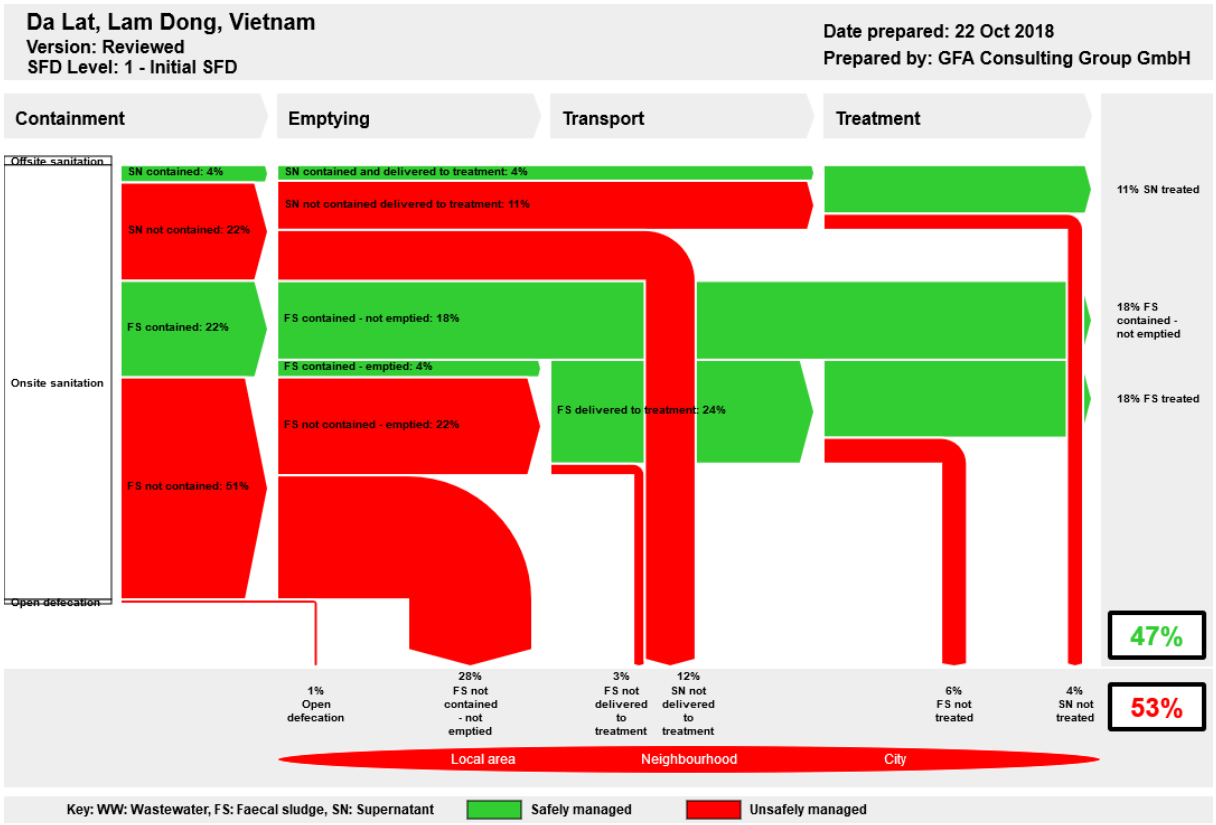
SFD Lite Report

Da Lat
Vietnam

This SFD Lite Report was prepared by GFA Consulting Group GmbH.

Date of production/ last update: 22/10/2018

1 The SFD Graphic



Produced with support from the SFD Promotion Initiative with funding from the Bill & Melinda Gates Foundation.
The SFD Promotion Initiative recommends that this graphic is read in conjunction with the city's SFD Report which is available at: sfd.susana.org

2 SFD Lite information

Produced by:

The present SFD Lite Report was produced by GFA Consulting Group represented by Lena Westhof and Thuylinh Dang.

Date of production: 22/10/2018

3 General city information

Da Lat is located on the Langbiang highland plateau at the northern area of Lam Dong Province. The city is bordered by Lac Duong district in the North, by Don Duong district in the East and Southeast, by Lam Ha and Duc Trong districts in the West and Southwest (Figure 1). Da Lat is situated at an average height of about 1,500m above sea level. The highest point in the city centre is the Museum House (1,532 m); the lowest point is còn Nguyen Tri Phuong valley (1,398 m).

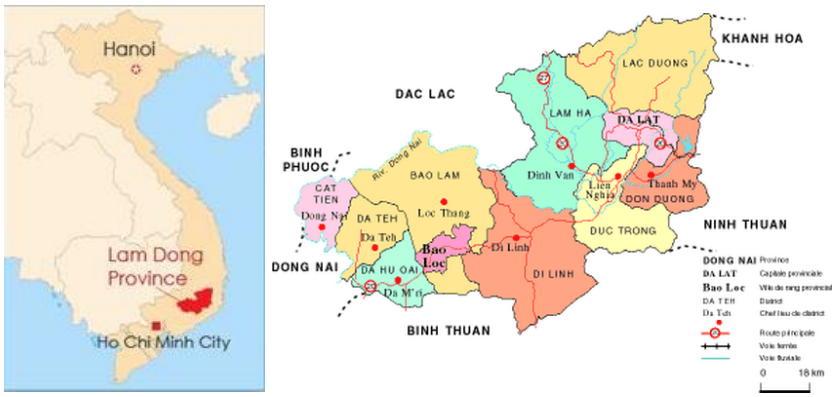


Figure 1 Map of Lam Dong province in Vietnam (Radio Free Asia, 2014) (Tuan Linh Travel, 2018)

The city consists of 12 wards and 4 communes with a total population of 226,978 people by the end of 2017 (CIPTT, 2018). The population density differs between wards and communes (Figure 2). People reside mostly in the central area with a maximum density of 15,632 people/km^2. In the communes, the average population density is only 100 people/km^2.

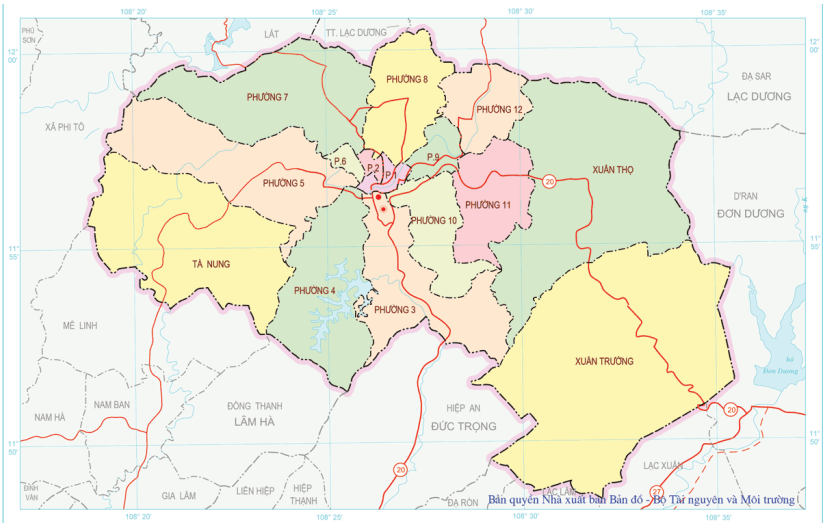


Figure 2: Map of Da Lat City showing wards and communes (CPFP, 2009)

With the advantage of elevation and forest vegetation, particularly pine forests, Da Lat has a mild mountain climate, and it is pleasant all year round. The rainy season usually starts in the end of April, early May and ends in late October, early November. Total rainfall during the rainy season accounts for nearly 8 % of the total annual rainfall. The average annual rainfall in Da Lat is 1,739 mm with 161 rainy days per year on average (DoIC, 2018). The level of the groundwater table fluctuates strongly from 2m to 12m deep according to the topographical condition (DoIC, 2018).

Located in the Central Highlands, the economy in Da Lat is mainly based on tourism, services and agriculture. In the first half year of 2018, the city received about 3.4 million tourists. The estimated wastewater amount generated by tourists in the year 2020 is about 15,600 m^3/d (Woo & Tran, 2013).

Da Lat has a network of traditional storm water drains, which cover approximately 60% of the total road network. Even though a trench system was built to receive rainwater, it also happens that wastewater or supernatant from septic tanks is discharged into the storm water drains (Figure 3).

Figure 3: Open drains in Da Lat (Woo & Tran, 2013)

4 Service outcomes

4.1 Project area: Household connections to separate sewerage system

Many provincial wastewater systems in Vietnam are based on combined systems with household septic tanks connected directly but informally to the drainage system. In the inner part of the city Da Lat, sewerage is collected by a separate sewerage system (SSS) which specifically excludes rainwater. The Danish International Development Agency (DANIDA) funded the construction of the new sewerage collection system connected to a central wastewater treatment plant. The Project area consisted of ward 1, 2 and partly of wards 5, 6 and 8 (compare Figure 2).

The DANIDA-funded wastewater projects in Da Lat and in Buon Ma Thuot were both formulated on the same principle: the use of separate sewer system networks with household connections. The conditions in Da Lat did not require households to abandon their septic tanks, but instead incorporated it into the overall wastewater scheme (World Bank; Australian Aid, 2013), (KII-1, 2018). However, some households connected their roof drains to the new system, resulting in rapid inflow of rainwater to the SSS, causing surcharged conditions. While the Wastewater Enterprise in Da Lat actively seeks to remove all such inflow problems, the inflows persist, as it is difficult to find all inflow locations (World Bank; Australian Aid, 2013).

4,500 households in Da Lat are connected to the new separate sewer system (World Bank; Australian Aid, 2013). Assuming a number of five persons per households; this results in 22,500 persons connected to the separate sewing system. The Director of the Wastewater Division in Da Lat confirmed a connection rate of 10% of the population of Da Lat (KII-2, 2018). As mentioned above, there are no direct connections of toilets to the separate sewer system; all connections retain a septic tank as a pre-treatment (KII-1, 2018) (World Bank; Australian Aid, 2013).

For the supernatant in the separate sewer system, we assume a good transportation rate to the treatment plant of 90%. We assume a good condition of this DANIDA-funded Sewer System with low leakage rate. Nevertheless, even if it is a separate sewer without rainwater, we assume that strong individual rain events might lead to infiltration of rainwater followed by a reduced transportation rate to the treatment plant.

4.2 Outside of the project area: Containment, Emptying and Transport

In total, 82% of the households in Da Lat have septic tanks, 14% of the households have urine-diverting toilets and 3% of households have lined pits with semi-permeable walls and open bottoms without overflow (Woo & Tran, 2013). The amount of people without any sanitation facility practicing open defecation is <1 % (Woo & Tran, 2013). 10% of the population are connected to the newly constructed separated sewer network after septic tanks. In the areas of Da Lat, which are not covered by the new DANIDA-funded wastewater project, the sewage is discharged into open drains (78 %), directly to water bodies (6 %), to the open ground and low-lying terrains (14 %) and elsewhere (2 %) (Woo & Tran, 2013). The latter percentages refer only to the share, which is not covered by the new wastewater project.

The SFD Graphic Generator requires information about the proportion of each type of onsite container, which is faecal sludge. The FAQs (question 26) on the Susana homepage suggest an approach in case there is no specific additional data on which more accurate estimates can be made. In case the septic tank is connected to soak pits, open water or open ground it is recommended to use the default 100% value. If the septic tank is connected to sewer networks or open drains, it is recommended to use the value 50%. In the case of Da Lat, we have both cases: As considerably more septic tanks are connected to a separate sewer or open drain than to soak pits, open ground or open water, we will choose the value 60 % for this proportion.

The ground water level in Da Lat can vary from 2m to 12m. In the case of Da Lat, only the lined pit with semi-permeable walls and open bottoms are affected by the risk of groundwater pollution. As there is no additional information available to estimate the risk for groundwater pollution, the risk was assumed as 50%. The total proportion of lined pits is only 4 %, therefore, the risk assumption does not have very much influence in the final SFD.

The SFD matrix requires information about the proportion of emptied faecal sludge. In Da Lat, it is common that vacuum trucks empty septic tanks. They discharge as many as three truckloads per day of septage (about 6.180 m^3/year) to the inlet works of the WWTP (World Bank; Australian Aid, 2013) (KII-2, 2018). This information gives an idea that at least a part of the septic tanks is emptied regularly and at least a part of the collected septage is transported to the Wastewater Treatment Plant. Assumptions have been taken to give a definite percentage. In the following, we will assume:

- an emptying rate (F3) of 50% for all containment technologies
- a transportation rate to the treatment plant (F4) of 90% as there are high fees from the authorities for illegal dumping into the environment

4.3 Treatment

Since 2006, Da Lat WWTP utilizes a primary/secondary flow train of an Imhoff Tank followed by a trickling filter (Figure 4). The designed capacity of the treatment system is 7,400 m^3/d, while the functional capacity is only 6,000 m^3/d. The treated wastewater at the SSS-based WWTP in Da Lat meets standards for Class B effluent in accordance with QCVN 40:2011/BTNMT in terms of BOD, COD, total suspended solids (TSS), and total Nitrogen (TN), but not for ammonium and phosphorus.

Figure 4: Wastewater Treatment Plant in Da Lat (Woo & Tran, 2013)

For the proportion of faecal sludge and supernatant delivered to the treatment plants, which is treated (F5 and S5); the assumption of 75% was taken. The Wastewater treatment plant is only in operation since 2006, it is designed to also receive sludge from septic tanks and the effluent values indicate a good treatment efficiency. Nevertheless, heavy rain events and strong variation in the influent can affect the treatment efficiency.

There is no information available if the open drains transport the supernatant from the septic tanks to the treatment plant. Therefore, the assumption of 50% was made.

A summary of the collected and assumed data is given in the following SFD matrix (Table 1).

Table 1: SFD Matrix for Da Lat

Da Lat, Lam Dong, Vietnam, 22 Oct 2018. SFD Level: 1 - Initial SFD
Population: 227000
Proportion of tanks: septic tanks: 60%, fully lined tanks: 100%, lined, open bottom tanks: 100%

System label	Pop	F3	F4	F5	S4d	S5d	S4e	S5e
System description	Proportion of population using this type of system	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
T1A2C2 Septic tank connected to a centralised foul/separate sewer	10.0	50.0	90.0	75.0	90.0	75.0		
T1A2C6 Septic tank connected to open drain or storm sewer	56.0	50.0	90.0	75.0			50.0	75.0
T1A2C7 Septic tank connected to open water body	4.0	50.0	90.0	75.0				
T1A2C8 Septic tank connected to open ground	10.0	50.0	90.0	75.0				
T1A2C9 Septic tank connected to 'don't know where'	1.0	50.0	90.0	75.0				
T1A3C10 Fully lined tank (sealed), no outlet or overflow	14.0	0.0	90.0	0.0				
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of	2.0	50.0	90.0	75.0				
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	2.0	50.0	90.0	75.0				
T1B11 C7 TO C9 Open defecation	1.0							

5 Data and assumptions

To produce this present SFD Lite for Da Lat, Vietnam; a wide desk-based literature review was carried out. The literature review included publications and reports from universities, donor agencies, consultancies and official information published by local/national institutions.

The literature gives an overview about different aspects of the sanitation situation in Vietnam, but only very little information was found specifically for the city of Da Lat. Due to the large DANIDA-funded wastewater project, some information about this project and the new technology and infrastructure was found, but especially regarding the remaining area well validated data is missing. Many of the assumptions taken during the preparation of this SFD are based on an unpublished draft report from 2013, which might not be the best data source, but if it is the only one with figures about the remaining area in Da Lat, the information was appreciated and used to make the assumptions.

To validate the assumptions interviews with Mr. Christopher Scharfe, the GFA Team Leader of the DANIDA-funded Consultancy Project “Training in 5 WWT projects and 1 WS project in Vietnam” and with Mr. Cong Khanh Huynh, Director of the Wastewater Management Division in Da Lat were carried out. It was not possible to validate every single assumed figure during these interviews, but the general description of the situation in Da Lat was confirmed.

6 List of data sources

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