# SFD Report

# Siraha Municipality
# Nepal

## Final Report

This SFD Report - SFD level 2 - was prepared by
Environment and Public Health Organization (ENPHO)

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SFD Report Siraha Municipality, Nepal, 2023

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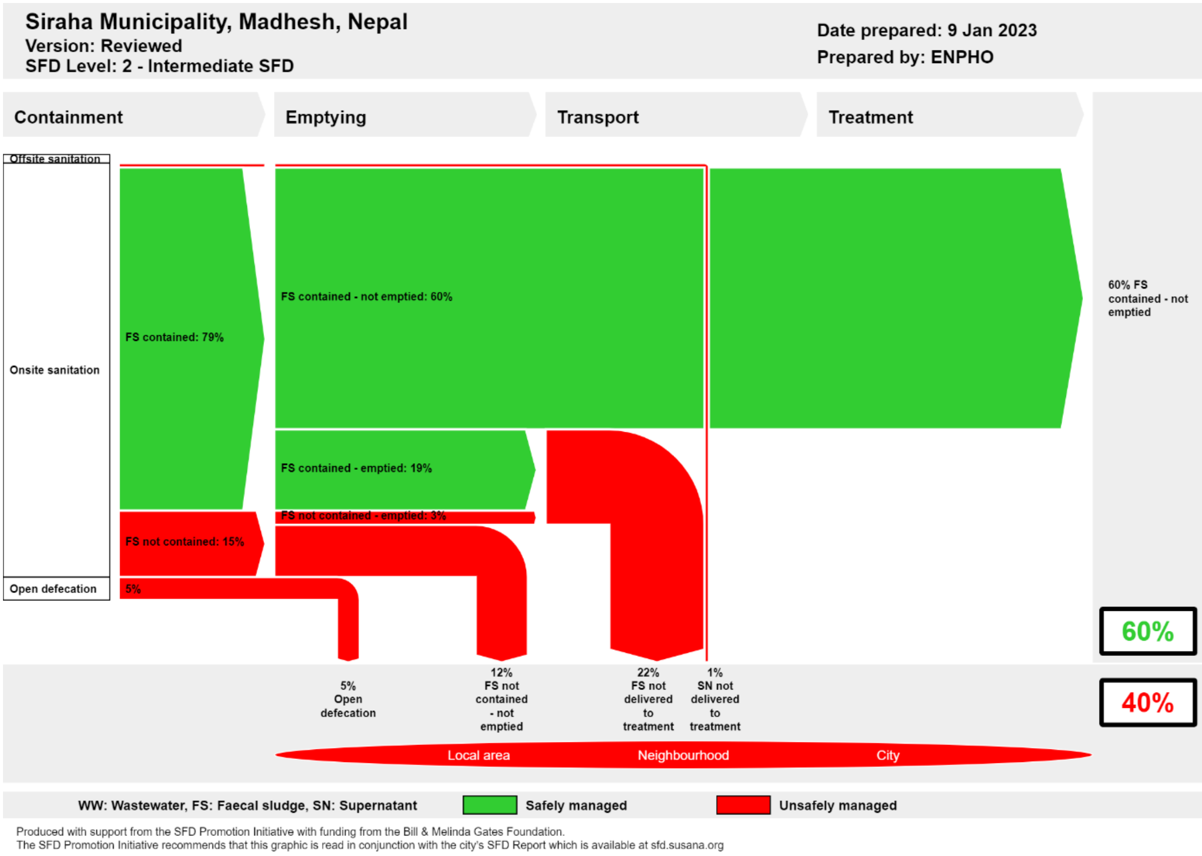
## 1. The SFD Graphic




## 2. Diagram information

**SFD Level:**

This SFD is a level 2 - Intermediate report.

**Produced by:**

Environment and Public Health Organization (ENPHO).

**Collaborating partners:**

Deutsche Welthungerhilfe e.V.

Siraha Municipality.

Municipal Association Nepal (MUAN).

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**Date of Production:** 09/01/2023

## 3. General city information

Siraha municipality is in southern terai region of Nepal. The municipality was restructured in 2016 by merging former village development committees namely Lagadigadiyani, Laxminiya, Samhaitha, lagadigoth and Hakpara in Siraha Municipality. The municipality is divided into 22 political ward boundaries.

The total population of the municipality is 96,543 as per the preliminary report of census 2021. The total population was 98,393 residing in 17,828 households as reported in the WASH profile 2019.

## 4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. The municipality was declared free of open defecation on 23rd March 2018. Despite this, the sanitation coverage in the municipality is only 95%. The families without own toilet defecate in open places or use neighbour's toilet.

All the households with access to sanitation facility rely on onsite sanitation. Fully lined tanks and lined tanks with impermeable walls and open bottom are used by population residing in 20% and 27% of households. While 52% of the population use either twin pits or single pits termed as lined pit with semi-permeable walls and open bottom. Only 26% of containments have been emptied at least once since the installation. Mechanical emptying and transportation is popular in the municipality. However, the municipality lacks treatment facility for the faecal sludge. Thus, the Faecal Sludge (FS) emptied and transported is disposed directly into farmland, riverbanks, and barren land.

The SFD graphic shows that 60% of the excreta generated are safely managed while 40% of the excreta generated are unsafely managed. The safely managed percentage of FS generated by 60% of the population is temporary until the the tanks and pits become full and FS from the containment is emptied.

The main water supply service provider in the municipality is Siraha Water Supply Project managed by Water Supply and Sanitation Division Office (WSSDO). However, the coverage is low and most of the households rely on handpumps to uplift groundwater for drinking.

## 5. Service delivery context

Access to drinking water and sanitation has been defined as fundamental rights to every citizen by the constitution of Nepal. To respect, protect and implement the rights of citizen embedded in the constitution, the Government of Nepal (GoN) has endorsed the Water Supply and Sanitation Act 2022 which has emphasized on a right to quality sanitation services and prohibited direct discharge of wastewater and sewage into water bodies or public places.

Several policies have been in places to accomplish the sanitation need of people. Particularly, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 has proved as an important strategic document for all stakeholders to develop uniform programs and implementation mechanism at all levels. It strengthens institutional set up with the formation of water and sanitation coordination committee at every tier of government to actively engage into sanitation campaign. Currently, the municipality have formed a Water, Sanitation and Hygiene (WASH) Plan with the technical support from Welthungerhilfe (WHH). The sanitation programs will be developed and implemented as per the WASH plan.

## 6. Overview of stakeholders

Based on the regulatory framework for Faecal Sludge Management (FSM), the major stakeholders for effective and sustaining service delivery as presented in Table 1.

**Table1: Overview of Stakeholders.**

| Key Stakeholders | Institutions / Organizations |
|---|---|
| Public Institutions at Federal Government | Ministry of Water Supply |
| Public Institutions at Provincial Government | Ministry of Water Supply and Energy Development |
| Public Institutions at Local Government | Siraha Municipality |
| Non-governmental Organizations | Environment and Public Health Organization (ENPHO), Sabal Nepal |
| Private Sector | Private FS Emptying and Desludging facility providers, public toilet operators. |
| Development Partners, Donors | WHH, MuAN, |

## 7. Credibility of data

The major data were collected from random household sampling. Altogether, 375 households and 54 institutions were surveyed from 22 wards of the municipality. Primary data on emptying, transportation, and current sanitation practices in the municipality are validated from Key Informant Interviews (KIIs) with private desludgers, public toilet management, sanitation and environmental section. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program.

## 8. Process of SFD development

Data on sanitation situation were collected through household and institutional survey. Enumerators from the municipality were mobilized after providing orientation on sanitation technologies, objectives of the survey and proper use of mobile application, KOBOCOLLECT for collection of data for survey. Along with this, KIIs were conducted with officers and engineer of municipality, Water Supply and Sanitation Division Office, Siraha Water Supply Project, private desludging service providers to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce the SFD graphic, initially a relationship between sanitation technology used in questionnaire survey and SFD PI methodology was made. Then, data were fed in SFD graphic generator to produce the SFD graphic.

## 8. List of data sources

The list of data sources to produce this executive summary is as follows:


- WASH Plan. (2018). Water, Sanitation and Hygiene Plan 2020-2030. Siraha Muncipality.
- Siraha Municipality. (2019). WASH Profile of Siraha Municipality. Siraha Municipality.
- ENPHO. (2022). Sanitation situation analysis of selected municipalities in Siraha and Saptari District. unpublished.
- MoFAGA. (2017). Ministry of Federal Affairs & General Administration. Retrieved from Government of Nepal, Ministry of Federal Affairs & General Administration: https://www.sthaniya.gov.np/gis/
- MoH, N. N. (2017). Nepal Demographic and Health Survey 2016. Ramshah Path, Kathmandu, Nepal: Ministry of Health.
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SFD Siraha Municipality, Nepal, 2023

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This Executive Summary and the SFD Report are available from: www.sfd.susana.org

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# Abbreviations

| | |
|---|---|
| DWSSM | Department of Water Supply and Sewerage Management |
| ENPHO | Environment and Public Health Organization |
| FS | Faecal Sludge |
| FSM | Faecal Sludge Management |
| FSTP | Faecal Sludge Treatment Plant |
| GDP | Gross Domestic Product |
| GON | Government of Nepal |
| HH | Household |
| IRF | Institutional and Regulatory Framework |
| KII | Key Informant Interview |
| KM | Kilometre |
| MICS | Multiple Indicator Survey |
| MoWS | Ministry of Water Supply |
| NGO | Non-Governmental Organization |
| NPC | National Planning Commission |
| NRS | Nepali Rupees |
| NSHMP | National Sanitation and Hygiene Master Plan (NSHMP) |
| NUWSSSP | National Urban Water Supply and Sanitation Sector Policy |
| NWSSP | National Water Supply and Sanitation Policy |
| ODF | Open Defecation Free |
| PPP | Public-Private Partnership |
| RWSSNP | Rural Water Supply and Sanitation National Policy |
| SDG | Sustainable Development Goal |
| SDP | Sector Development Plan |
| SFD | Shit Flow Diagram |
| SFD PI | Shit Flow Diagram Promotion Initiative |
| WHH | Welthungerhilfe |
| WHO | World Health Organization |
| WSP | Water Supply Providers |
| WSSDO | Water Supply and Sanitation Divisional Office |
| WSUC | Water Supply and Sanitation Users Committee |
| WW | Wastewater |
| WWH | Welthungerhilfe |
| WWTP | Wastewater Treatment Plant |

# 1 City context

Siraha municipality is in southern terai region of Nepal. The municipality was restructured in 2016 by merging former village development committees namely Lagadigadiyani, Laxminiya, Samhaitha, lagadigoth and Hakpara in Siraha Municipality. The municipality is divided into 22 political ward boundaries (Siraha Municipality, 2019). The municipality is extended to 94.20 square kilometres with 96.6% agriculture land. Figure 1 shows the ward map of Siraha municipality.

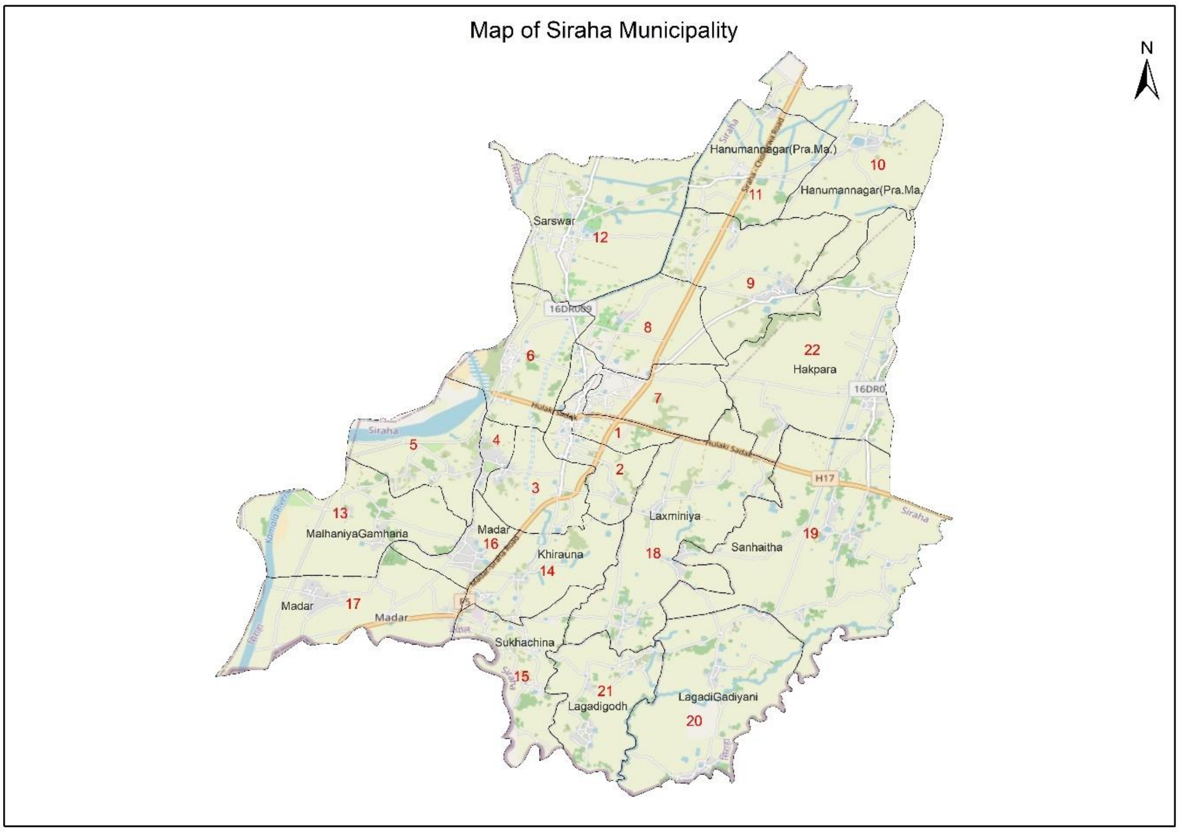


**Figure 1: Map of Siraha Municipality with ward boundaries.**

## 1.1 Population

The total population of the municipality is 96,543 as per the preliminary report of census 2021 (CBS, 2021). The total population was 98,393 residing in 17,828 households as reported in the WASH profile 2019. The total male and female populations were 49,000 and 49,383 respectively. The average family size is 5.49 (Siraha Municipality, 2019).

## 1.2 Climate

The average mean daily maximum and minimum temperatures of Siraha are 32ºC and 18ºC, respectively. It receives approximately 857 mm of rainfall annually. The precipitation is high from June to September (metoblue, n.d.). Figure 2 shows the graph on weather of Siraha.

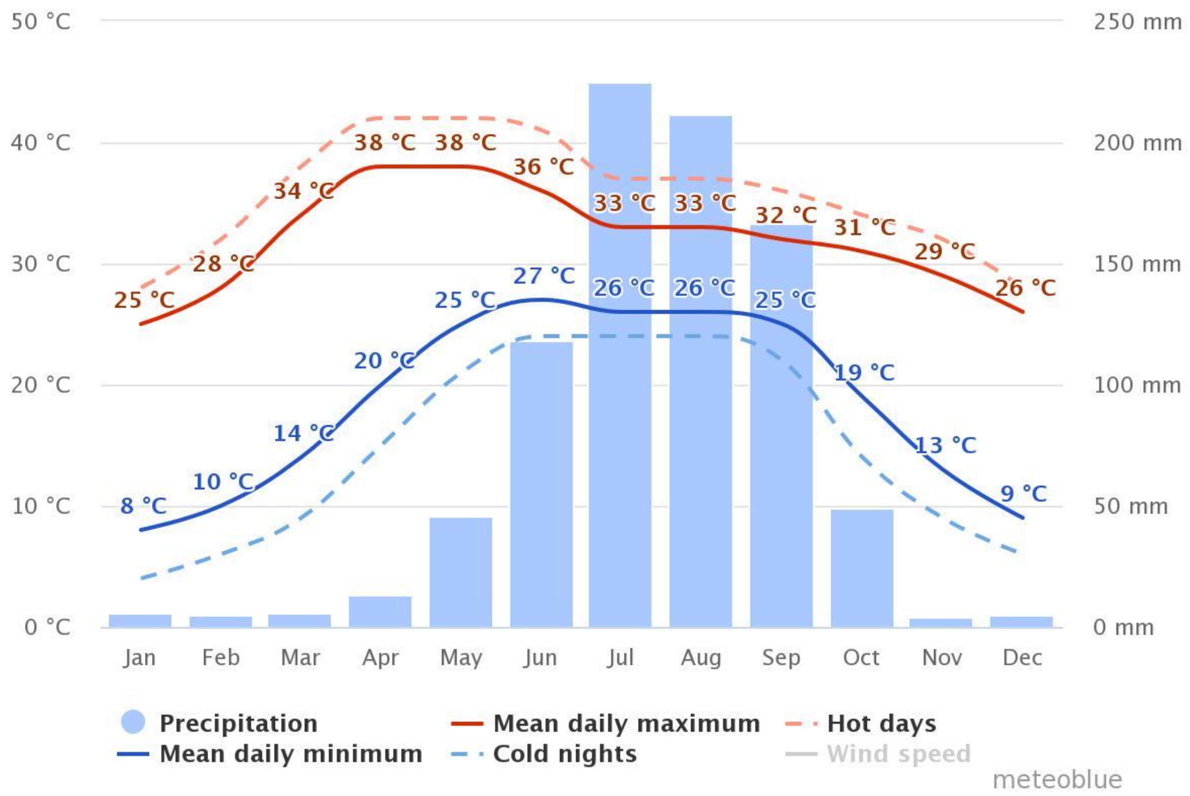


**Figure 2: Graphs on precipitation, mean daily maximum and minimum temperature of Siraha.**

## 1.3 Topography

The municipality is in the Eastern Terai Region of the country. Geographically, it lies between 25º35’18” North to 26º42’53” North, and 86º8’47” East to 86º16’17” East. The elevation of the municipality is nearly 100 m above sea level. The geological structure of the city contents alluvial sediments i.e., sand, silt and clay (Dahal, 2006). Groundwater is the source of drinking water in the Terai region. In addition, shallow groundwater aquifers are mostly used for the purpose of drinking water. The shallow groundwater originates from unconfined or semi-confined aquifers.

# 2 Service Outcomes

## 2.1 Overview

Siraha municipality was declared free of open defecation on 23rd March 2018. Yet almost 5% of households from poor and marginalized communities in the city do not have access to improved sanitation facilities, where improved sanitation is referred as sewered and non-sewered sanitation facilities with cistern flush or pour flush toilets connected to sewer or septic tanks or pits, ventilated improved pit latrines, pit latrines with cover slabs or compositing toilets.

### *2.1.1 Sanitation Systems in household buildings*

Any toilet system designed to handle or treat faeces or sewage at its source rather than transporting to another location is termed an onsite sanitation system (Augustine Chioma Affam, 2021). All the households with sanitation facilities in the municipality rely on onsite sanitation systems. The blackwater from the toilet is stored in the containment, where a well-designed septic tank is installed in only 0.3% of households. Instead, fully lined tanks and lined tanks with impermeable walls and open bottom containments are constructed by 46% of the households. Twin pits and single pits are popular in the municipality. Together, 53% of households have such types of pits installed by assembling pre-cast concrete rings one after another. Figure 3 shows the percentage of households with different types of containments.

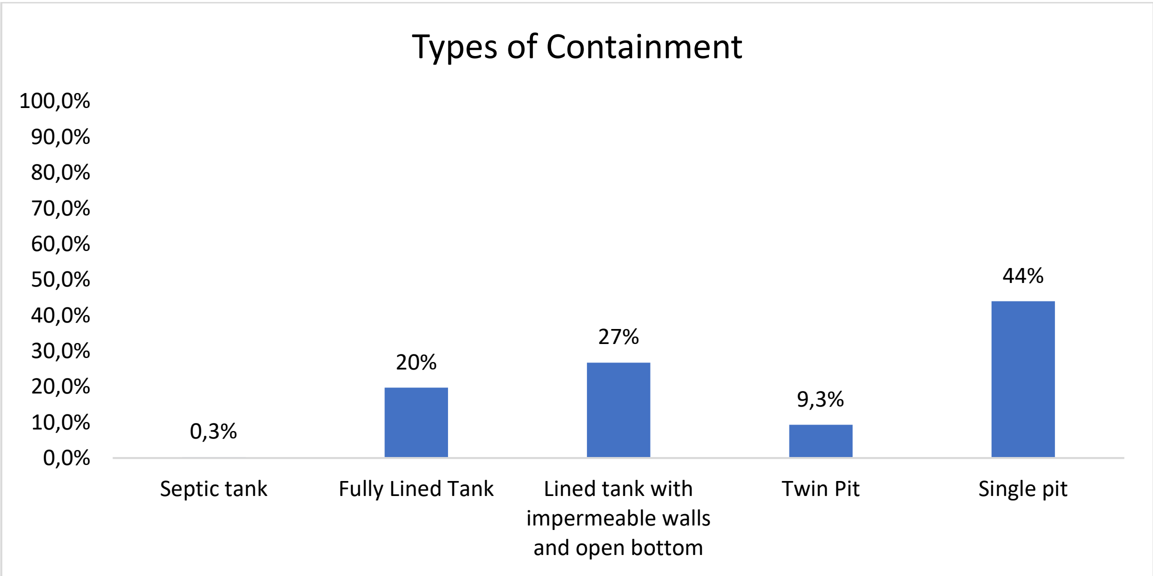


**Figure 3: Percentage of households with different types of containments in Siraha Municipality.**

Ideally twin pits are designed to safely store and treat faecal sludge on site. The facility consists of two sets of pits used alternatively to store faecal sludge dug or made from assembling pre-cast concrete rings at the minimum horizontal distance of 1.2 m. Both pits are connected from diversion box. However, most twin pits installed by the households are not as per the design. The minimum distance between two sets of pits is not maintained. Also, the connection pipes to the pits are in series. Thus, these pits function only as lined tanks with semi-permeable walls and open bottom. Figure 4 shows the design of twin pits and pits installed at household level.

**Figure 4: Inappropriate design of the twin pits.**

Moreover, 4% of households have provision of discharging effluent from containment to either soak pit, open drain, open ground/farm, or water resources. The discharge of effluent from containment to soak pit can be considered as good practice. However, there is a higher risk of polluting groundwater and surface water through discharging effluent to open drain, water resources and open ground/farm. Figure 5 shows the map locating households with different types of containments in the municipality.

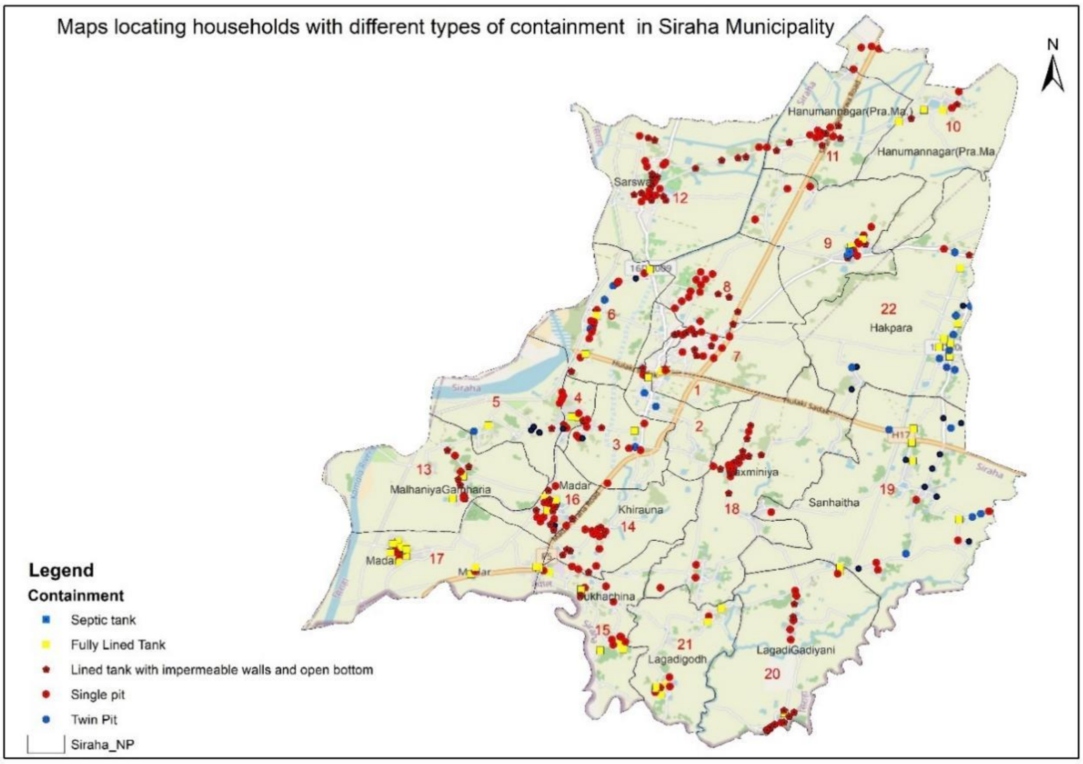


**Figure 5: Map locating households with different types of containment in Siraha Municipality.**

### 2.1.2 *Sanitation Systems in institutional buildings*

Altogether 54 buildings designed and built for the purpose of operating institutions were observed during the sanitation assessment survey in 2022. Among these, two rented buildings by a institutions do have incomplete toilet facility. Remarkably, 8% of the buildings have technically appropriate septic tanks for the storage of wastewater. Fully lined tanks are installed in 52% of the buildings. Figure 6 shows the percentage of types of containment in the institutional buildings.

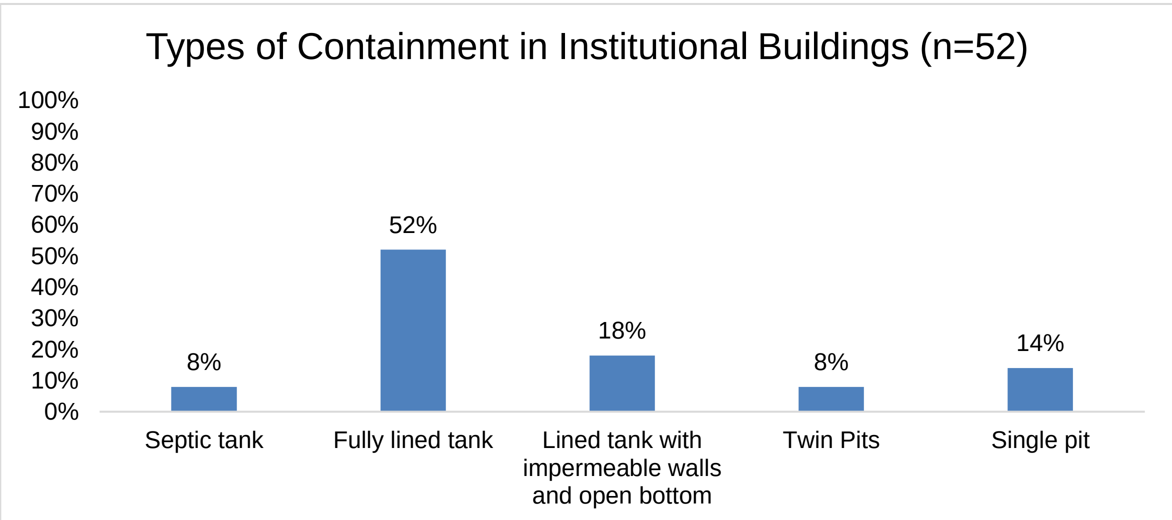


**Figure 6: Percentage of institutional buildings with different types of containments in Siraha Municipality.**

Figure 7 shows the maps locating institutional buildings with different types of containment.

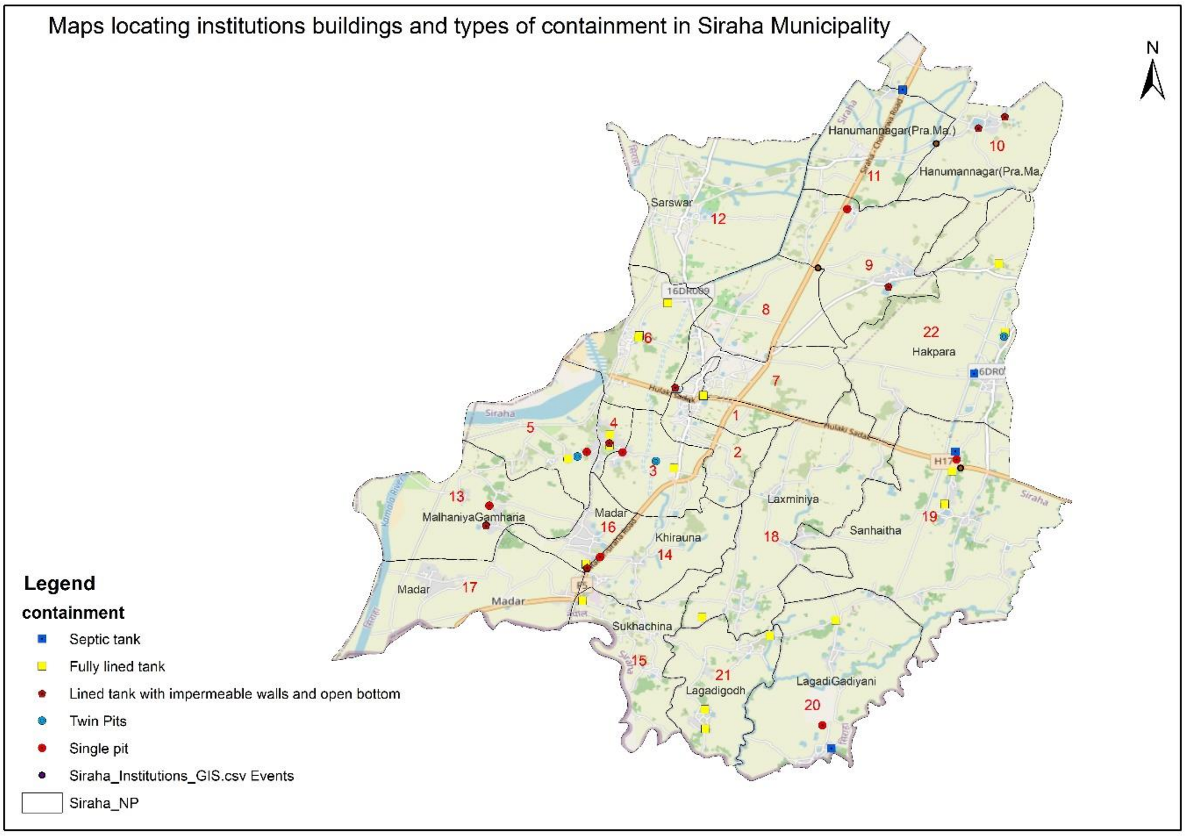


**Figure 7: Map locating institutional buildings with different types of containment in Siraha Municipality.**

### *2.1.3 Public Toilets*

The WASH Plan of Siraha Municipality reported nine public toilets in the municipality. Among these toilets only four public toilets have enough water and provision of a handwashing station. The report has emphasized that daily operation and maintenance and overall management of public toilet is a major challenge (WASH Plan, 2018). Figure 8 and Figure 9 show one of the public toilets located in the local vegetable market in the premises of a municipal building in the municipality.


**Figure 8: Public toilet located in local vegetable market in the premises of municipal building.**

**Figure 9: Overflowed urinal of the public toilet.**

### 2.1.4 *Emptying and Transportation Services of Containment*

Emptying is one of the major components of the sanitation service chain. It ensures the proper functioning of containment basically for the septic tank which functioned well until the volume of sludge is one-third of the total volume of the tank. Also, in other containments, regular emptying prevents overflow of the sludge and blockages. However, only 26% of the households have emptied their containment due to overflow of faecal sludge. While 42% of containments in institutional buildings have been emptied at least once.

Furthermore, twin pits are emptied more than other types of containment in the household buildings. Among the households with emptied containment at least once, 55%, 26% and 24% of households with twin pits, single pit and fully lined tanks, respectively have been emptied. While only 17% of the households with lined tanks with impermeable walls and open bottom have been emptied.

Emptying rate of the containment is determined by the number of users, duration of use, types, and size of the containment. 95% and 75% of the containments installed before 0 to 2 years and 3 to 5 years ago have not been emptied. During this period, 78% of the toilets were constructed among which, 64% are connected to lined tanks with impermeable walls and open bottom, twin pits, and single pits. Also, the average number of users and size of pits are 9 and 5 $m^3$, respectively. Table 1 shows the types of containment with emptying status and years of construction.

**Table 1: Descriptions on types of containment with emptying status and years of installation.**

| Types of containment | | Years of Installation | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | 3-5 | 6-10 | 11-15 | 16-20 | >20 | Grand Total |
| **Septic tank** | | **0%** | **0%** | **0%** | **0.3%** | **0%** | **0%** | **0.3%** |
| **Emptied Status** | No | 0% | 0% | 0% | 0.3% | 0% | 0% | 0% |
| | Yes | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Fully Lined Tank** | | **3.9%** | **3.4%** | **6.8%** | **3.4%** | **0.8%** | **1.4%** | **19.7%** |
| **Emptied Status** | No | 3.7% | 2.5% | 5.1% | 2.8% | 0.3% | 0.6% | 14.9% |
| | Yes | 0.3% | 0.8% | 1.7% | 0.6% | 0.6% | 0.8% | 4.8% |
| **Lined tank with impermeable walls and open bottom** | | **0.3%** | **3.9%** | **17.7%** | **3.4%** | **1.1%** | **0.3%** | **26.8%** |
| **Emptied Status** | No | 0.3% | 3.7% | 15.8% | 1.7% | 0.8% | 0% | 22.3% |
| | Yes | 0% | 0.3% | 2.0% | 1.7% | 0.3% | 0.3% | 4.5% |
| **Twin Pit** | | **0.3%** | **3.4%** | **3.1%** | **2.0%** | **0.6%** | **0.0%** | **9.3%** |
| **Emptied Status** | No | 0.3% | 1.7% | 1.7% | 0.3% | 0.3% | 0% | 4.2% |
| | Yes | 0% | 1.7% | 1.4% | 1.7% | 0.3% | 0% | 5.1% |
| **Single pit** | | **1.7%** | **8.5%** | **25.1%** | **6.2%** | **1.1%** | **1.4%** | **43.9%** |
| **Emptied Status** | No | 1.7% | 6.5% | 17.7% | 4.8% | 0.8% | 0.8% | 32.4% |
| | Yes | 0% | 2.0% | 7.3% | 1.4% | 0.3% | 0.6% | 11.5% |
| **Grand Total** | | **6%** | **19%** | **53%** | **15%** | **4%** | **3%** | **100%** |

Figure 10 shows the maps locating households with emptying status of the containment in the municipality.

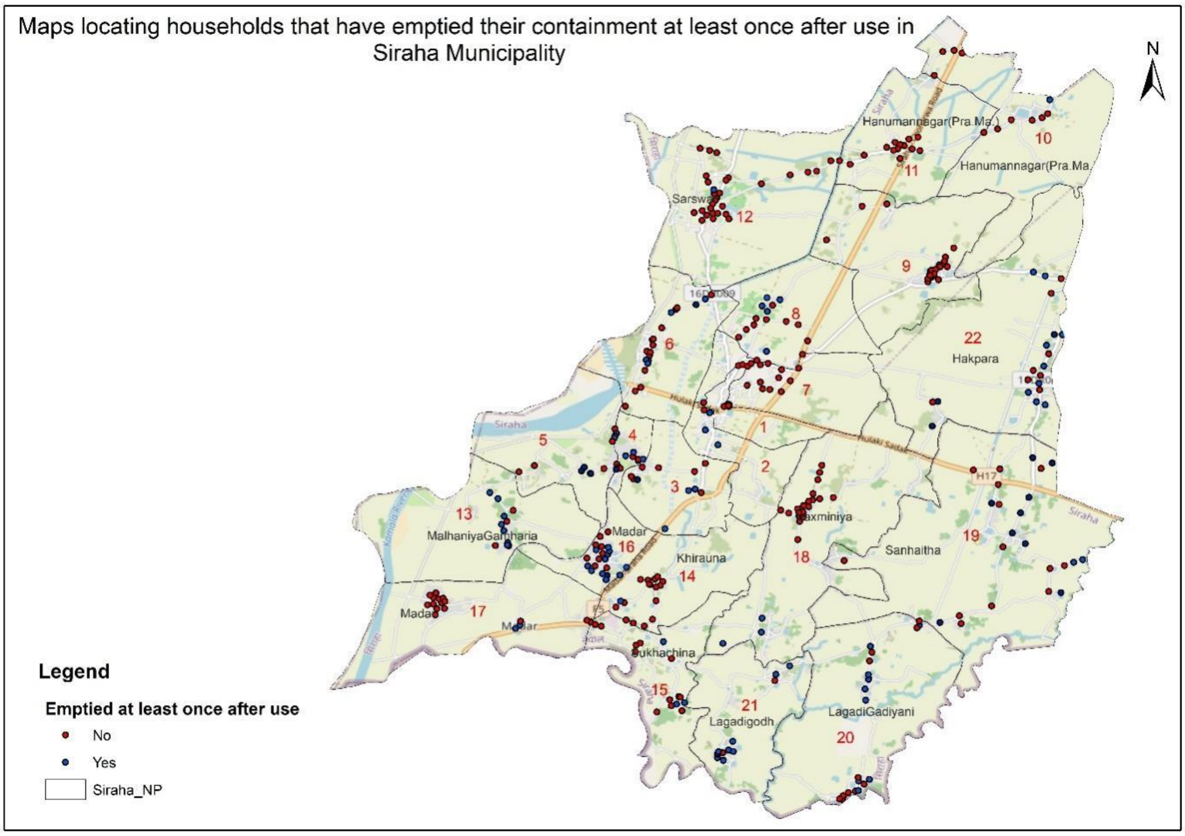


**Figure 10: Maps locating households with status of emptying their containment at least once after installation in Siraha Municipality.**

Private desludging service providers and traditional labour engaged in desludging activities are the major emptying service providers in the municipality. The two private desludging service providers have their main service area in the municipality and other desludging service provider comes from a neighbouring municipality.

*Bhogendra Sarsafai Safety Tanki* has been providing the desludging service since last year. The service is not registered in any government agencies. The service provider is equipped with a desludging vehicle with a tank capacity of 5,500 litres. It provides its service in the Siraha Municipality and occasionally in the neighbouring cities on demand. One driver and two helping staffs works in the desludging vehicle. The staff are provided with uniforms, gloves, and masks for safety during work. Similarly, *Siraha Safety Tanki Safai* has been providing the desludging service in the municipality for more than 5 years. The service provider has a 5,000-litre capacity desludging vehicle. It charges on average NPR 2,000 to 2,500 (USD 15 - 19) per trip. Whereas it charges NPR 500 (USD 4) per ring when the sludge is emptied from concrete ring containments. Generally, on average, 14 trips are made per week. Figure 11 shows the mechanical emptying of the containment.

**Figure 11: Mechanical emptying of the containment in Siraha Municipality.**

### *2.1.5 Treatment and Disposal of Faecal Sludge*

Treatment and safe disposal of faecal sludge is essential to ensure environmental protection and prevent health hazards. Neither the municipality nor the neighbouring municipalities possess a faecal sludge treatment plant. In the absence of the faecal sludge treatment plant, the community has adopted dumping faecal sludge into water bodies and open ground. Figure 12 shows the faecal sludge dumped in farmland.

**Figure 12: Faecal sludge being dumped in farmland in Siraha Municipality.**

## 2.2 SFD Selection Grid

The types of household containments in the municipality are re-categorized to match the containments defined by Shit Flow Diagram Promotive Initiative (SFD PI). Particularly, twin pits and single pits constructed by assembling pre-cast concrete rings one above another are classified as lined pits with semipermeable walls and open bottom. Upon reclassification of the containments, the types of sanitation technologies and their connections are selected in the SFD selection grid as shown in Figure 13.

| List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?) | List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | to centralised combined sewer | to centralised foul/separate sewer | to decentralised combined sewer | to decentralised foul/separate sewer | to soakpit | to open drain or storm sewer | to water body | to open ground | to 'don't know where' | no outlet or overflow |
| No onsite container. Toilet discharges directly to destination given in List B | | | | | Significant risk of GW pollution<br>Low risk of GW pollution | | | | | Not Applicable |
| Septic tank | | | | | Significant risk of GW pollution<br>Low risk of GW pollution | T1A2C6 | | | | |
| Fully lined tank (sealed) | | | | | Significant risk of GW pollution<br>Low risk of GW pollution | T1A3C6 | | T1A3C8 | | T1A3C10 |
| Lined tank with impermeable walls and open bottom | Significant risk of GW pollution<br>Low risk of GW pollution | Significant risk of GW pollution<br>Low risk of GW pollution | Significant risk of GW pollution<br>Low risk of GW pollution | Significant risk of GW pollution<br>Low risk of GW pollution | Significant risk of GW pollution<br>Low risk of GW pollution | T1A4C6 | | T1A4C8 | | T2A4C10<br>T1A4C10 |
| Lined pit with semi-permeable walls and open bottom | Not Applicable | | | | | | | | | T2A5C10<br>T1A5C10 |
| Unlined pit | | | | | | | | | | Significant risk of GW pollution<br>Low risk of GW pollution |
| Pit (all types), never emptied but abandoned when full and covered with soil | | | | | | | | | | Significant risk of GW pollution<br>Low risk of GW pollution |
| Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil | | | | | | | | | | |
| Toilet failed, damaged, collapsed or flooded | | | | | | | | | | |
| Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded | | | | | | | | | | |
| No toilet. Open defecation | Not Applicable | | | | | | | | T1B11 C7 TO C9 | Not Applicable |

**Figure 13: SFD selection grid for Siraha Municipality.**

Brief explanation of terms used to indicate the different frame selected in the SFD selection grid is explained in Table 2.

**Table 2: Explanation of terms used to indicate different frame selected in the SFD selection grid.**

| | |
|---|---|
| T1A2C6 | This is a correctly designed, properly constructed, fully functioning septic tank with an outlet connected to an open drain or storm sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, therefore all the excreta in this system is considered not contained. |
| T1A3C6 | A correctly designed, properly constructed, and well maintained fully lined tank with impermeable walls and open bottom. Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer the excreta in this system is considered not contained. |
| T1A3C8 | A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and open bottom. Since the tank is fitted with a supernatant/effluent overflow connected to open ground the excreta in this system is considered not contained. |
| T1A3C10 | A correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is not fitted with a supernatant/effluent overflow this system is considered contained. |
| T1A4C6 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to an open drain or storm sewer, the excreta in this system is considered not contained. |
| T1A4C8 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. Since the tank is fitted with a supernatant/effluent overflow connected to open ground, the excreta in this system is considered not contained. |
| T1A4C10 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur. However, since the tank is not fitted with a supernatant/effluent overflow this system is considered contained. |
| T2A4C10 | A correctly designed, properly constructed and well-maintained lined tank with sealed, impermeable walls and an open, permeable base, through which infiltration can occur - the excreta is therefore likely to be partially treated. The tank is not fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained. |
| T1A5C10 | A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow, so this system is considered contained. |
| T2A5C10 | A correctly designed, properly constructed and well-maintained pit with semi-permeable, honeycombed lined walls and an open, permeable base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow but since there is a 'significant risk' of groundwater pollution this system is considered not contained. |
| T1B11C7 to C9 | With no toilet, users defecate in water bodies, on open ground and to don't know where; consequently, the excreta is not contained. |

## 2.3 SFD Matrix

### *2.3.1 Proportion of Faecal Sludge from types of sanitation technologies*

The second step in the process of developing an SFD graphic is the calculation of the proportion of faecal sludge (FS) contained in each type of sanitation technologies. A detailed instruction on how to calculate the proportion of FS in SFD PI was followed. It stated that the default "100%" value is used where onsite containers are connected to soak pits, to water bodies or to open ground. It will model the contents as 100% faecal sludge and a proportion of this may be emptied periodically. The remaining not emptied fraction is made up of one or more of the following: faecal sludge which remains in the container, supernatant (when discharging to water bodies or to open ground), and infiltrate. Where onsite containers are connected to a sewer network or to open drains, a value of "50%" is used which means that half the contents are modelled as faecal sludge; a proportion of this may be emptied periodically.

The remaining not emptied fraction will comprise faecal sludge which remains in the container and, in the case of open-bottomed tanks, infiltrate. The other half of the contents is modelled as supernatant discharging into the sewer network or to open drains. The formula used for FS proportion calculation is shown below:

$$\frac{(\textit{Onsite container connected to soak pit, no outlet, water bodies or open ground}) * 100 + (\textit{Onsite container connected to sewer network or open drain}) * 50}{\textit{Onsite Container}}$$

The calculated FS proportion in each type of sanitation technologies are:

i. The proportion of FS in septic tanks is 50%, as all the septic tanks a connected to stormwater drain or open drain in the municipality. This implies that almost 50% of FS from such types of containment is discharged into open or stormwater in the form of supernatant.

ii. The proportion of FS in fully lined tanks is 98%, as the FS from fully lined tanks connected to open drain could not be contained.

iii. The proportion of FS from lined tanks with open bottoms and all types of pits is 99%, as the proportion of lined tanks with impermeable walls and open bottom connected to open drain is only 0.3%.

Upon calculation of proportion of FS in each type of sanitation technologies, the proportion of population using the technology selected in the SFD selection grids are fed in. Figure 14 shows the SFD matrix of the municipality.

**Siraha, Madhesh, Nepal, 23 Nov 2022. SFD Level: 2 - Intermediate SFD**
**Population: 98393**
**Proportion of tanks: septic tanks: 50%, fully lined tanks: 98%, lined, open bottom tanks: 99%**

| Containment | | | | | | |
|---|---|---|---|---|---|---|
| **System type** | Population | FS emptying | FS transport | FS treatment | SN transport | SN treatment |
| | **Pop** | **F3** | **F4** | **F5** | **S4e** | **S5e** |
| **System label and description** | Proportion of population using this type of system (p) | Proportion of this type of system from which faecal sludge is emptied | Proportion of faecal sludge emptied, which is delivered to treatment plants | Proportion of faecal sludge delivered to treatment plants, which is treated | Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants | Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated |
| **T1A2C6** Septic tank connected to open drain or storm sewer | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **T1A3C10** Fully lined tank (sealed), no outlet or overflow | 16.5 | 25.0 | 0.0 | 0.0 | | |
| **T1A3C6** Fully lined tank (sealed) connected to an open drain or storm sewer | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **T1A3C8** Fully lined tank (sealed) connected to open ground | 1.3 | 0.0 | 0.0 | 0.0 | | |
| **T1A4C10** Lined tank with impermeable walls and open bottom, no outlet or overflow | 22.7 | 14.0 | 0.0 | 0.0 | | |
| **T1A4C6** Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **T1A4C8** Lined tank with impermeable walls and open bottom, connected to open ground | 1.1 | 0.0 | 0.0 | 0.0 | | |
| **T1A5C10** Lined pit with semi-permeable walls and open bottom, no outlet or overflow | 40.0 | 29.0 | 0.0 | 0.0 | | |
| **T1B11 C7 TO C9** Open defecation | 5.3 | | | | | |
| **T2A4C10** Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 1.3 | 54.0 | 0.0 | 0.0 | | |
| **T2A5C10** Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | 10.4 | 25.0 | 0.0 | 0.0 | | |

**Figure 14: SFD Matrix of Siraha Municipality.**

### 2.3.2 *Risk Assessment of Groundwater Pollution*

The risk of groundwater pollution was assessed based on source of drinking water, secondary data on water quality and the vulnerability of the aquifer with regards to lateral spacing between sanitation system and groundwater sources.

**a. Sources of Drinking Water and Water Production**

Siraha Drinking Water Supply Project has been providing piped drinking water in Siraha since 1983. Currently, it has distributed only 375 taps in the area (KII2, 2022). The major source of water are two deep tube wells. The water supply is being managed by the Water Supply and Sanitation Division Office (WSSDO) under the Ministry of Physical Infrastructure of the provincial government. However, most households in the municipality rely on handpumps for drinking water supply. Figure 15 shows the piped drinking water supply systems of Siraha municipality.

**Figure 15: Overhead Tank for Piped Drinking Water Supply System in Siraha Municipality.**

**b. The vulnerability of the aquifer and lateral spacing between sanitation systems and groundwater source**

The term aquifer pollution vulnerability is intended to represent the varying level of natural protection afforded by the contaminant attenuation capacity of the unsaturated zone or semi-confining beds above an aquifer, because of physicochemical processes (filtration, biodegradation, hydrolysis, adsorption, neutralization, volatilization, and dispersion)—all of which vary with their texture, structure, clay content, organic matter, pH, redox and carbonate equilibria. Groundwater vulnerability is specific to containment type and pollution scenarios (Andreo, 2013) Here, among the various types of onsite sanitation technologies, lined tanks with impermeable walls and open bottom and lined pits are more prone to contribute to aquifer pollution as the nature of such containments impose more containment load from the land surface to groundwater.

A key determinant of risk variation is the soil and geological setting. Especially for consolidated hard rock sediments with poor soil cover and shallow water tables, the risk is higher. According to WHO criteria, if the travel time of pollutant to groundwater source is less than 25 days, there is significant risk to contamination; low risk, if the travel time is between 25 and 50 days; and very low risk if the travel time is greater than 50 days (Krishnan, 2011). The size of pores in the soil determines the infiltration rate. In the sandy loam soil, the permeability is approximately 2.5 cm per hour. Thus, between 25 and 50 days the pollutant could travel to the depth of approximately 30 metres (98.67 feet) in sandy loam soil. Hence, the people using open bottom tanks and consuming water from the handpumps with the depth up to 100 feet (30.48 m) and horizontal distance of the pump within 25 feet (7.62 m) from the source of pollutants are assumed at significant risk to groundwater pollution.

Figure 16 demonstrates the depth of handpumps and horizontal distance of it from source of pollutant by lined tanks with impermeable walls and open bottoms. Almost 4% of the people using lined tanks and open bottom containments are at significant risk to consumption of groundwater pollution from their containment.

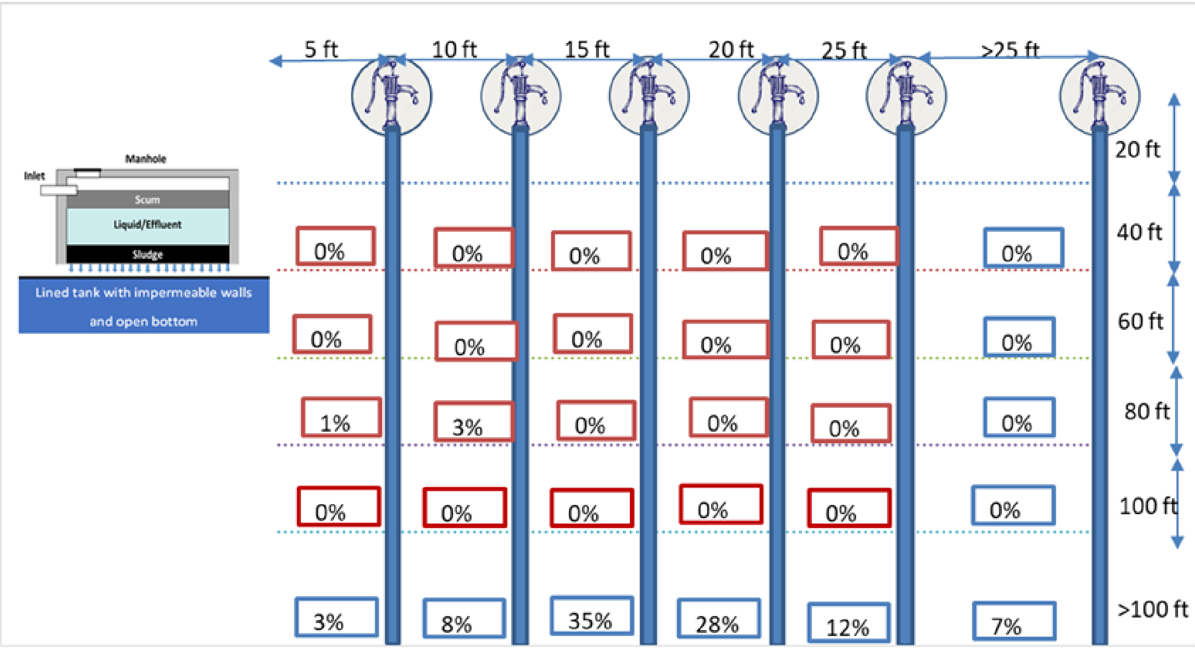


**Figure 16: Depth of handpumps and lateral spacing of it with containment types lined tank with impermeable walls and open bottom.**

Similarly, Figure 17 demonstrates the depth of hand pumps and horizontal distance of it with the containment type lined pit with semi-permeable walls and open bottom. It shows that 9% of the households are at high risk of groundwater contamination as the water pumped through handpump in these households.

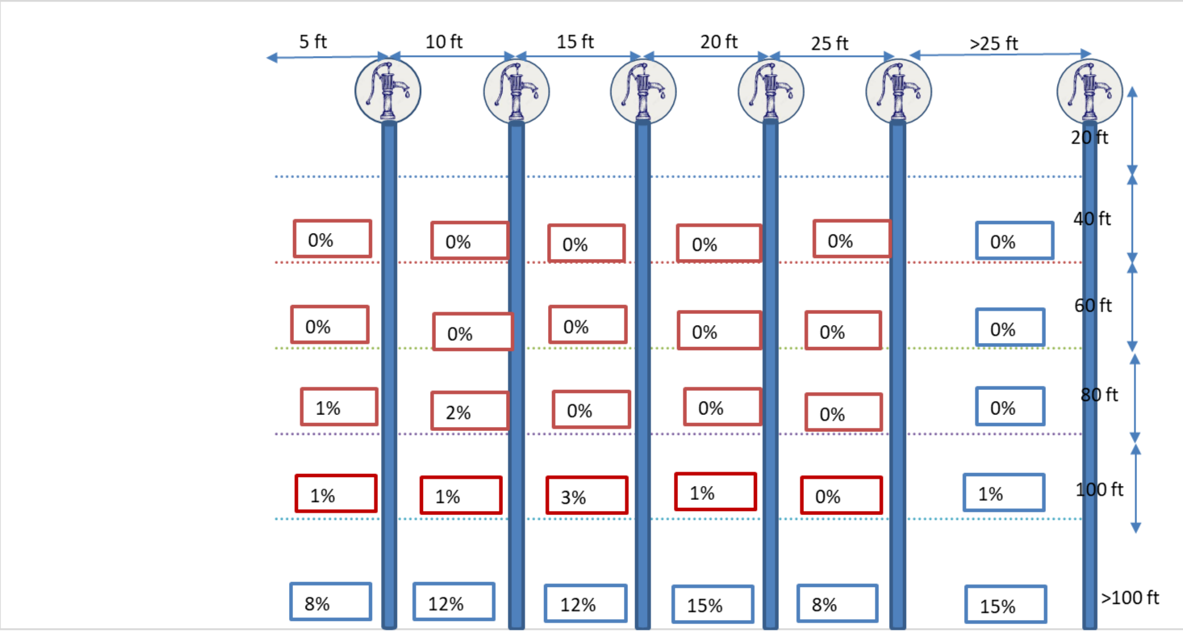


**Figure 17: Depth of hand pumps and lateral spacing of it with containment types lined pit with semi-permeable walls and open bottom.**

### *2.3.3 Proportion of Faecal Sludge Emptied (F3)*

The proportion of faecal sludge emptied (F3) is calculated based on the percentage containment emptied and the amount of FS emptied during the process. The information on FS emptied from containment is obtained from Key Informant Interviews (KIIs) with desludging service providers. It is revealed that most of the containment gets filled due to intrusion of the groundwater into the containment. Thus, the portion of liquid in the FS is high which can be easily pumped out by the desludging vehicle. So, almost 90% of the FS content in the containment is removed during emptying. Hence, actual proportion of FS emptied from each containment is calculated as:

$$\begin{aligned} &\textit{Actual Proportion of FS emptied } (F3) \\ &\qquad = \textit{percentage of containment emptied} \\ &\qquad \times \textit{proportion of FS removed during emptying} \end{aligned}$$

Table 3 shows the actual proportion of FS emptied from each containment.

**Table 3: Sanitation technologies and proportion of emptied faecal sludge.**

| SN | Sanitation Technologies | SFD Reference Variable | Percentage of Emptied Containment | Emptied Proportion of FS | Actual Proportion of Emptied FS (F3) | Remark |
|---|---|---|---|---|---|---|
| 1 | Septic tank connected to open drain or storm sewer | T1A2C6 | 0% | 0% | 0% | Containments not emptied |
| 2 | Fully lined tank (sealed), no outlet or overflow | T1A3C10 | 27.4% | 90% | 25% | |
| 3 | Fully lined tank (sealed) connected to an open drain or storm sewer | T1A3C6 | 0% | 0% | 0% | Containments not emptied |
| 4 | Fully lined tank (sealed) connected to open ground | T1A3C8 | 0% | 0% | 0% | Containments not emptied |
| 5 | Lined tank with impermeable walls and open bottom, no outlet or overflow | T1A4C10 | 15.3% | 90% | 14% | |
| 6 | Lined tank with impermeable walls and open bottom, connected to an open drain or storm water | T1A4C6 | 0% | 0% | 0% | Containments not emptied |
| 7 | Lined tank with impermeable walls and open bottom, connected to an open ground | T1A4C8 | 0% | 0% | 0% | Containments not emptied |
| 8 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow | T1A5C10 | 32% | 90% | 29% | |
| 9 | Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | T2A4C10 | 60% | 90% | 54% | |
| 10 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | T2A5C10 | 28% | 90% | 25% | |

### *2.3.4 Proportion of FS emptied which is delivered to Treatment Plant (F4 and F5)*

The municipality does not have any form of treatment plant to treat faecal sludge. Also, the people using twin pits reclassified as lined pits with semi-permeable walls and open bottoms are not using them properly. Thus, the percentage of FS emptied from such containment is not considered as treated. The FS emptied from the containments is dumped openly in farmland or water bodies. Thus, variables F4 and F5 for all sanitation systems are set to 0%.

### *2.3.5 Proportion of supernatant in open drain/storm sewer delivered to treatment (S4e)*

The actual proportion of supernatant from the containment to open drain and storm water drain is not able to observe. Thus, the proportion is estimated at 50% of the faecal sludge in the containment connected to open drain and storm water drain. While the proportion delivered to treatment plant and treated is 0% as no treatment facility is available.

## 2.4 SFD Graphic

Figure 18 represents the fate and flow of faecal sludge through each sanitation service chain. It shows that FS generated from 60% of the population is safely managed represented by "Green" colour arrowhead. However, the percentage resembles the FS stored in the containment without significant risk to groundwater. Thus, the safely managed percentage of FS generated by 60% of the population is temporary until the FS from the containment is emptied.

The FS and supernatant from 40% of the population is unsafely managed, represented by "RED" arrow heads. The percentage of unsafely managed FS is generated from containments where FS is not contained - not emptied (12%), openly dumped FS emptied (22%) which is disposed of untreated in the environment, supernatant not delivered to treatment (1%) and people practising open defecation (5%).

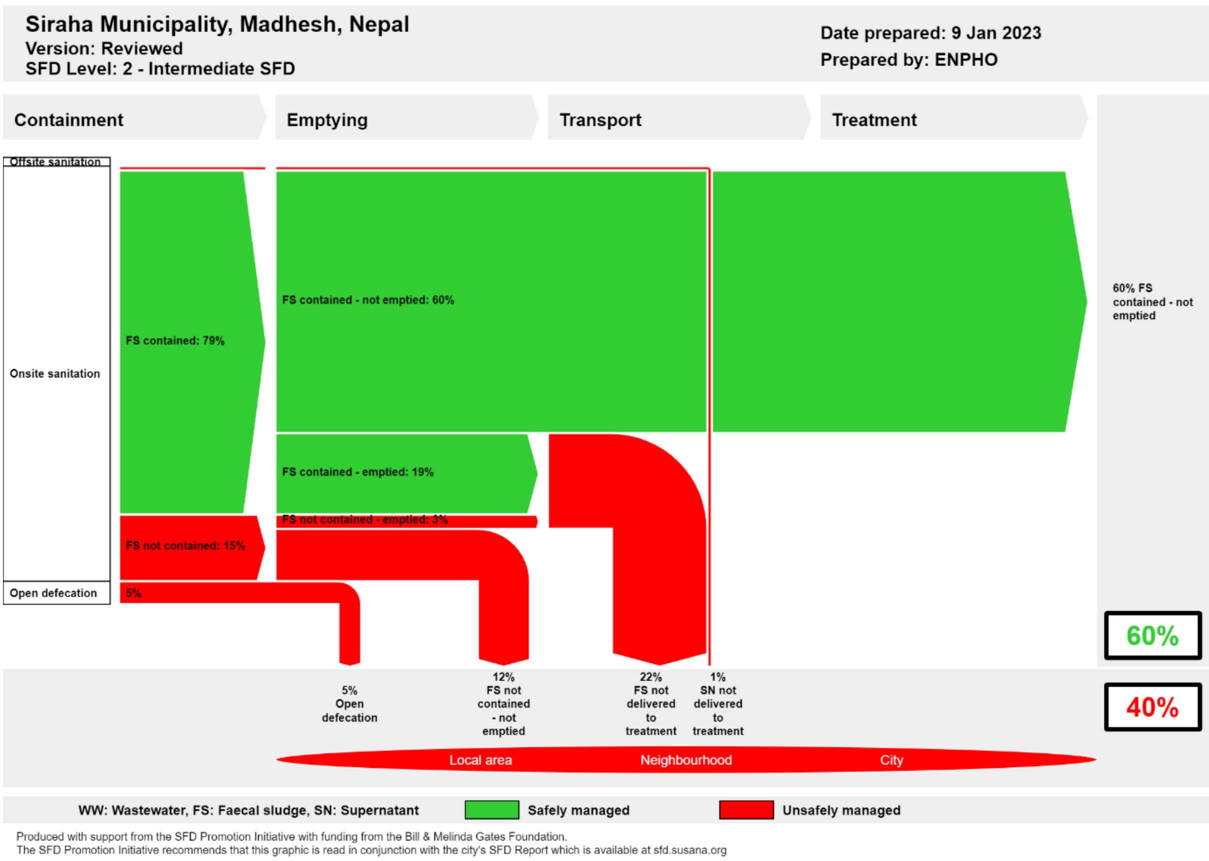


**Figure 18: SFD Graphic of Siraha Municipality.**

### *2.4.1 Offsite Sanitation*

Nepal Multiple Indicator Survey (MICS) reported that among the total households in Nepal, 10.7% of households has a toilet connected to the sewer network and in Madhesh province it is only 1.1% (CBS, 2020). However, the offsite sanitation system was not observed in Siraha municipality.

### *2.4.2 Onsite Sanitation*

All the population with access to toilets relies on onsite sanitation systems. As shown on the SFD Graphic (Figure 18), it is estimated that 79% of the population uses systems where the FS is considered contained, while 15% of the population uses systems where the FS is considered not contained.

***FS contained***

The definition of ‘FS contained’ is faecal sludge contained within an onsite sanitation technology which ensures safe level of protection from excreta i.e. pathogen transmission to the user or general public is limited. These are tanks or pits that are correctly designed, properly constructed, fully functioning, and/or are causing no risk- or only a ‘low’ risk- of polluting groundwater used for drinking (SuSanA, 2018).

The value is the summation of the percentage of population using fully lined tanks (sealed) without outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom without outlet or overflow (T1A4C10) and lined pits with semi-permeable walls and open bottom without outlet or overflow (T1A5C10) multiplied by proportion of FS contained in each containment. Thus, the FS generated by 79% of the population is considered contained.

***FS not Contained***

The definition of ‘FS not contained’ is faecal sludge contained within an onsite sanitation technology which does not ensure safe level of protection from excreta i.e. pathogen transmission to the user or general public is likely. These are tanks or pits that are incorrectly designed, or poorly constructed, or poorly functioning, and/or are causing a ‘significant’ risk of polluting groundwater used for drinking (SuSanA, 2018).

The value is obtained from the summation of percentage of population using, septic tanks connected to open drain or storm sewer (T1A2C6), fully lined tanks connected to open drain or storm sewer, open ground and no outlet or overflow (T1A3C6 and T1A3C8), lined tanks with impermeable walls and open bottom connected to an open drain or storm sewer and to open ground (T1A4C6 andT1A4C8), lined tanks with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A4C10) and lined pits with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A5C10) multiplied by proportion of FS in each containment.

***FS contained Emptied***

The proportion of FS contained emptied is the summation of the proportion of FS emptied from fully lined tanks (sealed) without outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10) and lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10). The calculation is shown in Table 4.

**Table 4: Calculation of FS contained emptied, and FS contained not emptied.**

| SN | Sanitation Technologies | SFD Reference Variable | Proportion of FS | Proportion of Emptied FS (F3) | FS contained emptied | FS contained not emptied |
|---|---|---|---|---|---|---|
| 1 | Fully lined tank (sealed), no outlet or overflow | T1A3C10 | 16.5% | 25% | 4.1% | 12.4% |
| 2 | Lined tank with impermeable walls and open bottom, no outlet or overflow | T1A4C10 | 22.7% | 14% | 3.2% | 19.5% |
| 3 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow | T1A5C10 | 40% | 29% | 11.6% | 28.4% |
| | | | | Total FS contained emptied | 18.9% | - |
| | | | | | Total FS contained not emptied | 60.3% |

***FS not contained - emptied***

The proportion of FS not contained emptied is the summation of the proportion of FS emptied from either technically appropriate or inappropriate containment with potential risk on direct contact with human or contamination of groundwater. The calculation of FS not contained - emptied is shown in Table 5.

**Table 5: Calculation of FS not contained - emptied.**

| SN | Sanitation Technologies | SFD Reference Variable | Proportion of FS | Proportion of Emptied FS (F3) | FS not contained emptied | FS not contained not emptied |
|---|---|---|---|---|---|---|
| 1 | Septic tank connected to open drain or storm sewer | T1A2C6 | 0.2% | 0.0% | 0.0% | 0.2% |
| 2 | Fully lined tank (sealed) connected to an open drain or storm sewer | T1A3C6 | 0.8% | 0.0% | 0.0% | 0.8% |
| 3 | Fully lined tank (sealed) connected to open ground | T1A3C8 | 1.3% | 0.0% | 0.0% | 1.3% |
| 4 | Lined tank with impermeable walls and open bottom, connected to an open drain or storm water | T1A4C6 | 0.3% | 0.0% | 0.0% | 0.3% |
| 5 | Lined tank with impermeable walls and open bottom, connected to an open ground | T1A4C8 | 1.1% | 0.0% | 0.0% | 1.1% |
| 6 | Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | T2A4C10 | 1.3% | 54% | 0.7% | 0.6% |
| 7 | Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution | T2A5C10 | 10.4% | 25% | 2.6% | 7.8% |
| | | | | Total FS not contained emptied | 3.0% | - |
| | | | | | Total FS not contained not emptied | 12% |

***FS not delivered to treatment***

The municipality does not have treatment facility to treat faecal sludge. So, all the FS emptied from contained and not contained containments is disposed into farmlands, riverbanks, and jungle. The proportion of FS not delivered to treatment 22%, is the summation of FS contained emptied and FS not contained- emptied.

***Supernatant (SN) not delivered to treatment***

The proportion of supernatant is obtained from containments connected to open drain or storm water sewer calculated as 50% of FS contained in each containment. The total proportion of supernatant (SN) is 1% of FS generated by the total population. Since the municipality lacks proper sewer network and treatment plant, the supernatant is disposed directly into water bodies. Hence the proportion of SN not delivered to treatment is 1%.

### *2.4.3 Open Defecation*

Despite Open Defecation Free (ODF) status, people residing in 5% of households still go for open defecation. The people living in poverty and those who do not own land mostly do not have toilets.

# 3 Service delivery context description

## 3.1 Policy, legislation, and regulation

The constitution of Nepal 2015 has established right to access to clean drinking water and citizen as fundamental right. In Article 35 (4) related to right to health recognizes citizen's rights to access to clean drinking water and sanitation. In addition, Right to Clean Environment, Article 30 (1) recognizes that every person shall have the right to live in a healthy and clean environment (GoN 2015). To respect and promote the right of citizens to wards accessing clean drinking water and sanitation services, the government has promulgated and amended necessary laws. The most relevant legislation for promotion of safe sanitation services is discussed here.

**Local Government Operation Act, 2017**

Local Governance Operation Act 2017 has promulgated to implement the rights of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act defined roles and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level. Regarding the management of sanitation, the act entitles local government to conduct awareness campaigns, design and implement sanitation programs at the local level.

**Environment Protection Act, 2019**

Environment protection act 2019 is promulgated to prevent and control pollution from different development activities. It defines "Pollution" as the activities that significantly degrade, damage the environment, or harm the beneficial or useful purpose of the environment, by changing the environment directly or indirectly because of wastes, chemical, heat, noise, electrical, electro-magnetic wave, or radioactive ray. It provides the mechanism for appointing environmental inspector to control pollution by federal, provincial and local government.

**Water Supply and Sanitation Act, 2022**

The act was promulgated to ensure the fundamental right of citizen to easy access on clean and quality drinking water, sanitation services and management of sewerage and wastewater. It defines sewerage and wastewater management as construction of sewer networks and treatment plants to preserve sources of water. It has entitled federal, provincial, and local level for the operation and management of water and sanitation services. The act also explicitly defines the responsibility of every citizen to preserve, conserve and maintain the sources of water and use responsibly.

**Environment Friendly Local Governance Framework 2013**

The environment-friendly local governance framework 2013 has been issued to add value to environment-friendly local development concept encouraging environmental protection through local bodies. The framework has set basic and advanced indicators for households, settlement, ward, village, municipality, and district levels for declaration of environment friendly. The use of water sealed toilets in households as basic indicators for sanitation and health. Provision of toilet with safety tank and use as advanced indicators for sanitation. Provision of gender, children and disabled friendly public toilets in parks, petrol pumps and main market as basic indicator for municipal level. Advance indicators such as drainage discharged only after being processed through biological or engineering technique. While it has failed to identify the necessity of faecal sludge treatment plants as it has assumed safety tank in the households is sufficient for treating faecal sludge.

**Institutional and Regulatory Framework for Faecal Sludge Management, 2017**

Ministry of Water Supply through its Department of Water Supply and Sewerage Management (DWSSM) articulated and endorsed Institutional and Regulatory Framework (IRF) for Faecal Sludge Management in Urban Areas of Nepal in 2017. The main objective of the IRF is to define the specific roles and responsibilities of key institutions for the effective management and regulation of Faecal Sludge Management (FSM). The framework primarily envisioned featuring FSM in the national policy and issuing policy directives into local government to incorporate FSM in their urban planning along with strengthening and enhancing the capacity of the local government to deliver effective services. A local government has been endowed with overall responsibility to plan, implement, and regulate the FSM services within its jurisdiction. The provision of the ability to engage the private sector and other relevant stakeholders such as the Water and Sanitation Users Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

**Total Sanitation Guideline, 2017**

Total Sanitation Guideline was promulgated by the Ministry of Water Supply in April 2017 after the successful implementation of the National Sanitation and Hygiene Master Plan (NSHMP) 2011. It provides guidelines for sustaining ODF outcomes and initiating post-ODF activities through an integrated water, sanitation and hygiene plan at municipalities and districts. The guideline redefined sanitation as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish a hygienic environment and promote public health. Indicators are set to guide total sanitation movement with an arrangement for resource management, monitoring and evaluation, capacity building.

## 3.2 Policies

Historically, the National Sanitation Policy (1994) was the guideline for the planning and implementation of sanitation programs. The policy had promoted sanitation issues together with issues on water supply in rural communities. Also, Rural Water Supply and Sanitation National Policy (RWSSNP) 2004, has set a new target to provide safe, reliable, and affordable water supply with basic sanitation facilities. The policy focused on delivering quality services on water and sanitation to the marginalized and vulnerable groups. However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery. Thus, the National Urban Water Supply and Sanitation Sector Policy (NUWSSSP) was formulated and enforced in 2009. It focused on achieving coherent, consistent, and uniform approaches of development in urban areas with the involvement of different agencies and institutions. Both these policies were limited to addressing emerging issues and challenges in the rural and urban areas. Thus, the National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by the Government of Nepal (GON) to address the emerging challenges and issues with the adoption of new approaches and resolve the inconsistency in RWSSNP and NUWSSSP.

The goal of the NWSSP was to reduce urban and rural poverty by ensuring equitable socio-economic development, improving health and the quality of life of the people and protection of environment through the provision of sustainable water supply and sanitation services. It adopted innovative technologies and knowledge emerged in the sector. Remarkably, it was the first official document that recognized discharge of untreated wastewater and dumping of septic sludge heavily polluted the surface water sources in urban areas.

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation. Nepal committed to Millennium Development Goals (MDGs) for 2000 - 2015. One goal was accomplished through declaration of the country as free from open defecation on 30th September 2019. National Sanitation and Hygiene Master Plan, 2011 was developed for coordinated planning and implementation of National Sanitation Campaign. The campaign strengthened institutional set-up tier of government in a participatory approach. In an alignment total sanitation campaign was initiated formally to sustain ODF. The guideline set various indicators to assess the sustainability of sanitation services. Remarkably, it extended sanitation definition as management of services and facilities to safely dispose of/reuse faecal sludge, collection and treatment of solid waste and wastewater to establish the hygienic environment and promote public health (NPC, 2017).

Similarly, Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (SDP 2016-2030) was formulated in 2016 for sector convergence, institutional and legal reforms, capacity development and establishing coordination and harmonization in the sector. The SDP classified service system and delineated roles and responsibilities for effective and sustainable service delivery. The SDP highlighted that majority of households rely on onsite sanitation system (70%) that requires effective treatment of faecal sludge. However, there is lack of concrete policies, guidelines, and indicators on Faecal Sludge Management in the sector for effective planning, implementation, and service delivery.

## 3.3 Institutional roles

Federal, provincial, and local government are entitled for implementation of water and sanitation programs to ensure the rights on access to safe water and sanitation.

### At Federal Government

**National Planning Commission**: At the federal government, the National Planning Commission (NPC) is the specialized and apex advisory body for formulating a national vision, developing policy, periodic plans, and sectoral policies. The NPC assesses resource needs, identifies sources of funding, and allocates budget. It serves as a central agency for monitoring and evaluating development policy, plans and programs. It supports, facilitates, and coordinates with federal, provincial, and local government for developing policy plans and implementation.

**Ministry of Water Supply**: Ministry of Water Supply (MoWS) is the lead ministry responsible for planning, implementation, regulation, and monitoring and evaluation of sanitation programs in the country (GoN, 2015). Under the MoWS, Department of Water Supply and Sewerage Management (DWSSM) plan and implement water and sanitation projects funded by foreign donors or inter provincial projects or serves at least 15,000, 5,000 and 1,000 people in terai, hilly and mountain region respectively (GoN, 2015). The organizational structure of DWSSM is shown in Figure 19.

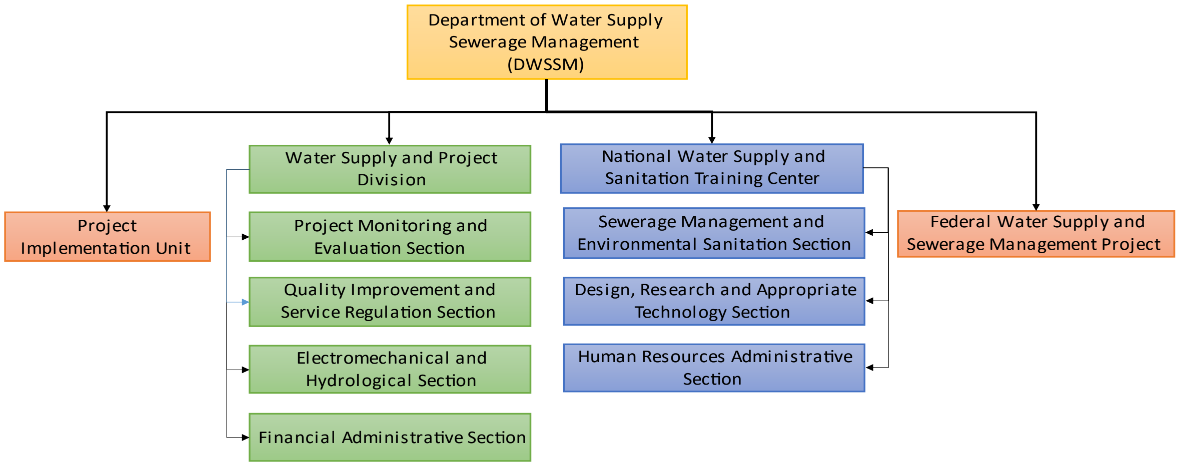


**Figure 19: Organizational Structure Department of Water Supply and Sewerage Management (DWSSM).**

### At Provincial Government

**Ministry of Physical Infrastructure:** Ministry of water supply and energy development of provincial government in Madhesh province is major executing body for planning, developing, and implementing water supply and sanitation programs. Planning and implementation of water supply and sanitation infrastructure in the province is executed through Water Supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

i. Inter local government projects.

ii. Beneficiaries between 5,000 to 15,000 in terai region, 3,000 to 5,000 in hilly region and 5,00 to 1,000 in Himalayan region.

### At Local Government

**Municipal council:** The municipality consists of 7 divisions including a sanitation related section. The Sanitation sub-section lies under the Infrastructure Development and Environmental management section. Figure 20 shows the organizational structure of the municipality. The sub-section has been providing door to door solid waste collection service in the municipality. The municipality has allocated the land and budget for developing a sanitary landfill site in the municipality. Besides, Sabal Nepal, a non-government organization has been implementing water and sanitation program in community level through the support of Welthungerhilfe (WHH).

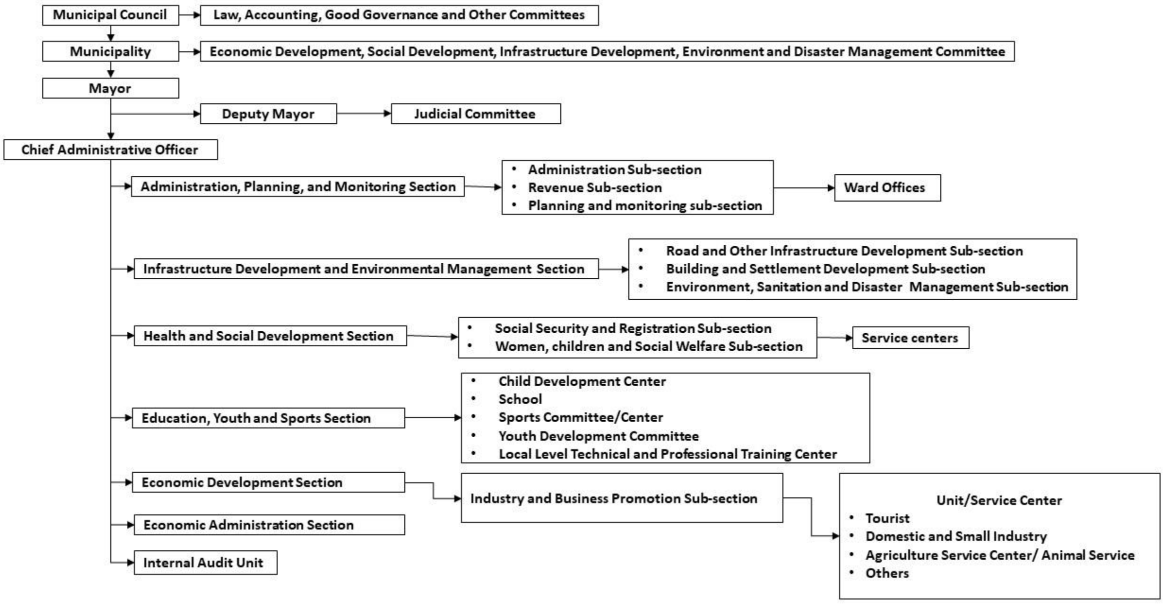


**Figure 20: Organizational Structure of Siraha Municipality.**

## 3.4 Service provision

Urban Water Supply and Sanitation Policy 2009 has emphasized the Public-Private Partnership (PPP) in water supply and sanitation to improve service delivery (MoPIT, 2009). Also, the Public-Private Partnership Policy, 2015 encourages private sector investment in the development and operation of public infrastructure services for comprehensive socio-economic development. The policy has aimed to remedy challenges such as structuring of projects, land acquisition, coordination and approval, payments to private sectors and approval for environment impact (MoF, 2015).

## 3.5 Service standards

The sanitation service standards have set by Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). It classifies sanitation services as high, medium, and basic based on sanitation facilities in place. The sanitation service levels with indicators are shown in Table 6. However, FSM specific standards have yet to be developed and implemented.

**Table 6: Sanitation Service Level and its Components.**

| S.N. | Service Components | Service Level | | |
|---|---|---|---|---|
| | | High | Medium | Basic |
| **1** | Health and Hygiene Education | ✓ | ✓ | ✓ |
| **2** | Household Latrine | ✓ | ✓ | ✓ |
| **3** | Public and School Toilets | ✓ | ✓ | ✓ |
| **4** | Septic tank sludge collection, transport, treatment, and disposal | ✓ | ✓ | ✓ |
| **5** | Surface drains for collection, transmission, and disposal of greywater | ✓ | ✓ | ✓ |
| **6** | Small-bore sewer collection for toilet and septic tank effluent, low-cost treatment and disposal | | ✓ | |
| **7** | Sanitary sewers for wastewater collection, transmission, non-conventional treatment, and disposal | ✓ | | |
| **8** | Sanitary sewers for wastewater collection, the transmission of conventional treatment and disposal | ✓ | | |
| **9** | Limited solid waste collection and safe disposal | ✓ | ✓ | ✓ |

# 4 Stakeholder Engagement

## 4.1 Key Informant Interviews (KIIs)

Key Informant Interviews (KIIs) and objective sharing of the study were conducted with the major stakeholders of sanitation sector of the municipality. Interviews was performed with Mr. Bali Ram Yadav, Chief Administrative Officer, and Mr. Suresh Chobar, section head in environment and Disaster management section of the municipality.

Similarly, private desludging service providers were interviewed to understand faecal sludge management practice and the business opportunities of the sector in the municipality. KIIs were also performed in context of public toilets with care takers of the toilets to find faecal sludge generation from the public toilets of the municipality as well as public toilet management practice. Other stakeholders interviewed was a in charge water supply in Siraha Municipality from WSSDO. List of KIIs conducted with their designation in the organization are working is shown in Table 7.

**Table 7: List of Key Informant Interviewed personnel.**

| S.N. | Name | Designation | Organization/ Company | Purpose of KII | Date |
|---|---|---|---|---|---|
| 1. | Bali Ram yadav (KII-1) | Chief Administrative Officer | Siraha Municipality | Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development | September 18, 2022 |
| 2. | Suresh Chobar (KII-2) | Section Head (Environment and Disaster Management section) cum proprietor of private desludging service | Siraha Municipality | Sanitation status, Ongoing projects on Sanitation, Policies and plan for Sanitation development | September 18, 2022 |
| 3. | Jagdish Paswan (KII-3) | Plumber cum In-charge | Siraha Water Supply Project | Water Supply and quality of water in Siraha municipality | September 19, 2022 |
| 4. | Bhogendra Mestar (KII-4) | Private Desludging Service Provider | Private Desludging Service Provider | Emptying practices, finances, requirement, disposal and treatment | September 19, 2022 |
| 5. | Arjun Mukhiya (KII-5) | Private Desludging Service Provider | Private Desludging Service Provider | Emptying practices, finances, requirement, disposal and treatment | September 20, 2022 |

## 4.2 Household Survey

Household survey was conducted in all wards of the municipality through mobilization of enumerators selected by the municipality. The enumerators were given two days orientation about sanitation and methods for conducting the household survey. The household survey was conducted using the mobile application "KOBOCOLLECT" after orientation. SFD team members along with municipal focal person went on field visits in households to encourage enumerators and observe household sanitation status (Figure 21).

**Figure 21: Household survey and field monitoring visit.**

### 4.2.1 Determining Sample Size

The number of households to be sampled in the municipality was determined by using Cochran (1963:75) sample size formula $no = \frac{z2pq}{e2}$ and its finite population correction for the proportion n= $n_o/(1+ (n_o-1)/N)$.

Where,

| | | |
|---|---|---|
| Z | 1.96 | At the confidence level of 95% |
| p | 0.5 | Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set at 50% since this percentage would yield the maximum sample size as the percentage of the population practising some form of sanitation is not known at the intervention sites). |
| q | 1-p | |
| e | +/-5% | Level of precision or sampling error. |
| N | | A total number of population (households in the municipality). |

This is followed by proportionate stratification random sampling such that each ward in the municipality is considered as one stratum. The sample sized required in each ward is calculated as

$n_h = (N_h/N)*n$, where $N_h$ is a total population in each stratum.

Thus, a total of 375 households were sampled from 17,828 households distributed in 22 wards with proportionate stratification random sampling. The household samples surveyed in the municipality is shown in Figure 22.

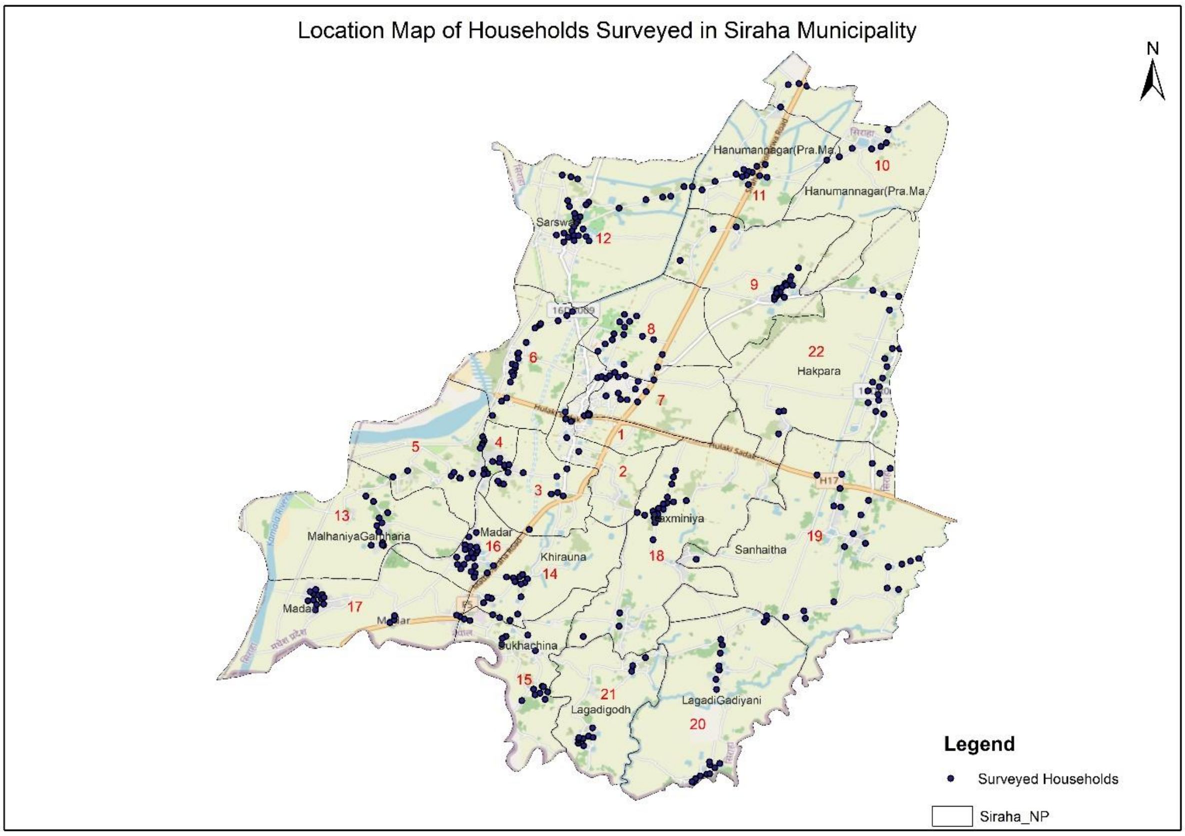


**Figure 22: Distribution of sampling points in different wards of Siraha Municipality.**

## 4.3 Direct Observation

Various sanitation technologies in the households in all the wards were observed and visual references were kept (Figure 23). Also, observation of the emptying of containments and transportation of faecal sludge were carried out. The disposal site of private entrepreneur was observed during the usage.

**Figure 23: Household survey observation.**

## 4.4 Sharing and Validation of Data

The Shit Flow Diagram Sharing and Validation workshop was conducted in the municipality to share the findings of the sanitation situation survey and receive the suggestion from municipal stakeholders. Altogether, 54 participants including the mayor, deputy mayor, ward chairpersons, other members from municipal executive council, sectoral staffs, faecal sludge desludging service providers etc. actively participated on the workshop and provided the valuable suggestions (Figure 24 and Figure 25). The list of participants with their designation is attached in Appendix 2.


**Figure 24: Sharing of the findings during validation workshop.**


**Figure 25: Group photo with participants of Sharing and validation workshop in Siraha municipality.**

# 5 Acknowledgements

We would like to acknowledge Dr. Nabin Kumar Yadav, Mayor and Ms. Babita Kumari Sah Deputy Mayor of Siraha Municipality for continuous support in the study. We would also like to thank Mr. Bali Ram Yadav, Chief Administrative Officer of the municipality.

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We are grateful to Mr. Giri Khatri, Technical Expert- WASH and DRR and Mr. Niroj Giri, MEAL officer at Welthungerhilfe for guidance and support for the study. We are grateful to Ms. Bhawana Sharma, Executive Director and Mr. Rajendra Shrestha, Program Director of Environment and Public Health Organization (ENPHO) for tremendous support and guidance during the whole process of the study.

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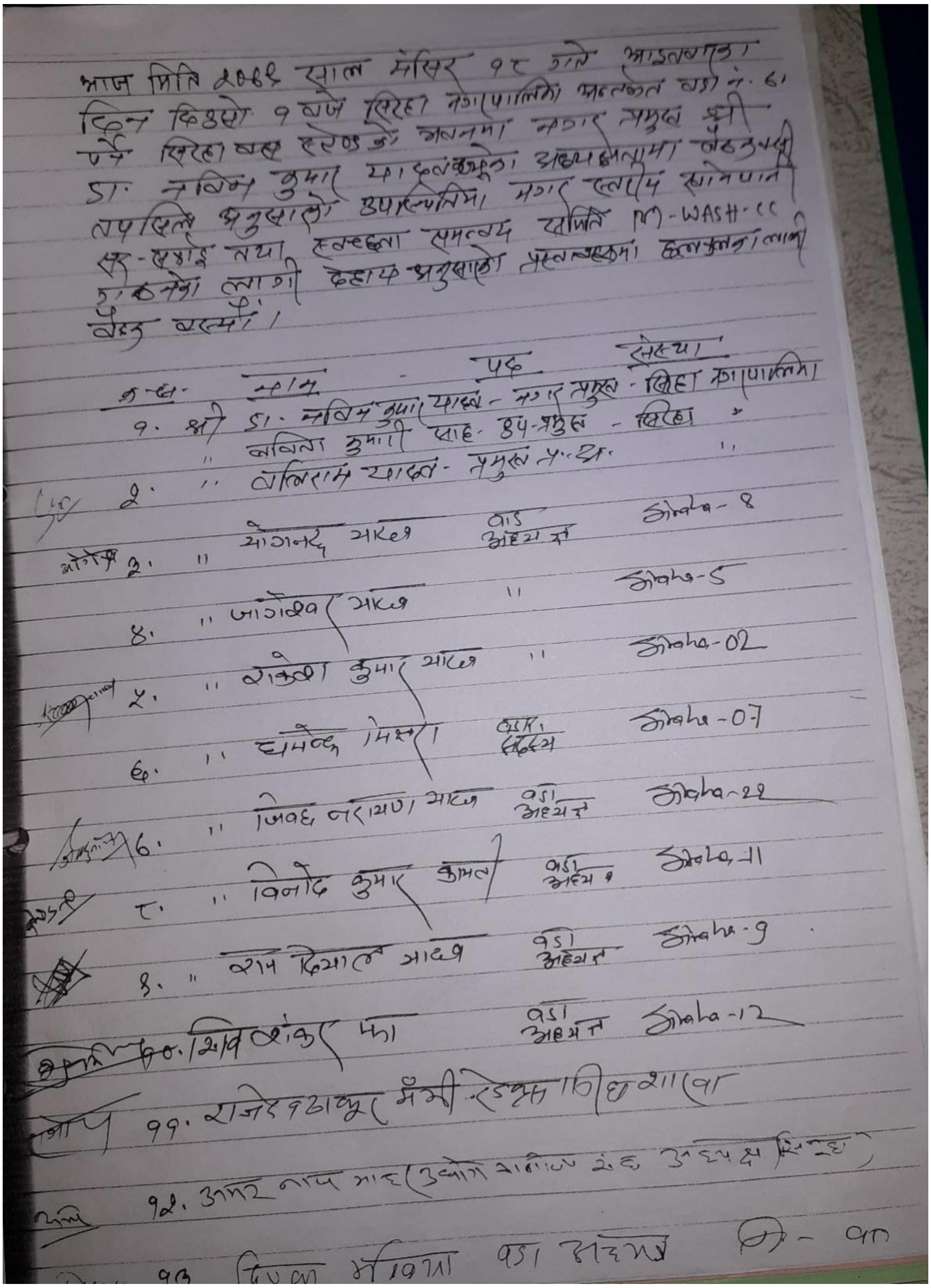
# 7 Appendix

## 7.1 Appendix 1: Roles and Responsibility of Various Tiers of Governments Delineated in Drafted SDP 2016 – 2030

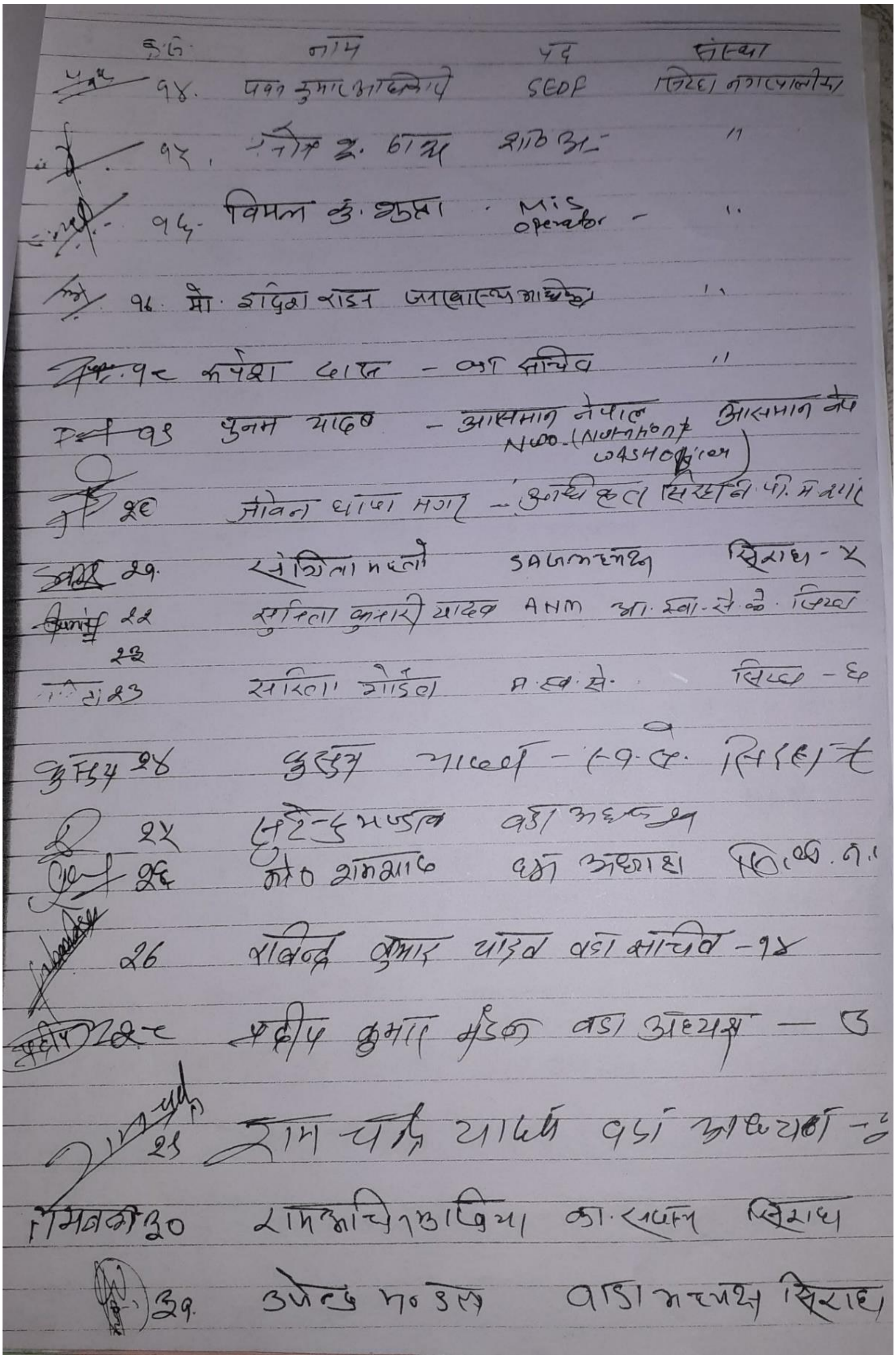
| **System Classification** | | **Minimum Key HR Required** | **Regulation & Surveillance** | **Financing & Construction** | **Ownership of System** | **Service Delivery** | |
|---|---|---|---|---|---|---|---|
| **Size** | Sanitation | | | | | Provision | Production |
| **Small** | Onsite sanitation | Water Supply and Sanitation Technician (WSST) | Federal and or Provincial Government | User+/ community+/ other | | | |
| **Medium** | Septage Management | Sub-engineer | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Users committee/ Utility manager |
| **Large** | Septage or FSM Management | WASH Engineer + finance & admin staff | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Utility Manager |
| **Mega** | Septage/ FSM Management | WASH Engineer + finance & admin staff | Federal and or Provincial Government | Provincial+/ Local Govt+/ Community+/ Private Sector | | Local Govt | Utility Manager |

## 7.2 Appendix 2: List of Participants present in Sharing and Validation meeting of SFD report



आज मिति २०७९ साल मंसिर १८ गते आइतबारका दिन बिहान ९ बजे सिरहा नगरपालिका अन्तर्गत वडा नं. ६ पर्ने सिरहा बस हरेड्ड्को भवनमा नगर प्रमुख श्री डा. नविन कुमार यादवज्यूको अध्यक्षतामा नगर स्तरीय खानेपानी तथा सरसफाई तथा स्वच्छता समन्वय समिति M-WASH-CC ... बैठक बस्यौं।

| क्र.सं. | नाम | पद | संस्था |
|---|---|---|---|
| १. | श्री डा. नविन कुमार यादव | नगर प्रमुख | सिरहा नगरपालिका |
| | नविता कुमारी साह | उप-प्रमुख | सिरहा " |
| २. | " बलिराम यादव | प्रमुख प्र. अ. | " |
| ३. | " योगेन्द्र यादव | वडा अध्यक्ष | Siraha-8 |
| ४. | " जागेश्वर यादव | " | Siraha-5 |
| ५. | " राकेश कुमार यादव | " | Siraha-02 |
| ६. | " धर्मेन्द्र मिस्त्री | वडा सदस्य | Siraha-07 |
| ७. | " शिवचन्द्र नारायण यादव | वडा अध्यक्ष | Siraha-22 |
| ८. | " विनोद कुमार कामत | वडा अध्यक्ष | Siraha-11 |
| ९. | " राम दियाल यादव | वडा अध्यक्ष | Siraha-9 |
| १०. | शिवशंकर झा | वडा अध्यक्ष | Siraha-12 |
| ११. | राजेन्द्र ... | मंत्री | रेडक्रस सिरहा शाखा |
| १२. | अमर नाथ साह | उद्योग वाणिज्य संघ उपाध्यक्ष | सिरहा |
| १३. | [illegible] महिला | वडा अध्यक्ष | [illegible] |



| क्र.सं. | नाम | पद | संस्था |
|---|---|---|---|
| १४. | पवन कुमार अधिकारी | SEDF | सिरहा नगरपालिका |
| १५. | मनोज कु. ठाकुर | सब इ. | " |
| १६. | विमल कु. गुप्ता | MIS operator | " |
| १७. | मो. इद्रिश राइन | जनस्वास्थ्य शाखा | " |
| १८. | कमेश्वर दास | वडा सचिव | " |
| १९ | पुनम यादव | आसमान नेपाल NGO (Nutrition WASH officer) | आसमान नेपाल |
| २० | जीवन थापा मगर | अधिकृत | सिरहा नि.पी. |
| २१. | संगिता महतो | SAGUN प्रमुख | सिरहा - ५ |
| २२ | सुनिता कुमारी यादव | ANM | आ.स्वा.से.के. सिरहा |
| २३ | सरिता गोंड | म.स्वा.से. | सिरहा - ६ |
| २४ | कुसुम चौधरी | न.पा.स. | सिरहा न. |
| २५ | सुरेन्द्र मण्डल | वडा अध्यक्ष | |
| २६ | मो० शमशाद | वडा अध्यक्ष | सि.न.पा. |
| 26 | रविन्द्र कुमार यादव | वडा सचिव - १४ | |
| २८ | प्रदीप कुमार मंडल | वडा अध्यक्ष — ७ | |
| २९ | राम चन्द्र यादव | वडा अध्यक्ष - ३ | |
| ३० | रामशचिन्द्र चौरसिया | का.स. | सिरहा |
| ३१. | उपेन्द्र मण्डल | वडा अध्यक्ष | सिरहा |

३२ रोशन कुमार चौधरी - प्राविधिक सहायक सि.न.पा.

३३ मुकेश कुमार साह - कम्प्युटर सिरहा न.पा.

३४ दीपक कुमार यादव - Diploma सिरहा न.पा.-६

३५ जय शंकर यादव - बाल क्लब - सिरहा-२२

३६ निरज गिरि WHH (MEAL officer) -

३७ ज्ञान श्रेष्ठ ENPHO -

३८ श्रीया खनाल ENPHO -

३९ धर्मेन्द्र कु. मिश्रा वार्ड ६ कल्याणकारी अध्यक्ष - 6 वार्ड

४० मधुसूदन [illegible] - प्राचार्य श्री चन्द्र मा.वि. सिरहा

४१ मनोज कुमार यादव प्र.अ. श्री प्र.आ.मा.वि. [illegible]

४२ संतोष [illegible] अपन दैनिक

४३ ~~[illegible]~~ अशोक कुमार यादव [illegible] वडाअध्यक्ष

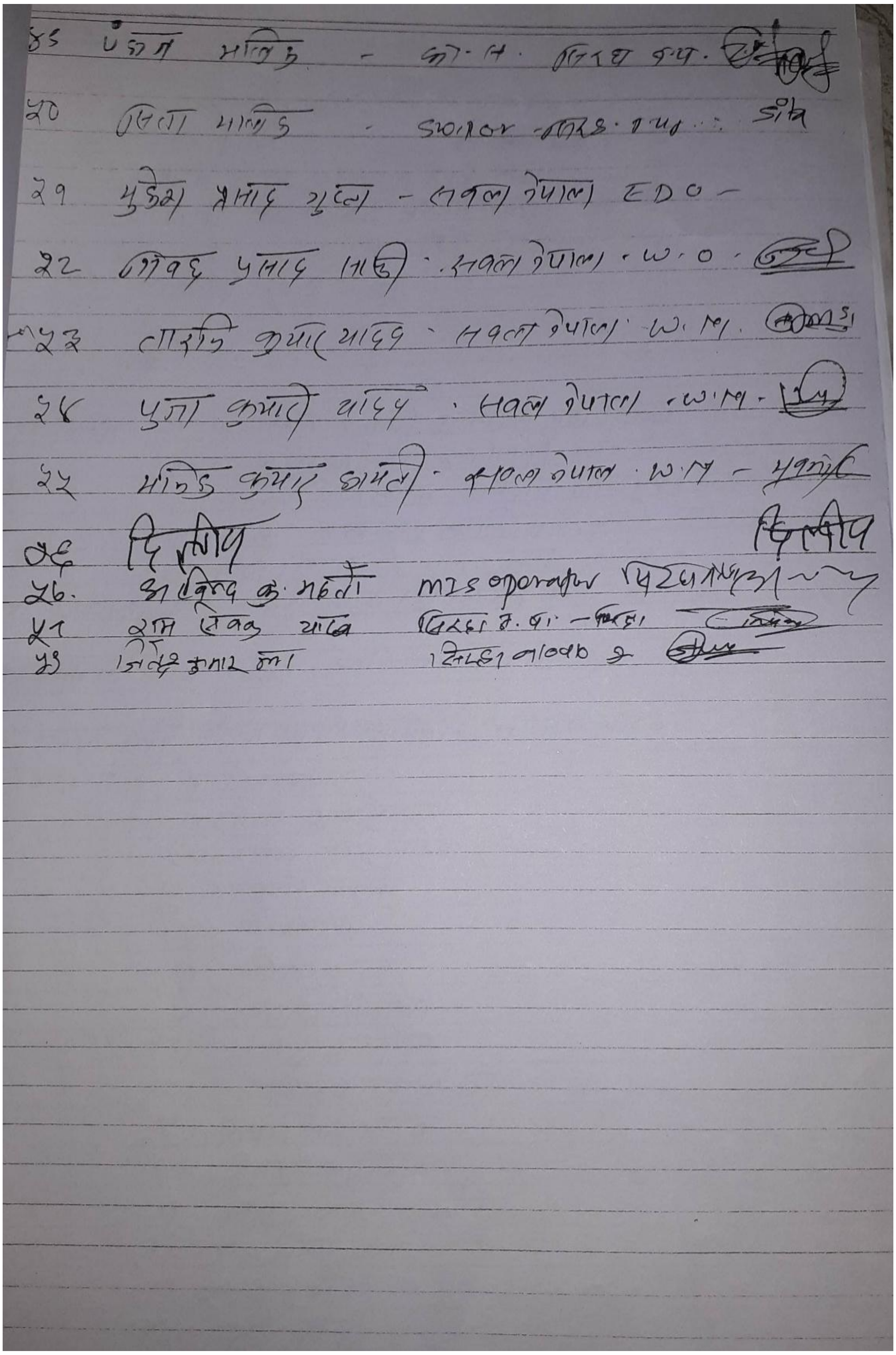
४४ शैलेन्द्र कु. यादव ~~[illegible]~~ वडा अध्यक्ष सिरहा-१

४५ उमेश प्रसाद यादव वडा अध्यक्ष - सिरहा-१

४६ शत्रुघ्न यादव - सचिव - [illegible]

४७ राम शोभित यादव अध्यक्ष सिरहा नं. १२

४८ सरिता यादव - [illegible]



४९ पंकज मल्लिक - को.अ. सिरहा न.पा.

५० रिता मल्लिक - Senior सहायक न.पा.

५१ मुकेश प्रसाद गुप्ता - सफल नेपाल EDO -

५२ गोविन्द प्रसाद साह - सफल नेपाल W.O.

५३ तारणि कुमार यादव - सफल नेपाल W.M.

५४ पुजा कुमारी यादव - सफल नेपाल W.M.

५५ मनिष कुमार कामैती - सफल नेपाल W.M. -

५६ दिलीप

५७. अरविन्द कु. महतो MRS operator सिरहा नगरपालिका

५८ राम सेवक यादव सिरहा न.पा. - सिरहा

५९ जितेन्द्र कुमार झा सिरहा नगरपालिका

SFD Promotion Initiative

SFD Siraha Municipality, Nepal, 2023

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This Executive Summary and the SFD Report are available from: www.sfd.susana.org