SFD Lite Report

Nanded
India

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Centre for Science and Environment.

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1 The SFD Graphic

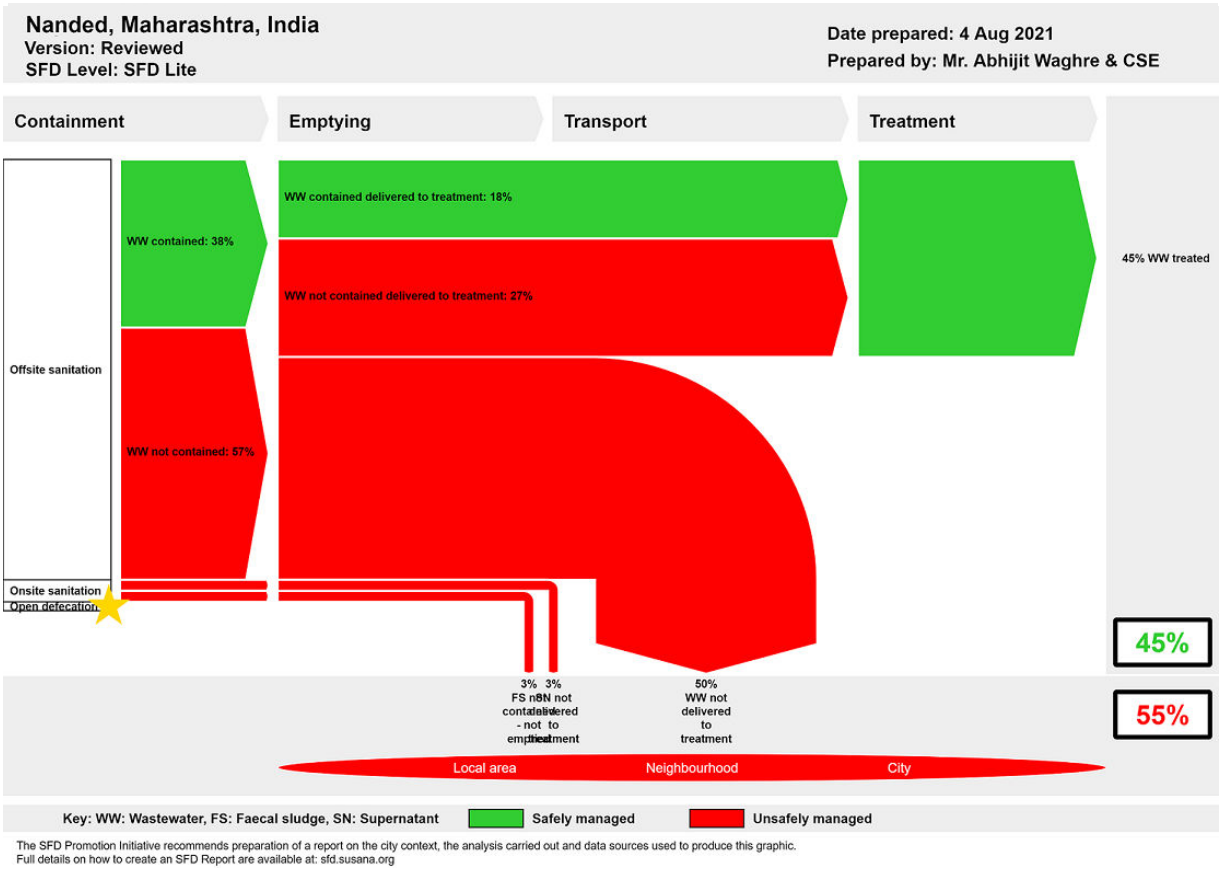

Figure 1: SFD Graphic for Nanded.

2 SFD Lite information

Produced by:

- Centre for Science and Environment, New Delhi.
- This report was compiled as part of the SFD Promotion Initiative (SFD-PI) phase 3 project funded by the Bill and Melinda Gates Foundation (BMGF). We would like to thank Dr. Sunil Lahane, Municipal Commissioner, Dr. Baburao Bikkad, Deputy Commissioner, Mr. Sanghratna Sonsale, Deputy Engineer of Water and Sewerage Department, NWCMC, Mr. Tanaji Deshmukh, Desludging Operator of Nanded North and Mr. Ganpat Dhutraj, Sanitation Worker for supporting and providing the data required and cooperating for Key Informant Interviews (KIIs) & Focussed Group Discussions (FGDs).
- Special thanks to Mr. Dhruv Pasricha, Programme Officer, CSE, Mr. Harsh Yadava, Senior Research Associate, CSE, Mr. Vikash Agarwal, Research Intern, CSE and Mr. Sachin Sahani, Consultant, CSE for their valuable inputs.

Collaborating partners:

- Nanded Waghala City Municipal Corporation, Nanded.

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3 General city information

Nanded is a historical city located in the Marathwada region of Maharashtra State in India (Annex 1 and Annex 2)[1]. Nanded Waghala is regarded as the second most holy city after Amritsar due to the presence of Gurdwara Takhat Shri Hazur Sahib, one of the five Takhats of the Sikh community[2]. Nanded is also the second-largest city in the Marathwada region of Maharashtra and the 81st popular city in India[3,4]. Nanded is located at the banks of Godavari River 77°10' E and 18° 30 'N spread across 63.44 sq. km. Nanded receives 950 mm of average annual rainfall with 20℃ and 34℃ average maximum and minimum temperature[5]. The city has 489 metres of altitude from mean sea level[6]. Its historical importance brings lots of tourist throughout the year and results in 30,921 floating population per day[7].

Nanded Waghala City Municipal Corporation (NWCMC) is the city administration and Urban Local Body (ULB) which has divided into 4 administrative zones with a total of 20 election wards (NWCMC, 2021). As per the Census 2011, the population of the city was 550,439 and total number of households was 102,297[8].

Table 1: Population Growth Rate of Nanded (Source: NCDP NWCMC, 2006; Census 2011; SMA DPR, 2018).

Census Year	Population	Decadal Growth	CAGR	Source
1981	191,269	-	-	NCDP, NWCMC, 2006
1991	309,316	62%	4.92%	NCDP, NWCMC, 2006
2001	430,733	39%	3.37%	NCDP, NWCMC, 2006
2011	550,439	28%	2.48%	Census 2011
2021	665,577	21%	1.92%	SMA DPR 2018

According to Census 2011, there was a total of 27,418 slum households in Nanded (Table 1). Present population of Nanded is estimated as 665,577 with 133,115 households[9].

Nanded gets its daily water supply from the Vishnupuri dam, which is located near Asarjan Village. In addition, in the event of an emergency, the Isapur Dam and Asna Weir provide 6 Million Litres per Day (MLD) of water to the city[10]. The city has black cotton soil and hard rock. Approximately 20% of drinking water is produced from bore wells which are spread across the city. The groundwater level of Nanded ranges from 5 to 10 metres post and pre monsoon which shows low risk of groundwater contamination. The details of Nanded's water supply, source of water, etc. are provided in Table 2.

Under the Swachh Bharat Mission (Urban), NWCMC ULB (ULB Census Code: 802737) has been recently certified as an one time ODF+ and ODF++ on 2nd August, 2021[11].

[1,8] District Census Handbook of Nanded, Maharashtra, Census of India, 2011.
[2,3,5,6] Environmental Status Report of Nanded City 2014-2015.
[4,7,9] Swachh Maharashtra Mission Detailed Project Report 2018.
[10] KII with Deputy Engineer of Water and Sewerage Department, NWCMC.
[11] http://swachhodfurban.org/?id=jjzgfwsca767qzp.

Table 2: Details of Water Supply Sources of Nanded (Source: KII with Deputy Engineer of NWCMC).

S. No	Source of Water Supply	Population Covered	Water Supply per Capita (Lpcd)	Total Elevated Storage Reservoirs (ESR) in Nanded	Total Water Supply through ESR (MLD)	Total Water Supply by Bore Wells (MLD)	Pre-Monsoon Ground Water Level range (mbgl)	Post-Monsoon Ground Water Level range (mbgl)
1	Vishnupuri Dam	665,577	120	39	65	15	9-10	4-5

(Keywords: Lpcd - Litre per capita per day, MLD – Million Litres per Day, mbgl – metres below ground level)

4 Service outcomes

Nanded, Maharashtra, India, 4 Aug 2021. SFD Level: SFD Lite
Population: 665577
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

Containment										
System type	Population	WW transport	WW treatment	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4a	W5a	W4c	W5c	F3	F4	F5	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 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 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
T1A1C1 Toilet discharges directly to a centralised combined sewer	38.0	47.0	100.0							
T1A1C6 Toilet discharges directly to open drain or storm sewer	57.0			47.0	100.0					
T1A2C6 Septic tank connected to open drain or storm sewer	5.0					0.0	0.0	0.0	0.0	0.0

Table 3: SFD Matrix for Nanded, Maharashtra (Source: Abhijit/CSE/2021).

The outcome of the SFD graphic shows that 45% of the excreta flow is classified as 'Safely Managed' and the remaining 55% is classified as unsafely managed (Figure 1). The unsafely managed excreta originate from wastewater (WW) not delivered to treatment (50%), Faecal Sludge (FS) not contained – not emptied (3%) and Supernatant (SN) not delivered to treatment (3%). The safely managed excreta originate from WW, contained and not contained, which is delivered to treatment (45%).

Overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

4.1 Off-site Systems (OSS)

Currently, Nanded Waghala City Municipal Corporation (NWCMC) has the sewer coverage up to 986 km which connects 95% population of the city. NWCMC claims 95% of sewer coverage of the city is functional for which it charges 300 Indian Rupees (INR) (USD 4) per seat for the sewerage connection[12]. According to data obtained from NWCMC, a total of 57% of households are connected to open drain and storm sewer (T1A1C6) (Figure 2) and 38% of households are directly connected to sewer network[13] (T1A1C1).

It has been observed during the field visits that households which are connected to open drains and storm water drains are eventually ending up with the sewer line[14]. It was also found that there is continuous discharge of wastewater from particular drainage to Godavari River without treatment which causes the bad odour in the surroundings of riverfront (Figure 3)[15].

City official said there are no diversion of wastewater and only leakages occurs due to obsoleted sewer system[16]. As per city official, there is no manual scavenging present in the city[17].

Figure 2: Households connected to open drain in Ward No. 7 (Abhijit/CSE/2021).

Figure 3: Discharge of wastewater to Godavari River without treatment (Abhijit/CSE/2021).

Nanded North Office has a total of 23 sanitation workers with 3 jetting and 2 hydraulic suction vehicles, with a capacity of 3,000 litre and 6,000 litre respectively. On an average, jetting vehicle makes 16 trips per day while hydraulic vehicle makes 10 trips per day[18]. Sewage collected by hydraulic vehicle is usually discharged to open drains which eventually meets to nearby sewage pumping station[19].

[12] KII with Junior Engineer of Water and Sewerage Department, NWCMC.
[13] KII with Clerk of Property Tax Department, NWCMC.
[14, 15] Field observations during sample household surveys.
[16, 17] KII with official of Swachh Bharat Mission, NWCMC.

Figure 4: Manual cleaning of blocked sewers in Maganpura of Ward 9 (Abhijit/CSE/2021).

Figure 5: Field visit to Sangvi STP (Abhijit/CSE/2021).

Desludging Operator also said that these vehicles are used majorly to clean the blocked sewers throughout a year (Figure 4)[20]. During field visits (Figure 5), it was found that there is an increase in sewer blockages during rainy season[21]. Cases of manual cleaning of sewers with no use of Personal Protective Equipment (PPE) kits were also found[22]. NWCMC has a total of 7 sewage pumping stations namely Brahmpuri, Maltekdi, Arvind Nagar, Sangvi, Vasarni, National River Action Plan (NRAP) and Deglur naka[23]. The details of Sewage Treatment Plants (STPs) in Nanded are provided in Table 3.

Table 3: Sewage Treatment Plants in Nanded (Source: KII-7; KII-8, KII-10, 2021).

S. No	Location	Design Capacity (MLD)	Current Sewage Inflow (MLD)	Treatment Technology	Current Status & Year of Commissioning	Sewage Catchment Zones	No. of Pumps and Daily Working Hours	Discharge of Treated Sewage
1	Sangvi	15	12	ASP	Operational / 2019	Nanded North	6 Nos -70 HP / 10 h	Asna River
2	Bondar	87	16-17	ASP	Operational / 2012	Nanded North	6 Nos – 225 HP / 6 h	Godavari River
3	Elichpur	30	2	AL	Operational / 2011	Nanded South	1 No -350 HP / 4 h	Godavari River

(Keywords: MLD – Million Litres per Day, ASP – Activated Sludge Process, AL – Aerated Lagoon).

According to the person in charge of the STP, Chunnal Nala STP design capacity of 10 MLD has been under construction[24].

[18,19,20] KII with Desludging Operator of Nanded North.
[21, 22] Field Observations.
[23, 24] KII with the person in charge of STPs, NWCMC.

As there were no flow meters installed to measure wastewater reaching the STPs, pumping capacity per hour factor was used to estimate wastewater reaching to all STPs (Table 5).

Table 5: Pump Specifications by Kirloskar Brothers Limited (Source: KII-13).

Sr No.	Pump Specification	Discharge capacity m^3/h
1	30 HP	90-100
2	70 HP	190-200
3	100 HP	300
4	150 HP	400-410
5	225 HP	450

According to the details of pumps, it was estimated that a total of 47% of the wastewater is reaching to the STPs (variable W4a) through sewers. The wastewater reaching STPs through open drains and storm water drains (variable W5a) was also estimated at 47%. The total wastewater generation of Nanded is estimated to be 64 MLD, of which only half of that is able to reach STPs. The quantity of wastewater reaching at STPs (47%) is getting 100% treated (variables W5a and W5c set to 100%). According to Elichpur STP operator, the discharge standards prescribed by Central Public Health and Environmental Engineering Organisation (CPHEEO) are met by the all STPs, hence the wastewater treated at the STP is disposed into Asna and Godavari River.

Community Toilets (CTs)/Public Toilets (PTs): According to city official, there are 32 PTs and 12 CTs in the city which are directly connected to the sewers (Figure 6)[25]. Field surveys for inspection of PTs were carried and during field surveys of PTs. It was reported that there are a total of 40 PTs in the city[26].

Figure 6: Field survey of a public toilet in Ward No 08 (Abhijit/CSE/2021).

[25] KII with official of Swachh Bharat Mission, NWCMC.
[26] Field Surveys of Public Toilets.

4.2 On-Site Sanitation Systems

As per city official, a total of 6,205 households are connected to septic tanks[27]. Also, Desludging operator of Nanded North informed that these septic tanks are majorly located in the Zone 1 of Taroda while Zone 2 and Zone 3 have much less septic tanks compared to Zone 1. These septic tanks are rarely emptied and DSO (Desludging Service Officer) office receives very rare requests from individual households for emptying these tanks. Only 1 or 2 septic tanks are emptied per month which is also very rare[28].

Containment: Based on sample household survey, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with relevant stakeholders, it was found that these tanks are majorly circular septic tanks which are connected to open drains or storm water drains (T1A2C6, 5%) (Figure 7 and Figure 8). The general size of circular septic tanks are usually about 1.4 x 2.5 x 1.9 m[29].

Emptying/Transportation/Treatment: FGDs concluded that there is no regular emptying of septic tanks and it occurs only after 15-20 years. Also there are very rare requests from public to DSO office for emptying of septic tanks which shows people are not emptying there tanks unless and until it reaches it full capacity[30]. Therefore, variables F3, F4 and F5 were all set to 0%.

Figure 7: Circular septic tank connected to open drain in Ward No. 01. (Abhijit/CSE/2021).

Figure 8: Abandoned circular septic tank in Ward No. 01 (Abhijit/CSE/2021).

[27] KII with official of Swachh Bharat Mission, NWCMC.
[28, 30] KII with DSO and FGD with Sanitation Workers.
[29] Household Surveys.

5 Data and assumptions

Census 2011 and Environmental Status Report of Nanded City 2014-2015 were considered as the baseline and the data for all the stages of sanitation chain were updated based on the data collected from field through KIIs, FGDs, observations and secondary data collected from relevant stakeholders. Following assumptions were made for developing the SFD graphic for Nanded:

- Volume of wastewater generated is estimated as 80% of volume of water supplied.
- As per the guidance given in the frequently asked questions (FAQs) in the Sustainable Sanitation Alliance (Susana) Webpage, it was considered that 50% of the contents of septic tanks is faecal sludge.
- Total supply of water to the city is 80 MLD of which 15 MLD is supplied by tankers, bore wells and Reverse Osmosis (RO) plants.
- Less than 25% of the sanitation facilities are located <10 metres away from groundwater sources.
- Less than 25% of drinking water is produced from groundwater resources.
- Proportion of wastewater conveyed to STP by open drains/ storm water drains was considered as 47% (variable W4c) including losses, tapping and leakages. It was observed that open drains were tapped into the sewers and, on the later stage, these ended up into the STPs, so the transportation efficiency for open drains shall either be equivalent to sewers or less than that as open drains construction have quality (leakage, continuous flow, etc.) issues in comparison with the sewers.
- The OSS proportion for emptying (variable F3) of septic tanks (T1A2C6) is considered as 0% as there are very rare occurrence of emptying of septic tanks, assuming benchmark of 10 years in which emptying was to be done. So, households emptying their systems in less than 10 years were considered emptying which never happened, similarly for transport (variable F4) and treatment (variable F5), 0% was considered.

6 Context-adapted SFD Graphic

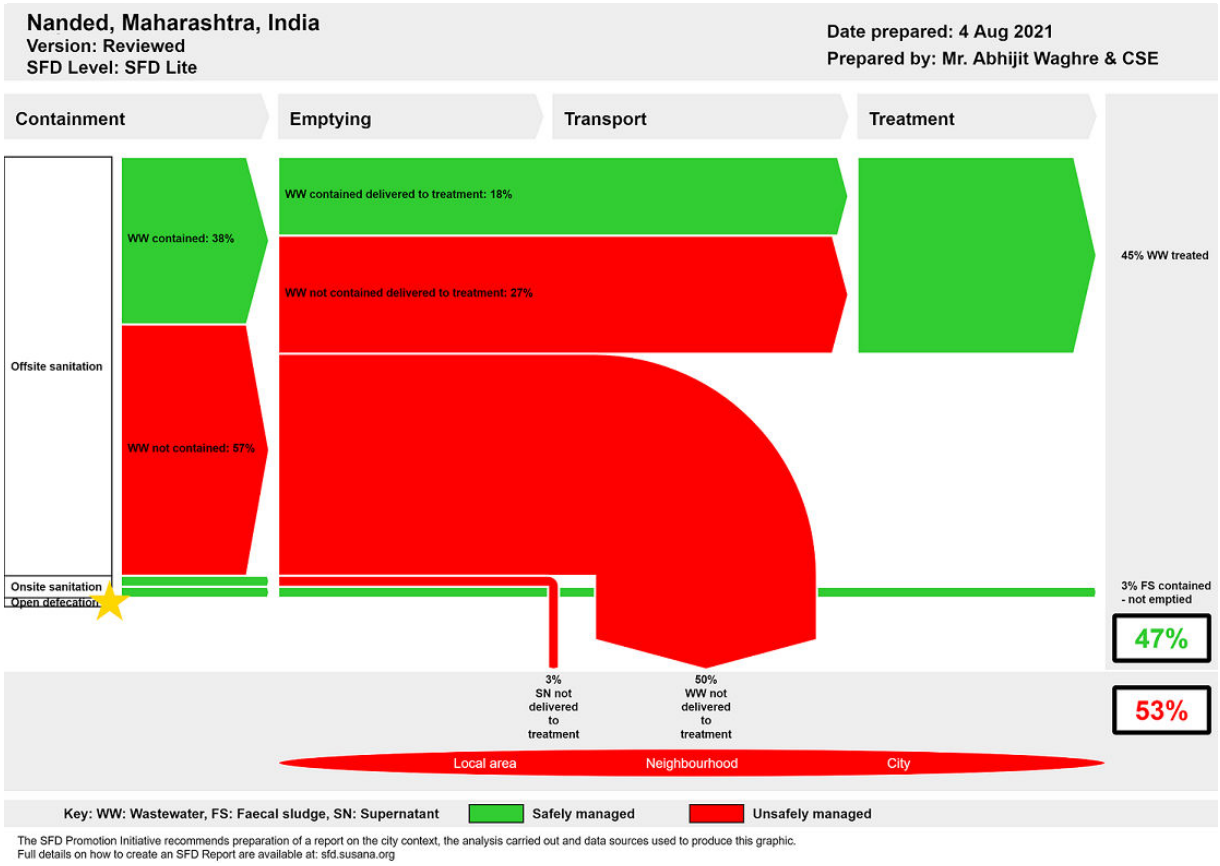


Figure 9: Context-adapted SFD Graphic for Nanded, Maharashtra (Source: Abhijit/CSE/2021).

The only difference suggested in the context-adapted SFD is at containment stage for correctly designed septic tanks, now connected to a centralized combined sewer. According to the assumptions, 50% of the proportion of the content of the septic tank is solid Faecal Sludge (FS), which is generated and collected inside the septic tanks. The remaining 50% of the content is Supernatant (SN) which attributes to be 3% of the population flows through sewers. The FS collected in the septic tank but not emptied is considered to be contained and hence 3% of FS is contained but not emptied (represented green in colour at containment stage). Overall, excreta of 53% of the population is not safely managed according to the context-adapted SFD graphic.

7 List of data sources

Reports and Literature

- District Census Handbook of Nanded, Maharashtra, Census of India, 2011.
- Environmental Status Report of Nanded City 2014-2015.
- Ground Water Year Book of Maharashtra and Union Territory of Dadra and Nagar Haveli, GOI, CGWB, 2019-2020.
- Nanded City Development Plan, NWCMC, June 2006.
- Swachh Maharashtra Mission Detailed Project Report 2018.

Key Informant Interviews (KIIs)

- KII-1, 2021; Interview with Mr. Vishwanath Swami, Junior Engineer, Water Supply & Sewerage Department, NWCMC.
- KII-2, 2021; Interview with Mr. D. Patil, Clerk, Property Tax Department, NWCMC.
- KII-3, 2021; Interview with Mr. S. Sonsale, Executive Engineer, Water Supply and Sewerage Department, NWCMC.
- KII-4, 2021; Interview with Mr. Shiromani Kejakr, SBM data operator, NWCMC.
- KII-5, 2021; Interview with Mr. Tanaji Deshmukh, DSO, NWCMC. (North)
- KII-6, 2021; Interview with Mr. Ganpat Dhutraj, Sanitation Worker, NWCMC. (North)
- KII-7, 2021; Interview with Mr. Omkar Swami, Operator, Sangvi STP, NWCMC.
- KII-8, 2021; Interview with Mr. Shankar Puyyad, In-Charge of STPs, NWCMC.
- KII-9, 2021; Interview with Mr. Vijay Mahajan, Operator, Bondhar STP, NWCMC.
- KII-10, 2021; Interview with Mr. Arvind Kumar Suman, Pubilc Toilet In-Charge, Star-in, Workshop, Nanded.
- KII-11, 2021; Interview with Mr. R. Sonsale, Operator, Elichpur STP, NWCMC.
- KII-12, 2021; Interview with Mr.Govind Thetey, Sanitary Inspector, NWCMC.
- KII-13, 2021; Interview with Mr. Yogesh Patil, Associate Manager, Kirloskar Brothers Limited.

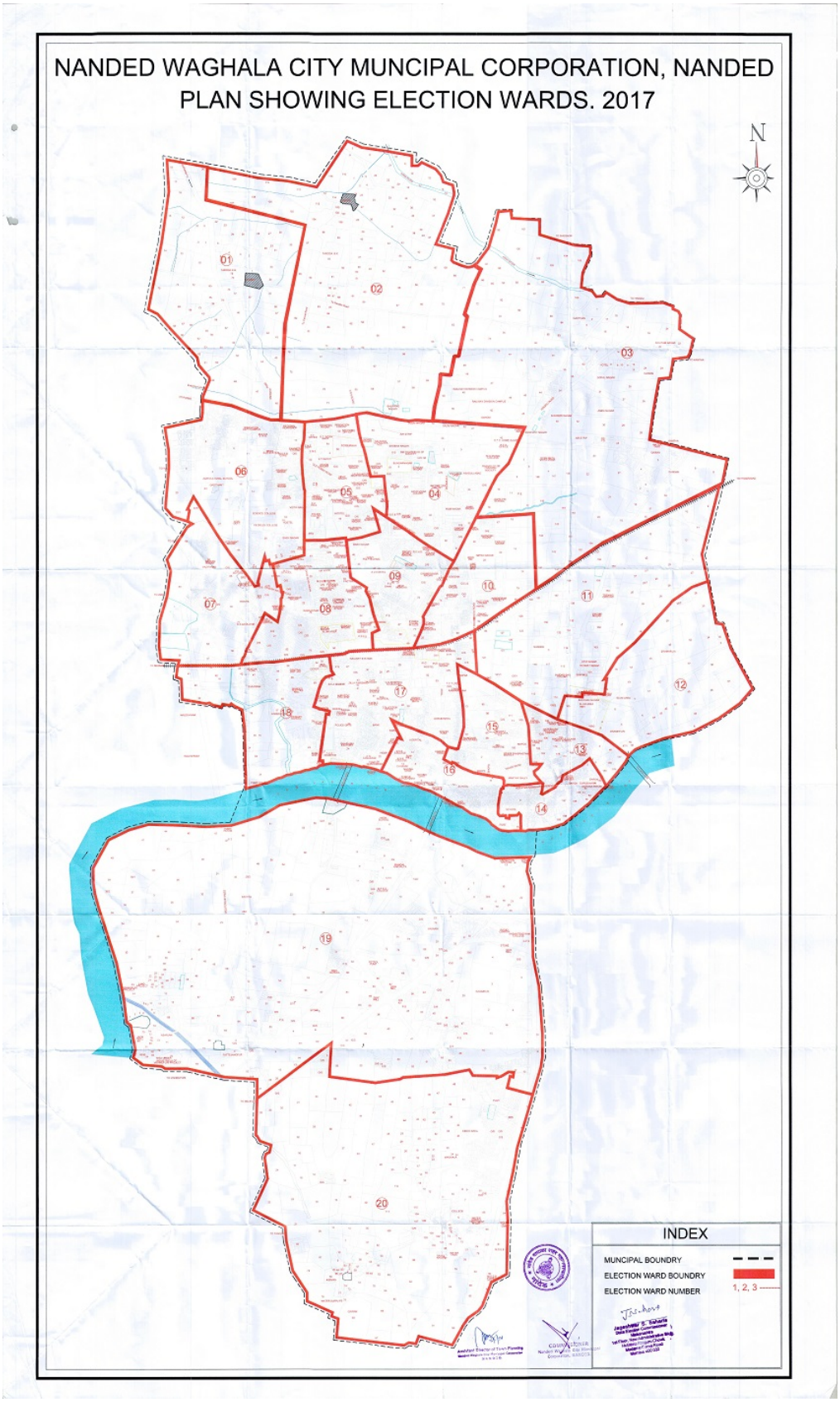
Focus Group Discussions (FGDs)

- FGD-1, 2021; Focus Group Discussion with Sanitation Workers.
- FGD-2, 2021; Focus Group Discussion with Local Peoples.

Field Observations

- Visit to 3 Sewage Treatment Plants.
- Visit to approximate 50 households, covering Slums, Lower Income Groups (LIG), Middle Income Groups (MIG) and Higher Income Groups (HIG) spread throughout the city.
- Survey of Public Toilet (10 No.).
- Survey of Godavari Riverfront.

Annex 1:


NANDED WAGHALA CITY MUNCIPAL CORPORATION, NANDED
PLAN SHOWING ELECTION WARDS. 2017
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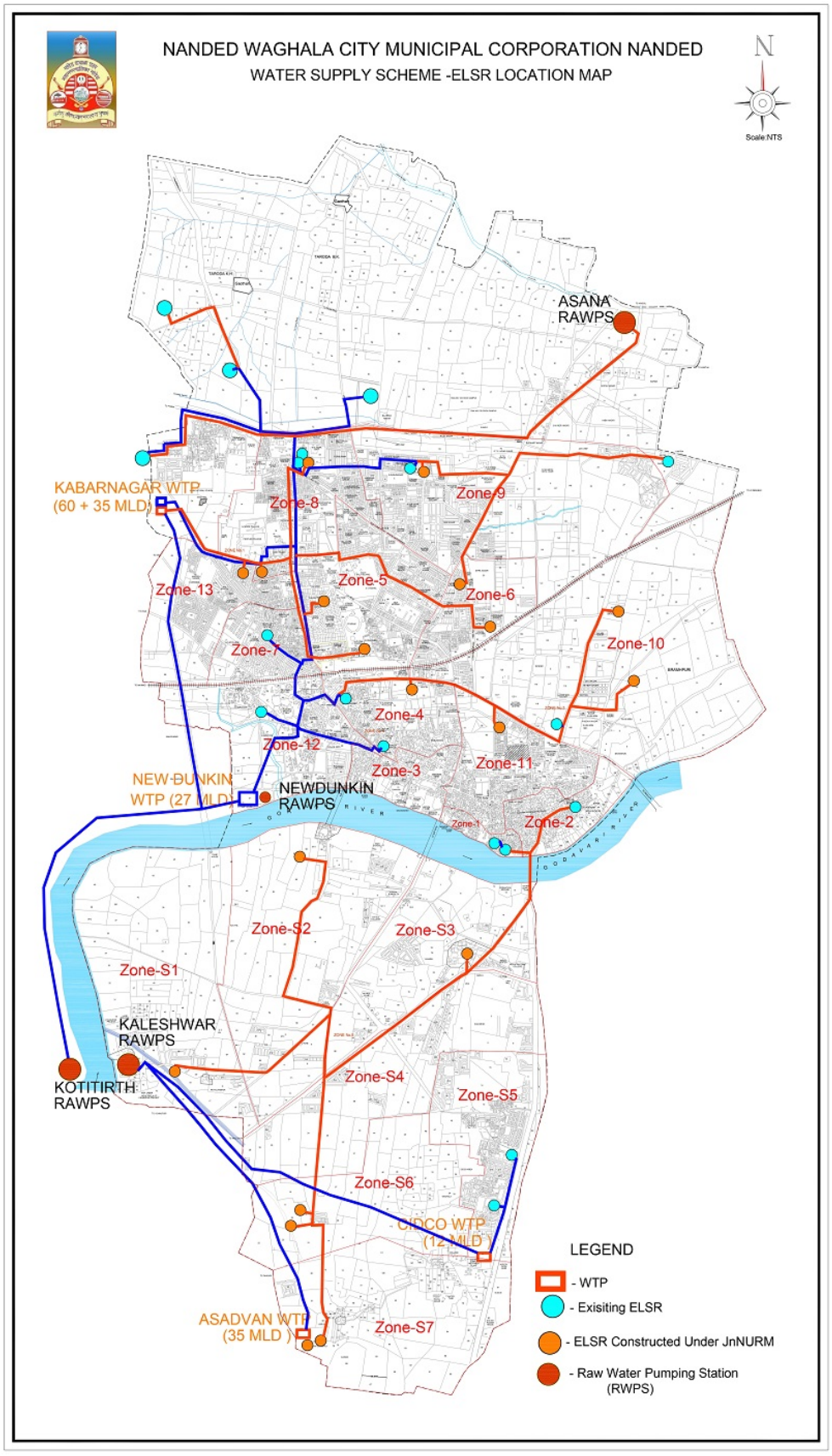
INDEX
MUNCIPAL BOUNDRY
ELECTION WARD BOUNDRY
ELECTION WARD NUMBER
1, 2, 3

Annex 2:


NANDED WAGHALA CITY MUNICIPAL CORPORATION NANDED
WATER SUPPLY SCHEME -ELSR LOCATION MAP
N
Scale:NTS
ASANA RAWPS
KABARNAGAR WTP (60 + 35 MLD)
Zone-8
Zone-9
Zone-13
Zone-5
Zone-6
Zone-7
Zone-10
Zone-4
Zone-12
Zone-3
Zone-11
NEW DUNKIN WTP (27 MLD)
NEWDUNKIN RAWPS
Zone-2
Zone-S2
Zone-S3
Zone-S1
KALESHWAR RAWPS
KOTITIRTH RAWPS
Zone-S4
Zone-S5
Zone-S6
CIDCO WTP (12 MLD)
ASADVAN WTP (35 MLD)
Zone-S7
LEGEND
- WTP
- Exisiting ELSR
- ELSR Constructed Under JnNURM
- Raw Water Pumping Station (RWPS)

Nanded, India, 2021.

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