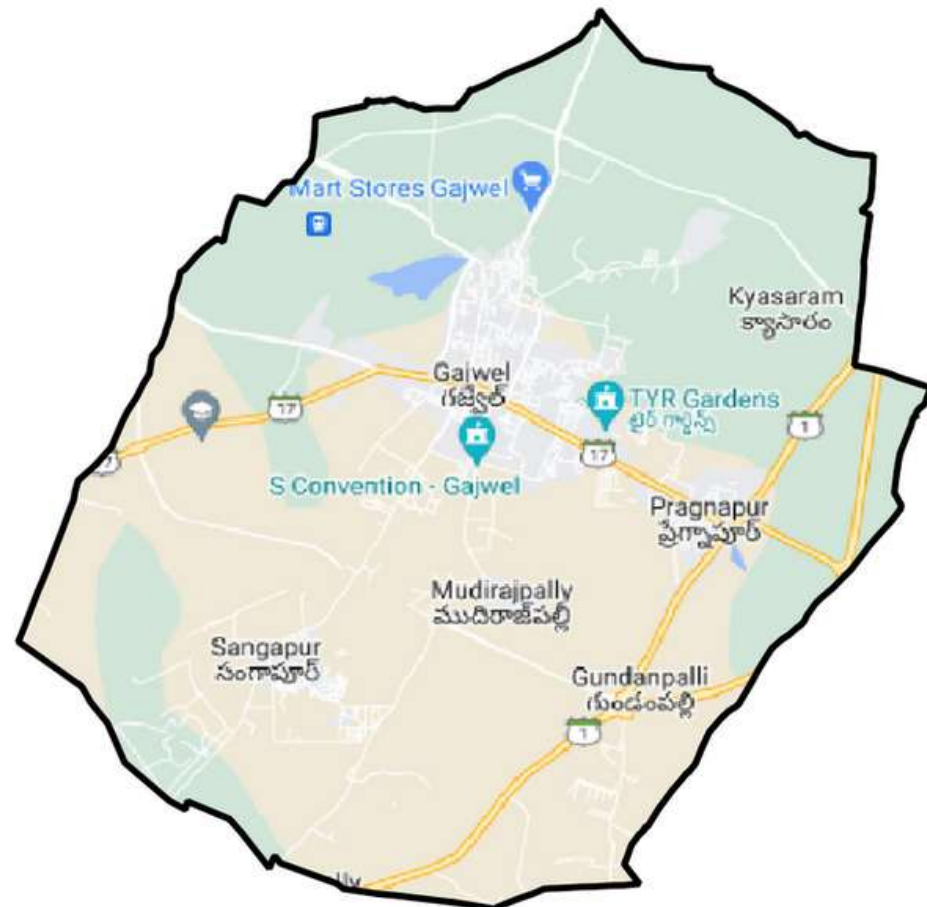




Utility Planning

WASTE WATER

GAJWEL - PRAGNAPUR MUNICIPALITY



Group members:

- Atri Ray
- Ipshika Ghosh
- Poccha Reddy
- Prashant Gawai
- Shubham Yadav
- Surabhi Yadav
- Taranum Muzaffar
- Tushar Gautam

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CITY PROFILE

- The Gajwel - Pragnapur Municipality is located in the Siddipet district of Telangana State.
- It has an average elevation of 568 meters (1866 ft) above sea level.
- Gajwel is about 53 km from Hyderabad.
- Till 2012, Gajwel was a Panchayat, and in 2012, it was upgraded as Nagara Panchayat.
- Gajwel-Pragnapur Municipality is spread over an area of 51.90 sq. km.
- The town's population is 37,747, according to the 2011 census. Recording a compound annual growth rate of 2.26%, the town's population is projected to be 47,178 in 2021.
- The town's overall work participation rate is 41.3%.
- The share of main work workers is 35.9%, while the share of marginal workers is 5.4%.

Source: <https://gajwelmunipality.telangana.gov.in/> and Census 2011

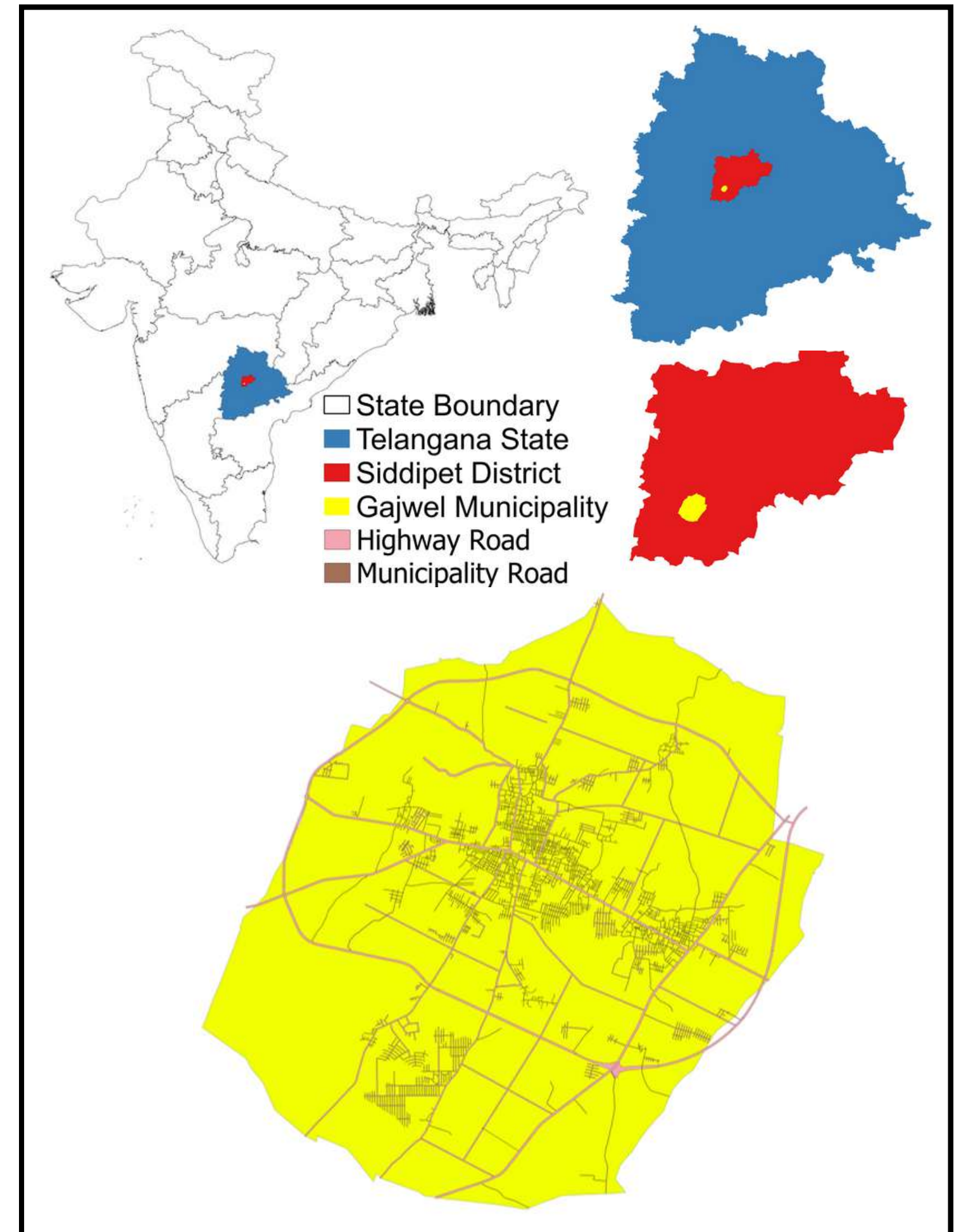


Figure 1: Map of Gajwel - Pragnapur Municipality

QUANTITY ASSESSMENT OF WASTE WATER

Waste Water Generation

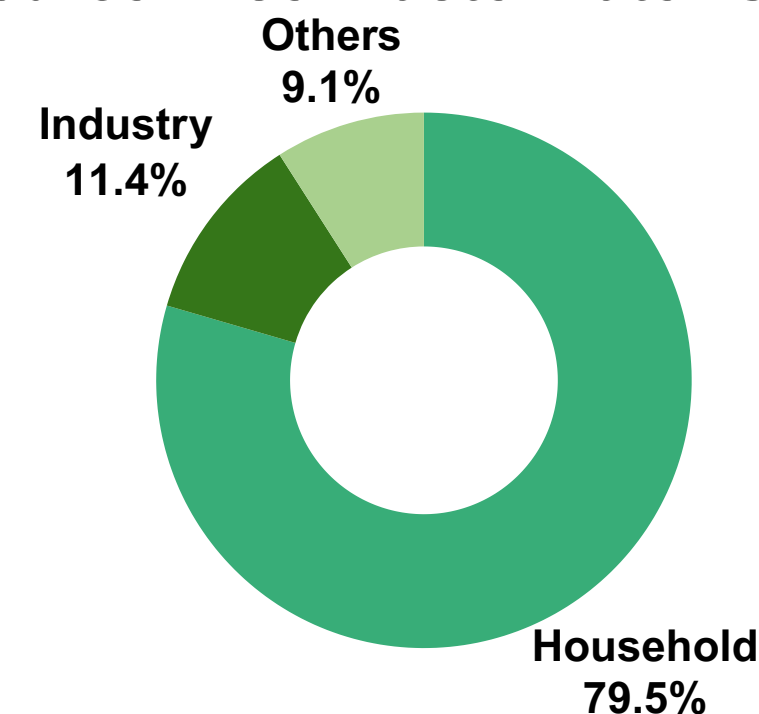
Table 1: Source-wise Waste Water Generation in Gajwel - Pragnapur Municipality (in mld)

Sources	2011		2021		2031		2041	
	Water consumption	Waste water generated	Water consumption	Waste water generated	Water consumption	Waste water generated	Water consumption	Waste water generated
Household	5.66	4.25	7.07	5.31	8.84	6.63	11.05	8.29
Industry	0.60	0.52	0.83	0.71	1.15	0.98	1.54	1.32
Others	0.57	0.49	0.71	0.61	0.89	0.76	1.10	0.94
Total	6.84	5.25	8.62	6.62	10.89	8.37	13.70	10.55

Table 2: Assumptions for Calculation of Waste Water Generated

Sources	Waste water generated as a percentage of water consumption	Assumed Percentage
Household	70 - 80%	75%
Industry	80-90%	85%
Others	80-90%	85%

Figure 2: Source-wise Waste Water Generation



Composition of Waste Water Generation from Households

Table 3: Number of Households connected to sewer and pits in Gajwel - Pragnapur Municipality

	2011	2021	2031	2041
Total Households	5552	8388	12673	19146
Sewer Connections	546	5033	7604	11488
Pits/Septic Tanks	3624	3355	5069	7658

**Figures for the years 2031 and 2041 have been projected using Compound Annual Growth Rate (CAGR = 4.21)*

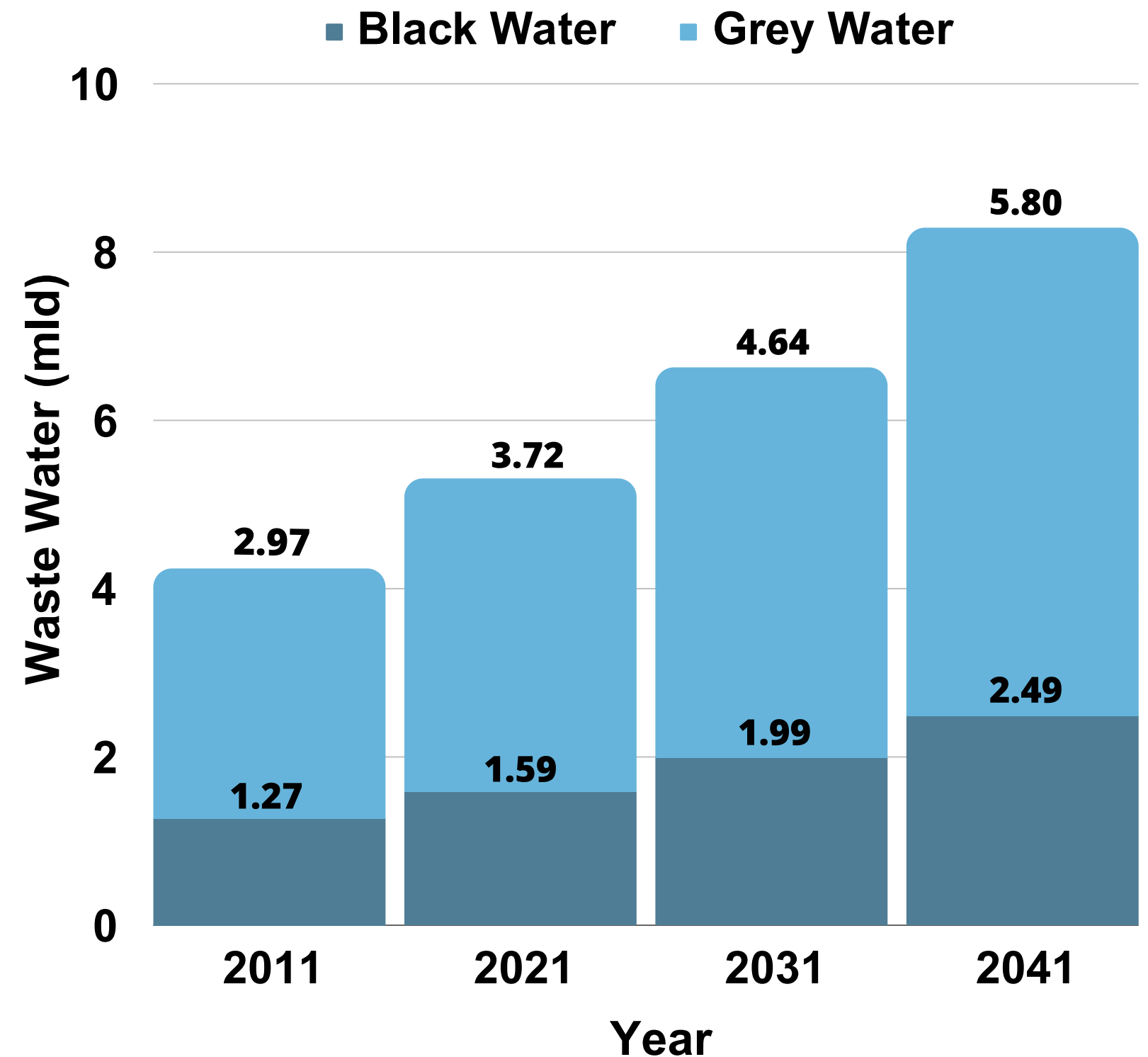
Source: Data for 2011 has been compiled from Census, 2011 and for the remaining years, data has been computed by authors

Assumptions:

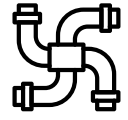
1. Out of the total households, 60% have sewer connections, while the rest 40% have pits/septic tanks.
2. Of the total waste water generated by households, grey water constitutes 70% and black water comprises the other 30%.

Source: Patil et. al, p. 1, 2021

Figure 3: Composition of black water and grey water within all households



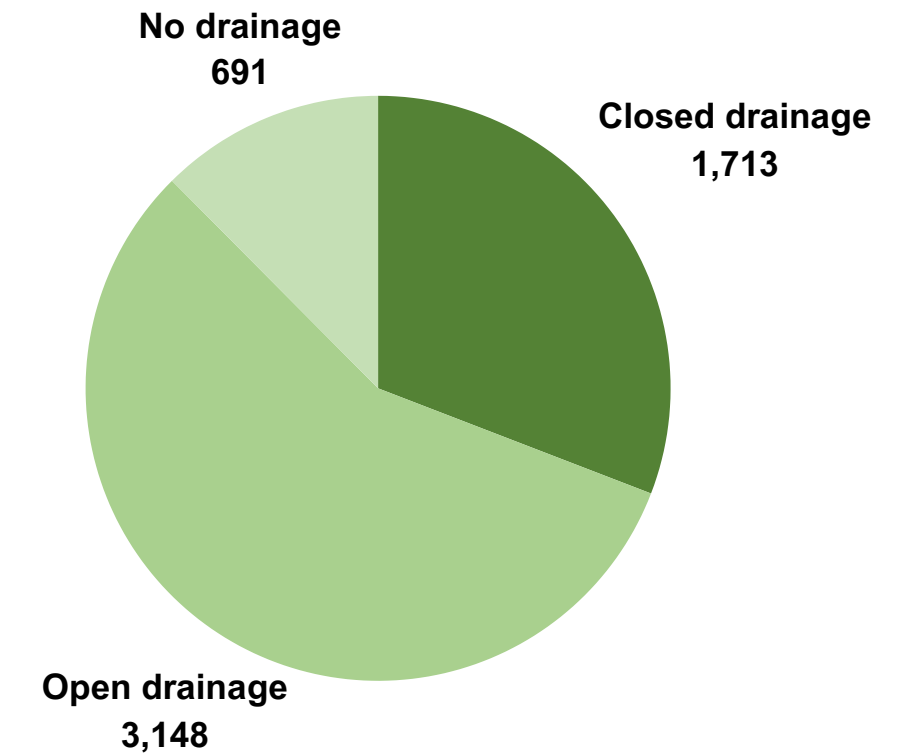
Sanitation: Progress, Challenges, and ODF Status in Gajwel-Pragnapur Municipality



Gajwel-Pragnapur municipality lacks proper sanitation infrastructure.

- Limited Closed Drainage: The percentage of households (30.85%) connected to closed drainage systems indicates that a minority have access to more structured and possibly safer means of managing wastewater.
- Prevalence of Open Drainage: A majority of households (56.72%) rely on open drainage systems, which might pose health and environmental concerns due to potential contamination and lack of proper management.
- Significant Lack of Drainage: A notable percentage (12.43%) of households lacks any drainage infrastructure, potentially leading to unhygienic living conditions and environmental challenges.

Figure 4: Waste Water Outlet of Households



Source: Census 2011



Gajwel municipality currently has 24 public toilets, up from 21 in 2011, which is below the required 47 as per the standard of one toilet per 1,000 population. *Source : A mission for enhancing liveability of towns in Telangana (2021) Pattana Pragathi*



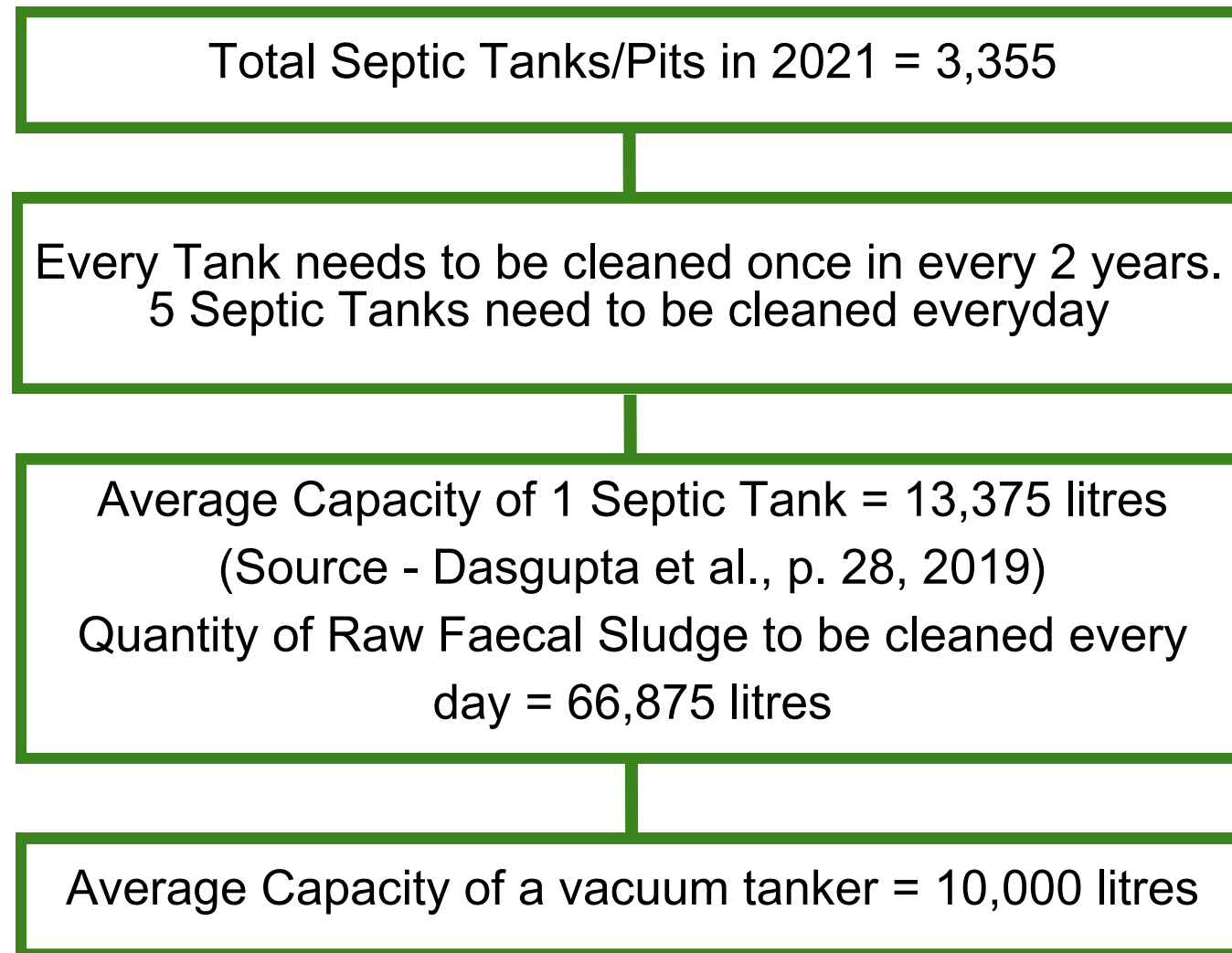
Efforts are underway to address this shortage, with 11 new toilets already constructed and plans for an additional four.



The municipality has maintained its Open Defecation Free (ODF) status since 2016.

Analysis of Infrastructure Requirement

Vacuum Tankers for Transport of Raw Sludge



Optimum Tankers Required



Number of Tankers = 4



No. of Trips to be taken by each tanker per day = 2

Wastewater Treatment Plants

- Existing STPs in Gajwel = 0
- Distance to the closest operational STP in Siddipet = 40 - 50 km
- Installed Capacity of the STP = 7.25 mld
- Actual Utilisation of Installed Capacity = 5 mld
- Technology used in sewage treatment process - Moving Bed Biofilm Reactor (MBBR)
(Source - CPCB, 2021)



Proposed Number of Treatment Plants = 2



Treatment Facility with the ability to co-treat faecal sludge and septage with sewage



Installed Capacity = 7.25 mld
Technology to be used - MBBR

WASTE WATER TREATMENT

Sewage Treatment Plant Moving Bed Biofilm Reactor (MBBR)

MBBR process is based on the bio-film of organisms developed on carrier elements

This media is floating in the Aeration tank and kept floating by air from diffusers which are placed at the bottom of tank

The process enhances the activated sludge process by providing greater biomass in aeration tank and thus by reducing volume of the tank

Sedimentation tank is provided for settlement of sloughed biomass

Clear water clarifier overflows from weir and is further subjected to disinfection

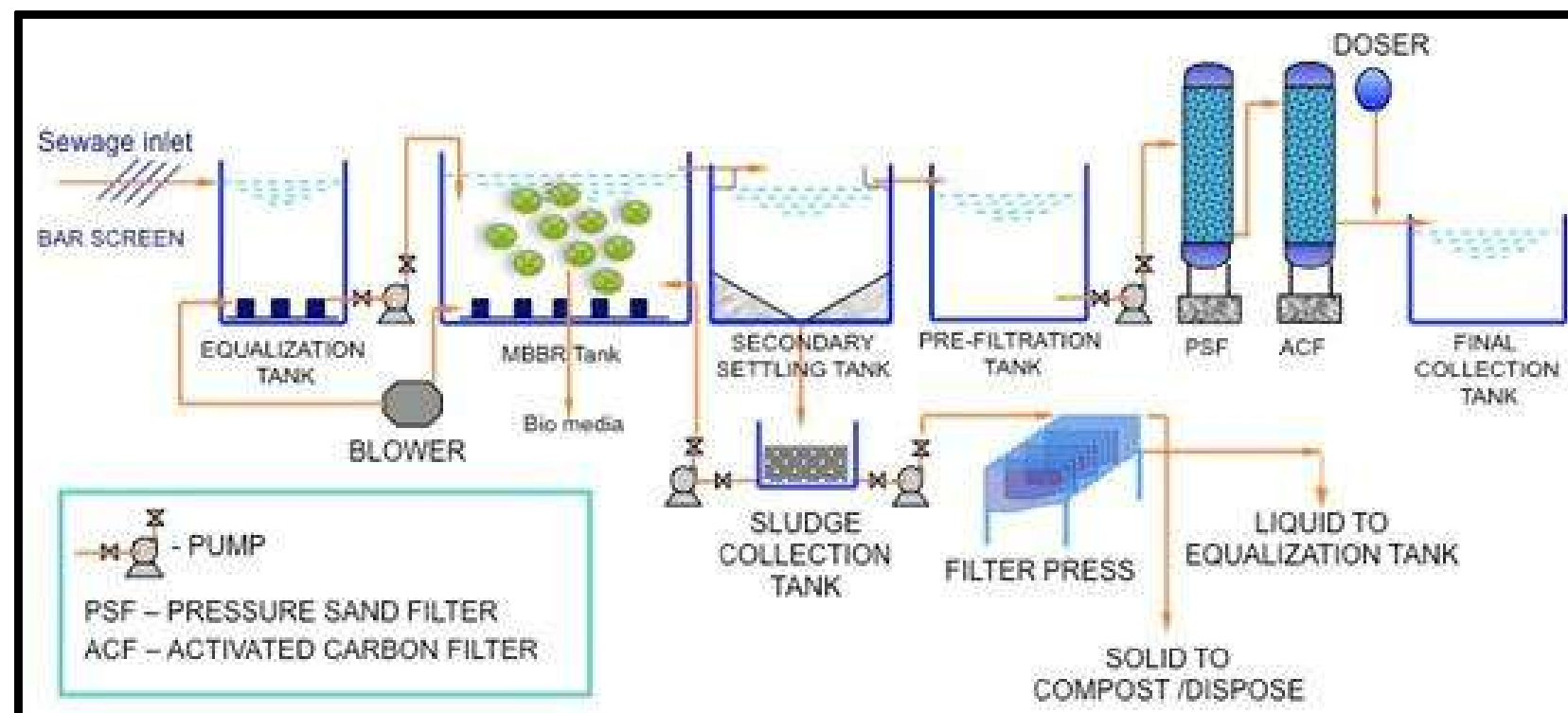


Figure 7: Schematic Representation of MBBR Technology

Source: <https://www.ecomena.org/mbbr-technology-in-wastewater-treatment/>

Faecal Sludge Treatment Plant

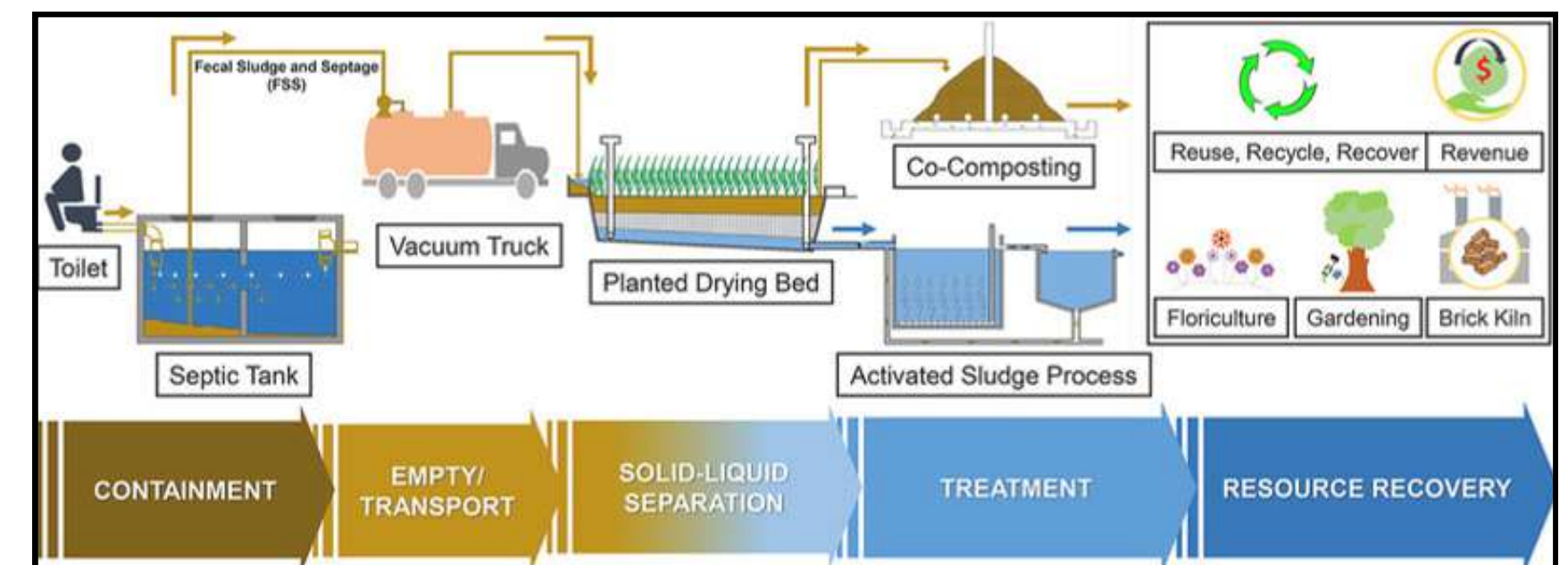
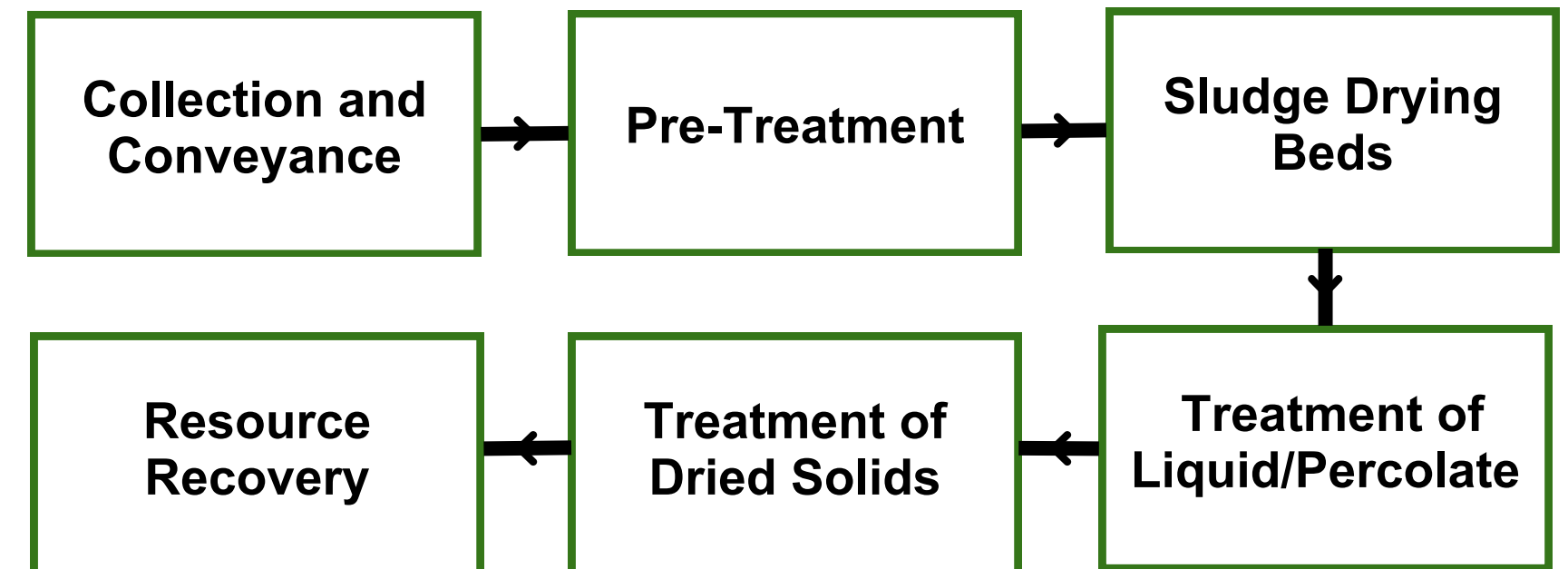
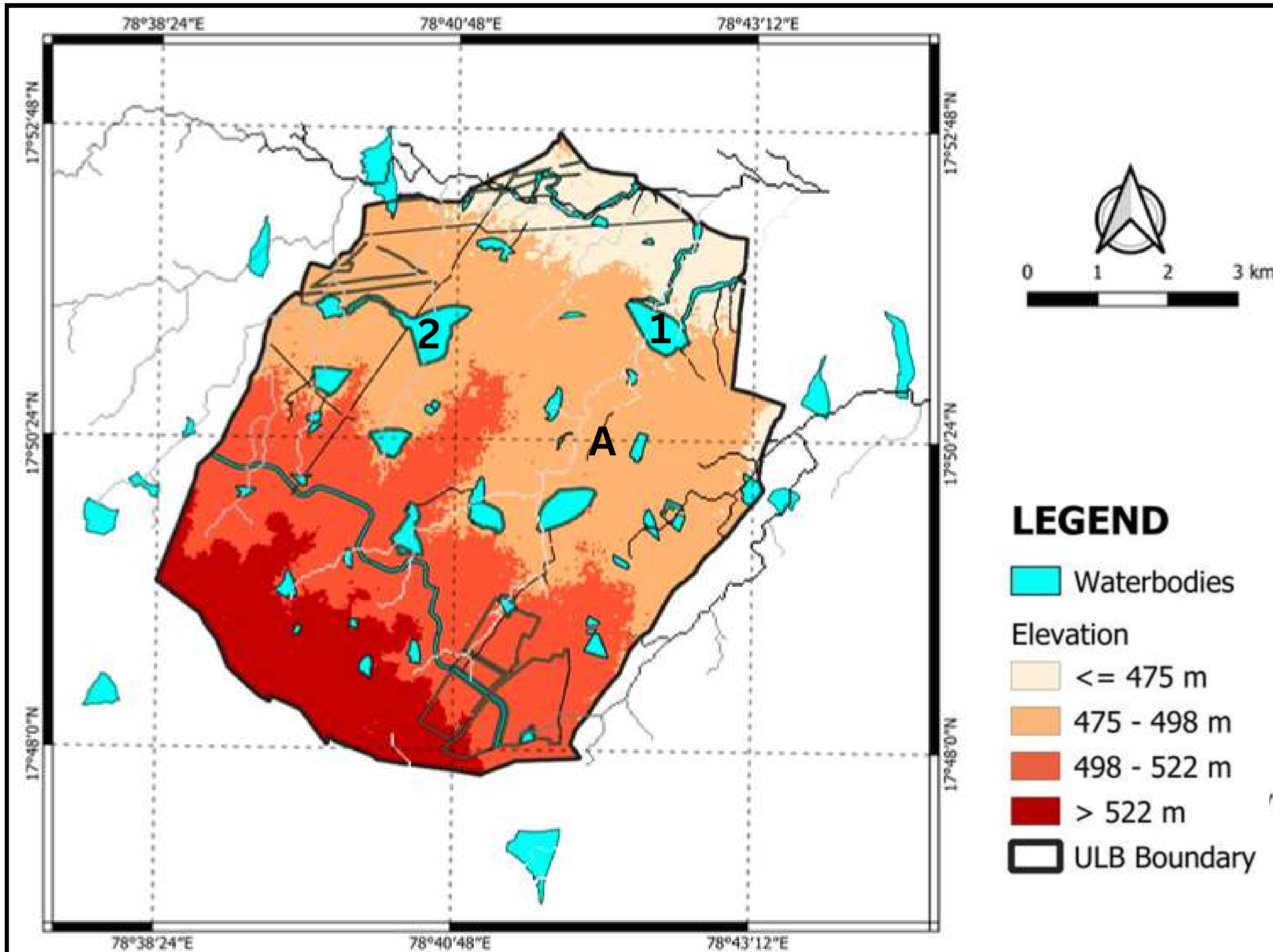


Figure 8: Schematic Representation of FSM

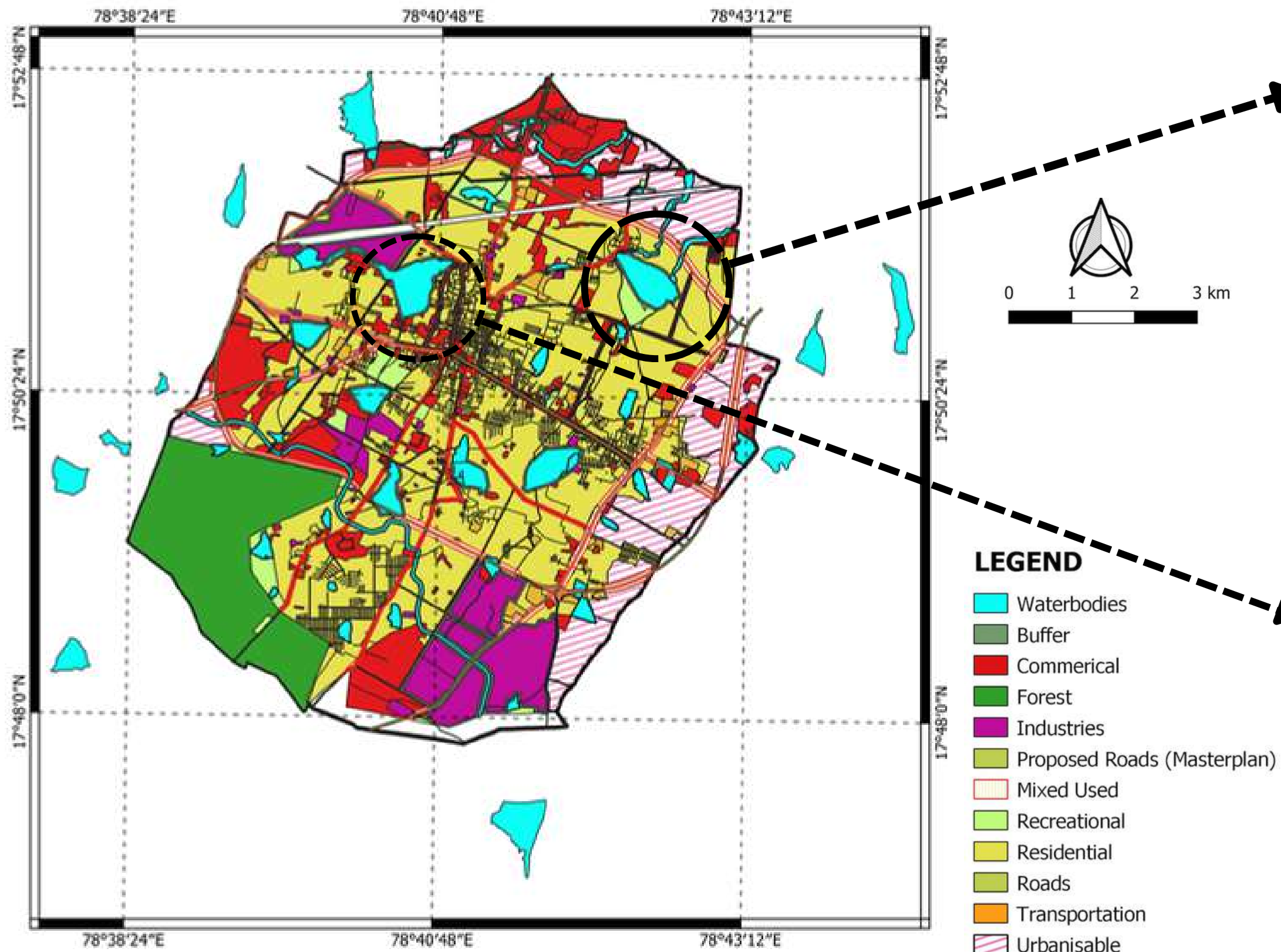
Source: Shukla et al., 2023

PROPOSED LOCATIONS OF TREATMENT FACILITIES



- The DEM map suggests that the slope, in general, is in the North-East direction
- Stream segment 'A' is the primary drainage path for most of the city's built-up
- Drainage is the most efficient path for the flow of water (or sewage water in this case)
- Lake 1 (Keshavula Chervu) and Lake 2 (Pandavula Chervu) lie downstream from the city's built-up
- Lake 1 has lesser capacity but is located in the drainage path, which encompasses most built-up
- Lake 2 has a higher capacity but lies on a drainage path away from the drainage path, which encompasses the entire city. It is located very near the built-up

Figure 5: Waterbodies and Digital Elevation Map, Gajwel-Pragnapur Municipality



Keshavula Cheruvu
Area : 328126 sq. m
Vol: 984378 cu. m

The lake has built-up in the north western edge, southern edge has empty recreational spaces.



Pandavula Cheruvu
Area: 425832 sq. m
Vol: 1277496 cu. m

The lake mostly has agricultural land surrounding it on the upslope (southern side).

Figure 6: Proposed Location of Treatment Facilities

PROPOSED USES OF TREATED WASTE WATER

Total Waste Water Generated and Treated, 2041 = 10.55 mld

Public Use



Cleaning of Roads,
Railways stations and
bus terminals, greening
of public parks

0.60 mld (5.68%)

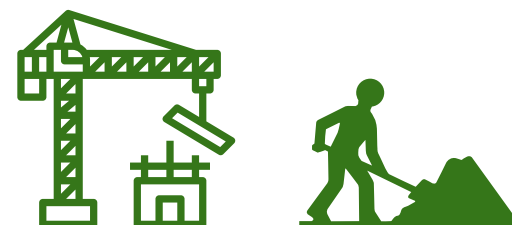
Firefighting



Fire hydrant and
sprinkler systems, fire
suppression tanks, fire
training exercises

2.00 mld (18.96%)

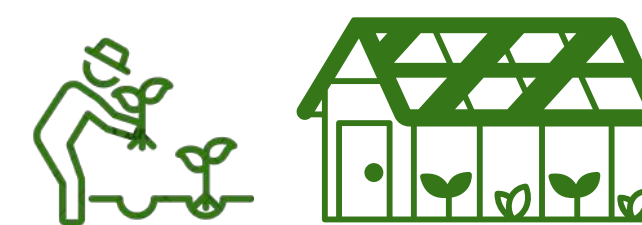
Construction Activities



Concrete mixing and
curing, dust control, soil
compaction, general
cleaning purposes

1.00 mld (9.48%)

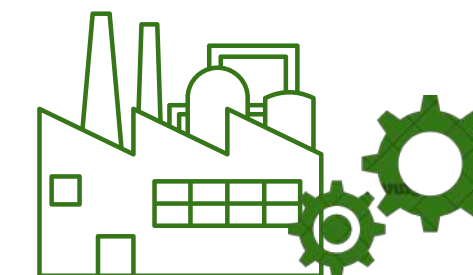
Horticulture



Drip Irrigation, soil
conditioning, nursery
activities, erosion
control

2.00 mld (18.96%)

Industries



Boiler Feed, Cooling
and Process Water,
Cleaning and other
non-potable needs

4.95 mld (46.92%)

**All of these uses are contingent upon the quality of the treated waste water.*

Source - CPHEEO, 2021

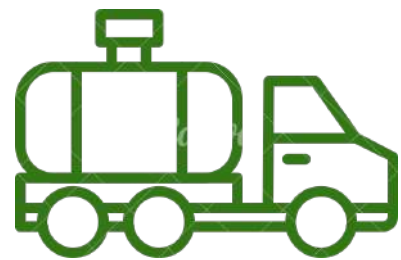
Water Tankers required for transporting treated waste water

Total treated waste water to be transported for public use = 0.6 mld

Purposes: Cleaning of Roads, Railways stations and bus terminals, greening of public parks

Average Capacity of 1 Water Tanker = 5 kl

Optimum Tankers Required



Number of Tankers = 40



No. of Trips to be taken by each tanker per day = 3

Cities generating revenues from reuse of treated waste water

- Ahmedabad
- Bengaluru
- Chandigarh
- Chennai
- Coimbatore
- Delhi
- Greater Mumbai
- Indore
- Jodhpur
- Nagpur
- Surat

Reuse and Recycle of Waste Water in Surat

- In 2014, treated waste water sold to industries in Pandesara Industrial Area at Rs. 18.20 per kl.
- Low rates led to increase in demand upto 40 mld, met through setting up of another treatment plant at Dindoli.
- Rates increased to Rs. 28.58 per kl.
- Till July 2021, Rs. 233 crores has been generated from the sale of treated waste water.



Bamroli Sewage Treatment Plant

Source - smc.gov.in

SUMMARY OF FINDINGS



Waste Water Generation

Total waste water generation in Gajwel-Pragnapur municipality is estimated to increase from 5.25 mld in 2011 to 10.55 mld in 2041. The majority of waste water, around 80%, is generated from households, followed by 11% by industry and 9% others.



Sanitation Infrastructure

As per 2011 Census data, only 30.85% households have closed drainage connections while a majority rely on open drains (56.72%) or have no drainage connectivity (12.43%). The municipality currently has a shortage of public toilets as per population norms and additional toilets are being constructed to achieve and maintain Open Defecation Free (ODF) status



Treatment Infrastructure

Currently there are no sewage treatment plants (STPs) present in Gajwel and the closest 7.25 mld STP facility is 40-50 km away in Siddipet. Two 7.25 mld treatment facilities are proposed, one near Keshavula Cheruvu and another near Pandavula Cheruvu, with Moving Bed Biofilm Reactor (MBBR) technology.



Faecal Sludge Management

Around 40% households are dependent on septic tanks/pits for sanitation as per estimates. Faecal sludge management plans propose cleaning 66,875 litres per day using 4 vacuum tankers and setting up a faecal sludge treatment plant with facilities such as sludge drying beds, anaerobic digesters etc.



Reuse Potential

With treated waste water availability estimated at 10.55 mld by 2041, reuse is proposed for applications in public cleaning, firefighting, construction, horticulture, industries which would require provisioning of water tankers. Revenue generation opportunities also highlighted through Surat case study of selling treated waste water to industries under a reuse policy.

Thank You