% | 97% | 64% |
| Community Toilets | 6% | 18% | 3% | 24% |
| Open Defecation | 1% | 31% | 1% | 16% |
| Sum may not add up to 100 as multiple forms of defecation may be practised | | | | |
| *Source:* TNUSSP Baseline Studies, 2016 | | | | |

**Figure 4.1**: Household Toilets in Town Panchayats

*Source*: TNUSSP Baseline Studies, 2016

It is important to note that although women who did not have individual toilets aspired to construct toilets to them, they preferred to connect their toilet with UGD rather than septic tank. Emptying septic tank, and its associated cost puts additional burden on the household. Community members often tend to fully weigh the pros and cons of building an individual toilet before making the decision.

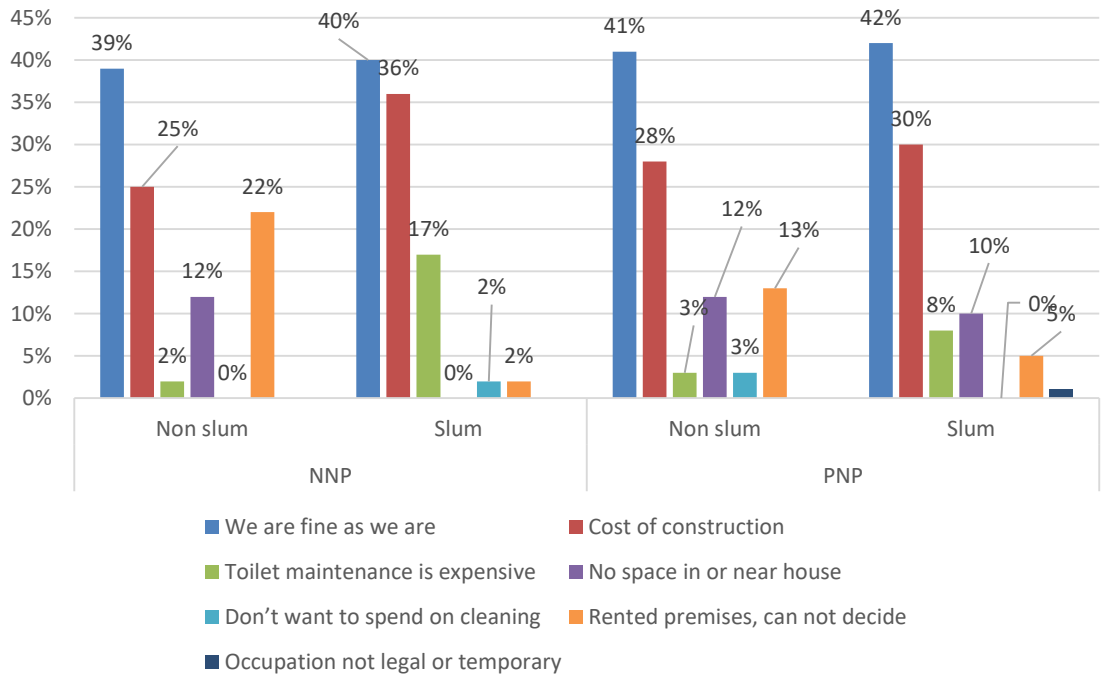
> *Most of the houses in Jothipuram have toilets because there is no space for people to defecate in the open as a result of the rapid construction that is taking place in the locality.With shrinking space people have been compelled to either construct individual toilets or use common toilet facilities available in the locality* - Pit Ring Manufacturers, Jothipuram, PNP.

### 4.2.2 Community Toilets and Public Toilets (CT/PTs)

While overall utilisation levels of CTPT is low at 7 per cent (n=44) in PNP and 9 per cent (n=37) of the households in NNP, differences between slums and non-slum areas are important. In PNP, while only 3 per cent of the non-slum households reported using CTPTs, the same statistic was 24 per cent for the slum sample. Similarly, only 6 per cent of the non-slum households in NNP reported using a CTPT but amongst the slum population, utilisation levels were at 18 per cent.

Among the main reasons cited for not having an individual toilet is the 'lack of perceived need/comfort with the current arrangement' reported by about 40 per cent of households across both slums and non-slums in PNP and NNP (Figure 4.2). This is followed by the high cost of construction, which acts as barrier and makes them choose either community toilets or open defecation.Community perspectives on factors enabling the people to use public toilets shows that where the people are living in congested areas in the absence of space, people considered public toilets as most useful for men and women. Many acknowledged that absence of public toilet would have caused health and environmental issues for adults and children due to mosquitoes and flies. In TPs, since the public space for open defecation is shrinking and with restrictions from railway authority increasing recently, number of women depending on the public toilets has increased.

**Figure 4.2:** Reasons for not having individual household toilet in Town Panchayats




*Source*: TNUSSP Baseline Studies, 2016

Despite the growing demand, the quality of community toilet maintenance in TPs leaves a lot to be desired. Common complaint is that insufficient number of toilets to serve the user population leads to long queues in the morning. This is exacerbated in TPs with those who have individual toilets also preferring to use community toilets. Among the main problems reported in using community toilets, were long waiting hours, lack of availability of water and lack of cleanliness.

> *Community toilets are extremely crowded during the mornings and most of the containment structures are overflowing with faeces and black water which has to be then diverted to the nearby drainages. With shrinking spaces for open defecation due to a rapid increase in the number of houses in the locality, a toilet in each household will be a reality soon enough* – Pit ring manufacturers, Jothipuram, PNP.

Discussions were held with the managers and users of two community toilets in PNP and one in NNP. Users are not charged any fee as the Panchayat runs the toilets and makes payment to the cleaner. With all three toilet facilities reporting irregularity of the part-time sweeper, it is not surprising that lack of cleanliness, bad odour, and excreta in the toilet pans have been cited as a major problem. Cleanliness in the women's sections appears to be a problem in particular.

> *In Coimbatore, people from most of the households with individual toilets too preferred to use the public toilets mainly to reduce expenses towards emptying septic tanks and water usage*– Community members Vivekanda Nagar and Om Sakti Nagar, Coimbatore.

**Figure 4.3**: Community toilets in Town Panchayats

*Source*: TNUSSP Baseline Studies, 2016

Across all the locations, community groups expressed strong displeasure with the current management and need for improvement in management of community toilets, their infrastructure, cleanliness and maintenance. For one, there is no designated person to maintain the toilet due to lack of manpower and toilets are cleaned mostly once in a day by the sanitation workers. Children stated that the doors are broken, there are no buckets, and water taps are damaged. In the absence of water taps inside the toilets, users need to carry water for cleaning. None of the toilets have exclusive seat for aged people or children. However, community groups report approaching town panchayats and ward councillors only when the sanitation workers failed to address the water clogging and blockage in septic tank. Not surprisingly, user experiences of community toilets are not highly rated.

**Table 4.5**: Summary of community perception of community toilets in TPs

| Location/Slum | Quality of toilet | Current Management | Aspiration regarding management | Bathing/ Washing Facility | Current Role of PRI members |
|---|---|---|---|---|---|
| Anna Nagar | Poor | Town Panchayat | Community led management team | Do not exist, but require | Less role |
| Vivekananda Nagar | | | | | |
| Chengamanaickannur | | | | | |
| Om Shakthi Nagar | | | | | |

*Source:* TNUSSP Baseline Studies, 2016

Neither is the community toilets cleaned by the managers regularly nor do users clean up properly after use by pouring adequate water. Men, women and youth agreed that the community users do not play any role in keeping the toilet clean and do not want to take any responsibility in future as well. However, users believed that formation of community committees would improve the condition of toilets (Table 4.5).

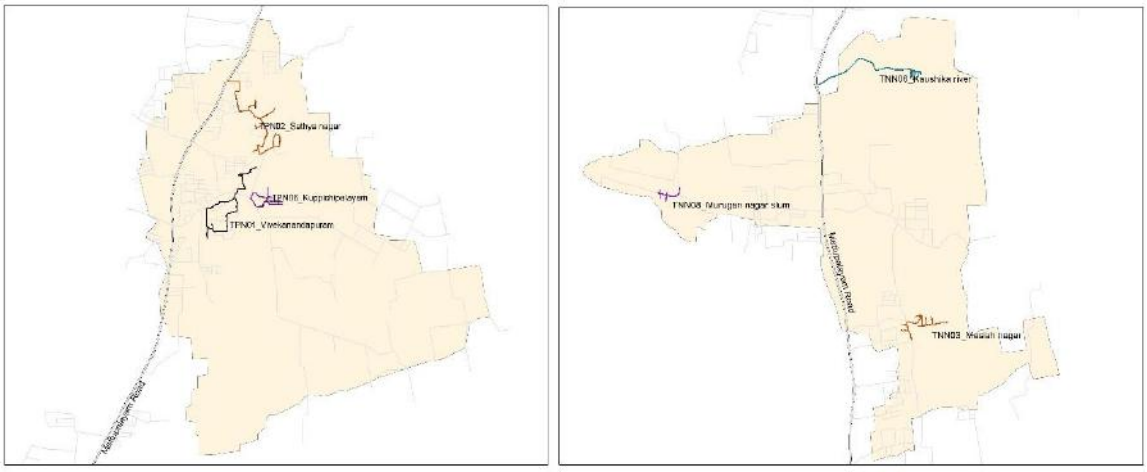
Since there is no underground network in both the TPs, the toilets are connected to on-site systems which have outlets that discharge wastewater into open/surface drains.

> *Women's toilets are choked with used cloth, rags, bottles, etc., especially inside the toilet pan, which makes it impossible to clean it. Furthermore, since there is no separate room for storing the cleaning items at the facility, they are stored at the Panchayat office and the cleaner has to bring the materials from there on a daily basis- Shakti Nagar, PNP*.

### 4.2.3 Open Defecation

A third of the slum households in NNP and 16 per cent of the slum households in PNP report open defecation. In PNP, a total of 26 households reported that all or some of their members engage in open defecation. Of these 26, 16 households (62 per cent) indicated that they have access to some form of toilet (individual/shared/community/public) but some or all of their members still choose to engage in open defecation. On the other hand, only 5 (16 per cent) out of the 33 NNP households engaging in open defecation said that they do so despite the availability of a toilet.

**Figure 4.4**: Map of Transects in Periyanaiken-palayam and Narasimhanaiken-palayam which have open defecation sites




*Source*: TNUSSP Baseline Studies, 2016

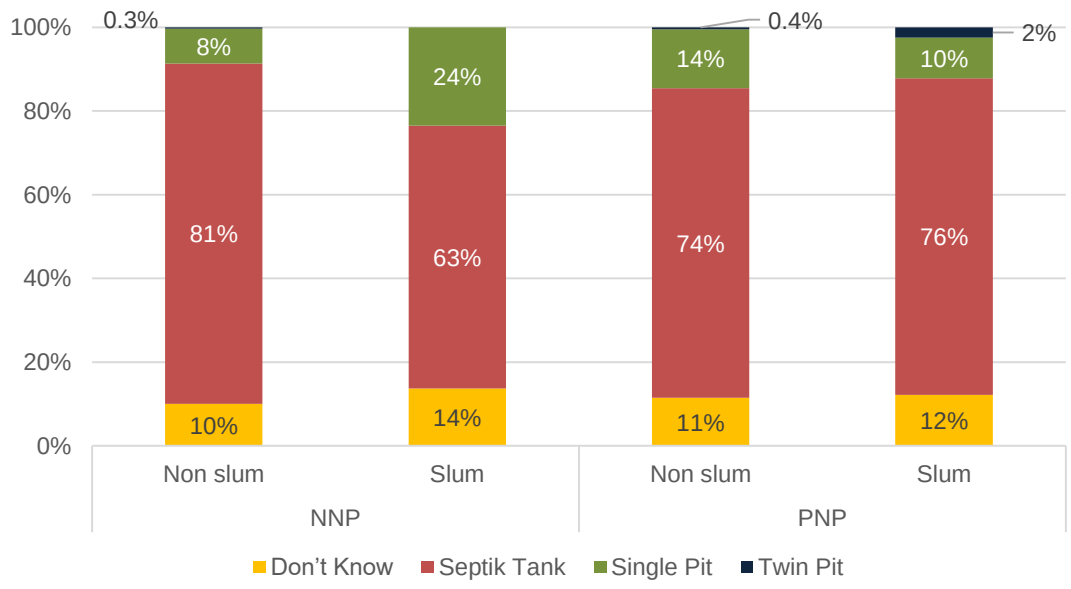
Three most common reasons for continued open defecation is community/public toilets get dirty and smelly, toilets are not always free, and that children cannot use toilets so they have to defecate in the open. Thus, as in Tiruchirappalli, it a combination of habit (especially for children) along with limited access to community toilet and poor quality of community toilets that is enabling the persistence of open

defecation. Six slum transects—two each in slum transects and one each in non-slum transects of PNP and NNP have designated open defecation sites (Figure 4.4).

## 4.3 Containment

There is no underground network in the two TPs of PNP and NNP. Nevertheless, barring 13 households which did not know what their toilets are connected to, the remaining households all reported that their toilets are connected to on-site systems which include single pits, twin pits and septic tanks. Of the 461 non-slum households and 82 slum households in PNP, more than three fourths report having a septic tank and about 14 per cent to 10 per cent have single pits respectively (Figure 4.5). A similar pattern is observed in 289 non-slum and 51 slum households in NNP. 82 per cent of the non-slum households have septic tanks and 8 per cent report having single pits. However, in slum households of NNP, 63 per cent have septic tanks, 24 per cent report having single pits. One household in NNP and four households in PNP have twin pits. In NNP, 38 per cent of the non-slum and 33 per cent of slum households share their septic tanks. In PNP, 47 per cent of the non-slum and 39 per cent of the slum households report sharing their septic tanks. In both NNP and PNP, typically septic tanks are shared with one to four households.

**Figure 4.5:** Type of onsite systems in Town panchayats




*Source*: TNUSSP Baseline Studies, 2016

**Box 4.1: Technical Study of Sanitation Services in Town Panchayats**

Pits are typically constructed by lower income households with area constraints. Average volume of the pit is about 3.37 M3 with no history of de-sludging pits at all.All pits were unlined at the bottom and had perforation on the side walls. Average volume of septic tanks were 16.4 M3, with 20 per cent of the tanks in the survey de-sludged although with a desludging frequency greater than 5 years. While 24 per cent of the septic tanks were lined at the bottom, 8 per cent of the household's report that their septic tanks were built as per CPHEEO standards. In terms of outlet —21 per cent of septic tanks had an outlet provided; 3 households were connected to storm water drains and 3 households had a soak pit arrangement.

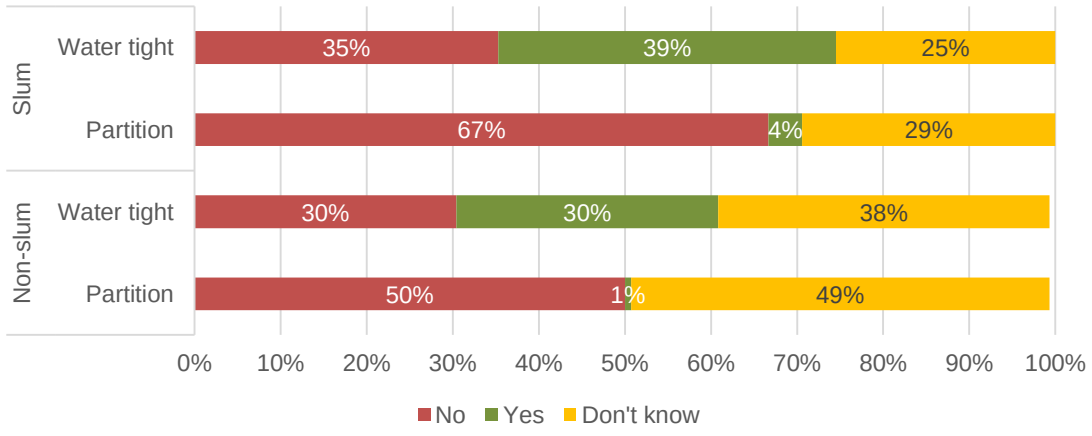
Typically, in NNP and PNP, most desludging calls happened during September, October and November, with operators even denying services to old sludge which is typically hard. Operators also report using kerosene/phenol to prevent smell, although use of safety gears was not reported. During all observations operators had to break open the access point using a crowbar, which took about 60 per cent of the total time of 45 minutes needed for de-sludging.

Desludging vehicles are custom built at garages in Chennai or Coimbatore, built for capacity ranging from 4,500–6,000 litres. Hose pipes were made of PVC with couplers used to join pipes to extent up to 200 feet. In spite of having a mandate to discharge in STP at Coimbatore, operators do not travel due to traffic congestion and distance.

Source: Tamil Nadu State Baseline Study: Technical Assessment of Sanitation Chain, TNUSSP, 2017

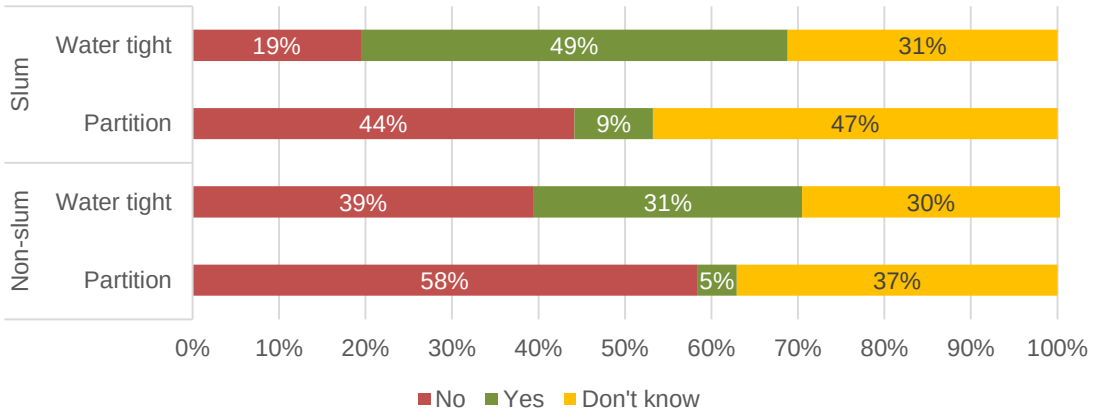
As per the WHO standards, it is necessary for a septic tank to be watertight and it should ideally have at the least one partition wall so as to meet the two chamber criteria. Majority of the slum households in PNP (49 per cent) and NNP (39 per cent) reported water tight septic tanks and in non-slum households, a third of households reported the same (Figure 4.6 and 4.7). In terms of having a partition in septic tanks, just four per cent to nine per cent of the households reported the same in all types except non slums households in NNP, where it was just one per cent.

**Figure 4.6:** Characteristics of Septic Tanks in NNP % of households




*Source*: TNUSSP Baseline Studies, 2016

**Figure 4.7:** Characteristics of Septic Tanks in PNP % of households

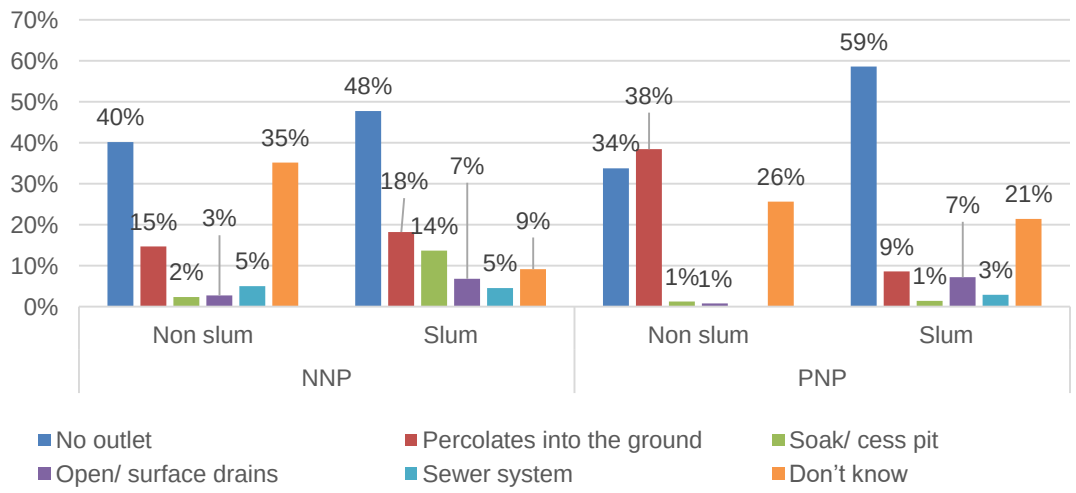



*Source*: TNUSSP Baseline Studies, 2016

When the WHO criterion is employed, only 8 non-slum and 6 slum households in PNP, and 2 slum households in NNP actually have septic tanks and the remaining households in PNP and NNP are variations of pits.

*'Most of the earthen tiles houses (poor households) use pits while the RCC houses have Basalt septic tanks. The primary reason for this difference is the price point of the containment structure. The pits are largely constructed under the government subsidy whereas the septic tanks tend to be self-funded'* - Mason, PNP

**Figure 4.8:** Disposal of Wastewater from Septic tanks and Soak pits in Town Panchayats (% of housheolds)




*Source*: TNUSSP Baseline Studies, 2016

'*Water sources such as open wells and bore wells in the locality cannot be utilised because they have been contaminated by seepage from the septic tanks, discharge of effluents from foundries, and open drainage systems'* - Bottled water manufacturer located in Veerapandi in PNP.

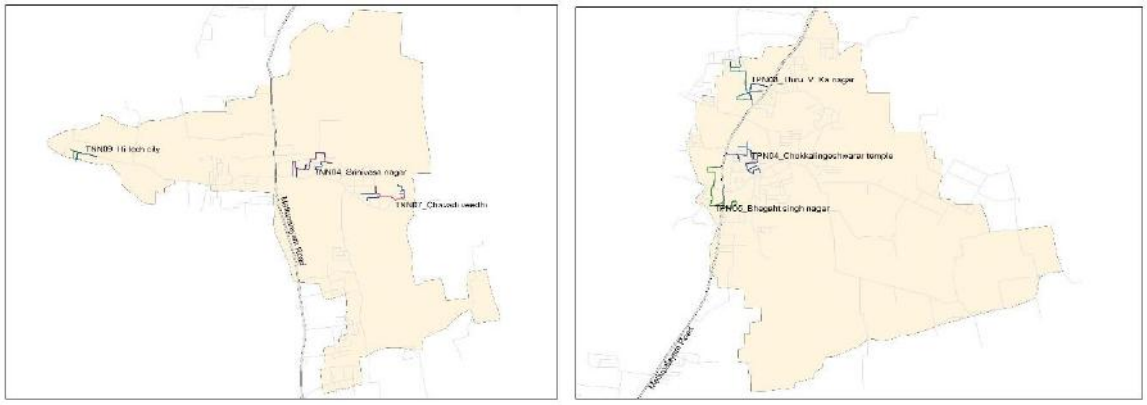
Households with on-site systems that are not twin pits[6] were also asked where the wastewater from their on-site systems goes to. In slum areas of PNP, 59 per cent of households do not have outlets while one-fifth said they are not aware of the mechanisms (Figure 4.8). In non-slum areas, 34 per cent of the households either do not have an outlet for their OS systems and 38 per cent allow for percolation into the ground. In NNP, 40 per cent to 48 per cent of the household's on-site systems do not have an outlet and around 15 per cent to 18 per cent of the households shared that the wastewater from their on-site systems percolates into the ground. About 7 per cent of the slum households report connnecting on-site systems to open drains or surface drains (Figure 4.9 and 4.10).

**Figure 4.9**: Containment structures in Town Panchayats

*Source*: TNUSSP Baseline Studies, 2016

[6]This includes households that said that their on-site systems are single pits or septic tanks and also those households which do not know what type of OS system they have

**Figure 4.10**: Map of Transects in Town Panchayats where waste water from households drains into open drains




*Source*: TNUSSP Baseline Studies, 2016

However, interactions with different stakeholders present a different picture with regard to the disposal of wastewater. Mason and plumbers from Om Shakthi Nagar in NNP indicate majority of households in their locality have their toilets connected with pits which have outlets that discharge directly into open surfaces or drains. Most commonly constructed containment structures in the TP as per builders are 'basalt septic tanks', 'brick septic tanks', and 'pit-ring models'. Basalt septic tanks are in fact variations of pit systems because the base of the structure allows for wastewater to percolate. Since more than half of the households in both TPs have pits, the proportion of on-site systems where the wastewater percolates into the ground is likely to be higher.

*Basalt structures take a very long time to fill up and I am yet to come across any such structure from which black water had to be removed. This is primarily because the black-water percolates from all sides in these kinds of structures* – Builder PNP.

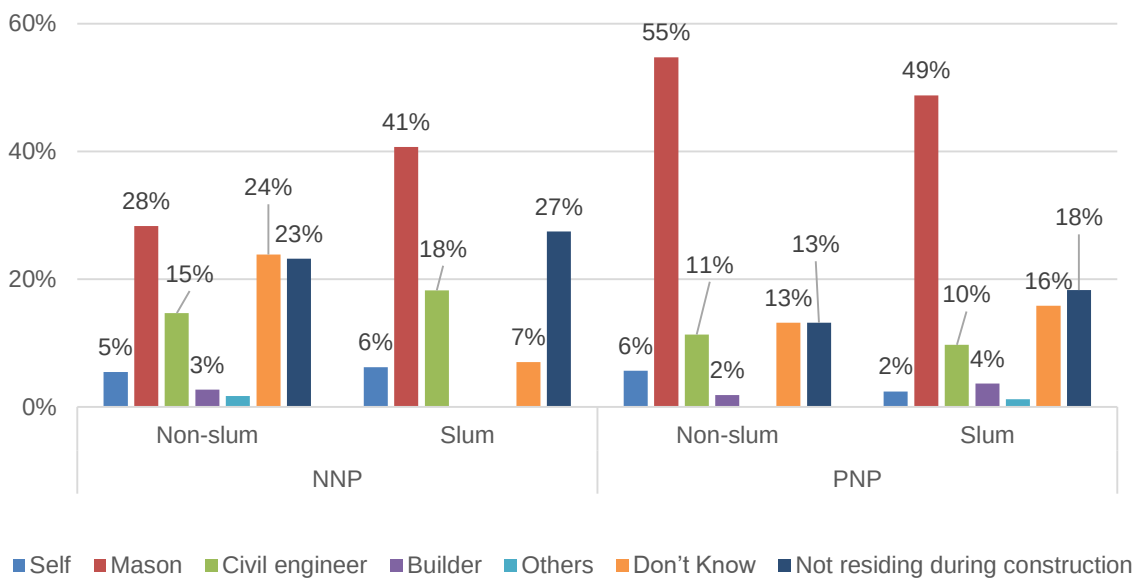
While households might not be able to distinguish between septic tanks and pits, it is important that those involved in construction be able to distinguish between the two. Both builders in TPs encourage households to construct 'basalt septic tanks' for the reason that these structures do not require wastewater to be pumped out which saves the households from incurring expenses on cleaning the system. This corroborates with survey results which indicate that majority of the households in PNP and NNP which report having a septic tank are actually pits since they are not watertight.

*Pits should be avoided at all costs because they have a short life span and have to be replaced often. Also, pit rings are not of good quality because the manufacturers use poor quality materials to make them. Further, as there is very little scope for percolation, the black water has to be pumped out frequently which means maintenance costs are quite high. However, households continue to opt for these structures because their construction cost is lowest amongst all the different types of containment structures. Furthermore, ready-made pit rings of different sizes are easily available in the market and they can be bought and fit at the location within a day or two*– Mason, NNP.

Across the two town panchayats, widespread involvement of masons is seen in slum and non-slum areas. In PNP, 55 per cent of the non-slum and 49 per cent of slum households reported that Masons

designed their on-site systems (Figure 4.11). In NNP, 41 per cent of the slum households said that Masons are responsible for designing their on-site systems. About 50 per cent of the non-slum households in NNP were unable to provide information regarding the same either because they did not know or they were not residing on the premises at the time of construction. Nevertheless, of the remaining 50 per cent of the households, half reported that the masons designed their on-site systems. Engineers designed the on-site systems in a sixth of the non-slum households in NNP and in a tenth of the households in PNP. Similarly, out of the respondents who knew about the stakeholder responsible for constructing their OS systems, a clear majority indicated that Masons are responsible for constructing their systems.

**Figure 4.11:** Design of onsite systems in Town Panchayats




*Source*: TNUSSP Baseline Studies, 2016

While it was not possible to interview any Engineers in the two TPs, discussions with builders and masons provided extensive understanding of the construction practices being followed.

Builders were against the use of pit structures due to their short life span. 'Pit structures are made up of cement and sand, and low cost iron wires are used to hold the cement and sand together. In order to make profit, the manufacturers of pit-ring structures use less cement and more sand which shortens the life of the structure. Moreover, the pit-rings stay immersed in black water as soon as the structure is filled since percolation only takes place from the bottom. This causes the rings to erode and lose their strength quickly.'

'*Brick containment structures are the best because they prevent the percolation of wastewater into the ground which in turn can contaminate the groundwater. However, since they are also very expensive to construct, it is best if all households get 'stone type' containment structures which has a long life, low construction cost, and no maintenance cost*' – Mason, NNP.

Both builders reported not following any specifications or standards while constructing on-site systems. The brick septic tanks are built with thick walls so that they are able to maintain form in loose soil whereas 'basalt septic tanks' are preferably built in, in soil which is tight enough to protect the walls made of basalt stones. 'Health conscious, upper-middle class people prefer brick type on-site system to stop percolation of black water into nearby bore-wells. Inside of the brick septic tanks are plastered with cement to prevent the percolation of wastewater'.

'We use Ordinary Portland Cement (OPC) and not the Portland Pozzolana Cement (PPC) as the former sets faster. OPC cement reportedly takes many more hours to set which increases the possibility of damage as a result of people walking over it. Our pits will last 3–4 years. Further, pits are easier to clean than septic tanks because pits have a hole on the top with an easily removable shutter which is sufficient to suck out all the waste whereas septic tanks have concrete top covers replacing which is substantially more difficult'-NNP pit ring manufacturers.

'Most households prefer septic tanks made of basalt since they have a low construction cost as well as low maintenance costs. However, those who have limited space and want to reduce the construction cost even further, prefer pit-ring type of septic tanks. Very few households that have large houses and enough space, to go for brick septic tanks' - PNP pit ring manufactures.

## 4.4 Collection, Conveyance, and Disposal

Majority of the households reported that their on-site system is located in and around their house buildings—in front, behind, or on the side of their houses (Table 4.6). However, in both the TPs, 18 per cent to 22 per cent of the non-slum households reported that the on-site system is below the pan. In slum household, this proportion was higher with 37 per cent of the NNP households and 27 per cent of PNP households reporting the same. Hence, accessing the OS system in these households could potentially be quite difficult.

**Table 4.6**: Accessibility of Onsite systems in Town Panchayats (percentage of households)

| | NNP | | PNP | |
|---|---|---|---|---|
| | **Non-Slum (n=456)** | **Slum (n=77)** | **Non-Slum (n=286)** | **Slum (n=51)** |
| **Location of onsite systems** | | | | |
| In front of the building | 18 | 24 | 22 | 13 |
| Behind the building | 12 | 10 | 18 | 17 |
| On one side of the building | 38 | 25 | 36 | 35 |
| Along the road | | | 1 | 1 |
| Below the pan or platform (below the building) | 22 | 37 | 18 | 27 |
| Others | 1 | | | 1 |
| Don't Know | 7 | 4 | 6 | 5 |

| **Table 4.6**: Accessibility of Onsite systems in Town Panchayats (percentage of households) | | | | |
|---|---|---|---|---|
| | **NNP** | | **PNP** | |
| | **Non-Slum (n=456)** | **Slum (n=77)** | **Non-Slum (n=286)** | **Slum (n=51)** |
| **Distance from the nearest access road to OS systems** | | | | |
| Less than 5 feet | 6 | 31 | 6 | 12 |
| 5 – 10 feet | 64 | 51 | 63 | 57 |
| Greater than 10 feet | 29 | 18 | 31 | 19 |
| **Is there an opening on top of the OS system?** | | | | |
| Yes | 50 | 49 | 52 | 53 |
| *Source*: TNUSSP Baseline Studies, 2016 | | | | |

Road access to the on-site systems for de-sludging truck in the two TPs does not emerge as a major problem with a majority of the households reporting that the access road are 5 feet wide or more. However, the situation appears to be a little different in non-slum and slum areas. In PNP, while only 6 per cent of the non-slum households indicated that the access road is less than 5 feet, 12 per cent of slum households said that their access roads are less than 5 feet wide. The difference is even larger in NNP; while 6 per cent of non-slum households have access road less than 5 feet wide, the same holds true for 31 per cent of the slum households.

In PNP and NNP, just half of the slum and non-slum households reporting having opening on their on-site systems. Therefore, in the two TPs, the location of the on-site systems, particularly in slum areas and their structure contribute to making the process of de-sludging through trucks more complicated and difficult.

The proportion of households that reported having their on-site systems cleaned is extremely low, particularly in NNP. In PNP, 18 per cent of slum and 26 per cent of non-slum households report getting their on-site systems cleaned since they started living in their current residence. In NNP, only 7 per cent of the non-slum households and 12 per cent of the slum households had had their on-site systems cleaned since they started residing in the current premises.

However, broadly speaking, 12 per cent of the slum households in both PNP and NNP reported having had their cleaning done in the past one to five years. Similarly, 6 per cent of the non-slum households reported having had their cleaning done one to five years. Main reasons for cleaning included smell/overflow from the onsite systems; slum households in NNP and 19 per cent in PNP had their onsite system cleaned in the past backflow into the toilet and when it was felt that cleaning was long overdue.

**Figure 4.12:** Desludging truck in Town Panchayat


*Source*: TNUSSP Baseline Studies, 2016

Private de-sludging service providers are commonly utilised service providers in both the TPs to empty on-site systems across both slum and non-slum settlements. Although use of vacuum trucks is the most common method, it is important to note that manual entry was also required in half or more of the households across locations (Table 4.7).

**Table 4.7**: Methods used for cleaning on-site systems in Town Panchayats

| | NNP | | PNP | |
|---|---|---|---|---|
| | **Non-Slum (n=21)** | **Slum (n=6)** | **Non-Slum (n=117)** | **Slum (n=14)** |
| Manually, carted and emptied nearby | | 17% | 1% | |
| Removed by suction truck with manual entry into OS system | 57% | 50% | 43% | 50% |
| Removed by suction truck without any manual entry into OS system | 43% | 33% | 52% | 29% |
| Don't Know | | | 4% | 21% |

*Source:* TNUSSP Baseline Studies, 2016

'Vacuum trucks are used to clean OS systems. Workmen involved in the cleaning process never come in contact with matter, and are provided with shoes, separate dresses, and gloves to ensure their safety. However, the workmen find it inconvenient to wear these while working so they often go unused. Main problem faced by the cleaning team is that we have to bear with the bad odour emanating from the on-site systems' - Proprietor, Cleaning services.

*Clients usually call us when they notice overflow of black water from their septic tanks. Factors like the size of the on-site system and the consistency of the faecal sludge determine the amount of time it takes to clean an on-site system*' -De-sludging service provider, NNP

One household in PNP and one in NNP mentioned that their on-site system had last been cleaned manually. All attempts made to interview them were unsuccessful.

Households largely seem to be unaware about where the fecal sludge is disposed once it has been removed from their on-site systems. Very few respondents (nine in all) are aware of how the fecal sludge is disposed. Four respondents stated that it is put in farmer's land, four others thought it is emptied in river or stream and one thought it was burnt.

*'Sludge is transported using a 10,000 litre capacity tank fitted on the lorry. We check the truck for any leakages as it would result in the cancellation of licenses for their vehicles. Two commonly used sites for dropping faecal sludge are—Ukkadam pumping station run by Coimbatore City Corporation where we have to pay an annual fee of INR 10,000, and agricultural fields on the request of farmers. We have not faced any problems in disposing at either of these two locations and ensure there is a disposal site available before cleaning any on-site system. However, in some places where the agricultural land is very near residential areas, the farmers have had to face opposition from the residents'* - Proprietor, Cleaning services.

Farmers who use fecal sludge, use it on land where fodder is grown and receive for free at the request of de-sludging operators. No soil testing is undertaken and no treatment is done before sludge is dumped into the land.

*'Four bore wells in my land have not been able to provide sufficient water for irrigation for my entire plot, and I had heard about the benefits of using sludge from farmers with lands adjacent to me and elsewhere. So I agreed to the proposition. We only receive sludge during non-monsoon months and since other farmers also pour it directly into their fields, we also did the same. Each load of sludge comes untreated - unwanted materials like plastic bags, containers, used sanitary pads, menstrual rags, blades, etc. Other farmers use chemicals to reduce smell but we allow it to dry up and do not go near that area for a week. I have been affected by psoriasis for the past year and am undergoing treatment for the same. This I think is more an allergic reaction and has nothing to do with the use of faecal sludge on his land'* – Farmer.

**Table 4.8**: Water quality results from various sources based on certain transect characteristics in Town Panchayats

| | **Ground water** | **HH Water** | **OD** | **Total** |
|---|---|---|---|---|
| Sample | | | | |
| **N** | **6** | **26** | **22** | **54** |
| OSS with visual exfiltration: high G/water area | 1 | 9 | 7 | 17 |
| OSS with visual exfiltration: Low G/water area | 2 | 5 | 5 | 12 |
| OSS without visual exfiltration: high G/water | 2 | 6 | 3 | 11 |
| OSS without visual exfiltration: Low G/water area | | 3 | 3 | 6 |
| Proposed UGD-High G/water area | 1 | 3 | 4 | 8 |

**Table 4.8**: Water quality results from various sources based on certain transect characteristics in Town Panchayats

| | Ground water | HH Water | OD | Total |
|---|---|---|---|---|
| Samples tested positive for F.Coli/total number of samples | | | | |
| OSS with visual exfiltration: high G/water area | 0/1 | 5/9 | 6/7 | 11/17 |
| OSS with visual exfiltration: Low G/water area | 0/2 | 0/5 | 5/5 | 5/12 |
| OSS without visual exfiltration: high G/water | 0/2 | 0/6 | 3/3 | 3/11 |
| OSS without visual exfiltration: Low G/water area | | 0/3 | 3/3 | 3/6 |
| Proposed UGD: High G/water area | 0/1 | 2/3 | 4/4 | 6/8 |
| Total | 0/6 | 7/26 | 21/22 | 28/54 |
| Samples tested positive for E.Coli/total number of samples | | | | |
| OSS with visual exfiltration: high G/water area | 0/1 | 3/9 | 6/7 | 9/17 |
| OSS with visual exfiltration: Low G/water area | 0/2 | 0/5 | 5/5 | 5/12 |
| OSS without visual exfiltration: high G/water | 0/2 | 0/6 | 3/3 | 3/11 |
| OSS without visual exfiltration: Low G/water area | | 0/3 | 3/3 | 3/6 |
| Proposed UGD: High G/water area | 0/1 | 0/3 | 4/4 | 4/8 |
| Total | 0/6 | 3/26 | 21/22 | 24/54 |

In the two TPs in Coimbatore, none of the ground water samples tested positive for E.Coli or F.Coli, while 7 of the 26 household water samples tested positive for F. Coli (Maximum FC 34 MPN/100 ml) and 3 of the 26 tested positive for E.Coli. Transects with visual exfiltration had more positive results than others. Almost all samples from open drains tested positive for E.Coli and F.Coli, three of which show high levels (900 MPN/100 ml). Maximum Nitrate levels observed in samples tested was 21 mg/L (from OD samples) as against the drinking water acceptable limit of 45 mg/L.

*Source*: TNUSSP Baseline Studies, 2016

## 4.5 Engagement with ULBs

Utilisation of municipal de-sludging services is negligible with a majority of the household's dependent on private service providers. To build the current OS system, 14 per cent of the households in PNP and three per cent to eight per cent of the households in NNP report seeking permission. In PNP, 60 per cent of non-slum households and 40 per cent of slum households, 47 per cent of the non-slum households and 35 per cent of the slum households report paying water and sanitation fee. Despite paying their fees, only 2 per cent (n=12) of the households from PNP and 3 per cent (n=10) of the households in NNP responded approaching them for any services. Reasons for approaching municipal authorities included irregular water supply, poor quality of water, discharge of sewage, blocked drains, and no or irregular garbage collection, with officials reported to respond in a timely manner and problems were resolved.

## 4.6 Hand washing and Menstrual Hygiene Management

Nearly 80 per cent of the non-slum households in NNP and PNP, report having a dedicated space for handwashing within the house and 12 per cent have provision outside the house. Of the slum households in PNP and NNP, about 45 per cent of the household's report having handwashing area inside the house, whereas among slum households, 24 per cent in PNP and 40 per cent in NNP have the space outside the house. About 2 per cent to 5 per cent of the households across settlements and TPs report problems with hand washing including lack of designated space and lack of hand washing soap.

Over 90 per cent of all household respondents report cleaning their hands before going to the toilet, before and after eating (Table 4.9). Handwashing before feeding a child ranges from 15 per cent to 28 per cent and after cleaning a child is from 9 per cent to 30 per cent. Hand washing is usually done with bar soap in a majority of the cases (80 per cent to 90 per cent), and with liquid soap or a detergent in about 15 per cent of the cases especially in non-slum areas.

**Table 4.9**: Events which triggered hand washing in the last week in Town Panchayats (percentage of households)

| | NNP | | PNP | |
|---|---|---|---|---|
| | **Non slum** | **Slum** | **Non slum** | **Slum** |
| Before preparing food | 89 | 80 | 91 | 85 |
| Before eat ing | 99 | 95 | 99 | 98 |
| After eating | 98 | 97 | 95 | 98 |
| After going to the toilet | 95 | 93 | 98 | 93 |
| Before feeding a child | 25 | 26 | 15 | 28 |
| After cleaning a child who has defecated | 21 | 22 | 9 | 30 |
| After touching animals | 19 | 36 | 21 | 19 |
| After using pesticides | 16 | 19 | 13 | 12 |

*Source*: TNUSSP Baseline Studies, 2016

In about 45 per cent to 54 per cent of the non-slum households in PNP and NNP child faeces is rinsed in the latrine, and in the remaining cases child use toilet (24 per cent to 39 per cent) or it is thrown in garbage. Few households report throwing child faeces in the bin/or cleaning it in the drain. In the slum households in NNP, the dominant practice is either make the child use the toilet (42 per cent) or throw faeces along with solid waste (25 per cent) or rinse it in the toilet (17 per cent). In PNP, slum households mainly throw it along with solid waste (36 per cent), rinse it in the drain (27 per cent) or the child uses toilet (18 per cent).

**Figure 4.13:** Handwashing areas in Community toilet and households

*Source*: TNUSSP Baseline Studies, 2016

In terms of menstrual practices, over 90 per cent of all non-slum and slum households report using sanitary napkins, except in slum areas of PNP where 83 per cent households report using sanitary napkin and the rest use cotton or cloth. Across locations two ways for disposing sanitary napkins were disposal along with solid waste (41 per cent to 66 per cent) or burning the napkins (24 per cent to 52 per cent) (Table 4.10).

**Table 4.10**: Disposal methods of sanitary napkins in Town Panchayats (Percentage of Households)

| | NNP | | PNP | |
|---|---|---|---|---|
| | **Non slum (n=85)** | **Slum (n=29)** | **Non slum (n=165)** | **Slum (n =47)** |
| Throw with rest of the solid waste | 45 | 41 | 66 | 51 |
| Separate designated place | 2 | 3 | 6 | 4 |
| Burn it | 34 | 52 | 24 | 34 |
| Bury it | 14 | 3 | 3 | 6 |
| Throw it in toilet | 5 | | 1 | 4 |

*Source*: TNUSSP Baseline Studies, 2016

Community engagement reveals that women dispose sanitary napkin in plastic bins despite provision of incinerator at community toilets. Most of the women and girls stated that they do not know how to use the incinerator and some said they are afraid to use it. Dustbins with sanitary napkins are emptied and burned behind the toilets in regular interval in places visited in PNP, while in NNP they are emptied irregularly.

## 4.7 Water Supply

Information on all sources of water used by the household were collected which revealed that in non-slum areas, piped water into the dwelling is the main water source for a majority of the households (Table 4.11). In slum households, although piped water is the main source for a large number of households - 57 per cent in NNP and 69 per cent in PNP, it is augmented by public tap water in about 30 per cent of the households.

**Table 4.11**: Main sources of drinking water for the household in Town Panchayats (percentage of reported sources)

| | NNP | | PNP | |
|---|---|---|---|---|
| | Non slum (n=311) | Slum (n=96) | Non slum (n=475) | Slum (n=134) |
| Piped water into dwelling/yard | 93 | 57 | 98 | 69 |
| Public tap water | 6 | 36 | 1 | 28 |
| Public open well | | 4 | | 1 |
| Public hand pump/tube well | | 2 | | |

*Source*: TNUSSP Baseline Studies, 2016

In about 87 per cent of the cases in NNP water is available at home, and in 8 per cent of the cases it takes about 30 minutes to fetch water. In PNP, in 96 per cent of the cases, water is available at home and in the rest of the cases, it takes about 30 minutes. Payments is made to town panchayat for water and in case of bottled water to private supplier. About half of the non-slum households report treating water before cooking and 31 per cent of the slum households in PNP and 40 per cent of the households in NNP report treating water. Non-slum households mainly boil water (70 per cent) followed by electronic treatment (17 per cent), and filter with cloth (4 per cent). Slum households also boil water (about 80 per cent) and in PNP, about 15 per cent of the households report also using electronic treatment device. Commonly faced issues with regard to water source include poor quality, erratic supply, need to supplement with alternate sources and control of water source by groups.

Water sources for washing and cattle rearing were different in two thirds of the slum households and in 53 per cent of the non-slum households in NNP and 40 per cent in PNP. The primary reason behind using a different water source is that drinking water supply is not regular. Further given drinking water is of better quality and more expensive, it cannot be used for washing and cattle rearing. Water used for washing purposes is piped water into dwelling or public tap water.

> *'Viral fever and dengue fever can be attributed to consumption of untreated water and breeding of mosquitoes in the locality due to lack of cleanliness and ignorance of the community. When the causes of these diseases are explained to them [community members], they just blame the local administration for not maintaining the environment'*– Dr from D.J. Hospital in PNP

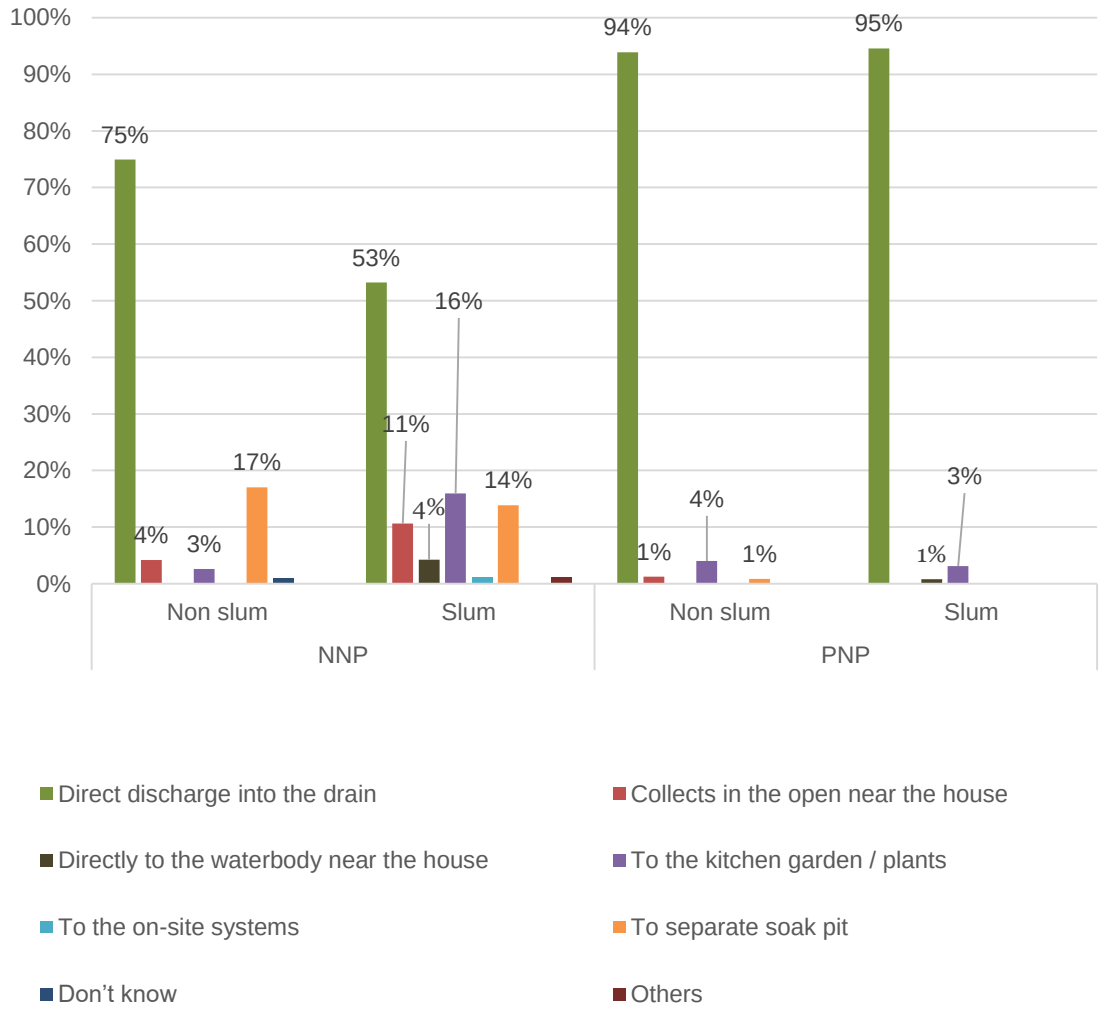
## 4.8 Solid Waste Management and Drainage

An overwhelming majority (over 95 per cent) of the slum and non-slum households across both places report door to door collection of solid waste, except in slum households in NNP where 70 per cent of the households report the same. Door to door collection is mainly done on a daily basis (in nearly 90

per cent of the cases) and in a small fraction of the cases on bi-weekly basis. In case collection is not done, garbage is reported to be dumped in community garbage bins, designated areas or vacant plots close by. In two cases in the slums of NNP, trash is reported to be thrown in water bodies close by.

As regards waste segregation, around 10 per cent of the households in NNP report segregating in both slum and non-slum areas. In PNP however, about 54 per cent of the non-slum households and 41 per cent of the slum households report segregating. Recyclable waste such as paper, metal and glass are sold to the designated waste collector (kabadiwala) or collected by the garbage collector.
Grey water from kitchen is mainly disposed-off in to the drain directly across both slums and non-slums in NNP and PNP. In the slums in NNP however, it is also used in the kitchen garden (16 per cent) or sent to a separate soak pit (14 per cent). Waste from bathrooms is also disposed-off in a similar as kitchen waste.

**Figure 4.14:** Disposal site for Kitchen waste in Town panchayats (% of households)




*Source*: TNUSSP Baseline Studies, 2016

**Figure 4.15:** Household wastewater connected to open drains in Town Panchayat

*Source*: TNUSSP Baseline Studies, 2016

## 4.9 Establishments

### 4.9.1 Profile of Establishments

A total of 25 establishments in the two TPs in Coimbatore (CBE) were covered, ten from NNP (six non slums and 4 slums) and 15 (12 non slums and 3 slums) from PNP (Table 4.12).

**Table 4.12**: Number of Establishments visited by type in Coimbatore

| Type of Establishment | NNP | PNP |
|---|---|---|
| Factory | 2 | 1 |
| Government Office | 1 | 2 |
| Hospital | | 2 |
| Hotel | | 2 |
| Nursing home | | 1 |
| Private Office | 2 | 2 |
| Restaurant | 1 | 1 |
| Shop | 4 | 4 |
| Total | 10 | 15 |

*Source:* TNUSSP Baseline Studies, 2016

### 4.9.2 Access

A total of 23 establishments reported the presence of dedicated toilet facility on their premises. Out of the 25, two establishments in NNP reported that their employees and students defecate in the open since the establishment does not have a toilet facility. Furthermore, one establishment in PNP uses a CTPT, the reason being that the establishment does not have a toilet of its own. The main reason for not having a dedicated toilet facility in the establishment was that it is a rented premises or/and lack of space.

All offices, hospitals, nursing homes, hotels and restaurants have dedicated toilet facilities for their employees, while only 82 per cent of factories/shops reported the same. In factories/shops, the average number of employees per toilet is 12 and the average number of visitors per toilet is 502 (Table 4.13). Similarly, for hotels/restaurants, while the mean number of employees per toilet is 0.3, the average number of visitors using one toilet is approximately 82. Hence, the per toilet usage levels by employees as well as visitors is highest for factories/shops.

**Table 4.13**: Usage levels of establishment toilets

| Type of establishment | N | Percentage of establishments with dedicated toilet for employees | Average number of dedicated toilets per establishment | Average number of employees per toilet | Average number of visitors per toilet |
|---|---|---|---|---|---|
| Factory/Shop | 9 | 82 | 3.4 | 12.4 | 501.5 |
| Government/Private Office | 7 | 100 | 5.6 | 2.0 | 3.4 |
| Hospital/Nursing home | 3 | 100 | 15.7 | 0.6 | 14.4 |
| Hotel/restaurant | 4 | 100 | 55.5 | 0.3 | 82.2 |

*Source:* TNUSSP Baseline Survey, 2016

### 4.9.3 Containment

Toilets in all the 23 establishments were reported as being connected to on-site systems. A total of 41 on-site systems were covered as part of these establishments. On-site systems, for the purpose of this study, refer to single pits, twin pits, and septic tanks. All the 41 on-site systems for which data collected was reported as being septic tanks. Out of these 41, only 19 (46 per cent) were reported as water-tight and only 7 were said to also have partition walls. Thus, just 7 (17 per cent) of the OS systems are septic tanks and the rest are some variations of a pit. For 50 per cent (20) of the systems, it was reported that there is no outlet for wastewater to get discharged while 20 per cent (8) reported that the wastewater percolates into the ground. Only one establishment out of the 41 reported that the wastewater drains into a soak away pit with filter media.

### 4.9.4 Collection, Conveyance, and Disposal

Around 83 per cent of the on-site systems are located in and around the building of the establishment, while in two of the 41 instances, it is located below the pan (Table 4.14). In addition, 78 per cent of the OSS are accessible by roads that are wider than 10 feet while the width of the access roads to the other systems is between 5 to 10 feet. However, only 41 per cent (n=17) of the systems are accessible by cess-pool machine hose pipe, as they have covers which can be removed. Hence, while a majority of the OS systems are easily accessible by de-sludging trucks, the entire process of emptying the systems can be quite laborious since in half of the cases the covers of the on-site systems are sealed.

| **Table 4.14**: Location of OS system (% of households) | |
|---|---|
| In front of the building | 5 |
| Behind the building | 44 |
| On the side of the building | 34 |
| Below the building | 7 |
| Other | 2.4 |
| Don't Know | 3 7 |
| *Source:* TNUSSP Baseline Studies, 2016 | |

During the survey, it was confirmed that only 18 out of the 41 on-site systems have been cleaned during the time the respondent has been working in the current premises of the establishment. Of these 18, 13 were last emptied less than a year ago while the remaining 5 were emptied in the past two to three years. The primary reason (15 cases) reported for undertaking de-sludging of these systems was that 'enough years had passed', while two respondents indicated backflow and smell/overflow as the primary reason.

Out of the 18 OS systems that were de-sludged, 13 were cleaned by a private cess-pool vehicle while the remaining 5 reported having availed services from a municipal cess-pool vehicle. Data on the methods employed by the vehicles indicates that in 10 cases manual entry into the system was required while for the remaining 7 manual entry was not required. Hence, despite the use of vacuum trucks, humans still come in contact with sludge while cleaning on-site systems. None of the respondents were aware where the sludge from the on-site systems is disposed.

## 4.10 Schools

A total of 16 schools were covered in Coimbatore, all in non-slum areas.

### 4.10.1 Access

Two schools in Coimbatore reported that their students, teachers or staff continues to defecate in the open despite toilet facilities being present on school premises. The reason for this is because the school toilets are not always working due to water shortage. In none of the schools was the use of CT/PT by students, teachers or staff reported.

On average, across the 16 schools—6 in NNP and 10 in PNP, there are an average 291 girls and 253 boys studying in the schools with average 8 males staff members and 28 female staff members (Table 4.15). The table below presents the average user burden on toilets in the schools. Average number of boys, girls and staff per toilet are higher for PNP than NNP.

| **Table 4.15**: Usage of toilets in schools- NNP and PNP | | |
|---|---|---|
| | **NNP** | **PNP** |
| Average number of common facilities for girls | 3.8 | 8.6 |
| Average number of common facilities for boys | 2 | 6 |
| Average number of common facilities for Staff only | 8 | 15 |

| **Table 4.15**: Usage of toilets in schools- NNP and PNP | | |
|---|---|---|
| | **NNP** | **PNP** |
| Mean number of girls per toilet | 28.5 | 39.1 |
| Mean number of boys per toilet | 33.5 | 56.8 |
| Mean staff members per toilet | 1.2 | 5.2 |
| *Source:* TNUSSP Baseline Studies, 2016 | | |

### 4.10.2 Containment

All the 16 OS systems for which data collected were reported as being septic tanks, although detailed data is available only for 15 on-site systems.

However, for 13 out of the 14 systems, the respondents did not know whether the system is water-tight or not. Although 14 of the 16 onsite systems report having a cover for the on-site systems, information on whether there are partition walls inside or if it is water tight is limited and hence it is not possible to accurately determine the type of on-site system present on the school premises. For seven out of the 15 systems, the respondents did not know where the wastewater from the OS system goes. Of the remaining nine, seven were said to have no outlet, while in rest of the cases, it was reported that the wastewater percolates into the ground.

### 4.10.3 Collection, Conveyance, and Disposal

Accessibility of OS systems in terms of location, width of access road and covering of on-site systems to accommodate the sludge removing equipment were analysed. Out of the 15 on-site systems, 7 are located behind the school buildings while the other 7 are located on the side. Furthermore, 10 out of the 15 systems were reported as being accessible by roads that are 5–10 feet wide while the remaining 4 have access roads wider than 10 feet. Last of all, 14 out of the 15 systems have covers which can be removed so they are accessible by the hose-pipe of cess-pool vehicle. Hence, the on-site systems in the schools of Coimbatore are quite easily accessible.

During the survey, it was confirmed that only 5 out of the 15 on-site systems have been cleaned during the time the respondent has been working in the current premises of the establishment, of which 4 were reported as having been last cleaned in the past one year. The reason for emptying these OS systems was because it was felt that enough years had passed and it was time to get it cleaned.

All five systems were cleaned by a private cess pool vehicle while the respondent of the fifth one did not know who was responsible for cleaning it. When asked about the method, respondent for only one system was able to provide an answer—removed by suction truck with manual entry into pit. None of the respondents were aware where the trucks had disposed-off the fecal sludge removed from their on-site systems.

# 5 Conclusions

# 5. Conclusions

Results from the baseline survey in both Tiruchirappalli and PNP and NNP indicate deficits across the entire sanitation chain and highlight the need to address gaps.

## 5.1. Access

Access to household toilets – individual or shared is better among non- slum households than slum households in all three locations. Those without access to household toilets have resorted to use of community toilet, which is welcome. However, lack of cleanliness, long queue during peak hours, poor repair and maintenance, lack of water are some of the key aspects which need to be addressed to improve usage of community toilets. Simultaneously, wherever feasible efforts need to be made to improve access to individual toilets using funds from the on-going SBM. Beyond access is the issue of behavior as demonstrated by members of households with toilet access resorting to open defecation to save cost and out of habit. This needs to be addressed through communication strategy which highlights the ill effects of open defecation including its impact on environment and health.

## 5.2. Containment

Although on-site sanitation system, (within that septic tank) is reported by households in Tiruchirappalli and town panchayats as their existing containment system, their construction is in variance with the CPHEEO norms. While households report to have septic tanks, when the WHO criteria of a septic tank - watertight systems with partition is applied, only a fraction of households have a proper septic tank and rest are variations of a pit. Furthermore, safe disposal of wastewater from such on-site systems is often not ensured, with very few households reporting wastewater draining into soak pits. While majority of the households have no outlet for wastewater, in few instance it is also disposed off in the open/surface drains, Viewed in conjunction with the fact that reported containment structures are not watertight systems, this indicates the possibility of water seeping into the ground which has clear implications for water quality. Water samples from all three locations point to varying degrees of contamination.

The issue of non-compliance to CPHEEO norms in construction of on-site system needs to be addressed through awareness among stakeholders. Training programmes could be designed for masons, engineers, and ULB officers to highlight the importance of compliance to norm during the construction of containment structures. Awareness campaigns for households are particularly relevant as their considerations of cost, space and lack of understanding of regular cleaning decides the type of containment structures actually built.

## 5.3. Collection, Conveyance and Disposal

As per CPHEEO norms septic tanks need to be cleaned periodically at an interval of 2–3 years. In our sample, instances of cleaning reported are higher in Tiruchirappalli as compared to PNP and NNP. However, deslugding septic tank is triggered by backflow into the toilet or foul smell, or overflow during rainy season rather than as a routine regular cleaning cycle. All three locations have mechanised desludging vehicles run by private operators, who are available on call. Access to septic is reasonable with structure being located in and around the building which allows access for hose pipes in all cases except in slums of PNP and NNP. However, the structure in many cases is completely closed which warrants breaking it open for cleaning thus increasing the hazards to the worker in the process. While

most of the cleaning is done by suction trucks in Tiruchirappalli, mechanized suction along with manual entry is required in half or more of the households in PNP and NNP. Manual entry is sometime required to engage the hose and in some cases due to the formation of hard sludge due to infrequent cleaning. Residents are either unaware of the sites of disposal of fecal sludge or report disposal in STP, while others acknowledge sludge being dumped in water bodies or farmland especially in PNP and NNP. Desludging operators also report that workers do not use personal protection gears despite availability (few instances) due to lack of good fit, and inconvenience during cleaning.

This highlights the need for building safe and accessible containment structures in line with CPHEEO norms which support regular cleaning and minimize hazards for the workers. Further, awareness among stakeholders of the importance of regular desludging needs to be built to ensure both individual protection while also making the process of desludging safe for operators. This also highlights the need for appropriate treatment structures to facilitate safe disposal and reuse of fecal sludge. Review of existing options for personal protection equipments/ gears exclusively for desludging workers needs to be undertaken to understand their issues / needs and these need to be addressed through improved design.

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