SFD Report

Banepa 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 Banepa Municipality, Nepal, 2023

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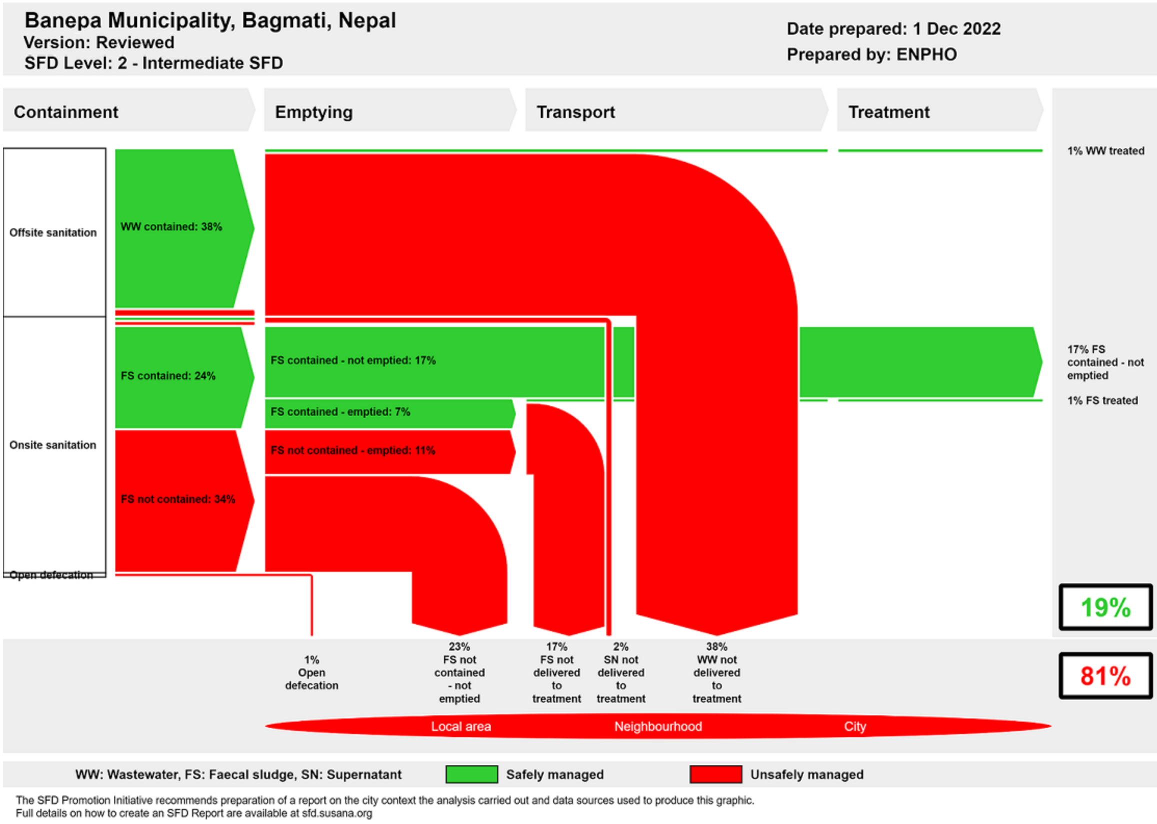
1. The SFD Graphic



2. Diagram information

SFD Level:

This SFD is a level 2 - Intermediate report.

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Banepa Municipality, Municipal Association of Nepal (MuAN), United Cities and Local Government- Asia Pacific (UCLG- ASPAC).

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3. General city information

Banepa Municipality is located in Kavrepalanchok District, Bagmati Province of Nepal. It has 14 wards and covers the area of 54.59 sq km. It is surrounded by Panauti Municipality in the south, Mandandeupur Municipality in the north, Dhulikhel Municipality and Panchkhal Municipality in the east, and Bhaktapur District in the west. The municipality has urban and rural settlements. Particularly, ward numbers 7, 8 and 9 are core urban clusters and the remaining wards are rural.

The national population and housing census report 2021 shows that the municipality has a total population of 67,690, with 33,172 males and 34,518 females residing in 16,698 households. The municipality has a population density of 1,231 person per square kilometre (GON, 2021).

Banepa has a temperate climate with dry winters and warm summers (Climate Data, n.d.). The warmest months are June, July and August, with daily mean temperatures ranging from 21 °C to 22 °C. The coldest days usually occur in January, February, and December, when daily mean temperatures range from 8 °C to 10 °C. The average annual precipitation amounts to about 3,166 mm (Nomadseason, 2022).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the municipality is briefly explained in this section. 99.2% of the households in the municipality owns a toilet. The households without a toilet defecate in nearby farms and forests. The municipality has four public toilets in a bus park and market areas in ward number 8. Three public toilets in bus park area were constructed by Banepa Municipality and a public toilet in Chardobato market area was constructed by the private sector.

Among the households with their own toilet, 39.8% and 60.2% of households have offsite and onsite sanitation system, respectively. The decentralized combined sewer network has been constructed at ward numbers 7, 8 and some parts of ward numbers 5, 6, 9 and 10 of the municipality. The sewer network was developed under the Urban Environmental Improvement Project (UEIP) supported by Asian Development Bank (ADB) and implemented by Ministry of Physical Planning and Works (MoPPW) in 2006. The Department of Urban Development and Building Construction (DUDBC) under the MoPPW was the main implementing agency of the project.

The project has also constructed three decentralized Wastewater Treatment Plants (WWTPs) in the municipality. A WWTP located in Chandeshwori was functional at the initial period. However, the sewer network is currently disconnected and wastewater is disposed of in the nearby stream. While the WWTPs in Budol and landfill site near Shrikandapur were never operated as a result of the elevation difference between the WWTPs and the sewer networks.

Similarly, a Decentralized Wastewater Treatment System (DEWATS) operated by the community was constructed in Nala. The DEWATS was constructed in 2012 by the support of EAWAG, UN-Habitat, Water Aid, CIUD and ENPHO. The Nala Water Supply and Sanitation User's Committee has been operating the plant.

Regarding the onsite sanitation, the lined tank with impermeable walls and open bottom is the popular containment in the municipality. 37.7% of households have installed such containment. 24.6%, 20.2% and 13.2% of households have built single pits, unlined pits constructed with dry stone walls and fully lined tanks, respectively. 2.6% and 1.8% have installed a septic tank and a household anaerobic biogas digester, respectively.

38.36% of the households with onsite sanitation system have emptied their containment at least once since it was used. Among them, 53.7% of households have emptied it manually, 28.7% have directly discharged or disposed of the faecal sludge into the open environment during the rainy season while only 17.5% have emptied their containment mechanically. A municipal desludging service from Dhulikhel Municipality and the private sector from Kathmandu valley is providing desluding services.

The housheolds practising manual emptying either dispose of the faecal sludge directly into farm lands or burry in the pit. 16.6% of the households mix the faecal sludge in a compost pit installed for purpose of composting the organic waste from the household while 38.0% and 40.5% of these households burry in the pit and disposed of the faecal sludge directly into the farmland. 4.7% of the households have disposed of the faecal sludge into the stormwater drain.

The main water supply service provider in the municipality is Nepal Water Supply Corporation (NWSC) and served the core urban households. Besides, water supply and sanitation user's committees are actively involved on providing the drinking water in rural context. Currently, Kavre Valley Integrated Water Supply Project has been implemented as a combined water supply scheme for the Banepa, Panauti, and Dhulikhel municipalities under Secondary Town Integrated Urban Environmental Improvement Project with the suport of ADB.

Overall, the SFD graphic shows that 19% of the excreta generated are safely managed while 81% of the excreta generated are unsafely managed. Importantly, most of the safely managed sanitation (17% FS contained – not emptied) is faecal sludge (FS) stored in containments with only a low risk of causing groundwater pollution. This outcome should be considered only a temporary situation until the FS from the containments are emptied.

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 place to accomplish the sanitation needs 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 in sanitation campaigns. The draft Sector Development Plan (SDP) has envisioned the delineation of roles and responsibility of federal, provincial, and local government in an aim to initiate sustainability of Open Defecation Free (ODF) outcomes. 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. IRF 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.

Banepa municipal council has enforced Water Supply and Sanitation Users' Committee Management Procedure, 2020 to ensure the access to safe drinking water for all people in the municipality and provide the procedure for the formation of water supply and sanitation user's committee in municipal level to provide the services in the community (Banepa Municipality, 2020).

6. Overview of stakeholders

Based on the IRF for Faecal Sludge Management (FSM) and Local Government Operation Act 2017, the major stakeholders for effective and sustaining service delivery in the municipality are as presented in Table 1.

Table 1: Overview of Stakeholders.

Key Stakeholders	Institutions / Organizations
Public Institutions at Federal Government	Ministry of Water Supply Department of Urban Development and Building Construction Nepal Water Supply Corporation Water Supply and Sanitation Division Office (WSSDO)
Public Institutions at Local Government	Banepa Municipality Office Kavre Valley Integrated Water Supply Project Nala Water Supply and Sanitation User's Committee
Non-governmental Organizations	Environment and Public Health Organization (ENPHO)
Private Sector	Public toilet operators
Development Partners, Donors	MuAN, BMGF, UCLG ASPAC

7. Credibility of data

The major data were collected from random household sampling. Altogether, 382 households and 57 institutions were surveyed from 14 wards of the municipality in 2022. Primary data on current sanitation practices in the municipality are triangulated from Key Informant Interviews (KIIs) with municipal officials, public toilet operators and water supply committee. The overall data and findings were shared with the stakeholders of the municipality and validated through a sharing program on 16 December 2022.

8. Process of SFD development

Data on sanitation situation were collected through household and institutional survey. The local enumerators from each wards of the municipality were trained on all aspects of sanitation service chain starting from user interface, containment, emptying, transport, treatment, end use or safe disposal of excreta and the use of mobile application; *KoboCollect* was used for collection of data from households and institutions. Moreover, KIIs were conducted with officers and the engineer of the municipality, public toilet operators, Office in-charge of Nepal Water Supply Corporation and officer of Kavre Valley Integrated Water Supply Project to understand the situation practices across the service chain. Types of sanitation technologies used in different locations were mapped using ARCGIS. To produce the Shit Flow Diagram (SFD) graphic, initially a relationship between sanitation technology used in questionnaire survey and Shit Flow Diagram Promotion Initiative (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:

- GON. (2021). National Population and Housing Census 2021. Government of Nepal, Office of the Prime Minister and Council of Ministers, National Statistics Office.
- Climate Data. (n.d.). Climate of Banepa. Retrieved from climate data.org: https://en.climate-data.org/asia/nepal/central-development-region/banepa-56656/
- MoWS. (2017a). Institutional and Regulatory Framework for Faecal Sludge Management in Urban Areas of Nepal. Kathmandu,Nepal: Ministry of Water Supply.
- MoWS. (2022a). Water Supply and Sanitation Act. Ministry of Water Supply; Government of Nepal.
- Nomadseason. (2022). Nomadseason. Retrieved from Climate in Banepa, Bagmati Province, Nepal: https://nomadseason.com/climate/nepal/bagmati-province/banepa.html

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Abbreviations

ABR	Anaerobic Baffle Reactor
ADB	Asian Development Bank
BOD	Biochemical Oxygen Demand
CFU	Colony Forming Unit
DEWATS	Decentralized Wastewater Treatment System
DUDBC	Department of Urban Development and Building Construction
DWSSM	Department of Water Supply and Sewerage Management
ENPHO	Environment and Public Health Organization
FRC	Free Residual Chlorine
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSTP	Faecal Sludge Treatment Plant
HH	Household
IRF	Institutional and Regulatory Framework
KII	Key Informant Interview
KVIWSP	Kavre Valley Integrated Water Supply Project
MoPPW	Ministry of Physical Planning and Works
MoUD	Ministry of Urban Development
MoWS	Ministry of Water Supply
MuAN	Municipal Association of Nepal
NGO	Non-Governmental Organization
NMICS	Nepal Multiple Indicator Cluster Survey
NPC	National Planning Commission
NUWSSSP	National Urban Water Supply and Sanitation Sector Policy
NWSSP	National Water Supply and Sanitation Policy
O&M	Operation and Maintenance
ODF	Open Defecation Free
RBTP	Reed Bed Treatment Plant
RWSSNP	Rural Water Supply and Sanitation National Policy
SDG	Sustainable Development Goal
SDP	Sector Development Plan
SFD PI	Shit Flow Diagram Promotion Initiative
SFD	Shit Flow Diagram
SN	Supernatant
UCLG ASPAC	United Cities and Local Governments Asia Pacific
UEIP	Urban Environmental Improvement Project

UNICEF	United Nations Children's Education Fund
WASH	Water, Sanitation and Hygiene
WSUC	Water Supply and Sanitation User's Committee

1 City context

Banepa Municipality is in Kavrepalanchok District, Bagmati Province of Nepal. It has 14 wards and covers the area of 54.59 sq km. It is surrounded by Panauti Municipality in the south, Mandandeupur Municipality in the north, Dhulikhel Municipality and Panchkhal Municipality in the east, and Bhaktapur District in the west. The municipality has urban and rural settlements. Particularly, ward numbers 7, 8 and 9 are core urban clusters, 5, 6 and 10 wards are urbanizing cluster and remaining wards are rural.

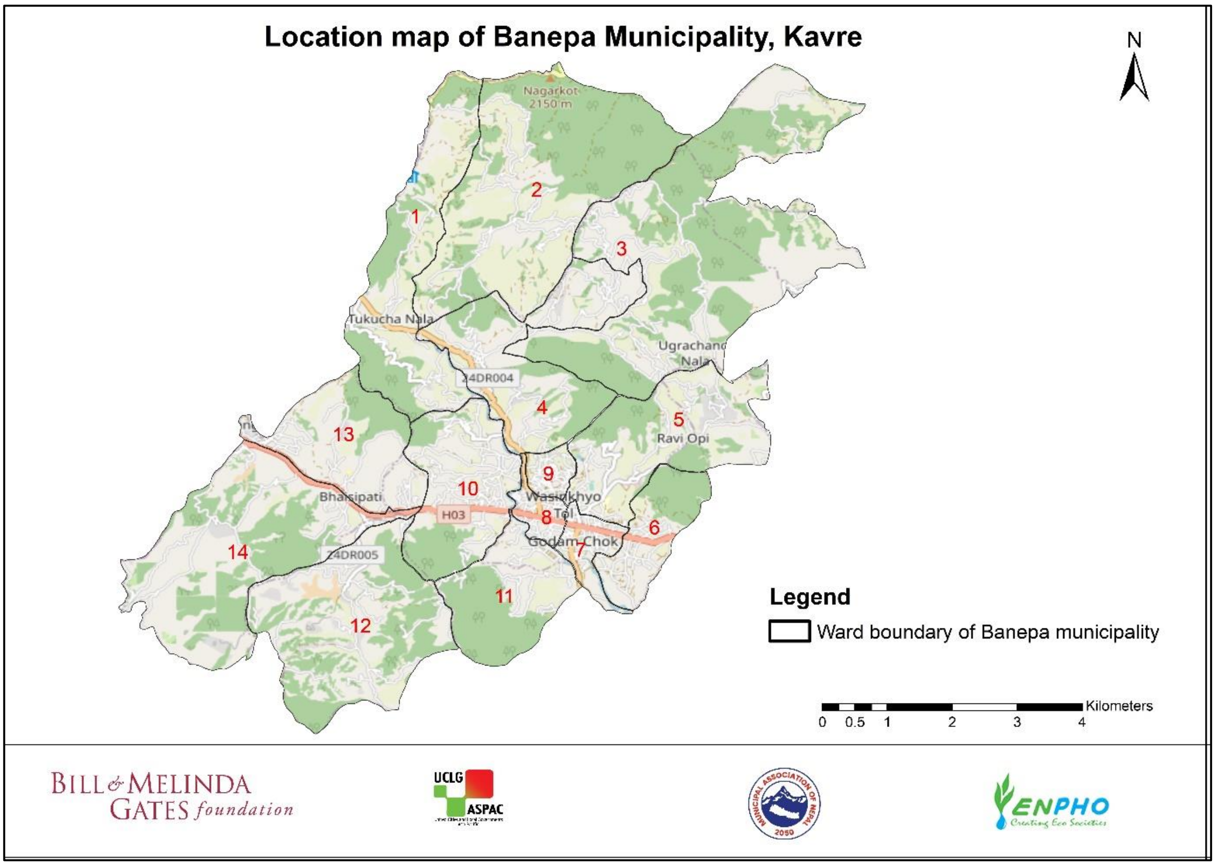

Figure 1: Map of Banepa municipality with ward boundaries.

1.1 Population

According to census 2021, Banepa Municipality has total population of 67,690 and 16,698 households. The total male and total female are 33,172 and 34,518. The population density of the municipality is 1,231 people per square kilometre (NPHC, 2021). The ratio of male to female population is 0.96. A ward number 7 has the highest population of 7,755 (3,809 male and 3,946 female), while ward number 11 has the least population with 2,268 (1,113 male and 1,155 female). Moreover, ward 10 has the highest number of households (1,997), while ward 2 has the least number of households (548).

1.2 Climate

The Banepa Municipality has a temperate climate with dry winters and warm summers. Under the Köppen–Geiger climate classification, Banepa features a subtropical highland climate (Climate Data, n.d.). The warmest months are June, July and August, with daily mean temperatures ranging from 21 °C to 22 °C. The coldest days usually occur in January, February, and December, when daily mean temperatures range from 8 °C to 10 °C. Temperatures typically range between 8 °C and 22 °C throughout the year. It usually has the most precipitation in June, July and August, with an average of 30 rainy days and 707 mm of precipitation per month. The average annual precipitation amounts to about 3,166 mm (Nomadseason, 2022).

1.3 Topography

Banepa Municipality is situated in the lesser Himalayan region (Chhetri M, 1993). It is located on 27° 37'47.24" N latitude and 85° 31' 16.97" E longitude. The elevation ranges between 1,400 meters to 1,800 meters above mean sea level (NSET, 2003). Punyamati and Chandeshwori khola are the major rivers in the municipality. Punyamati Khola runs through the north-west of the municipality whereas Chandeshwori Khola enters the municipality at the north -eastern side of the municipality. Both rivers meet at the southern side of the municipality.

The rock succession of Banepa has been subdivided into consolidated phyllite and metasandstone basement rocks and quaternary sediments (Chhetri M, 1993). The quaternary sediments consist of black carbonaceous lacustrine clay deposits and alluvial fine to coarse sand and gravel. Thick black carbonaceous clay indicates lacustrine deposit (Dill et al, 2003). The thickness of sediment ranges from 20 to 40 m, of which gravel, clay and sand individually approach up to 20m, 15m and 5m, respectively (Shrestha S , 2008).

2 Service Outcomes

2.1 Overview

The municipality was declared as an Open Defecation Free (ODF) Zone on 24th December 2018. The outcomes of the declaration were shifting of the unsanitary practices of open defecation towards regular and safe use of water shield toilet (KII_1, 2022). However, it was revealed that 1% of the households still lack access to improved sanitation facilities.

2.2 Sanitation Systems

Offsite sanitation refers to a sanitation system in which excreta (referred to as wastewater) is collected and transported away from the plot where they are generated. An offsite sanitation system relies on a sewer technology for transport (SuSanA, 2018) whereas onsite sanitation refers to a sanitation technology or sanitation system in which excreta (referred to as faecal sludge) is collected and stored and emptied from or treated on the plot where they are generated (SuSanA, 2018). The offsite sanitation system and onsite sanitation system is practiced by 39.8% and 60.2% of the households in the municipality. The proportion of households connected to piped sewer system in the Bagmati Province was 39.0% in 2019 (NIMCS, 2021).

2.2.1 Offsite sanitation System

The sewer networks in the core urban areas of the municipality were upgraded and improved under Urban Environmental Improvement Project (UEIP) by Department of Urban Development and Building Construction (DUDBC) under the Ministry of Physical Planning and Works (MoPPW) in 2006. The project laid altogether 8,026 metres and 330 metres of sewer network in the core urban area and Chandeshwori sub-system located in ward numbers 7, 8 and some parts of ward numbers 5, 9 and 10. Also, it replaced 1,983 metres of old sewer networks in the core urban area of the municipality (KII_1, 2022) (KII_2, 2022). River crossings were installed in eight sections of the sewer networks. Unfortunately, most of the river crossings have washed away or disconnected as shown in Figure 2.

Figure 2: Damaged and disconnected river crossings for sewer networks.

Similarly, it constructed three decentralized reedbed wastewater treatment plants (WWTPs). Wastewater treatment plant in Chandeshwori was constructed to treat wastewater conveyed from Chnadeshwori sub-system while two wastewater treatment plants in Budole and landfill site, the downstream of core urban areas, were constructed. Chandeshwori WWTP was designed for gravity flow system while the remaining two WWTPs were designed as uplift system to compensate difference in the elevation between sewer network and treatment site. Thus, pumping stations were built in Budole and Landfill site WWTPs. The component and capacity of these WWTPs is shown in Table 1.

Table 1: Capacity and units of wastewater treatment plants in Banepa Municipality.

S.N.	WWTP	Capacity (m3/day)	Preliminary Unit	Primary Unit	Secondary Unit
1.	Chandeswori	126	Bar Screen, Grit & Grease Chamber	Settler	Horizontal Constructed Wetland
2.	Budole	390	Bar Screen, Grit & Grease Chamber	Settler	Horizontal Constructed Wetland
3.	Landfill site	1172	Bar Screen, Grit & Grease Chamber	Settler	Horizontal Constructed Wetland

Figure 3 shows the overview of the municipality locating core urban area, Nala core community settlement and WWTPs.

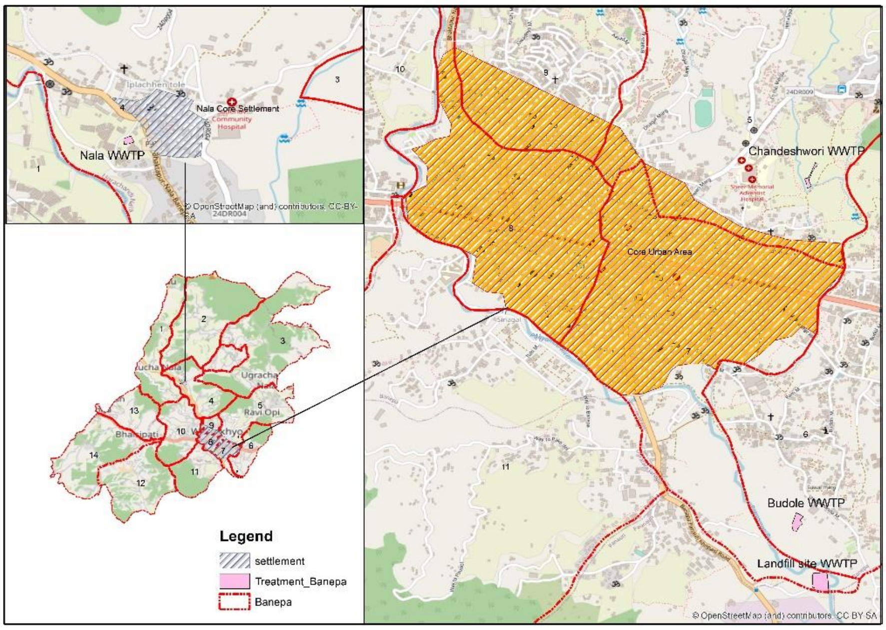

Figure 3: Overview of Banepa Municipality, core urban area and WWTPs.

Simplified sewer systems for conveying blackwater were developed in the core settlement of Nala by a separate village development committee. The sewer and WWTP were constructed through collaboration between community user group and national/ international non-government organizations. The major stakeholders were Swiss Federal Institute of Aquatic Science and Technology (EAWAG), UN Habitat, WaterAid, Center for Integrated Urban Development (CIUD) and Environment and Public Health Organization (ENPHO).

Current Status of WWTPs

Currently, none of the WWTPs constructed under the UEIP projects were functional. A WWTP at Chandeshwori was functional during the initial phase for approximately two years after the construction. However, after the disconnection of the sewer network to the WWTP at the river crossing the system was non-functional. Figure 4 shows the current physical overview of the WWTP at Chandeshowri.


Figure 4: A deserted settler, untrimmed and overgrown reeds in the constructed wetland in Chandeshwori WWTP.

WWTPs in Budole and landfill site never came to operation since its construction. Both the treatment plants lack pumping set. Also, after the damaged river crossing of the sewer networks, the wastewater is directly dumped into the Punyamata River. Figure 5 shows the overview of the wastewater treatment plants of Budole.


Figure 5: Overview of non-functional WWTPs in Budole and pumping station without pumping set.

The wastewater treatment in Nala is being operated and managed by Nala Water Supply and Sanitation User Community. Though the plant is functional, the community has been dealing with the overflow of wastewater in the plant. The connection of the graywater into the simplified sewer from the households led to overflow of wastewater in the plant exceeding its designed capacity. Figure 6 shows the overview of the wastewater treatment in Nala and overflow of wastewater in the constructed wetland.

Figure 6: Overview of Nala wastewater treatment plant and overflown constructed wetland.

2.2.2 *Onsite Sanitation System*

Containment

60.2% of the households in the municipality have onsite sanitation system. Figure 7 shows the households with onsite sanitation technologies with different types of containment. It shows that onsite sanitation systems do even exist in the core urban area with the facility of sewer network.

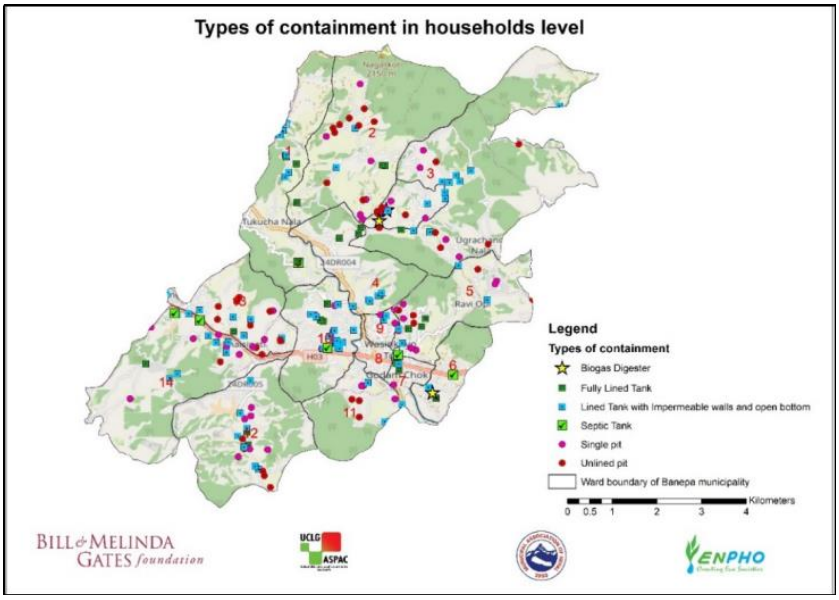

Figure 7: Map locating households with onsite sanitation technologies in Banepa Municipality.

Lined tanks with impermeable tanks and open bottom and fully lined tanks are installed in urban areas of the municipality while single pits and unlined pits are prevalent in the rural area of the municipality. Also, anaerobic biogas digesters and septic tanks have been installed in a few households.

An anaerobic biogas digester is a waste to energy conversion technology designed to treat faecal sludge along with organic solid waste and potential to produce biogas (Linda Strande, 2014). Almost 1.8% of the households have been using a biogas digester. A septic tank is a properly designed onsite sanitation technology with sealed wall and bottom having outlet for an effluent to discharged into an either soak pit or sewer network. It has been installed in 2.6% of households.

A fully lined tank is an onsite sanitation technology which is used to safely store faecal sludge. The walls and bottom of tank are totally lined and sealed. Lined tank with impermeable walls and open bottom is an onsite sanitation technology where the walls of the tank are lined, and the bottom of tank is not lined and allows infiltration of leachate. It is the most popular containment in the municipality.

Single pits are circular onsite technologies made by assembling pre-cast concrete rings one above another. There is no lining between the two rings and allows infiltration of effluents from walls and bottom. Out of the 60.2% of the households that have an onsite sanitation system, 24.6% of the households have such types of pits installed. An unlined pit is a containment constructed with mud mortar stone or brick wall or dry-stone walls with open bottom. 20.2% of the households have constructed unlined pits.

Figure 8 shows the percentage of households with onsite sanitation technologies with different types of containment in the municipality.

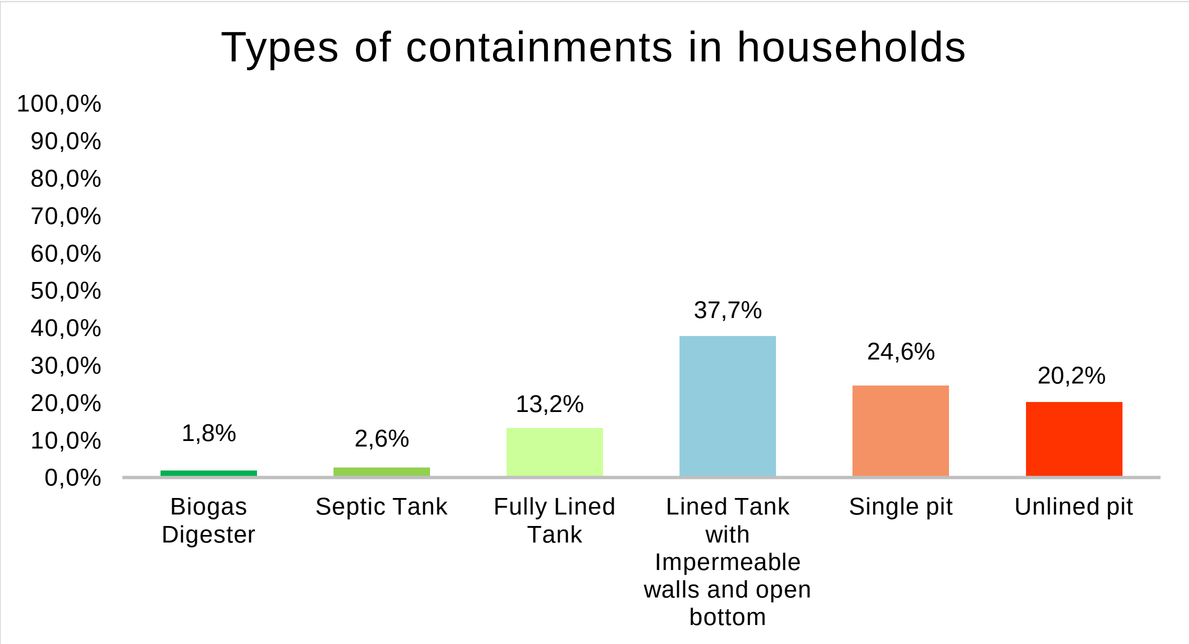

Figure 8: Types of containment in households in Banepa Municipality.

Furthermore, 11.7% and 9% of households having fully lined tanks and lined tanks with impermeable walls and open bottom in the core urban area of the municipality have connected effluent into sewer network.

Emptying and Transport

Emptying and transporting of faecal sludge is an essential service for proper functioning of onsite sanitation technologies (Linda Strande, 2014). 38.36% of the households in the municipality have emptied the containments at least once since the containment was used. Among them, 53.7% of households have emptied their containment manually and 28.75% have directly discharged or disposed of the faecal sludge into the open environment during rainy season. Both self-manual emptying and direct disposal into environment can lead to direct exposure of person involved in emptying activities to pathogens (WHO, 2018). The remaining 17.5% have emptied their containment mechanically. A municipal desludging service from Dhulikhel Municipality and Panauti Municipality and private sector from Kathmandu valley is providing desluding services in the municipality (KII_1, 2022).

Treatment and Disposal

Manually emptied faecal sludge from the containment is disposed of into a compost pit except those practising direct discharged into water bodies or open ground. Composting is the biological decomposition of organic matter; naturally degrades organic matter into dark and humus-like matter that can be used as a soil amendment (Linda Strande, 2014). At least two months of composting is essential to deactivate helminth eggs for safe use of the compost (Cofie and Kone, 2009). However, in the municipality, the faecal sludge emptied is mixed in the organic solid waste without following any precautions or proper method.

Also, direct application of faecal sludge in farmland is observed in the municipality. The practice of direct application of faecal sludge in the farmland has a potential health hazard (Cofie et. al., 2005). The direct use of faecal sludge has the highest level of risk for human health, therefore not recommended to practice it (Linda Strande, 2014). Whereas the fate of mechanically desludged faecal sludge from neighbouring municipalities and private sector from the Kathmandu Valley is unknown.

2.2.3 Sanitation System in Institutional Building

The institutional buildings located in the core urban area of the municipality have connected waste from the toilet into sewer network. Thus, 21 out of 57 institutions surveyed have their toilet connected to a decentralized combined sewer system while 36 institutional buildings have onsite sanitation systems. The lined tank with impermeable walls and open bottom is the popular onsite sanitation technology in institutions of the municipality. Figure 9 shows the different sanitation technologies available in the institutions of Banepa Municipality.

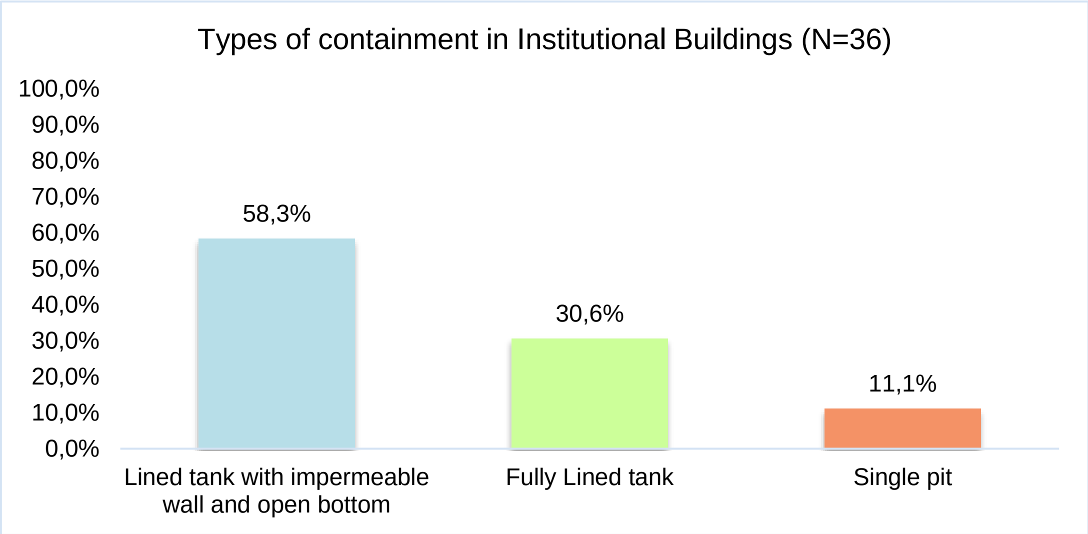

Figure 9: Types of containment in institutional building.

Figure 10 shows a map the sanitation system and technologies in institutional buildings in the municipality.

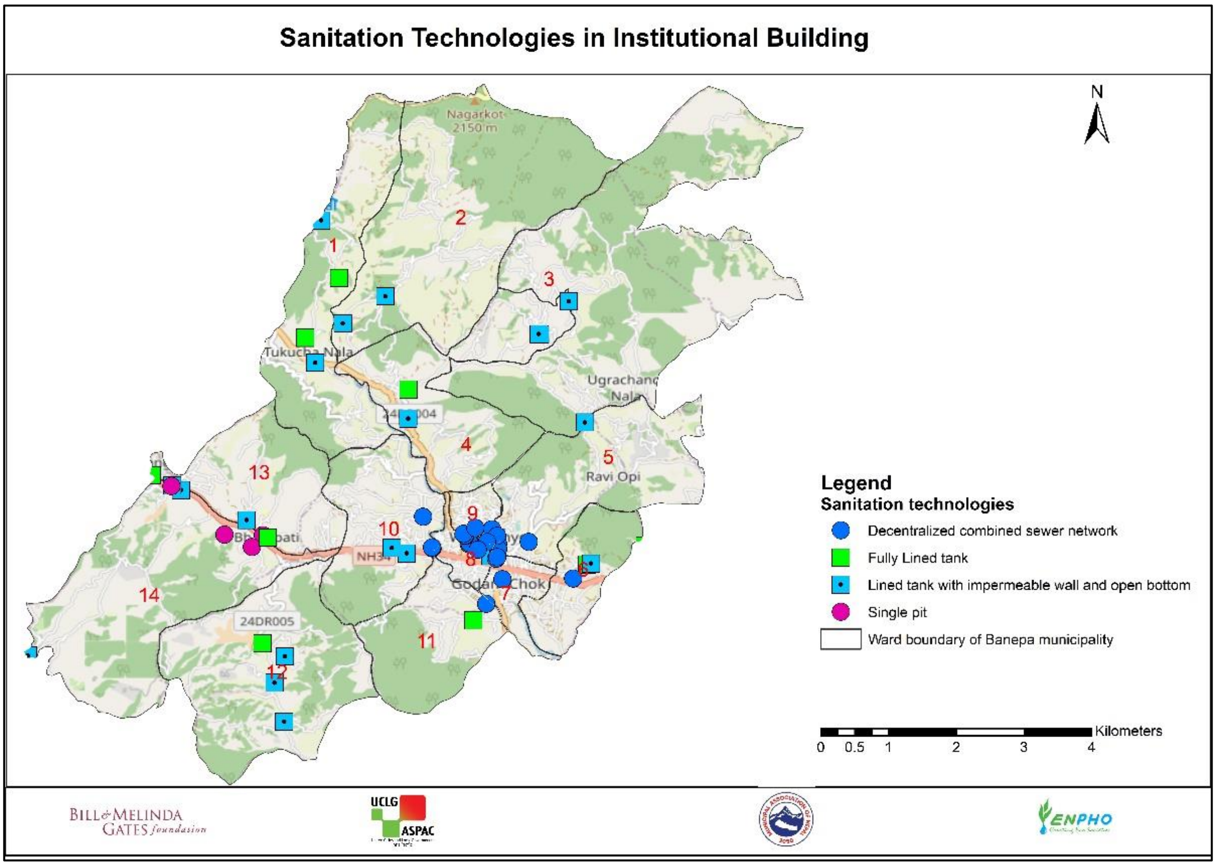

Figure 10: Map locating institutional building with types of sanitation systems and technologies.

2.2.4 Public Toilets

There are four public toilets being operated in the municipality. Three public toilets are located at the Buspark area while one public toilet lies at market area. A public toilet of Chardobato market area was constructed and operated by private sector.

Public Toilet in Buspark area

Three public toilets in Buspark area were constructed by municipality and leased to private sector for its daily operation and maintenance. However, only two out of three public toilets were operated regularly. Although the toilets were connected to the sewer system, there is an issue with overflowing during the rainy season. The water in the public toilet is supplied by piped water supply managed by Nepal Water Supply Corporation (NWSC) but water supply is not regular. Figure 10 shows operational public toilets in the Buspark area.

Figure 11: Public toilets in Banepa Buspark area.

2.3 SFD Matrix

2.3.1 SFD Selection Grid

The SFD selection grid consists of the types of containment technologies in vertical column in List A, while top horizontal row (List B) consists of a list where each of containment technologies are connected to. The existing containment technology was classified to fit in the SFD grid.

Prior to selection of containment technologies, single pits constructed by assembling pre-cast concrete rings one above another is categorized as lined pit with semi-permeable walls and open bottom. Also, anaerobic biogas digester is categorized as a fully lined tank, which is regularly emptied and treated, as the technology is capable of treating the Faecal Sludge (FS).

The various types of sanitation technologies selected for the SFD graphic generator are shown in the SFD selection grid, as shown in Figure 12 and explained in Table 2.

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			T1A1C3	T1A1C4	Significant risk of GW pollution Low risk of GW pollution	T1A1C6	T1A1C7	T1A1C8		Not Applicable
Septic tank			T1A2C3		Significant risk of GW pollution Low risk of GW pollution	T1A2C6				
Fully lined tank (sealed)			T1A3C3		Significant risk of GW pollution Low risk of GW pollution	T1A3C6		T1A3C8		T1A3C10
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	T2A4C3 T1A4C3	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	T1A4C6		T1A4C8		T2A4C10 T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									T2A5C10 T1A5C10
Unlined pit										T2A6C10 T1A6C10
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution 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 12: SFD selection grid of Banepa Municipality.

Table 2: Explanation of different variables and containment technologies selected in the SFD selection grid (SuSanA, 2018).

SN	Variables	Explanation
1	T1A1C3	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning decentralised combined sewer All the excreta in this system is considered contained.
2	T1A1C4	This is a fully functioning toilet discharging directly to a correctly designed, properly constructed, fully functioning decentralised foul/separate sewer. All the excreta in this system is considered contained.
3	T1A1C6	A fully functioning toilet discharging directly to an open drain or storm sewer. All the excreta in this system is considered not contained.
4	T1A1C7	A fully functioning toilet discharging directly to a water body. All the excreta in this system is considered not contained.
5	T1A1C8	This is a fully functioning toilet discharging directly to open ground. The excreta is raw, untreated and hazardous and since it discharges directly to open ground. All the excreta in this system is considered not contained.
6	T1A2C3	This is a correctly designed, properly constructed, fully functioning septic tank with an effluent outlet connected to a correctly designed, properly constructed, fully functioning decentralised combined sewer. The supernatant/effluent flowing from the tank is only partially treated and is still hazardous, but since it is captured in the sewer, all the excreta in this system is considered contained.

7	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.
8	T1A3C3	This is a correctly designed, properly constructed and well maintained fully lined tank with impermeable walls and base. Since the tank is fitted with a supernatant/effluent overflow connected to a correctly designed, properly constructed and fully functioning decentralised combined sewer, the excreta in this system is considered contained.
9	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 are considered not contained.
10	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.
11	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.
12	T1A4C3	This is 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 a decentralised combined sewer, the excreta in this system is considered contained.
13	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.
14	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.
15	T1A4C10	This is a correctly designed, properly constructed and well maintained lined tank with sealed, impermeable walls and an open, through which infiltration can occur. Since there is not a 'significant risk' of groundwater pollution, the excreta of this system are considered contained.
16	T1A5C10	This is 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.
17	T1A6C10	This is a correctly designed, properly constructed and well maintained unlined pit with permeable walls and base, through which infiltration can occur. The tank is not fitted with a supernatant/effluent overflow so this system is considered contained.
18	T1B11 C7 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.
19	T2A4C3	This is 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 tank is fitted with a supernatant/effluent overflow connected to decentralized combined sewer but since there is a 'significant risk' of groundwater pollution, all the excreta in this system is considered not contained
20	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.
21	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.
22	T2A6C10	A correctly designed, properly constructed and well maintained unlined pit with permeable walls and 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.

2.3.2 *Risk of Groundwater Pollution*

The risk of water pollution was assessed based on the 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.

Sources of Drinking Water

Nepal Water Supply Corporation (NWSC) is the major water supply service provider in the municipality. It is a public utility organization under the Ministry of Water Supply (MoWS). It has been providing water to 2,800 households of core urban area of the municipality. It supplies water from four water supply networks via Chandeshwori, Old Dhaneshwore, New Dhaneshwor and Sashipani network. All these network tap water from spring and stream sources, collect in reservoirs in respective schemes and distribute to different areas of the municipality (DUDBC, 2009). Figure 13 shows the sedimentation tank in one of the water supply network operated by NWSC (KII_3, 2022). Water supply in the unserved area by NWSC is provided by Water Supply and Sanitation User's Committee (WSUC). WSUCs are operating water supply schemes in Chamunda, Tusal, Kodar Chunatal, Nala, Magar Samuha, Itapu, and Rautgaun.

Figure 13: Sedimentation unit in water supply schemes operated by NWSC.

Besides, Kavre Valley Integrated Water Supply Project (KVIWSP) is being implemented through Secondary Towns Integrated Urban Environmental Improvement Project (STIUEIP). The major objective of the KVIWSP is to improve the water supply system in the three cities of Banepa, Panauti and Dhulikhel municipalities. As a combined water supply scheme for the three municipalities, the scheme is considering extracting water from Roshi Khola and its tributaries, such as Khar Khola, Gudgude Khola, Bairamahadev Kholsi, and Shishakhani Kholsi. 90% of the work has been completed, and the supply of water will be regular and sufficient to meet the needs of the present population after the implementation of the project (KII_5, 2022). Figure 14 shows the slow sand filtration unit constructed under KVIWSP.

Figure 14: Overview of slow sand filter unit in water supply system developed under KVIWSP.

The household survey shows that 62% of the households rely on piped drinking water supply either operated by NWSC or WSUCs. While 24% of households have tapped nearby spring sources to fulfil the water requirement. Also, 12% of the households depend on bottled water and private water vendor as shown in Figure 15.

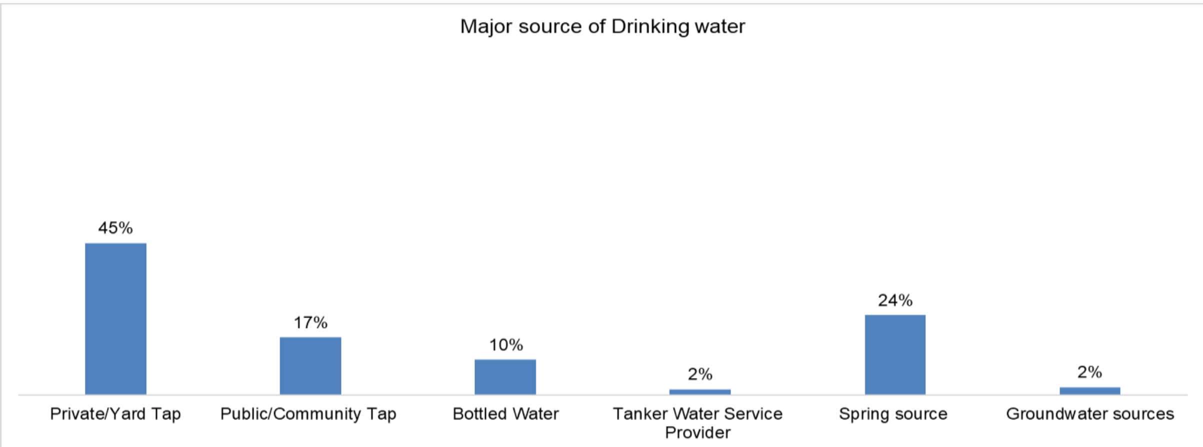

Figure 15: Major sources of drinking water as reported in the household survey.

Quality of Drinking Water

The capacity assessment and benchmarking of water services providers on 2016 conducted by Ministry of Water Supply and Sanitation has reported none of the sources of water tapped by NWSC, Banepa Branch comply the National Drinking Water Quality Standard (NDWQS). All five samples from the source were contaminated with *E. coli*. Also, no Free Residual Chlorine (FRC) was detected in samples from the taps (MoWS, 2016). This indicates a risk of health hazard upon consumption of water distributed from piped drinking water supply from NWSC, Banepa Branch.

A similar result was obtained during water quality assessment by Banepa Municipality during 2022. The unpublished water quality report shows that one out of two water samples from the sources was contaminated with *E. coli*. None of the samples from the taps shows presence of FRC and all the samples were contaminated while the water samples from private vendor comply NDWQS. This implies that there is risk with water pollution in the source. However, the presence of the *E. coli* is within low to medium risk category as per the WHO guideline. Thus, in the SFD graphic, households consuming direct spring sources and groundwater from depth lower than 80 feet (24.3 m) are considered as having significant risk to water pollution. Table 3 shows the data of water quality testing from the different sources and locations of the municipality conducted by Banepa Municipality.

Table 3: Water Quality Testing Report.

SN	Sample Site	Water Quality Testing Result				
		Turbidity (NTU)	Temperature (ºC)	pH	FRC	*E. coli* (CFU)
1	Banepa Layaku -Source water	5	26.5	7.7	ND	Nil
2	Banepa Chandeshwor-Source water	5	25.5	7.7	ND	13
3	Reservoir water	5	26	6.8	ND	Nil
4	Pulbazar- tap water	5	24.8	7.4	ND	27
5	Banepal Layaku- Tap water	5	25.2	7.6	ND	7
6	Banepa Chandeshwor - Tap water	5	25.6	7.1	ND	45
7	Gaurishankar Khane Pani Udhog Filter	5	25.4	6.9	ND	Nil
8	Ugratara Janagal Gaurishankar Khane Pani Udhog	5	26	6.9	ND	Nil

Source: Banepa Municipality, 2022 (unpublished data)

2.3.3 Proportion of the contents of each type of onsite container which is faecal sludge

A detailed instruction from the SFD PI was used as guide to calculate the proportion of the contents of each type of onsite container which is faecal sludge. It stated that the default "100%" value should be used where onsite containers are connected to soak pits, to water bodies or to open ground.

This 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 faecal sludge proportion calculation is shown below:

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

2.3.4 SFD matrix

SFD matrix is a table which contains the means to calculate the variables for each of the sanitation systems chosen in the SFD selection grid. It comprises of list of possible containment technologies in the first column and list of all possible places to which the containment technology could be connected in the top rows. Figure 16 shows the SFD matrix of Banepa Municipality.

Banepa Municipality, Bagmati, Nepal, 1 Dec 2022. SFD Level: 2 - Intermediate SFD
Population: 67690
Proportion of tanks: septic tanks: 50%, fully lined tanks: 85%, lined, open bottom tanks: 93%

Containment												
System type	Population	WW transport	WW treatment	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment	SN transport	SN treatment
	Pop	W4b	W5b	W4c	W5c	F3	F4	F5	S4d	S5d	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in sewer system, which is delivered to decentralised treatment plants	Proportion of wastewater delivered to decentralised treatment plants, which is treated	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in sewer system, which is delivered to treatment plants	Proportion of supernatant in sewer system that is 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
T1A1C3 Toilet discharges directly to a decentralised combined sewer	36.6	0.0	0.0									
T1A1C4 Toilet discharges directly to a decentralised foul/separate sewer	1.1	100.0	100.0									
T1A1C6 Toilet discharges directly to open drain or storm sewer	0.8			0.0	0.0							
T1A1C7 Toilet discharges directly to water body	0.5											
T1A1C8 Toilet discharges directly to open ground	0.5											
T1A2C3 Septic tank connected to a decentralised combined sewer	0.5					89.0	0.0	0.0	0.0	0.0		
T1A2C6 Septic tank connected to open drain or storm sewer	1.0					22.3	0.0	0.0			0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	5.2					31.2	57.1	100.0				
T1A3C3 Fully lined tank (sealed) connected to a decentralised combined sewer	1.0					44.5	0.0	0.0	0.0	0.0		
T1A3C6 Fully lined tank (sealed) connected to an open drain or storm sewer	1.6					59.3	0.0	0.0			0.0	0.0
T1A3C8 Fully lined tank (sealed) connected to open ground	1.0					89.0	0.0	0.0				
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	6.0					29.7	0.0	0.0				
T1A4C3 Lined tank with impermeable walls and open bottom, connected to decentralised combined sewer	0.8					29.7	0.0	0.0	0.0	0.0		
T1A4C6 Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	5.2					37.5	0.0	0.0			0.0	0.0
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	3.9					29.7	0.0	0.0				
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	6.0					26.0	0.0	0.0				
T1A6C10 Unlined pit, no outlet or overflow	5.2					35.6	0.0	0.0				
T1B11 C7 TO C9 Open defecation	1.0											
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.0					24.3	0.0	0.0				
T2A4C3 Lined tank with impermeable walls and open bottom, connected to a decentralised combined sewer, where there is a 'significant risk' of groundwater pollution	0.8					59.3	0.0	0.0			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	8.5					36.2	0.0	0.0				
T2A6C10 Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.8					24.0	0.0	0.0				

Figure 16: SFD matrix of Banepa Municipality.

2.3.5 *Calculation of proportion of FS in each containment*

The proportion of FS in septic tanks was set to 50%, the proportion of FS in fully lined tanks was set to 85% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 93% according to the relative proportions of the systems in the municipality, as per the guidance provided by SuSanA.

2.3.6 *Calculation of proportion of FS emptied from containment (Variable F3)*

In average, 89% of total faecal sludge from the containment is emptied during emptying mechanism as per household survey conducted. Thus, actual emptied proportion of faecal sludge was taken as 89% of the emptied containment. Hence, the proportion of FS emptied from the sanitation technology is calculated as 89% on the sanitation technology emptied. Table 4 shows the calculation of variable F3.

Table 4: Actual emptying proportion for existing containment technologies.

SN	SFD Reference Variable	Containment Technologies	Percentage of emptied containment	Emptied proportion of FS	Actual proportion of emptied FS (F3)
1	T1A2C3	Septic tank connected to a decentralised combined sewer	100.0%	89%	89.0%
2	T1A2C6	Septic tank connected to open drain or storm sewer	25.0%	89%	22.3%
3	T1A3C3	Fully lined tank (sealed) connected to a decentralised combined sewer	50.0%	89%	44.5%
4	T1A3C6	Fully lined tank (sealed) connected to an open drain or storm	66.6%	89%	59.3%
5	T1A3C8	Fully lined tank (sealed) connected to open ground	100.0%	89%	89.0%
6	T1A3C10	Fully lined tank (sealed), no outlet or overflow	35.0%	89%	31.2%
7	T1A4C3	Lined tank with impermeable walls and open bottom, connected to decentralized combined sewer	33.3%	89%	29.7%
8	T1A4C6	Lined tank with impermeable walls and open bottom, connected to an open drain or storm sewer	42.1%	89%	37.5%
9	T1A4C8	Lined tank with impermeable walls and open bottom, connected to open ground	33.3%	89%	29.7%
10	T1A4C10	Lined tank with impermeable walls and open bottom, no outlet or overflow	33.3%	89%	29.7%
11	T1A5C10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow	29.1%	89%	26.0%
12	T1A6C10	Unlined pit, no outlet or overflow	40.0%	89%	35.6%

13	T2A4C3	Lined tank with impermeable walls and open bottom, connected to a decentralised combined sewer, where there is a 'significant risk' of groundwater pollution	66.6%	89%	59.3%
14	T2A4C10	Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	27.3%	89%	24.3%
15	T2A5C10	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	40.6%	89%	36.2%
16	T2A6C10	Unlined pit, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	26.9%	89%	24.0%

2.3.7 Calculation of proportion of wastewater in sewer system, which is delivered to treatment plant

There are four WWTPs in the Banepa Municipality. Decentralized Wastewater Treatment System (DEWATS) of Nala has received the wastewater from core areas of Nala Bazar, Ward 4 of the municipality. The toilets from that area have been connected to the simplified sewer network which delivers the wastewater into the DEWATS. It has been operated regularly by Nala Water supply and Sanitation Committee. Thus, 100% of the wastewater obtained from that area has been assumed as treated. Thus, both values for variables W4b and W5b have been set to 100% (system T1A1C4).

There is a decentralized combined sewer system for ward 5, 6, 7, 8, 9 and 10. Initially, it was connected to a wastewater treatment plant at Chandeshwori, Budol downstream and landfill site. However, the treatment plant of the Chandeshwori, Budol downstream and Ratmate are not receiving wastewater. Due to breakage of sewer networks, the wastewater has been diverted directly to Punyamata and Chandeshwari River. Thus, the proportion of wastewater in the sewer system delivered to treatment plant (W4b) for system T1A1C3 is assumed as 0% based on the household survey and the Key Informant Interviews (KIIs) with stakeholders (KII_1 and KII_2, 2022).

Wastewater treatment plant is not functional because of operational and technical challenges. A WWTP located in Chandeshwori was functional at the initial period but currently, the sewer network is disconnected and wastewater is disposed of in the nearby stream due to lack of proper monitoring. While the WWTPs of Budole and the landfill site near Shrikandapur were never operated as a result of the elevation difference between the WWTPs and the sewer networks in addition to the destruction of the pumping system due to flooding events. Thus, the proportion of wastewater delivered to decentralised treatment plants (system T1A1C3), which is treated (W5b) was considered as 0%.

Furthermore, the containments which have been connected to open drain of ward 7 and 8 discharge directly to Punyamata River. Thus, the proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants and treated has been both assumed as 0%. This is for variables W4c and W5c for system T1A1C6, variables S4d and S5d for systems T1A2C3, T1A3C3, T1A4C3 and variables S4e and S5e for systems T1A2C6, T1A3C6, T1A4C6 and T2A4C3.

2.3.8 Calculation of FS emptied delivered to treatment plant and treated (Variables F4 and F5)

The emptied faecal sludge from improved containments and buried in a covered pit is classified as ‘safely disposed in situ’ and meets the SDG criteria for a ‘safely managed’ sanitation service (CBS, 2020). However, the traditional practice of composting and dig and bury of the FS after emptying in the municipality is not considered to be as a safely practice of managing emptied faecal sludge, as stated in section 2.1.5. Moreover, there are no designated place for Faecal Sludge Treatment Plant (FSTP) within the municipality and the desluding service providers dispose of the faecal sludge into the landfill site, agriculture land and forest area untreated. The desluding service providers from Dhulikhel Municipality have disposed of the faecal sludge in the solid waste landfill site (Jagam Shrestha, 2020). The Shankharapur treatment plant of Dhulikhel municipality near the landfill site is still under construction.

1% of households in the municipality have been using biogas digesters which have been modelled as a fully lined tank (sealed) containment while preparing the SFD graphic (system T1A3C10). The cow dung has been fed into a $4m^3$ and $6m^3$ capacity digester to mix with faecal sludge for biogas production. The home biogas reactors are small on-site waste systems that use a process called anaerobic and replace conventional septic systems (Water Online, 2015). Among them, 31.2% of the emptied fully lined tank with no outlet (F3 = 31.2%) and then 57.1% of the containment (biogas digester) have been producing the biogas (F4 = 57.1%). Thus, 100% of the households who have been using biogas digester has been considered as treated (F5 = 100%).

2.4 SFD Graphic

Figure 17 represents the fate and flow of wastewater (WW), faecal sludge and supernatant through each sanitation service chain. It shows that WW and FS generated from 19% of the population is safely managed represented by “Green” colour arrowhead. However, 17% resembles the FS stored in the containment without significant risk to groundwater pollution. Thus, the safely managed percentage of FS generated by 17% of the population is temporary until the FS from the containment is emptied. 1% of wastewater has been treated in DEWATS and 1% of the population have treated the FS using biogas digesters.

The WW, FS and supernatant from 81% of the population is unsafely managed, represented by “Red” arrow heads. The percentage of unsafely managed is generated from WW not delivered to treatment plant (38%), FS from containments where FS is not contained - not emptied (23%), openly dumped FS emptied (17%) which is disposed of untreated in the environment, supernatant not delivered to treatment (2%) and people practising open defecation (1%).

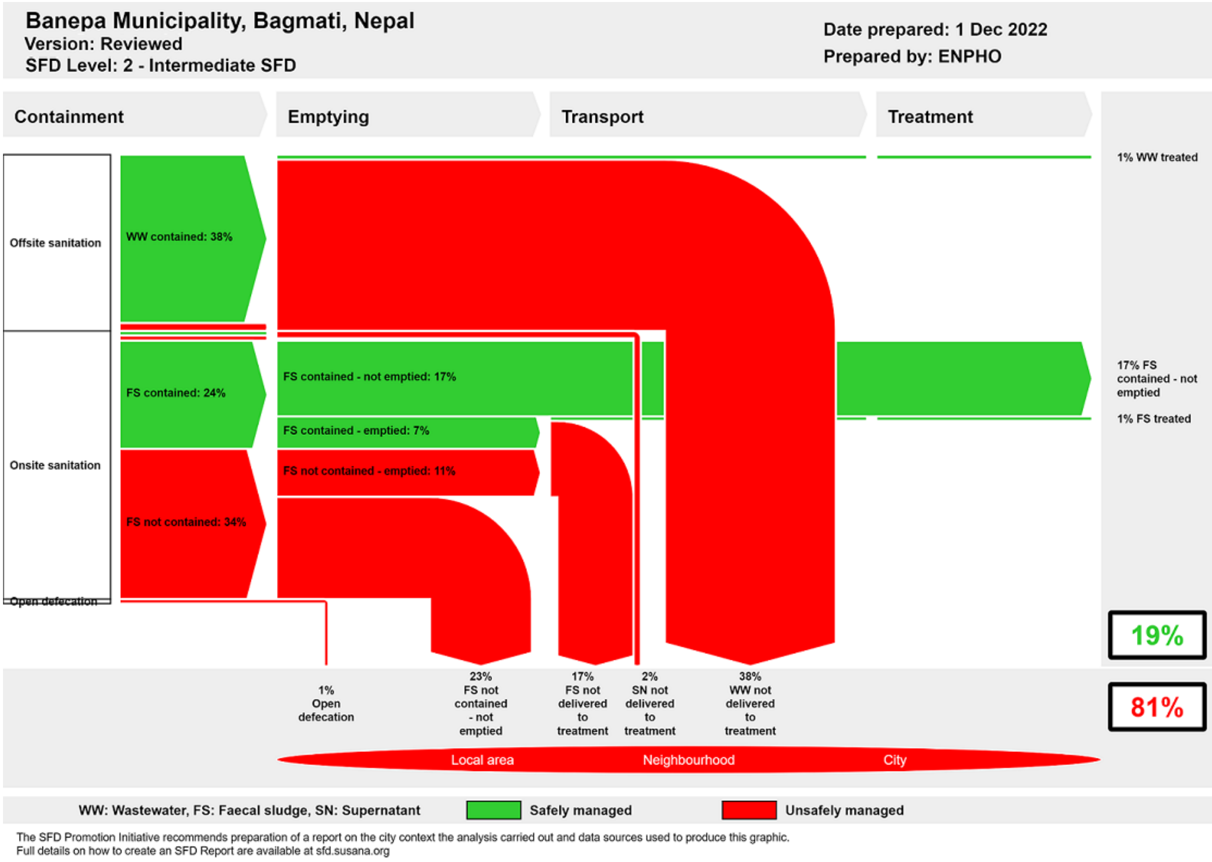

Figure 17: SFD graphic of Banepa Municipality.

2.4.1 Offsite Sanitation System

39.8% of the population in Banepa Municipality is relying on offsite sanitation system. Among those, 38% of the population have connected toilets to a sewer system while 1.8% of the population have discharged wastewater directly to open drain, water resources and open environment. 38% of the population have disposed wastewater to Punyamati River and Chandeshwari River near their houses in the city. Only 1% of the wastewater reached to treatment plant have been treated at Nala DEWATS.

2.4.2 Onsite Sanitation

60.2% of the population with access to toilets relies on onsite sanitation systems. As shown on the SFD Graphic (Figure 17), it is estimated that 24% of the population uses systems where the FS is considered contained, while 34% 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 septic tanks connected to a decentralised combined sewer (T1A2C3), fully lined tanks (sealed) connected to a decentralised combined sewer (T1A3C3), fully lined tanks (sealed), no outlet or overflow (T1A3C10), lined tanks with impermeable walls and open bottom, connected to decentralised combined sewer (T1A4C3), lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10), lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10) and unlined pits, no outlet or overflow (T1A6C10). Thus, the FS generated by 24% 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 an open drain (T1A3C6), fully lined tanks connected to an open ground (T1A3C8), lined tanks with impermeable walls and open bottom, connected to open drain (T1A4C6), lined tanks with impermeable walls and open bottom, connected to open ground (T1A4C8), lined tanks with impermeable walls and open bottom with no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A4C10), lined tanks with impermeable walls and open bottom, connected to a decentralized combined sewer, where there is a 'significant risk' of groundwater pollution (T2A4C3), lined pits with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A5C10) and unlined pits, no outlet or overflow, where there is a 'significant risk' of groundwater pollution (T2A6C10). Thus, the FS generated by 34% of the population is considered not contained.

2.4.3 Open Defecation

The Banepa Municipality was declared as an open defecation free municipality in 2018. However, 1% of the households are practising defecation at open environment. The toilets have not been constructed because of their extremely low economic status (KII_1, 2022).

3 Service Delivery Context

3.1 Policy, Legislation and Regulation

3.1.1 Policy

The Constitution of Nepal 2015 in Article 35 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 recognizes that every person shall have the right to live in a healthy and clean environment (GoN, 2015). To respect, promote and fulfill the provisions related to right on water and sanitation, Government of Nepal (GoN) has passed Drinking Water and Sanitation Act in 2022 through Ministry of Water Supply. The act elaborates right to clean water as to receive affordable, sufficient, and quality drinking water regularly as well as access to sanitation as affordable access to quality sanitation services (MoWS, 2022a).

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 in the marginalized and vulnerable groups. Participatory approach, community leadership project development, optimization of local resources and installation of locally appropriate technologies were major principles in the policy (DWSSM, 2004). However, it was unable to address the complex operational issue of urban water supply and sanitation service delivery (DWSSM, 2009). Thus, 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. Cost recovery principles, public private partnership, and sector effectiveness for improved service delivery are key principles of the policy (DWSSM, 2009). Both these policies were limited to addressing emerging issues and challenges in the rural and urban areas. Thus, National Water Supply and Sanitation Policy (NWSSP) was formulated in 2014 by the 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.

Recently, National Water, Sanitation and Hygiene Policy, 2022 has been drafted and undergone the process for endorsement. The draft policy is updated policy till date which has included the wide range of the sanitation services including treatment, reuse/ safe disposal of faecal sludge / wastewater. It emphasizes on the preparation of the municipal level Water

Sanitation and Hygiene (WASH) plan with the local leadership to ensure the WASH services for all (MoWS, 2022b).

Nepal is a signatory of the historical resolution of 2010 United Nations General Assembly on the Human Right to Water and Sanitation (UNGA, 2010). Nepal committed to Millennium Development Goals (MDGs) for 2000- 2015. The 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 setup 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 (FSM) in the sector for effective planning, implementation, and service delivery. In alignment, 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 FSM. It is framed upon existing laws such as Environmental Protection Act (2019) and Environmental Protection Rules (2020), Self-Local Governance Act and Rules 1999, Environmental Standards on Effluent Discharge 2000, Nepal National Building Code 2003, and Land Acquisition Act amendment 2010 (MoWS, 2017a). 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 Water and Sanitation Users Committee (WSUC) in the framework reflects a participatory approach that would help in sustaining the interventions.

The constitution of Nepal has provided the right for local government to form acts, rules and regulation based on the national policies and laws. Local Governance Operation Act 2017 has been formed to implement the right of local government and promote co-operation, co-existence, and co-ordination among federal, provincial, and local government. The act has mentioned the right, roles and responsibility of municipalities along with provision and procedure for approving laws and regulations at local level.

Banepa municipal council has prepared the Water Supply and Sanitation Users' Committee Management Procedure, 2020 to ensure the access to safe drinking water for all people in the municipality. It provides the procedure for the formation of water supply and sanitation user's committee in municipal level to provide the services in the community (Banepa Municipality, 2020).

3.1.2. 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 Level

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 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 18.

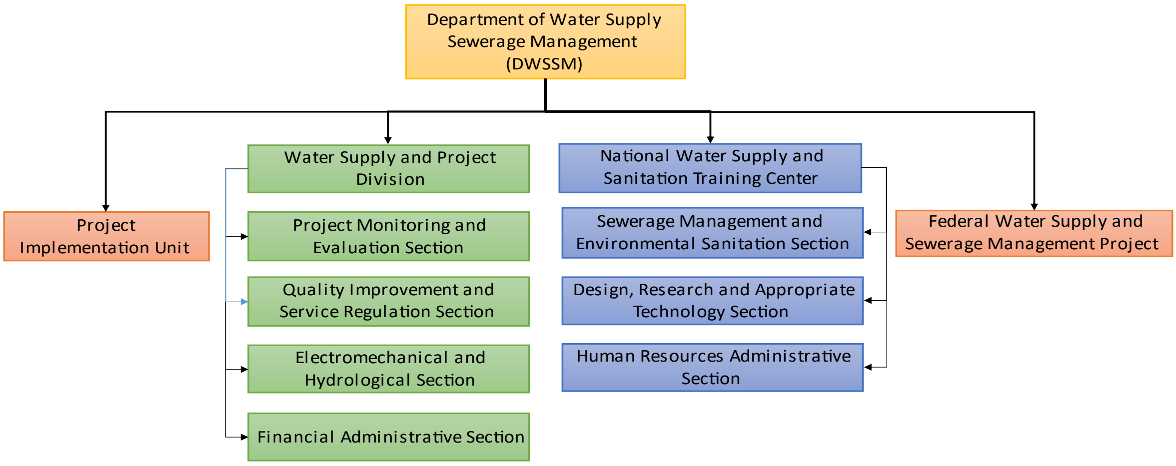

Figure 18: Organizational Structure Department of Water Supply and Sewerage Management.

Ministry of Urban Development: The Ministry of Urban Development (MoUD) works on integrated urban planning and development in municipalities, including faecal sludge management. DUDBC under MoUD is implementing body and sets standards for safe, affordable building construction and implementation for managed residential environment.

At Provincial Level

Ministry of Water Supply, Energy and Irrigation (MoWSEI): MoWSEI of provincial government in Bagmati is major executing body in the province. Planning and implementation of water supply and sanitation infrastructure is the province is executed through Water Supply and Sanitation Divisional Office (WSSDO). WSSDO implements the water and sanitation programs meeting the following criteria:

- Inter local government projects
- 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.

There is no separate section or unit of water supply and sanitation management till date in Banepa Municipality. Water and sanitation related activities has been performed by the administration unit (KII_1, 2022).

3.1.3. Service Standards

The sanitation service standards have been 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 5. However, FSM specific standards have yet to be developed and implemented.

Table 5: 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

Key Informant Interviews (KIIs) are qualitative in-depth interviews with people who know what is going on in the community. The purpose of KIIS is to collect information from a wide range of people who have first-hand knowledge about the concerned topic. KIIs were conducted with environment and sanitation related stakeholders. The KIIs were conducted with municipal officials, local elected bodies, water supply service provider, and public toilet service provider. The face-to-face interview was conducted and called after the interview to get more required information. The information was collected with key stakeholders about the status of sanitation services and water supply schemes. List of key informant stakeholders from the municipalities along with their organization and purpose are as shown in Table 6. Pictures of the KIIs conducted are shown in Figure 19.

Table 6: List of key stakeholders for KIIs.

KII code	Name	Designation	Organization	Purpose	Date
KII-1	Dhurba Raj Nepal	Administrative Officer	Banepa Municipality	Sanitation Status of Banepa Municipality	6 September, 2022
KII-2	Ram Sundar Bade	Sub Engineer	Banepa Municipality	Water supply, coverage, treatment	7 September, 2022
KII-3	Ram Chandra Lamichhane	Office in-charge	Nepal Water Supply Corporation	Water supply, coverage, treatment, water quality	7 September, 2022
KII-4	Mahendra Tamang	Public toilet operator		Status of public toilet	7 September, 2022
KII-5	Shyam Sundar Shrestha	Ward chairperson	Ward 4, Banepa Municipality	Status of Nala DEWATS	7 September, 2022
KII-6	Krishna Kayastha	Social Development Officer	Kavre Valley Integrated Water Supply Project	Status of Water Supply in Banepa Municipality	6 September, 2022

Figure 19: Key Informant Interviews with key stakeholders.

4.2. Household Survey

In each ward of the municipality, a random household survey was conducted (Figure 20). A two-day orientation was provided to local enumerators chosen by municipality representing each ward. They were oriented on each component of the sanitation service chain, starting from user interface to reuse / safe disposal along with the use of mobile application for data collection. They were mobilized in the community level to gather data from households and institutional level. The data were collected using the *KoboCollect* application. The list of the participants has been attached in Appendix 2.

Figure 20: SFD orientation for enumerators and household survey observation and monitoring visit.

Determining Sample Size

The sample size for the household survey in Banepa Municipality was determined by using Cochran (2963:75) sample size formula $n_0 = \frac{z^2pq}{e^2}$ and its finite population correction for the proportions:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$$

Where,

n_0		Sample size
z	1.96	z value found in z table at 95 % of the confidence level
p	0.5	Assuming that about 50% of the population should have some sanitation characteristics that need to be studied (this was set as 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)
q	1-p	
e	± 5 %	desired level of precision or sampling error
n		Reduced sample size
N		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 one stratum. The sample size required in each ward of the municipality was calculated as $n_h = \frac{N_h}{N} \times n$ where, N_h is total population of each ward of municipality.

Thus, 382 households out of 16,698 households distributed in 14 wards were sampled using proportionate stratification random sampling. The ward wise sample size has been attached in Appendix 3. The distribution of sampling points in the municipality are shown in Figure 21.

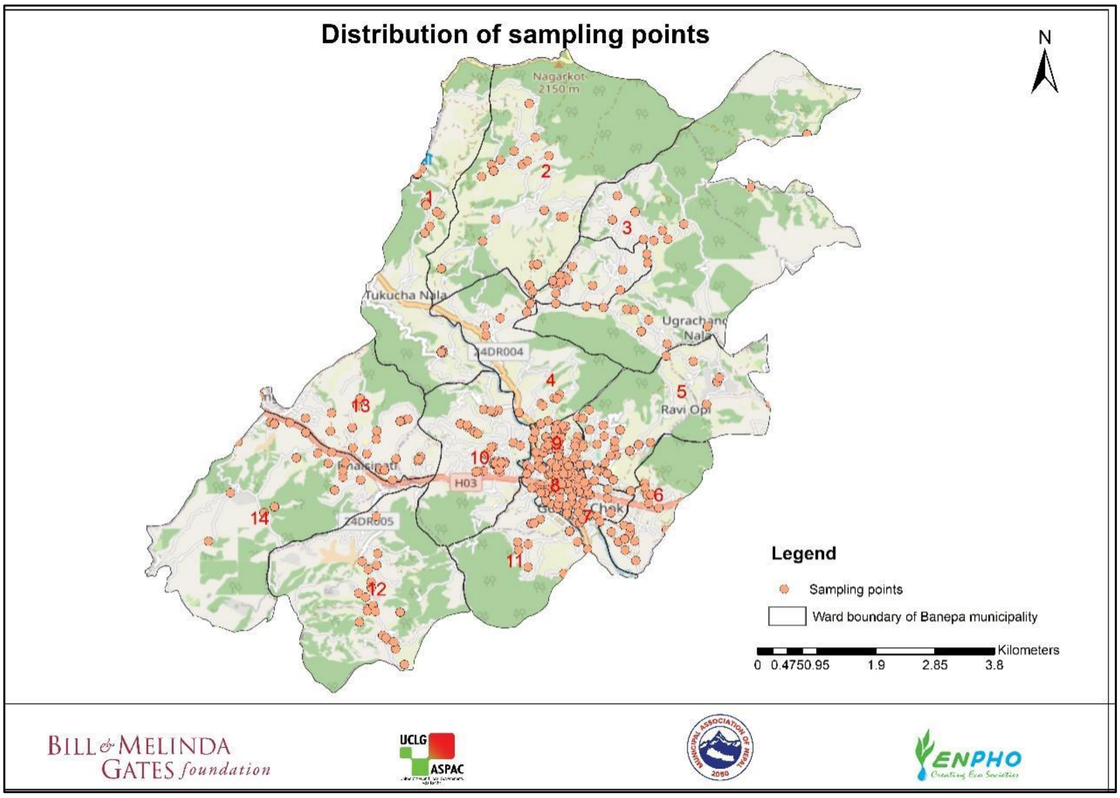

Figure 21: Distribution of sampling points in all wards of Banepa Municipality.

4.3. Institutional survey

The survey was conducted at 57 institutions of the municipality. The number of education institutions, government offices, healthcare facilities, hotels and commercial buildings are shown in Figure 22.

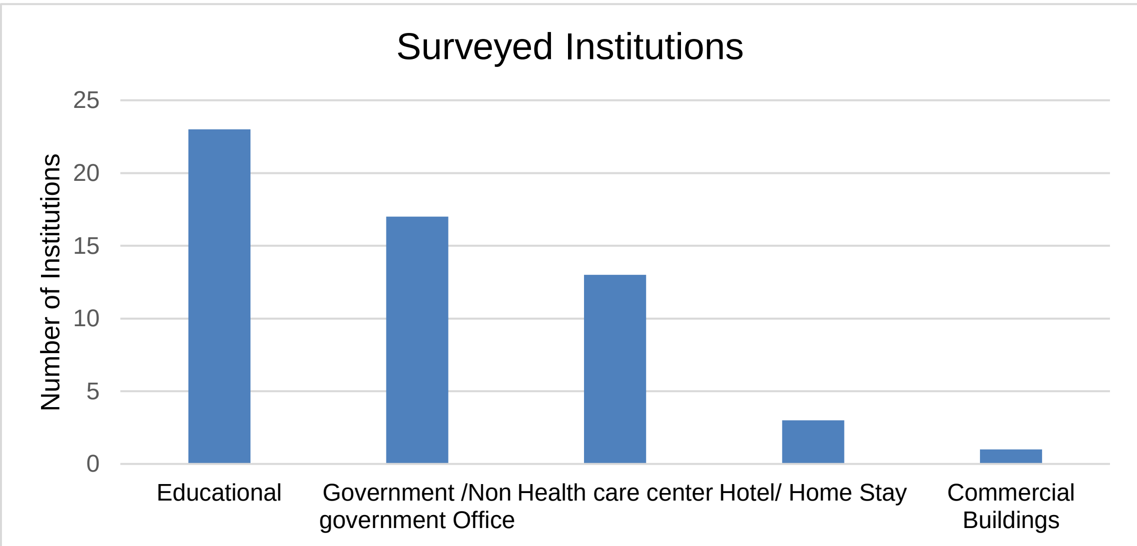

Figure 22: Surveyed institutions in the Banepa Municipality.

4.4. Sharing and Validation of Data

On 16 December, 2022, an SFD validation workshop was organized at municipality hall of Banepa Municipality, Kavre (Figure 23). The results of the SFD survey in Banepa Municipality were presented to Mayor, elected officials and relevant stakeholders. In the workshop, the results including sanitation status of the municipality, containment types in the municipality, emptying, transport, treatment and re-use or disposal practice of faecal sludge in the municipality were presented and discussed. Altogether, 49 participants including the Mayor, ward chairpersons, other members from municipal executive council, sectoral staffs etc. actively participated on the workshop and provided the valuable suggestions.

"*We are facing so many challenges with rapid urbanization of the municipality. We need to address sewer management in core urban settlement and faecal sludge management in per urban area of the municipalities. However, we are facing the difficulties on managing the resources to overcome it. We look forward discuss with the development partners to address the urban sanitation issues of the municipality*" Shanti Ratna Shakya, Mayor of Municipality, said. The list of participants with their designation is attached in Appendix 4.

Figure 23: SFD sharing and validation workshop in Banepa Municipality.

5. Acknowledgements

We would like to acknowledge the executing agency, United Cities Local Government – Asia Pacific (UCLG ASPAC) and implementing agency Municipal Association of Nepal (MuAN) of the Municipalities Advocacy on Sanitation in South Asia – II (MuNASS-II) for coordination with the municipality.

We offer our sincere gratitude to Mr. Shanti Ratna Shakya, Mayor, Ms. Bimala Sapkota Dahal, Deputy Mayor and Mr. Shiva Prasad Humegai, Chief Administrative Officer, Mr.Prakash Acharya, former Chief Administrative Officer and Mr. Shyam Sundar Shrestha, ward 4 Chairperson of Banepa municipality. We would also like to thank Mr. Dhruba Raj Nepal, Administrative Officer, Mr. Ram Sundar Bade, Sub Engineer and entire staffs of municipality for their remarkable support during the study.

We are thankful to Mr. Ram Chandra Lamichhane, Office in-charge, Nepal Water Supply Corporation, Mr.Krishna Kayastha, Social Development Officer, Kavre Valley Integrated Water Supply Project and Mr, Mahendra Tamang, Public Toilet Operator of the municipality.

We would like appreciate Dr. Roshan Raj Shrestha, Deputy Director of Bill and Melinda Gates Foundation (BMGF), Dr. Bernadia Irawati Tjandradewi, Secretary General and Mr. Satish Jung Shah, Knowledge Management Officer, UCLG ASPAC. Similarly, we are very much obliged to Mr. Bhim Prasad Dhungana, President, Mr. Ashok Kumar Byanju Shrestha, former President and Mr. Kalanidhi Devkota, Executive Director, Mr. Muskan Shrestha, Sanitation Advocacy Specialist, MuAN for their gracious support during the study.

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We are grateful towards the enumerators Ms. Kalpana Aacharya, Ms. Sarita Guragain, Mr. Aashish Bajgai, Ms Rupa Parajuli, Ms. Sangita Prajapati, Mr. Aadarsa KC, Ms. Sumina Dhaugada, Ms. Sabita Nemkul, Ms. Anisha Acharya, Ms. Nabina KC Khatri, Ms. Saruna Thapa, Ms. Rupa Bhujel, Ms. Sarita Shrestha, Mr. Amrit Basnet for their support during the survey.

6. References

Banepa Municipality. (2020). *Water Supply and Sanitation Users Commitee Management Procedure.*

CBS. (2011). *Central Bureau of Statistics.* Kathmandu, Nepal: National Planning Commission. Retrieved from National Planning Commission.

CBS. (2020). *Central Bureau of Statistics (CBS) Nepal Multiple Indicator Cluster Survey 2019,Survey Findings Report.C.* Kathmandu Nepal: UNICEF, National Planning Commission.

Chhetri M. (1993). *Geomorphological evolution of Banepa valley. Unpublished M. Sc. dissertation submitted to the Central Department of Geology, Tribhuvan University.*

Climate Data. (n.d.). *Climate of Banepa*. Retrieved from climate data.org: https://en.climate-data.org/asia/nepal/central-development-region/banepa-56656/

Cofie and Kone. (2009). Co-composting of faecal sludge and organic solid waste Kumasi, Ghana-Case study of sustainable sanitation projects. In O. K. Cofie. Sustainable Sanitation Alliance (SuSanA).

Cofie et. al. (2005). The use of human waste for peri-urban agriculture in Northen Ghana. In O. K.-B. Cofie. Renewable Agriculture and Food Systems.

Dill et al. (2003). *Infilling of the younger Kathmandu-Banepa intermontane basin during the later Quaternary (Lesser Himalaya, Nepal); a sedimentologicalstudy. Journal of Quaternary Science, v. 8, pp. 41-60.*

DUDBC. (2009). *Resource maps and spatial profile of Banepa Municipality.* Urban and Environmental Improvement Project, Department of Urban Development and Building Construction, Ministry of Physical Planning and Works.

DWSSM. (2004). *National Rural Water Supply and Sanitation Sector Policy. Kathamndu, Nepal.* Department of Water Supply and Sewarage Management, Ministry of Water Supply, Goverment of Nepal.

DWSSM. (2009). *National Urban Water Supply and Sanitation Sector Policy.* Kathmandu, Nepal: Department of Water Supply and Sewerage Management, Ministry of Water Supply, Government of Nepal.

Elizabeth Tilley, L. U. (2014). *Compendium of Sanitation Systems and Technology.* (Vol. 2nd Revised Edition). Dübendorf, Switzerland.: Swiss Federal Institute of Aquatic Science and Technology (Eawag).

GoN. (2015, September 30). *Constitution of Nepal: Goverment of Nepal*. Retrieved from https://lawcommission.gov.np/en/wp-content/uploads/2021/01/Constitution-of-Nepal.pdf

GON. (2021). *National Population and Housing Census 2021. Government of Nepal, Office of the Prime Minister and Council of Ministers, National Statistics Office.*

Jagam Shrestha, B. B. (2020). *Shit Flow Diagram of Dhulikhel Municipality, Environemnt and Public Health organization .*

KII_1. (2022). Sanitation Status in Banepa municipality.

KII_2. (2022). Status of Wastewater Treatment Plant in Banepa Municipality.

KII_3. (2022). Status of Water Supply in Banepa Municipality.

KII_4. (2022). Status of Public Toilet in Municipality.

KII_5. (2022). Status of Water Supply in Banepa Municipality.

KII_6. (2022). Status of Nala DEWATS of Banepa Municipality.

Linda Strande, M. R. (2014). *Faecal Sludge Management Systems Approach for Implementation and Operation.* London: IWA Publishing.

MoWS. (2016). *Water Service Providers Capacity Assessment and Benchmarking data year 2014-2015.* Ministry of Water Supply .

MoWS. (2017a). *Institutional and Regulatory Framework for Faecal Sludge Management in Urban Areas of Nepal.* Kathmandu,Nepal: Ministry of Water Supply.

MoWS. (2022a). *Drinking Water and Sanitation Act.* Ministry of Water Supply; Goverment of Nepal.

MoWS. (2022b). *Draft National Water, Sanitation and Hygiene Policy.* Ministry of Water Supply.

Nomadseason. (2022). *Nomadseason*. Retrieved from Climate in Banepa, Bagmati Province, Nepal: https://nomadseason.com/climate/nepal/bagmati-province/banepa.html

NPC. (2017). *Nepal Sustainable Development Goals, Status and Roadmap: 2016-2030.* National Planning Commission.

NSET. (2003). *Banepa Environmental Mapping Project, NSET, Nepal.*

Shrestha S . (2008). *Groundwater condition of Banepa area, Central Nepal.* Bulletin of the Department of Geology, Tribhuvan University, Kathmandu, Nepal, Vol. 11, 2008, pp. 31–40.

SuSanA. (2018). *Shit Flow Diagram Manual; Volume 1 and 2;SFD promotion initiatives.* www.susana.org.

UNGA. (2010). *Human Right to Water and Sanitation*. Retrieved from United Nations General Assembly.

Water Online. (2015). Retrieved from https://www.wateronline.com/doc/introducing-home-biogas-reactors-0001

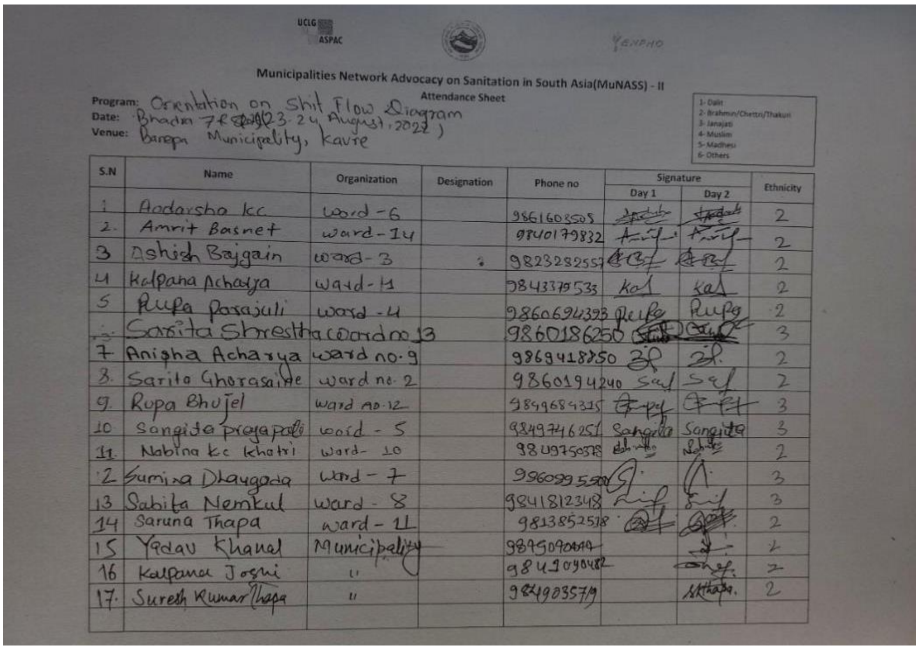
WHO. (2018). *Guidelines on Sanitation and Health, Geneva, Licence: CC BY-NC-SA 3.0 IGO.* Geneva.

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 of SFD orientation



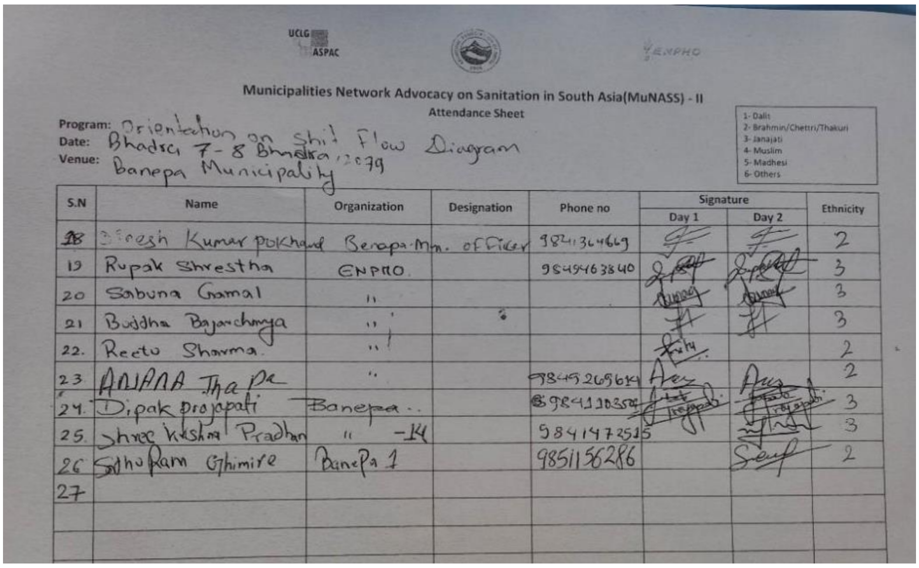
Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

Attendance Sheet

Program: Orientation on Shit Flow Diagram
Date: Bhadra 7-8 (23-24 August, 2022)
Venue: Banepa Municipality, Kavre

1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
1	Aadarsha kc	Word -6		9861603505			2
2.	Amrit Basnet	ward-14		9840179832			2
3	Ashish Bajgain	ward-3		9823282557			2
4	Kalpana Acharya	ward-11		9843379533			2
5	Rupa Parajuli	ward -4		9860694393			2
6	Sarita Shrestha	ward no 13		9860186250			3
7	Anisha Acharya	ward no. 9		9869418850			2
8.	Sarita Ghorasaine	ward no. 2		9860194240			2
9.	Rupa Bhujel	ward no.12		9849684315			3
10	Sangita prajapati	word - 5		9849746251			3
11.	Nabina kc khatri	ward- 10		9849750378			2
12	Sumina Dhaugoda	Ward - 7		9860995500			3
13	Sabita Nemkul	ward - 8		9841812348			3
14	Saruna Thapa	ward - 11		9813852518			2
15	Yadav Khanal	Municipality		9845090444			2
16	Kalpana Joshi	"		9841090482			2
17.	Suresh Kumar Thapa	"		9849035719			2



Municipalities Network Advocacy on Sanitation in South Asia(MuNASS) - II

Attendance Sheet

Program: Orientation on Shit Flow Diagram
Date: Bhadra 7-8 Bhadra, 2079
Venue: Banepa Municipality

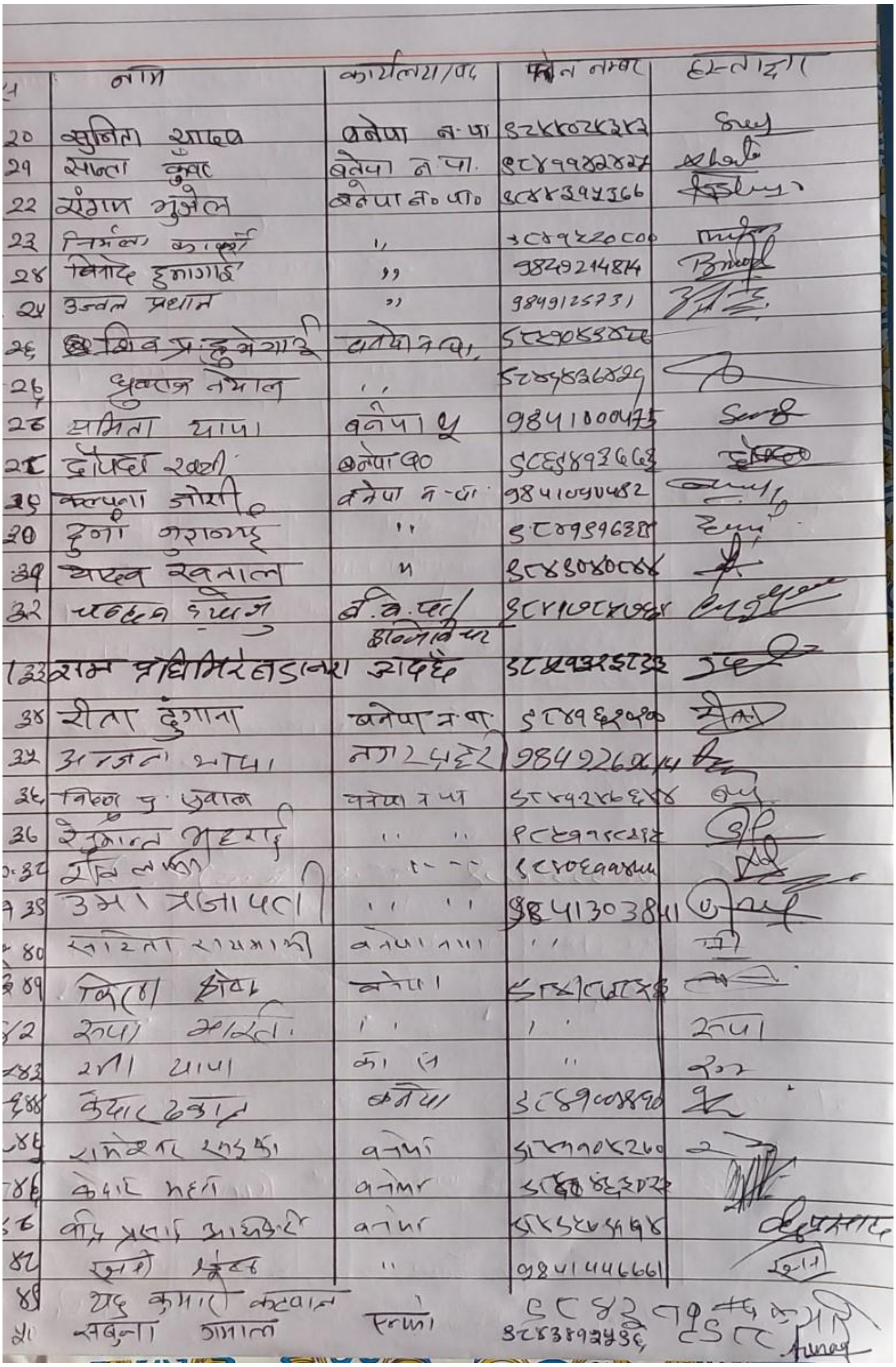
1- Dalit
2- Brahmin/Chettri/Thakuri
3- Janajati
4- Muslim
5- Madhesi
6- Others

S.N	Name	Organization	Designation	Phone no	Signature Day 1	Signature Day 2	Ethnicity
18	Sresh Kumar pokhrel	Benepa Mun.	officer	9841364669			2
19	Rupak Shrestha	ENPHO		9849463840			3
20	Sabuna Gamal	"					3
21	Buddha Bajracharya	"					3
22.	Reetu Sharma	"					2
23	ANJANA Thapa	"		9849269614			2
24.	Dipak prajapati	Banepa..		9841103504			3
25.	Shree Krishna Pradhan	" -14		9841472515			3
26	Sadhu Ram Ghimire	Banepa 1		9851156286			2
27							

7.3. Appendix 3: Ward wise sample size distribution in Banepa Municipality

Ward	Households	Population	Proportion	Required Sample
1	627	2,529	4%	14
2	548	2,294	3%	13
3	793	3,378	5%	19
4	1,134	4,544	7%	26
5	1,828	7,444	11%	42
6	1,826	7,154	11%	40
7	1,809	7,755	11%	44
8	1,674	6,881	10%	39
9	1,448	6,057	9%	34
10	1,997	7,515	11%	42
11	553	2,268	3%	13
12	677	2,818	4%	16
13	1,103	4,285	6%	24
14	681	2,768	4%	16
	16,698	**67,690**	**100%**	**382**

7.4. Appendix 4: List of participants present in Sharing and Validation meeting



क्र.सं.	नाम	कार्यालय/पद	फोन नम्बर	हस्ताक्षर
२०	सुनिता यादव	बनेपा न.पा	[illegible]	[illegible]
२१	[illegible] कुमार	बनेपा न.पा.	[illegible]	[illegible]
२२	संगम भुजेल	बनेपा न.पा.	[illegible]	[illegible]
२३	निर्मला कार्की	,,	[illegible]	[illegible]
२४	विनोद दुलागाई	,,	9849214814	[illegible]
२५	उज्वल प्रधान	,,	9849125731	[illegible]
२६	[illegible]	बनेपा न.पा.	[illegible]	
२७	ध्रुवराज नेपाल	,,	[illegible]	[illegible]
२८	प्रमिता थापा	बनेपा ५	9841000475	[illegible]
२९	द्रौपदी श्रेष्ठ	बनेपा १०	[illegible]	[illegible]
३०	कल्पना जोशी	बनेपा न.पा.	9841090482	[illegible]
३१	दुर्गा [illegible]	,,	[illegible]	[illegible]
३२	[illegible]	,,	[illegible]	[illegible]
३३	[illegible]	बि.बि.पा./ [illegible]	[illegible]	[illegible]
३४	राम प्रधान [illegible]	[illegible]	[illegible]	[illegible]
३५	सीता दुंगाना	बनेपा न.पा.	[illegible]	[illegible]
३६	अन्जना थापा	[illegible]	98492260[illegible]	[illegible]
३७	[illegible]	बनेपा न.पा.	[illegible]	[illegible]
३८	[illegible]	,, ,,	[illegible]	[illegible]
३९	[illegible]	,, ,,	[illegible]	[illegible]
४०	उमा प्रजापति	,, ,,	9841303841	[illegible]
४१	[illegible]	बनेपा न.पा.	,,	[illegible]
४२	[illegible]	बनेपा	[illegible]	[illegible]
४३	[illegible]	,,	,,	[illegible]
४४	[illegible] थापा	[illegible]	,,	[illegible]
४५	[illegible]	बनेपा	[illegible]	[illegible]
४६	[illegible]	बनेपा	[illegible]	[illegible]
४७	[illegible]	बनेपा	[illegible]	[illegible]
४८	[illegible]	बनेपा	[illegible]	[illegible]
४९	[illegible]	,,	9841446661	[illegible]
५०	[illegible]	[illegible]	[illegible]	[illegible]

आज मिति २०७९ पौष ७ गतेका दिन नेपाल नगरपालिका संघको आयोजनामा वातावरण र जनस्वास्थ्य संस्था (एन्फो) को प्राविधिक सहयोग र The United Cities and Local Goverment Asia Pacific ((UCLG-ASPAC) को सहकार्यमा Municipalities Network Advocacy on Sanitation in South Asia (MuNASS-II) कार्यक्रम अन्तर्गत बनेपा नगरपालिकामा Shit Flow Diagram (SFD) सम्बन्धी अन्तरक्रिया कार्यक्रममा निम्न अनुसारका सरोकार वालाहरूको उपस्थिति रह्यो।

उपस्थिति

क्र.स	नाम	कार्यालय/पद	फोन नम्बर	हस्ताक्षर
१	शान्ति रत्न शाक्य	बनेपा न.पा./प्रमुख	९८५१०९०३८२	[illegible]
२	शिव प्रसाद हुमागाईं	बनेपा न.पा. उप प्रमुख	९८५१०४५४८६	[illegible]
३	नुपेश बादे	वडा अध्यक्ष-९	९८५१०८२६०४	[illegible]
४	रामलाल दुवाल	वडा अध्यक्ष १३	९८४१४८८४३४	रामलाल दुवाल
५.	रविन्द्र सुनार	का.पा. सदस्य १४.	९८४१८८१३५२	[illegible]
६.	दिनेश कु. पोखरेल	सूचना अधिकृत	९८४१३६४६६३	[illegible]
७.	शम्भु कुमार महतो	जनस्वा. अधिकृत	९८५११८०३४५	[illegible]
८.	विजया सुवेदी	प्र०प्रा०अधि	९८५१६०८८१६	[illegible]
९	[illegible] अर्याल	ई. अ.	९८४१३८८८३६	[illegible]
१०.	सुरेश कुमार थापा	सू. प्र. अ.	९८४५०३२६१५	Skthapa.
११	सीता भट्टराई, श्रेष्ठ	उ.न.नि.अ	९८४३२६८०५४६	[illegible]
१२	महेश्वर श्रेष्ठ	जे.स्वा.नि..	९८४१५८३२६४	[illegible]
१३.	अजिता कर्माचार्य	जि.स्वा. शाखा	९८४८६०५६६	[illegible]
१४	मीरा देवी पन्त	शिक्षा शाखा	९८४१५५२८२५	[illegible]
१५	विक्रम श्रेष्ठ	का.पा. सदस्य	9851064794	[illegible]
१६	[illegible]	बनेपा-१२.	९८४३५३५८००	[illegible]
१७	रूपेन्द्र अधिकारी	प्राविधिक शाखा	९८४१२५३८६३	[illegible]
१८	भुवन थापा	ना. प्र. स्वा. प्र.	९८४३६४६१६०	[illegible]
१९	वच्चु बहादुर कार्की	[illegible] न.पा.	९८५११६२६३१	[illegible]

SFD Promotion Initiative

SFD Banepa Municipality, Nepal, 2023

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