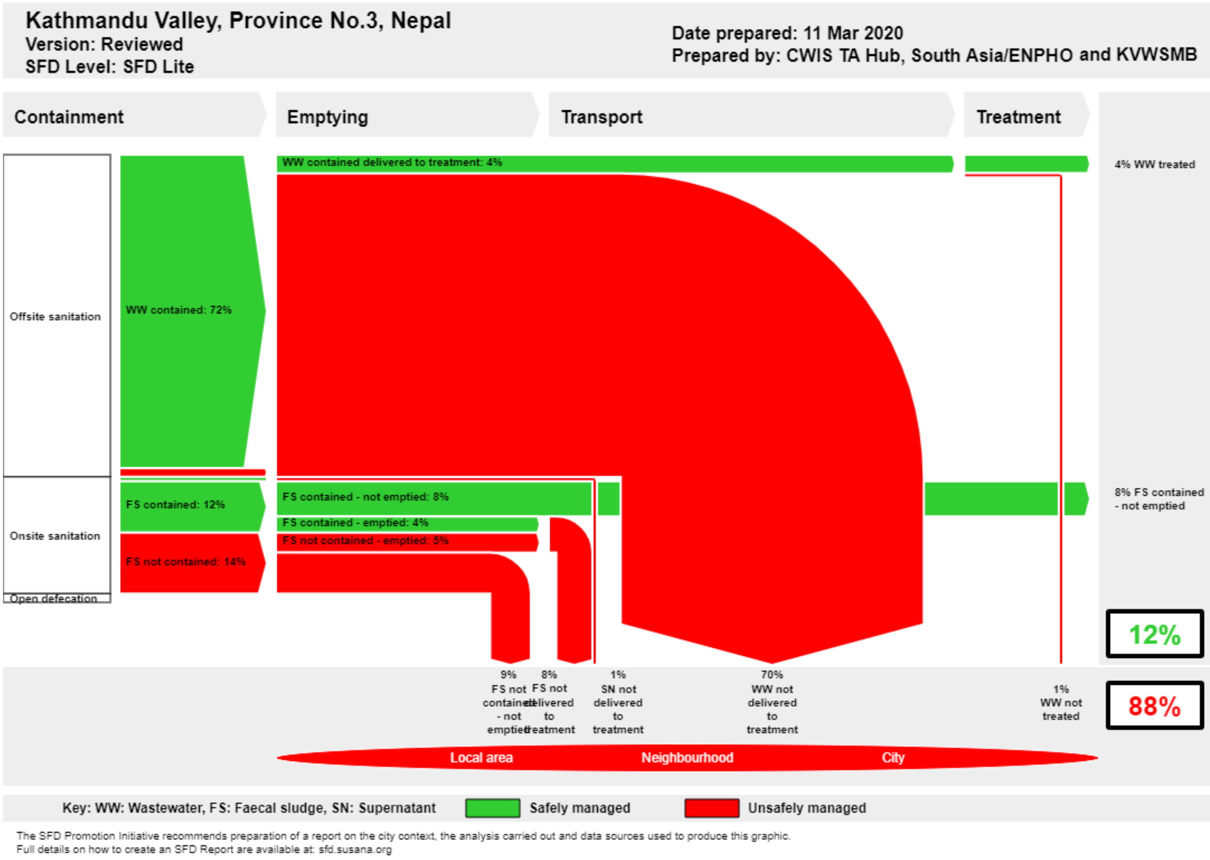
SFD Lite Report

Kathmandu Valley
Nepal

This SFD Lite Report was prepared by City-wide Inclusive Sanitation Technical Assistance Hub, South Asia (CWIS TA Hub, South Asia)/Environment and Public Health Organization (ENPHO) and Kathmandu Valley Water Supply Management Board (KVWSMB).

Date of production/ last update: 11/03/2020

1 The SFD Graphic



2 SFD Lite information

Produced by:

- The Shit Flow Diagram for Kathmandu valley was created by City-wide Inclusive Sanitation Technical Assistance Hub, South Asia (CWIS TA Hub, South Asia)/ Environment and Public Health Organization (ENPHO) and Kathmandu Valley Water Supply Management Board (KVWSMB) with the SFD graphic generator tool available on the SuSanA Website.

Collaborating partners:

- Eco- Concern Pvt. Ltd.
- DevCon.

Date of production: 11/03/2020

3 General city information

Kathmandu valley lies between the latitudes 27˚32'13'' and 27˚49'10'' north and longitudes 85˚11'31'' and 85˚31'38'' east at a mean elevation about 1,300 metres above sea level. Kathmandu Valley is the most developed and populated place in Nepal. The majority of offices and headquarters are located in the valley, making it the economic hub of Nepal. It is home to several world heritage sites: Pashupatinath, Kathmandu durbar square, Bhaktapur durbar square, Patan Durbar Square, Changunarayan temple, Swayambunath and Bouddha stupa. 'Kathmandu' is named after the Durbar Square called kaasthamandap, where Kaastha means 'wood' and Mandap means covered 'shelter' (Pant and Dangol, 2009). The total population of Kathmandu valley is 3,059,466 people residing in 683,954 households.

Kathmandu valley comprises of three districts: Kathmandu, Lalitpur and Bhaktapur with an area of 665 km^2. The valley includes two metropolitan cities, Kathmandu and Lalitpur and 16 municipalities, namely Bhaktapur, Budhanilkantha, Chandragiri, Changunarayan, Dakshinkali, Godawari, Gokarneshwor, Kageshwori Manohara, Kritipur, Madhyapur Thimi, Mahalaxmi, Nagarjun, Shankharapur, Suryabinayak, Tarakeshwor and Tokha.

The Kathmandu Valley has a subtropical cool temperate climate with an average summer temperature of 20˚C - 35˚C and 2˚C - 12˚C in winter. The mean annual precipitation is 56.18 inches (1,427mm).

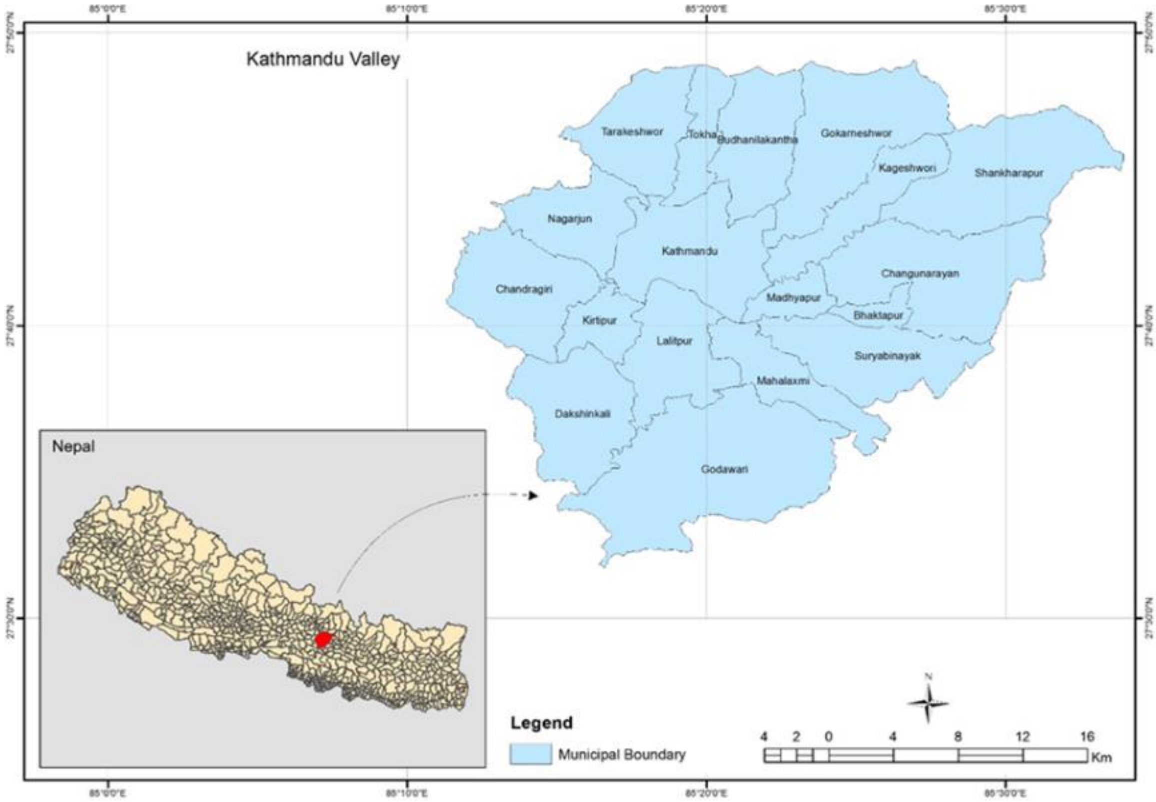


Figure 1: Map of Kathmandu Valley (Source: Innovative solution Pvt. Ltd., 2019).

4 Service outcomes

Table 1: Summary of the outcome of 18 SFD graphics from Kathmandu Valley.

Municipality/ Metropolitan city	Population	% of safely managed excreta	% of unsafely managed excreta
Bhaktapur	8,1748	3%	97%
Budhanilkantha	15,3303	4%	96%
Chandragiri	8,5198	1%	99%
Changunarayan	54,551	52%	48%
Dakshinkali	24,297	42%	58%
Godawari	116,045	3%	97%
Gokarneshwor	107,351	73%	27%
Kageshwori Manohara	102,235	22%	78%
Kathmandu	1,347,011	5%	95%
Kirtipur	6,5602	3%	97%
Lalitpur	28,4922	17%	83%
Madhyapur Thimi	8,3036	1%	99%
Mahalaxmi	112,157	43%	57%
Nagarjun	6,7420	1%	99%
Shankharapur	27,202	55%	45%
Suryabinayak	166,913	12%	88%
Tarakeshwor	81,443	28%	72%
Tokha*	99,032	2%	99%
Total (Kathmandu Valley)	**3,059,466**	**12%**	**88%**

*Numbers do not add up to 100% due to rounding.

Table 1 outlines a summary table with the population of the two metropolitan cities and 16 municipalities mentioned in section 3 that comprises the Kathmandu Valley and the outcome of evaluating the percentage of safely and unsafely managed excreta on each municipality/metropolitan city. Further detailed information about each municipality/metropolitan city can be found in the corresponding SFD lite report which can be downloaded at: *https://sfd.susana.org/about/worldwide-projects*. Table 1 also shows the total percentage of safely and unsafely managed excreta in the Kathmandu Valley corresponding to the SFD graphic that accompanies this compilation report.

Table 2: SFD Matrix for Kathmandu Valley.

Kathmandu Valley, Province No.3, Nepal, 11 Mar 2020. SFD Level: SFD Lite
Population: 3059466
Proportion of tanks: septic tanks: 100%, fully lined tanks: 92%, lined, open bottom tanks: 95%

System label	Pop	W4a	W5a	W4c	W5c	F3	F4	F5	S4d	S5d
System description	Proportion of population using this type of system	Proportion of wastewater in sewer system, which is delivered to centralised treatment plants	Proportion of wastewater delivered to centralised treatment plants, which is treated	Proportion of 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
T1A1C1 Toilet discharges directly to a centralised combined sewer	72.0	6.0	98.0							
T1A1C6 Toilet discharges directly to open drain or storm sewer	2.0			0.0	0.0					
T1A3C1 Fully lined tank (sealed) connected to a centralised combined sewer	1.0					21.0	0.0	0.0	0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	3.0					40.0	0.0	0.0		
T1A3C9 Fully lined tank (sealed) connected to 'don't know where'	1.0					50.0	0.0	0.0		
T1A4C1 Lined tank with impermeable walls and open bottom, connected to centralised combined sewer	2.0					4.0	0.0	0.0	0.0	0.0
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	5.0					40.0	0.0	0.0		
T1A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit	1.0					38.0	0.0	0.0		
T1A4C8 Lined tank with impermeable walls and open bottom, connected to open ground	1.0					27.0	0.0	0.0		
T1A4C9 Lined tank with impermeable walls and open bottom, connected to 'don't know where'	2.0					37.0	0.0	0.0		
T2A3C5 Fully lined tank (sealed) connected to a soak pit, where there is a 'significant risk' of groundwater pollution	1.0					44.0	0.0	0.0		
T2A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	6.0					32.0	0.0	0.0		
T2A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit, where there is a 'significant risk' of groundwater pollution	2.0					29.0	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	1.0					41.0	0.0	0.0		

4.1 Containment

Data presented in Table 2 were obtained by combining all the data available from the two metropolitan cities and 16 municipalities mentioned in section 3 that comprises the Kathmandu Valley, according to the population proportion that uses each sanitation system. As outlined in Table 2, the majority of the population of Kathmandu Valley are dependent on offsite sanitation systems (T1A1C1, 72%), followed by lined tanks with impermeable walls and open bottom (T2A4C10, 6%; T1A4C10, 5%; T1A4C1, 2%; T2A4C5, 2%; T1A4C9, 2%; T1A4C5, 1%; T1A4C8, 1% and T2A5C10, 1%) and fully lined tanks (T1A3C10, 3%; T1A3C1, 1%; T2A3C5, 1% and T1A3C9, 1%).

The other types of containment systems which account below 1% are not included in SFD graphic. These are onsite sanitation systems such as fully lined tanks (T1A3C5, 0.4% and T1A3C8, 0.1%) septic tanks (T1A2C5, 0.3%; T1A2C1, 0.1% and T1A2C6,0.1%), lined tanks with semi-permeable walls and open bottom (T1A4C6, 0.2% and T1A4C7, 0.2%), lined pits with semi-permeable walls and open bottom (T1A5C10, 0.4%), toilet facility directly connected to decentralized combined sewer (T1A1C3, 0.1%), unlined pits (T1A6C10, 0.1%), pits (all types) never emptied but abandoned when full and covered with soil (T1B7C10, 0.01%), pits (all types), never emptied, abandoned when full but not adequately covered with soil (T1B8C10, 0.1%), septic tanks connected to soak pit where there is high risk of ground water pollution (T2A2C5, 0.1%), lined tanks with impermeable walls and open bottom connected to sewer system with high risk of groundwater pollution (T2A4C1, 0.1%), unlined pits with high risk of groundwater pollution (T2A6C10, 0.1%), pits (all types), never emptied but abandoned when full and covered with soil with high risk of groundwater pollution (T2B7C10, 0.1%) and open defecation (T1B11C7 TO C9, 0.1%).

4.2 Emptying and transportation

As per the basic standards on settlement development, Urban Planning and Building Construction, it is mandatory to have septic tanks in order to get a building permission certificate (MoUD, 2015). Regardless of enforcement of such standards, except in Mahalaxmi Municipality, 17 municipalities of Kathmandu Valley lack standard design guidelines for the construction of containments. The data collected from the household survey and KIIs revealed that two types of emptying service are prevalent: either mechanical (70%) or manual (30%) (Eco Concern Pvt. Ltd., 2020). There are around 23 entrepreneurs providing desludging services using a private desludging vehicle, which consists of a tank equipped with a movable centrifugal pump on a truck for emptying, collection and transport. The cost for mechanical emptying is estimated according to the distance (travel time) and number of trips. Manually emptied faecal sludge is directly dumped by the household members and labours in the household premises whereas the wastewater and supernatant are transported through the sewer system (KII3, 2019).

4.3 Treatment

Only Guheshwori Wastewater Teatment Plant (WWTP) is in operation in Kathmandu Valley whereas three WWTPs (Kodku, Sallaghari and Dhobighat) are in construction phase, three WWTPs (Hanumante, Gokarna and Tukucha) are in procurement phase and one WWTP (Chalnakhel) is in planning phase, as presented in Table 3.

Table 3: Wastewater Treatment Plants in Kathmandu Valley.

Name of Treatment plant	Location	Capacity (MLD)	Process
Guheshwori	Guheshwori, Kathmandu	32.4	Operating
Dhobighat	Sundarighat	74	Under construction
Kodku	Balkumari, Lalitpur	17.5	Under construction
Sallaghari	Sallaghari, Bhaktapur	14.2	Under construction
Hanumante	Hanumanghat, Bhaktapur	1	Procurement phase
Gokarna	Gokarna, Kathmandu	3	Procurement phase

Tukucha	Thapathali, Kathmandu	17.3	Procurement phase
Chalnakhel	Dakshinkali	66.7	Planning phase

(Source: Eco Concern Pvt. Ltd., 2020)

Centralized Wastewater Treatment Plant (WWTP)

The centralized Wastewater Treatment Plant (WWTP) is located in the Guheshwori, Kathmandu Metropolitan city ward no.8 close to the bank of Bagmati River. The capacity of the existing wastewater treatment plant is 32.4 MLD (million litres per day) and the projected value for treatment of septage is 60m^3 per day. Even though the Gueshwori WWTP has been approved for co-treatment, the co-treatment has not been practised yet, due to some contractual issues (KII1, 2019).

The Guheshwori WWTP is based on an Activated Sludge Process (ASP) consisting of screening chambers, primary sedimentation tanks, activated sludge tanks, secondary sedimentation tanks, tertiary treatment facility, disinfection facility, sludge thickening facility, anaerobic sludge digester, biogas generation facility, and sludge dewatering machine (Figure 2) (HPCIDBC, 2019).

Figure 2: Schematic diagram of Guheshwori WWTP (Source: HPCIDBC, 2019).

Decentralized Wastewater System (DEWATS)

The Decentralized Wastewater System (DEWATS) is located in Ward no.4 of Gokarneshwor Municipality. It is assumed that 80% of the wastewater delivered to this treatment plant is treated and safely managed. The inflow capacity of the DEWATS is 0.5 MLD. The treatment plant consists of an screening chamber which is connected to a settling tank followed by a planted gravel filter (Gokarneshwor SFD Report, 2019). The treated effluent gets discharged to Bagmati River (Figure 3) (KII 2, 2019).

Figure 3: Decentralized Wastewater Treatment System.

Since the total population using this sanitation option is less than 1% (toilet facility directly connected to decentralized combined sewer: T1A1C3, 0.1%), this system it is not displayed in the SFD graphic for Kathmandu Valley.

Faecal Sludge Treatment Plant (FSTP)

With support from BORDA, ENPHO, Saligram Bal Griha and CDD Society, Mahalaxmi municipality has implemented a pilot faecal sludge treatment plant with an anaerobic treatment approach at Lubhu, (Figure 4). The treatment plant, established in 2016, is the first of its kind in Nepal with respect to the re-usability of all end products. The faecal sludge treatment plant is a gravity-based system with a designed capacity of 6m^3 per week. The treatment plant efficiency is nearly 98%, meaning that almost all the faecal sludge delivered to the treatment plant has been considered as treated and therefore, safely managed (Mahalaxmi SFD report, 2020).

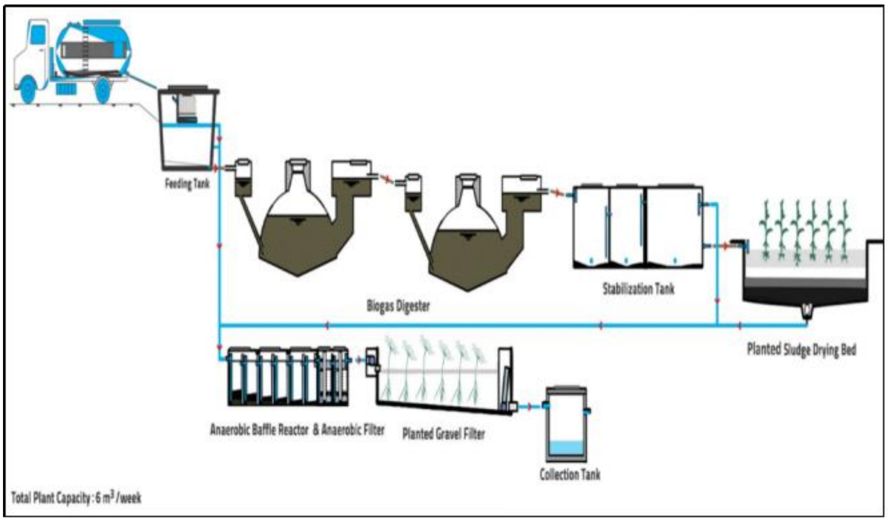


Figure 4: Overview of FS treatment technology of Lubhu FSTP (source: ENPHO).

According to the Mahalaxmi SFD report (2020), the total FS treated in the municipality is 12%. In the SFD graphic for Kathmandu Valley, variable F5 (proportion of faecal sludge delivered to treatment plants, which is treated) remains as less than 1% after computing the total percentage of the population using any onsite system with this treatment option in the entire Kathmandu Valley. Thus, variable F5 is set to 0% in these systems (T1A4C10, T1A4C5, T1A4C8 and T1A4C9).

4.4 Reuse and Disposal

Treated effluent released from both Guheshwori WWTP and DWATS of Gokarneshwori municipality gets discharged in the Bagmati River. While the wastewater and supernatant which do not reach the treatment plants get discharged in different rivers of Kathmandu Valley, including Bagmati, Hanumante, Sangle, Bishnumati, Manohara and Dhobi Rivers, among others.

Manually emptied faecal sludge is disposed by the household member or labour themselves in their household premises or in field. Whereas the mechanically emptied faecal sludge gets finally discharged in streams and rivers except in Mahalaxmi municipality.

In case of Mahalaxmi municipality, all the treated products obtained from the faecal sludge treatment plant are reused: the biogas is used for cooking by the treatment plant care taker, the treated wastewater is utilized for irrigation and the bio-solids produced are sold to local farmers every six months by the treatment plant care taker and applied as a soil conditioner (KII4, 2019).

4.5 SFD Graphic

According to the SFD graphic, 12% of the total faecal sludge and wastewater generated has been estimated as safely managed and 88% as unsafely managed. Out of the 72% of wastewater contained in the technology, wastewater generated by 4% of population is treated prior to disposal whereas user interface directly connected to the open drain, corresponding to 2%, gets discharged without any treatment. 1% of supernatant is released and not treated from the contained technology (fully lined tanks connected to a combined centralized sewer). Out of the 12% of faecal sludge contained in the technology, 4% is emptied but disposed without any treatment while 8% of the faecal sludge contained in the technology is not emptied and considered as safely managed since it originates in areas where there is low risk of groundwater pollution. Out of the 14% of faecal sludge not contained in the technology, 5% is emptied but disposed without any treatment while 9% of the faecal sludge not contained in the technology is not emptied and considered as unsafely managed since it originates in areas where there is high risk of groundwater pollution.

4.6 Groundwater Contamination

Data regarding the groundwater table were collected from the Key Informant Interviews of all municipalities. Among the 18 municipalities, seven municipalities were estimated with low risk of groundwater pollution, including Bhaktapur, Dakshinkali, Lalitpur, Changunarayan, Kathmandu, Mahalaxmi and Tarakeshwor whereas the remaining 11 municipalities were estimated as having high risk of groundwater pollution, including Godawari, Chandragiri, Kageshwori Manohara, Budhanilkantha, Gokrneshwor, Kritipur, Madhyapur Thimi, Nagarjun, Shankharapur, Suryabinayak and Tokha (HHs Survey, 2019).

5 Data and assumptions

The data for the SFD matrix were estimated using the data collected from the household survey carried out by CWIS TA Hub, South Asia in 2019. The collected data were further discussed and finalized with key informants of all 18 municipalities of Kathmandu Valley. The collected data of all 18 municipalities were compiled and adjusted by population to calculate the percentage of people using each sanitation system in Kathmandu Valley, as well as the proportion of faecal sludge which is emptied from each sanitation system (variable F3), delivered to treatment (variable F4) and treated (variable F5) as well as the proportion of supernatant in sewer system delivered to treatment plants (variable S4d) and treated (variable S5d).

The proportion of faecal sludge in septic tanks, fully lined tanks and lined tanks with impermeable walls and open bottom were set to 100%, 92% and 95%, respectively according to the relative proportions of the systems in Kathmandu Valley,as per the guidance given in the Frequently Asked Questions (FAQs) in the Sustainable Sanitation Alliance (SuSanA) website.

Wastewater generated by 6% of population from the Kathmandu Valley reaches the treatment facility, so variable W4a was set to 6%. This number results from taking into account the two municipalities (Kathmandu Metropolitan City and Gokarneshwor) with system T1A1C1 (toilet discharges directly to a centralised combined sewer) and the relative proportion of people using this system. The proportion of wastewater delivered to the WWTP, which is treated (variable W5a), was set to 98% since the wastewater treatment efficiency was assumed to be 98% (Kathmandu Metropolitan City SFD Report, 2020; Gokarneshwor SFD Report, 2020).

6 List of data sources

- Gokarneshwor SFD Report, 2020. Access to the report: https://sfd.susana.org/about/worldwide-projects/city/180-gokarneshwor.
- *HHs survey data, 2019, City-Wide Inclusive Sanitation Technical Assistance, South Asia.*
- *HPCIDBC,2019, High Powered Committee for Integrated Development of the Bagmati Civilization Innovative Solutions Pvt.Ltd, 2020.*
- *Mahalaxmi SFD Report, 2020.* Access to the report: https://sfd.susana.org/about/worldwide-projects/city/181-mahalaxmi.
- Kathmandu Metropilitan City SFD Report, 2020. Access to the report: https://sfd.susana.org/about/worldwide-projects/city/34-kathmandu.
- *KII1, December 2019, Project Implementation Directorate Officer, Kathmandu Upatyaka Kahanepani Limited, Kathmandu Metropolitan city.*
- *KII2, December 2019, Interview with Consultant, Eco Concern Pvt.Ltd.*
- *KII3, September 2019, Interview with Private desludging service provider, Lalitpur Metropolitan city.*
- *KII4, September 2019, Interview with care taker of faecal sludge treatment plant, Mahalaxmi Municipality.*
- *MoUD (2015), Ministry of Urban Development, Urban planning and building construction.*
- *Pant, P.R., Dangol, D., 2009, Kathmandu valley profile.*

SFD Kathmandu Valley, Nepal, 2020

Produced by:

City-Wide Inclusive Technical Assistance Hub, South Asia (CWIS TA Hub, South Asia), Amrita Angdembe

Environment and Public Health Organization (ENPHO)

Kathmandu Valley Water Supply Management Board (KVWSMB)

Editing:

Eco Concern Pvt.Ltd., Krishna Ram Yendyo

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SFD Promotion Initiative