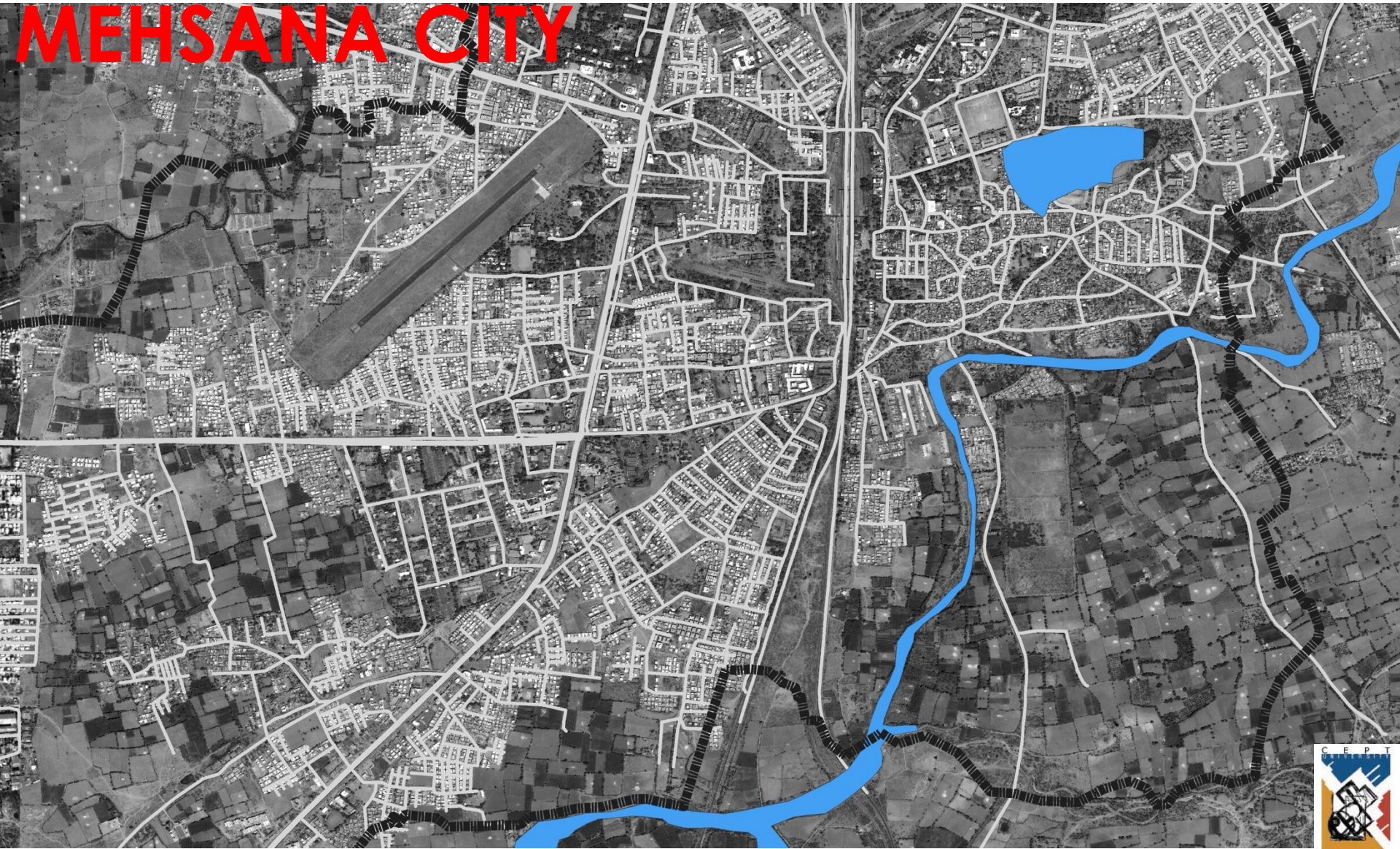


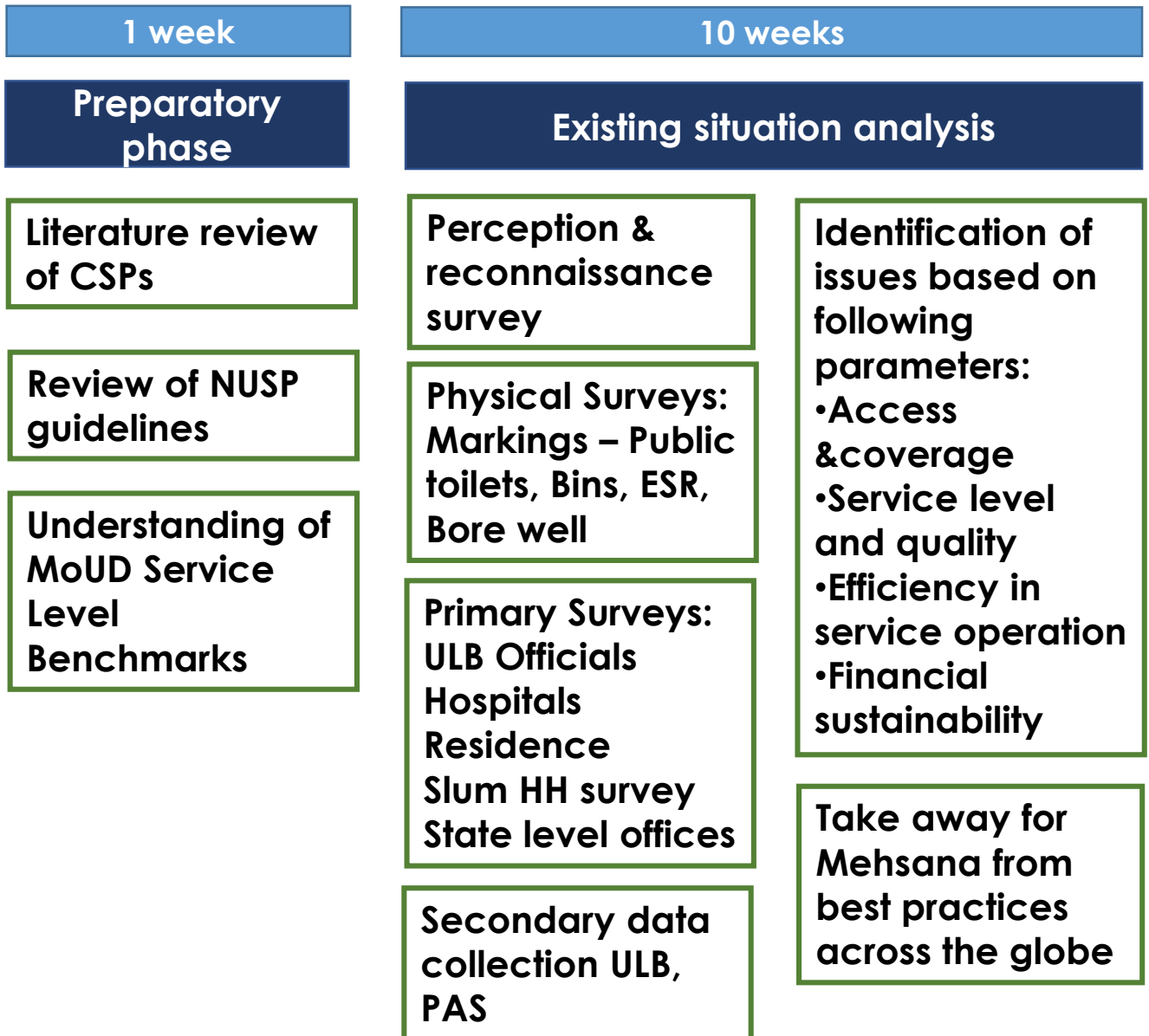
# Urban Water and Sanitation 'Plan and Projects'

**MEHSANA CITY**



# **AIM:** Preparing water supply and sanitation plan for the city of Mehsana.

**Methodology**





Institutional



Finance



Technology



Promotion



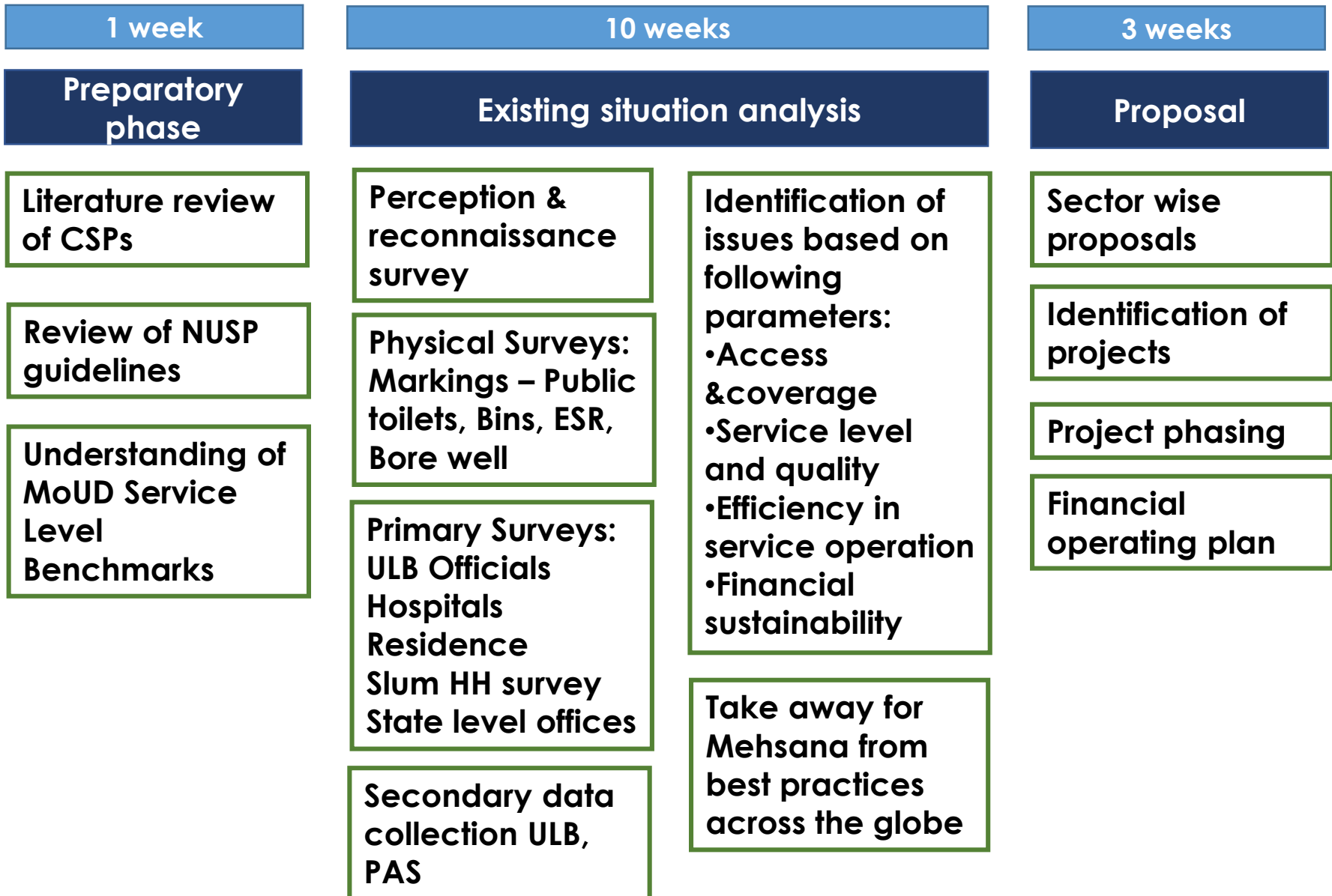
**WATER SUPPLY**

**WASTE WATER**

**SOLID WASTE**

# AIM: Preparing water supply and sanitation plan for the city of Mehsana.

Methodology



# CONTENTS

1. State & District Profile
2. Mehsana City Profile
  - Topography & Connectivity
  - Spatial Growth
  - Demography
  - Landuse and slums
3. Sectoral Analysis
4. Finance & Institutional Structure
5. Key Highlights & Concerns.

**Vision and objectives**

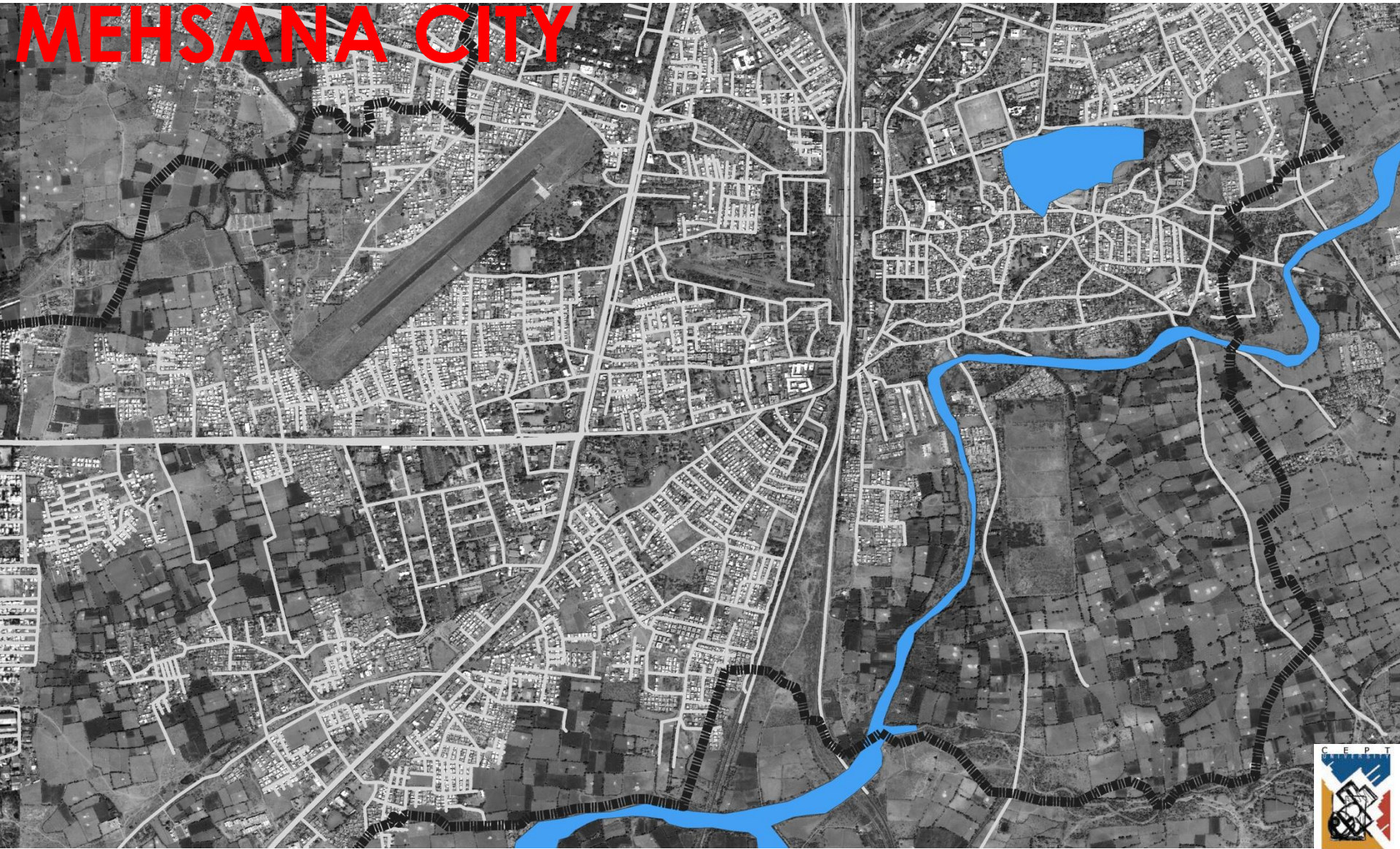
**WSS sector and Financial  
plans and proposals**

AUDIO/ VISUAL FORMAT

PRESENTATION  
FORMAT

# Urban Water and Sanitation 'Plan and Projects'

**MEHSANA CITY**



# **AIM:** Preparing water supply and sanitation plan for the city of Mehsana.

**Methodology**

**1 week**

**Preparatory phase**

Literature review of CSPs

Review of NUSP guidelines

Understanding of MoUD Service Level Benchmarks

**10 weeks**

**Existing situation analysis**

Perception & reconnaissance survey

Physical Surveys: Markings – Public toilets, Bins, ESR, Bore well

Primary Surveys: ULB Officials  
Hospitals  
Residence  
Slum HH survey  
State level offices

Secondary data collection ULB, PAS

Identification of issues based on following parameters:  
• Access & coverage  
• Service level and quality  
• Efficiency in service operation  
• Financial sustainability

Take away for Mehsana from best practices across the globe



Institutional



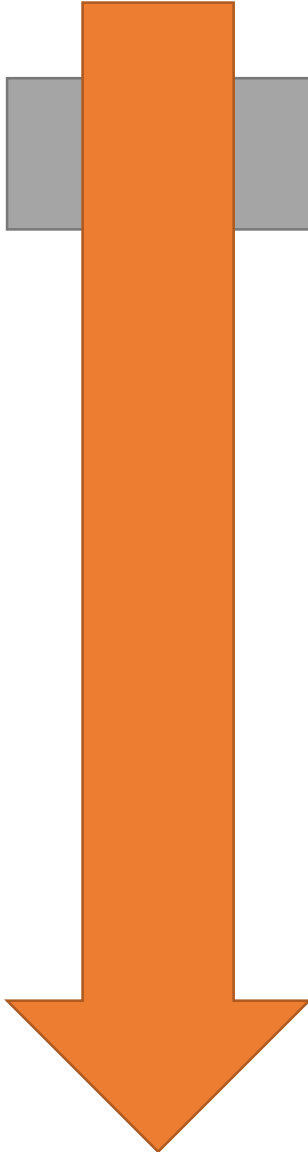
Finance



Technology



Promotion



**WATER SUPPLY**

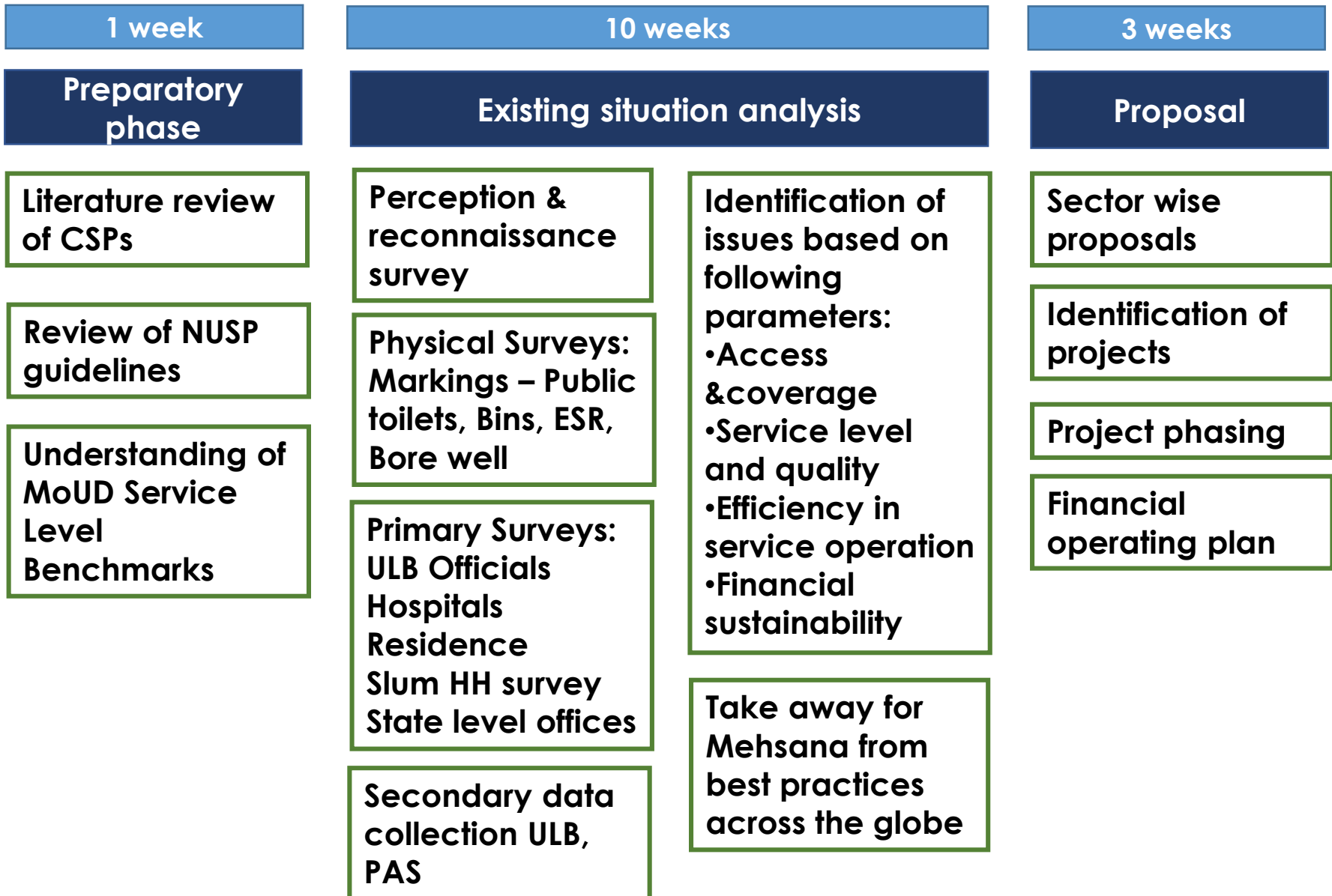
**WASTE WATER**

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# AIM: Preparing water supply and sanitation plan for the city of Mehsana.

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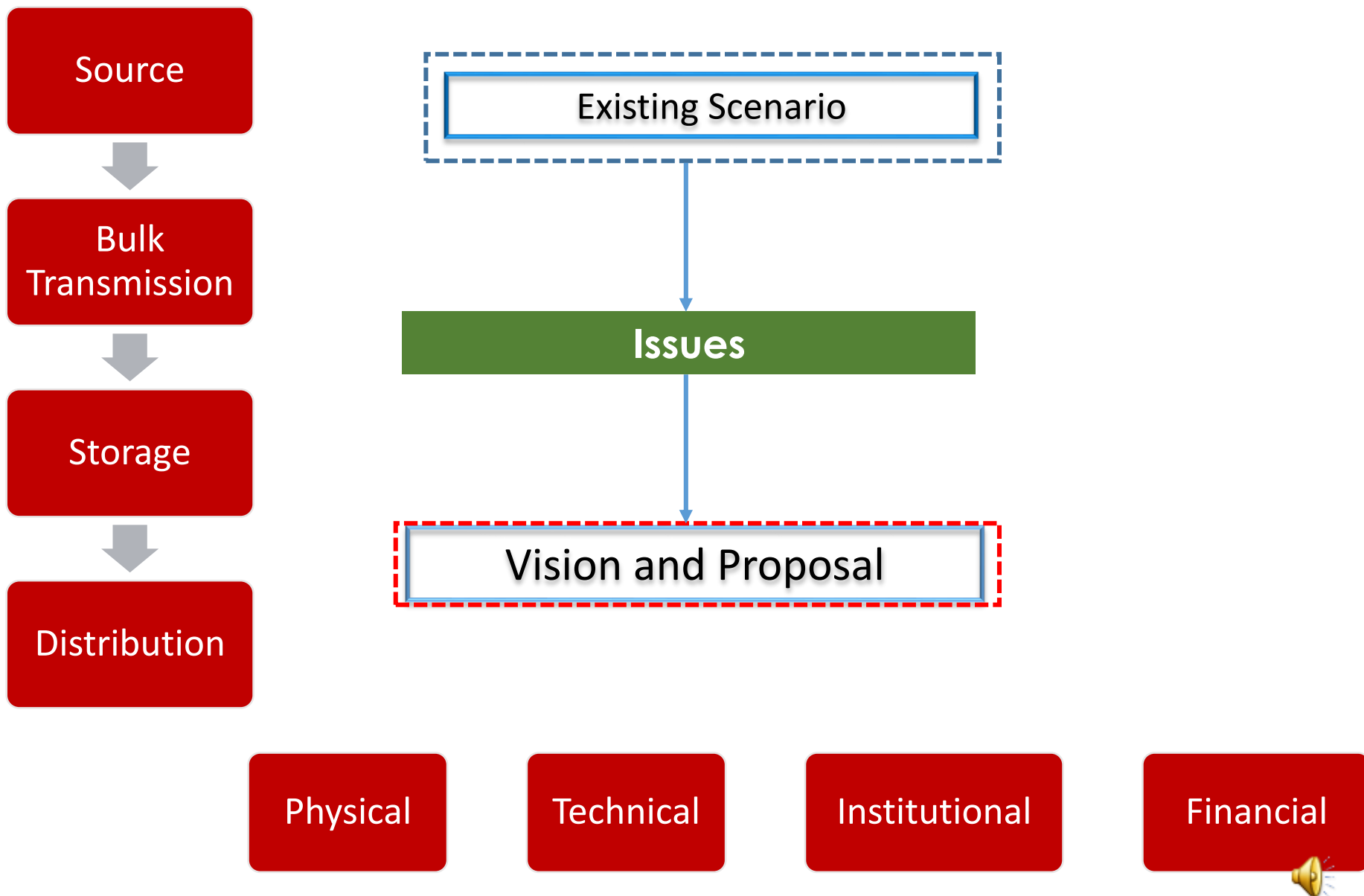
PRESENTATION  
FORMAT

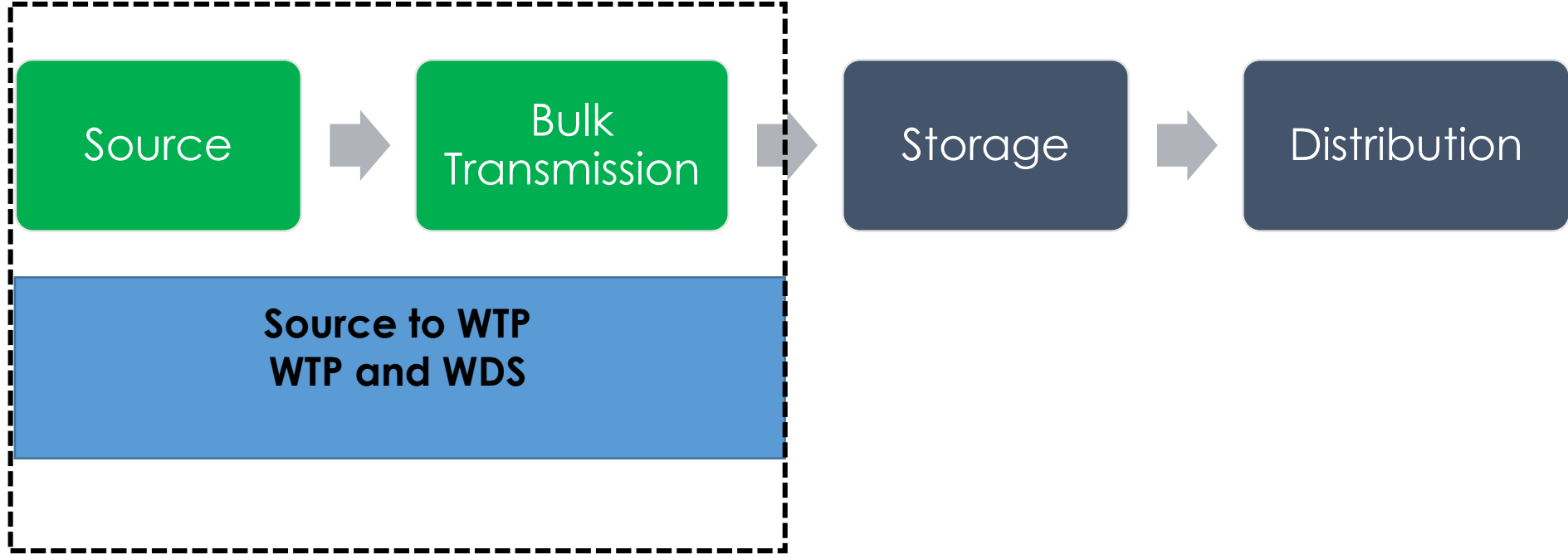


# WATER SUPPLY



# Methodology

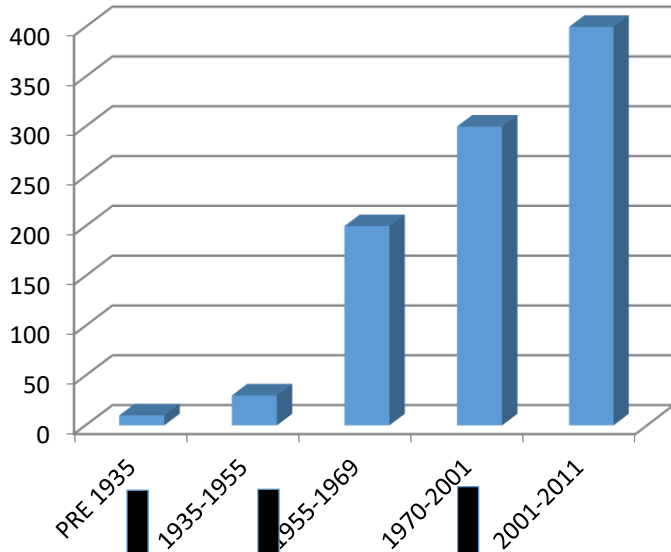




# Historical Background – Water Supply

**BORE WELL DEPTH (METRES)**

2007-2012 : NARMADA WATER SUPPLY



BORE WELL DEPTH (METRES)

OVER EXPLOITED AREA > 100%

- Dug wells by bullock & manual lifting
- Dug cum bore well, Diesel Pump
- Deep Tube Wells with electric motors



Source GWRE (2002)



# Bulk Transmission- Existing Scenario

- WTP Capacity = 91 mld
- Qty received : 70 MLD
- 240 lakh ltr. Cap clear water sump
- No metering at intake
- Quality treatment : alum + clariflocculation+ chlorination
- Water quality test : ph/turbidity/ chlorine
- Mehsana ( rural) : 6MLD
- Mehsana Urban : 26 MLD
- QUANTITY PRODUCED : 70MLD FOR DEDIYASAN WTP
- Metering at outlet

•Modhera Head works:120 lacs lit capacity

•1000 mm dia ,  
•rising main 23.6 km

•Off take Point from NMC, metrasan village  
•0.9 km, 1150mm dia, MS line

•Dediyasan

Mehsana,

Image © 2013 DigitalGlobe

Google earth

Imagery Date: 1/2/2013 23°35'26.53" N 72°15'58.30" E elev 71 m eye alt 21.96 km

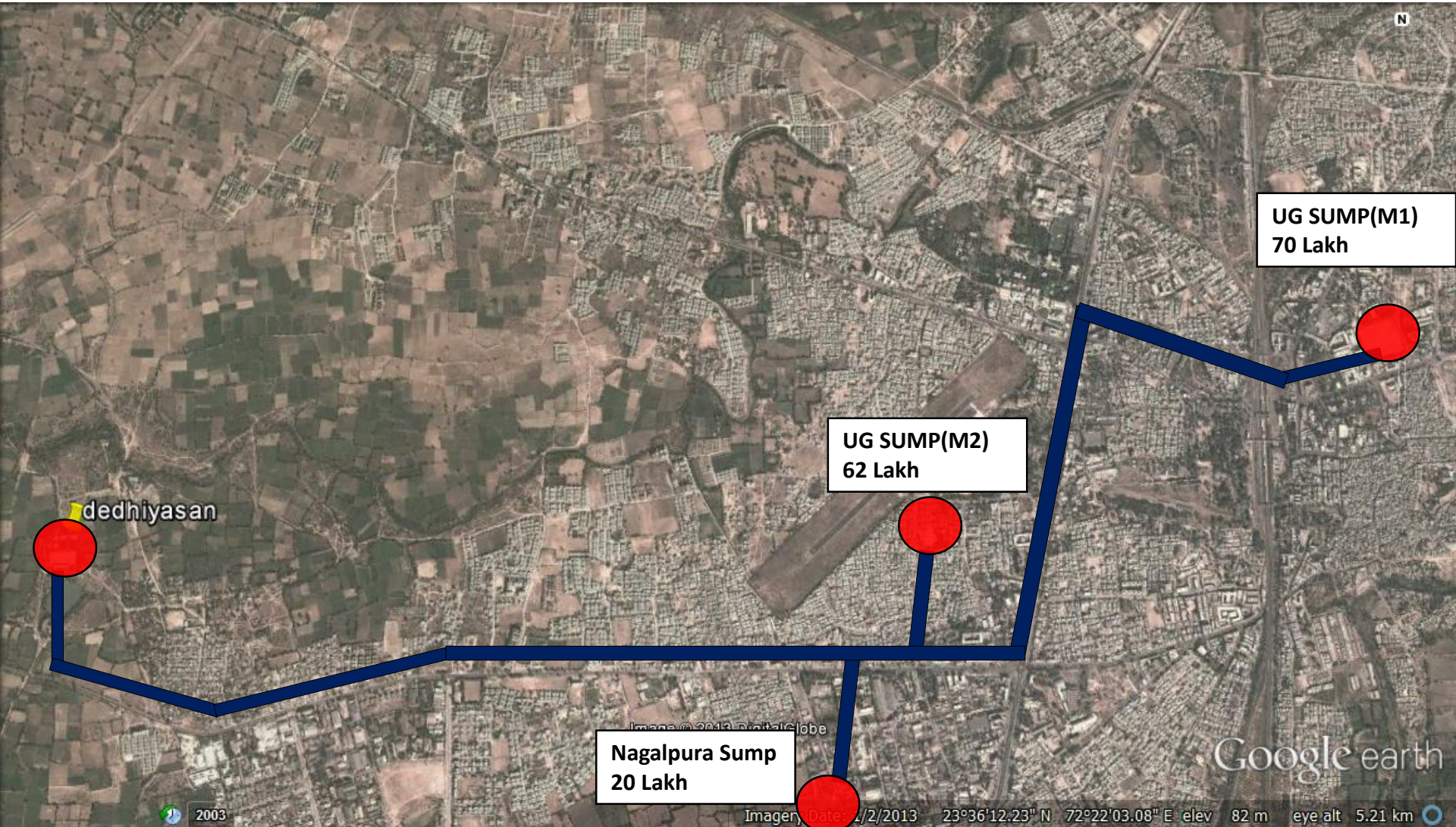
SSNNL

Rate : 4rs/1000kl

GWSSB



# Bulk Transmission- Existing Scenario



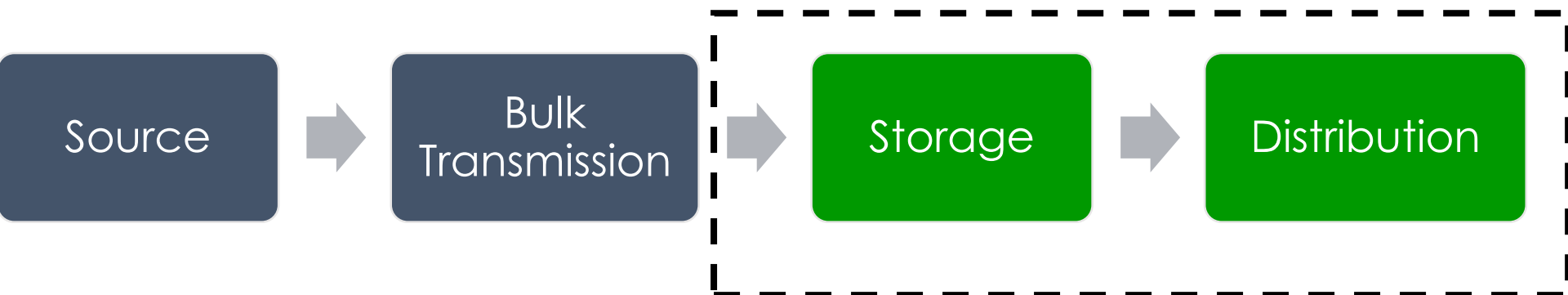
GWSSB

Rate : 6rs/1000kl

ULB

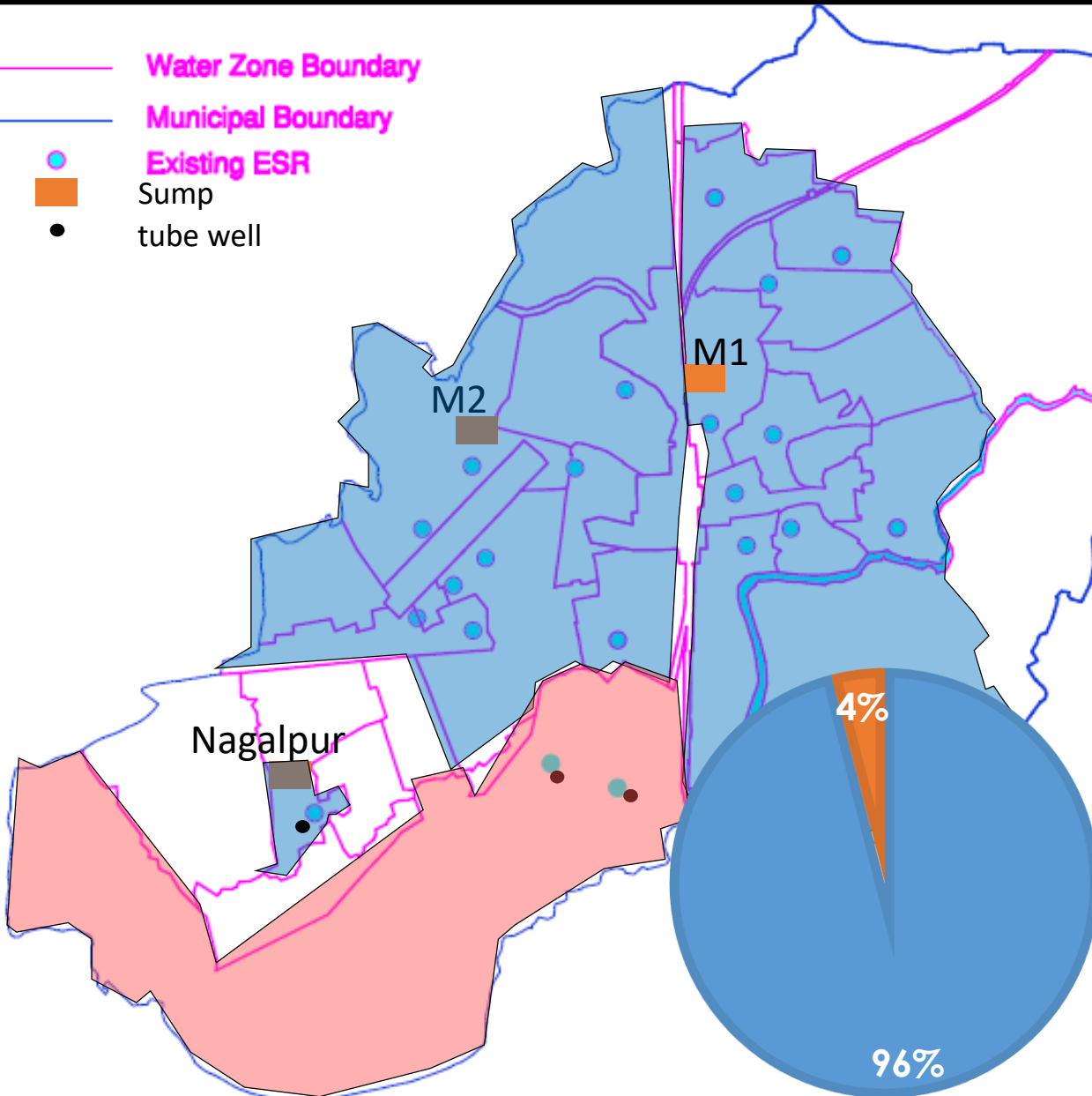






# Existing Water Supply Scenario

- Water Zone Boundary
- Municipal Boundary
- Existing ESR
- Sump
- tube well

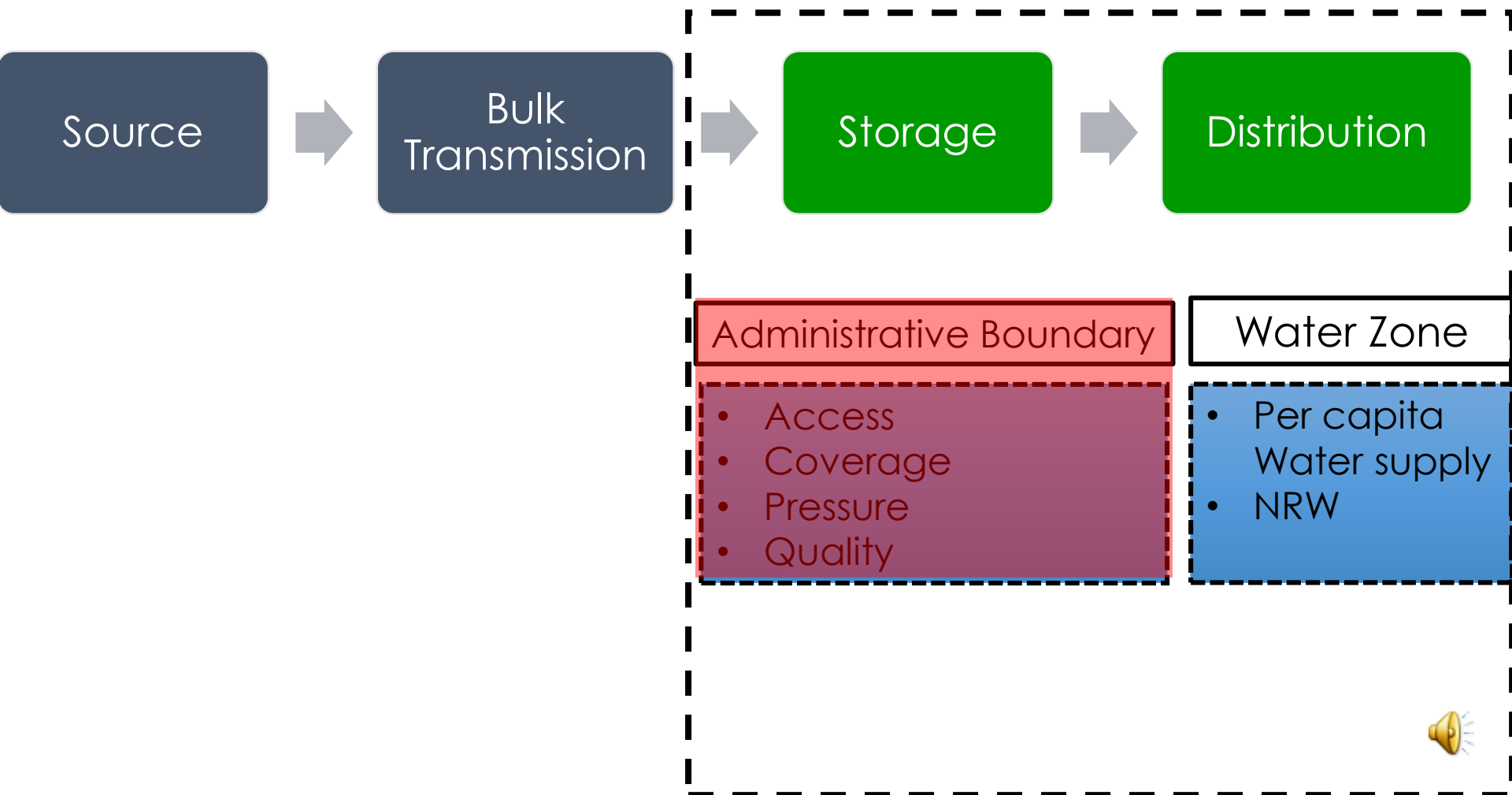


Three Sump:  
 M1: 70 Lakh Litre  
 M2: 62 Lakh Litre  
 Nagalpur: 20 lakh litre

Total 28 MLD Water from Narmada.  
 M1 +M2: 26 MLD  
 Nagalpur: 2 MLD

ESR:  
 M1: 9 no of ESR  
 M2: 9 no of ESR  
 Nagalpur: 3 no of ESR

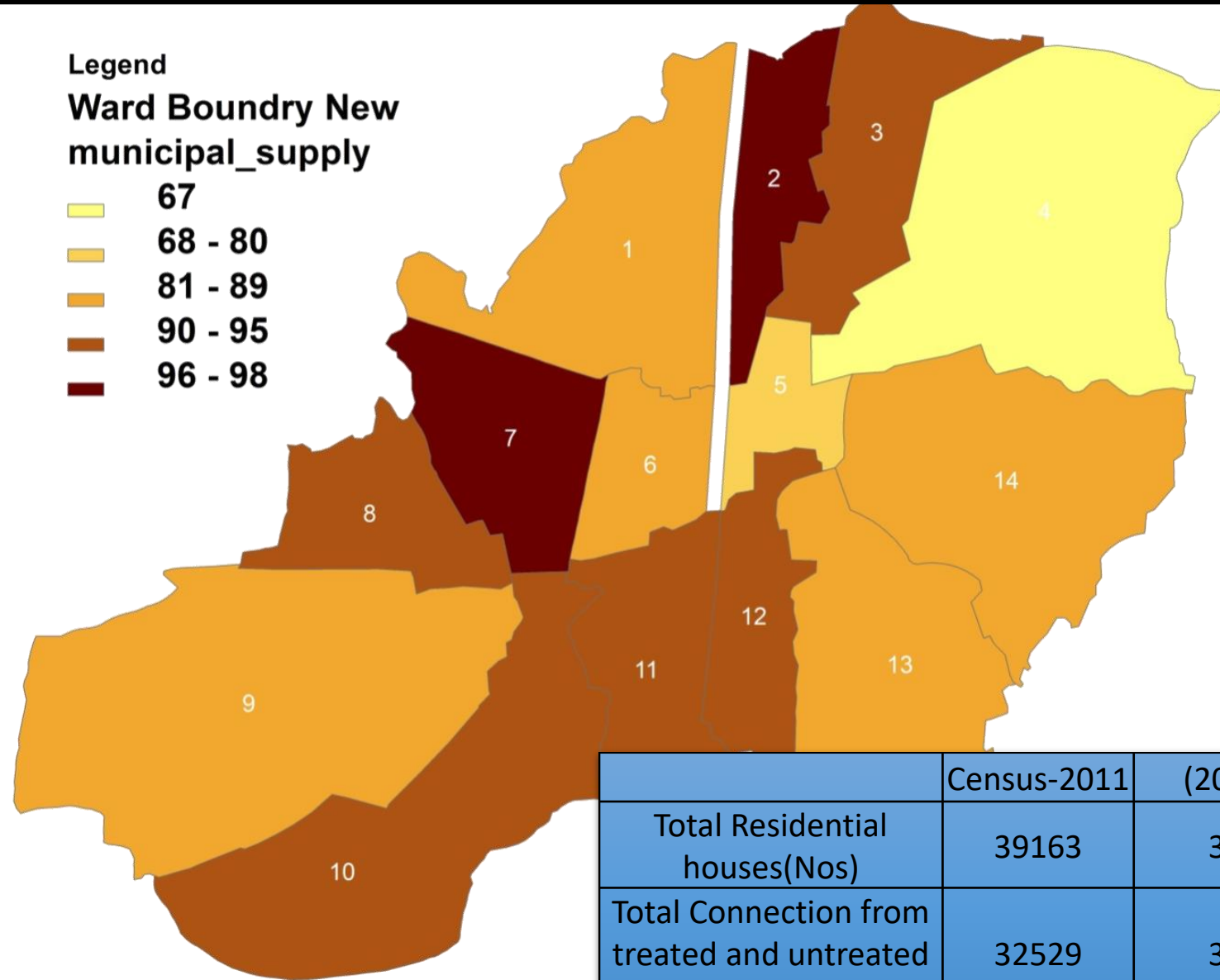
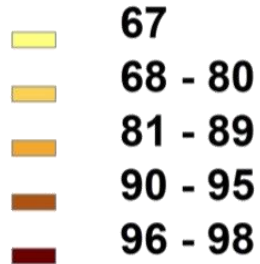




# Water Supply- Access

Legend

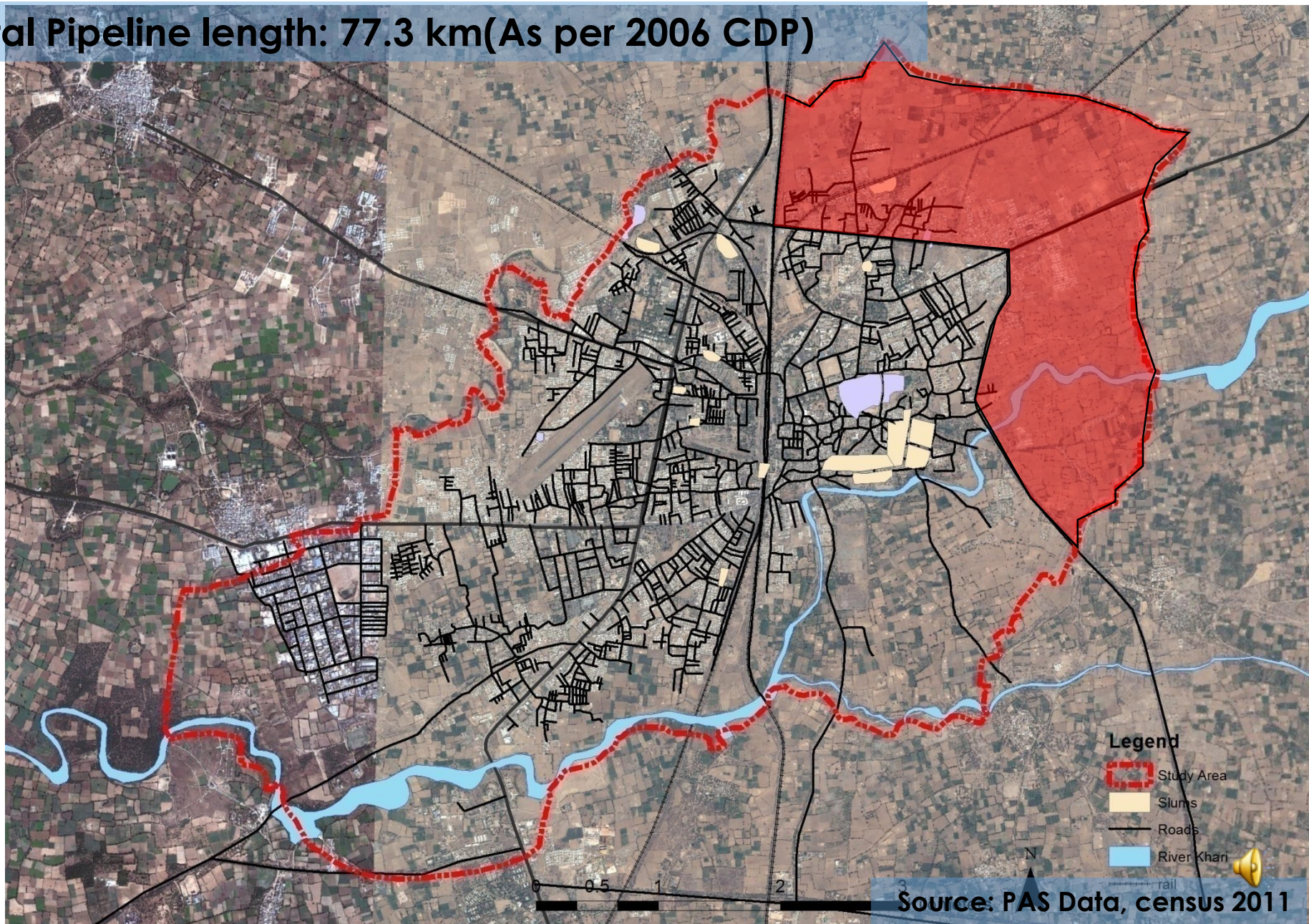
Ward Boundry New  
municipal\_supply



	Census-2011	(2010-11)	(2012-13)
Total Residential houses(Nos)	39163	39302	43174
Total Connection from treated and untreated source (Nos)	32529	31646	34687
<b>Access</b>	<b>83.06%</b>	<b>80.52%</b>	<b>80.3%</b>

# Water Supply- Coverage

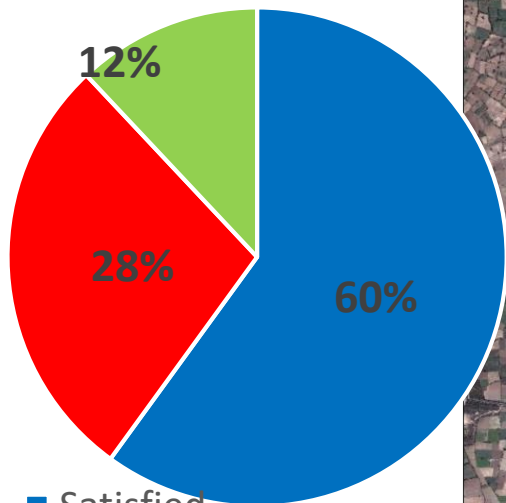
Total Pipeline length: 77.3 km(As per 2006 CDP)



# Water Supply- Pressure

- High losses in distribution network
- Tail end of water zones
- Lack of pressure in the areas where water is supplied through bore wells

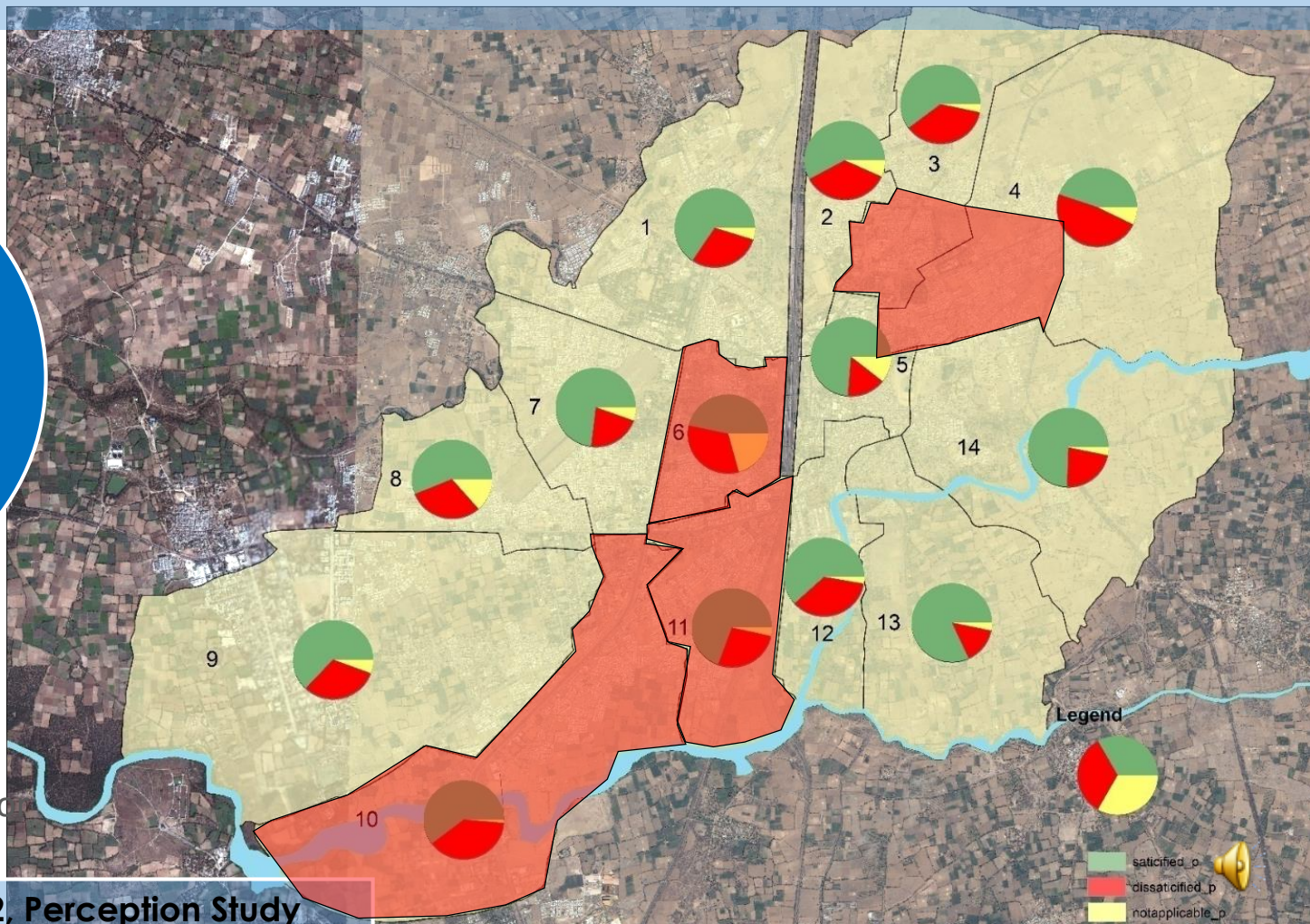
Pressure



■ Satisfied

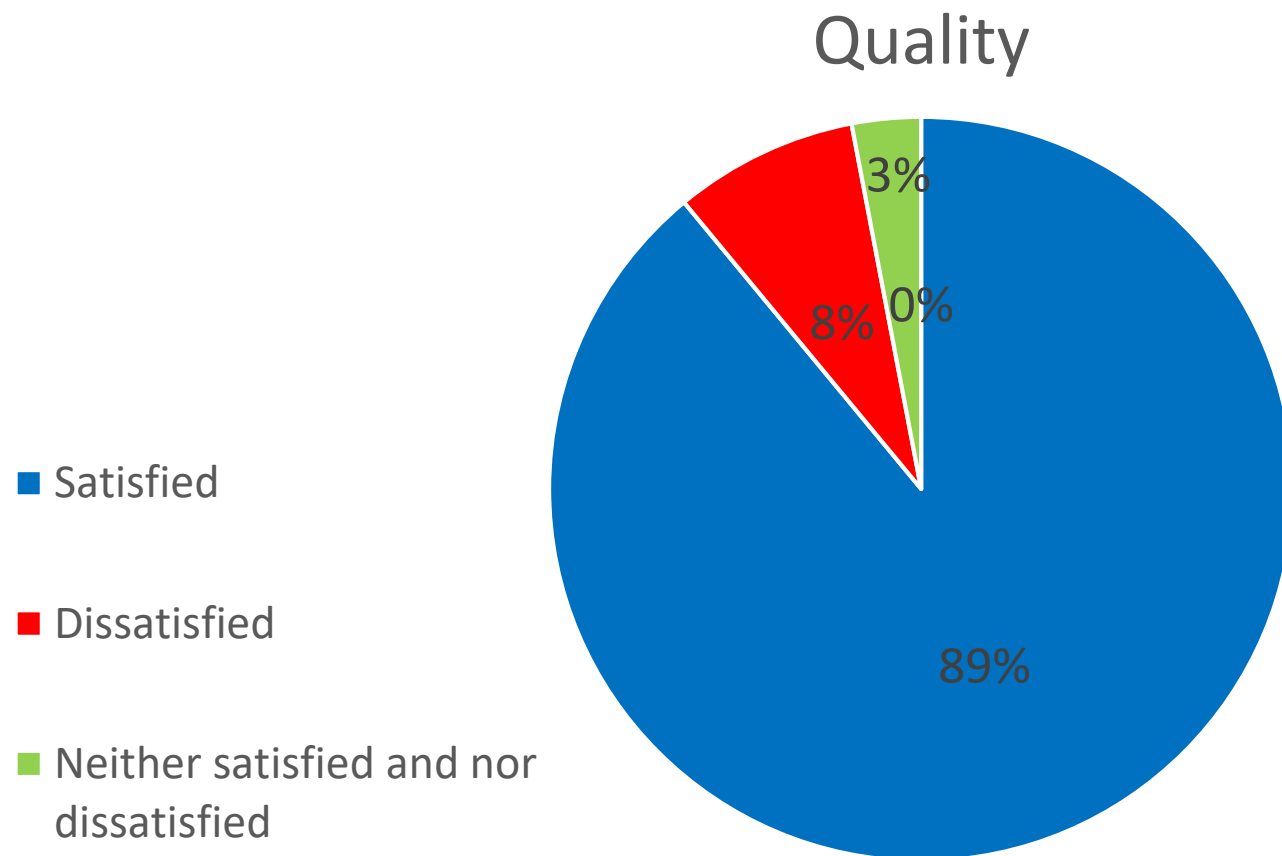
■ Dissatisfied

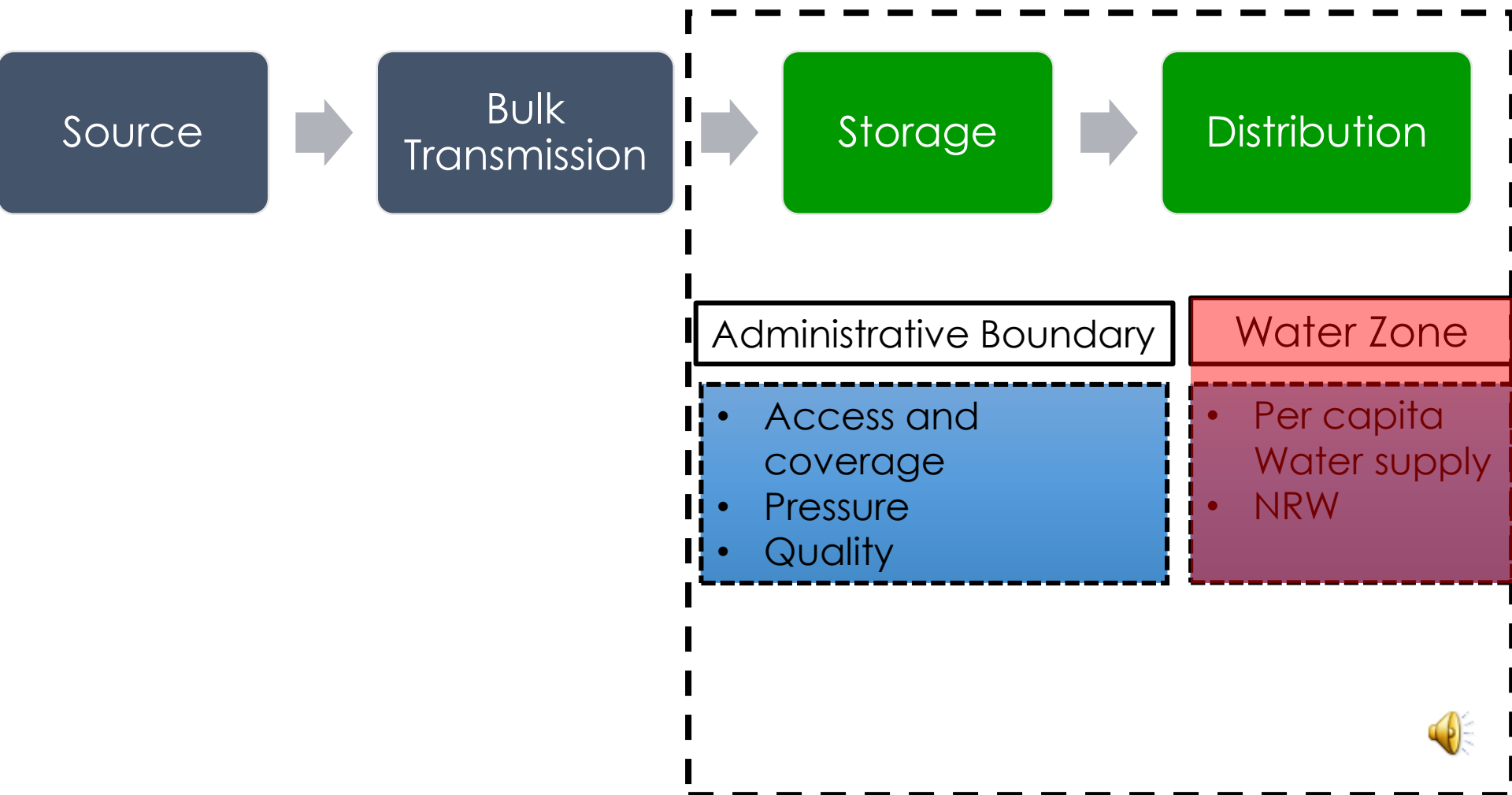
■ Neither satisfied and not dissatisfied



# Water Supply- Quality

- Chlorination treatment is done at Sump level for Narmada water.
- No treatment is done for bore well water supply.

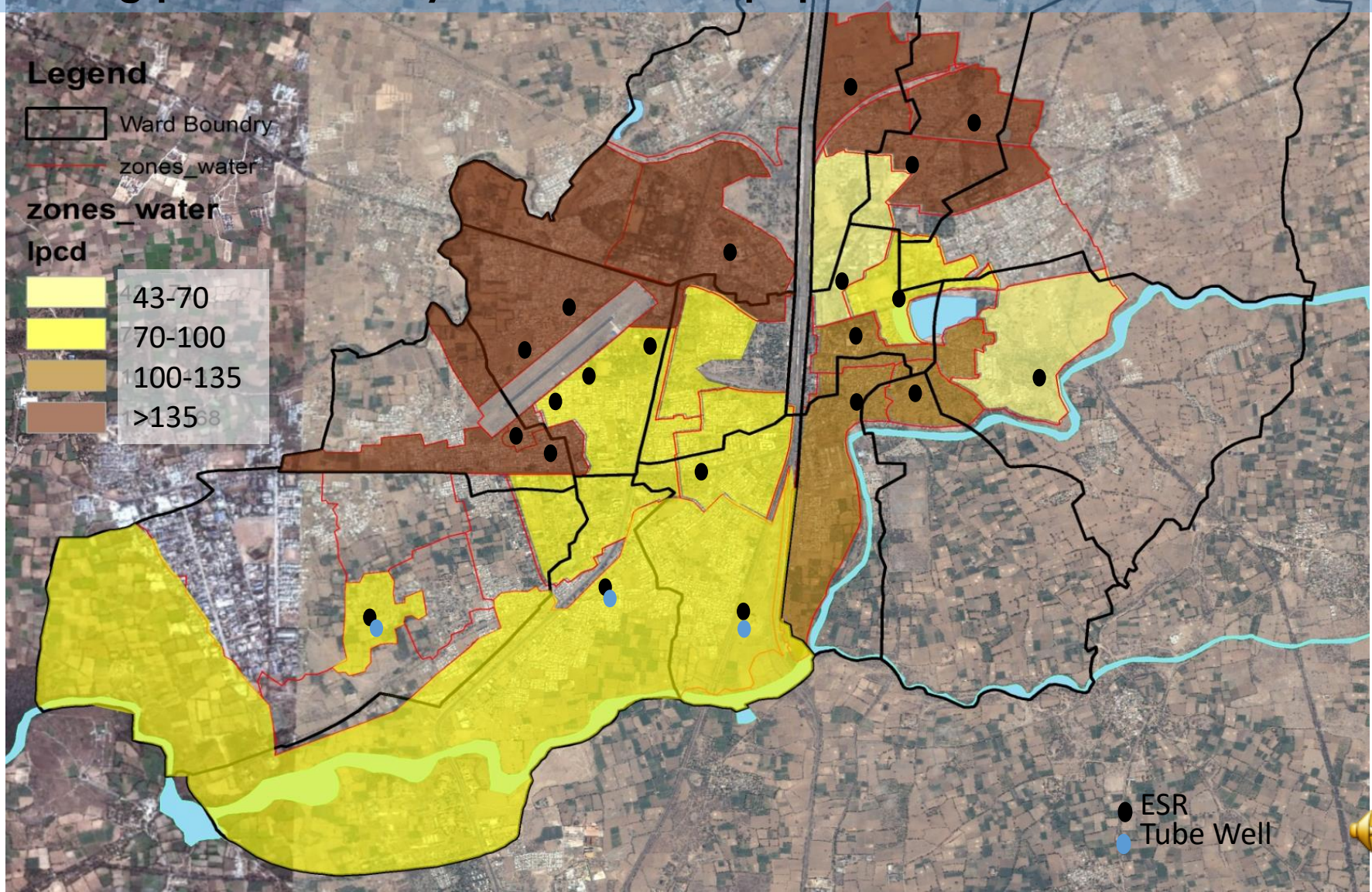




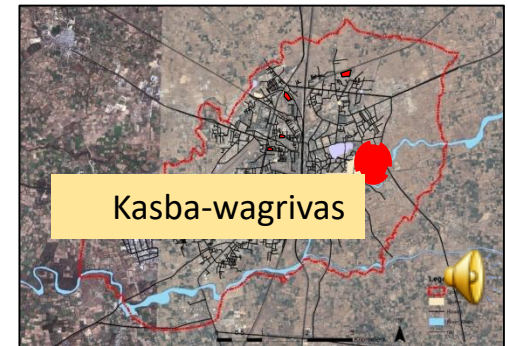


# Water Supply-LPCD

- Areas where water supply is less than 70 LPCD tends to be the area having predominantly lower income population.



# Kasba- wagarivas Area Scenario



- Population: 100
- Per capita water supply is less than 70 lit.
- Number of Households having individual connection is less.
- Stand Post: 5 Nos

# Water Supply-LPCD- Scenario

- Magpara Area



- Rabarivas Area

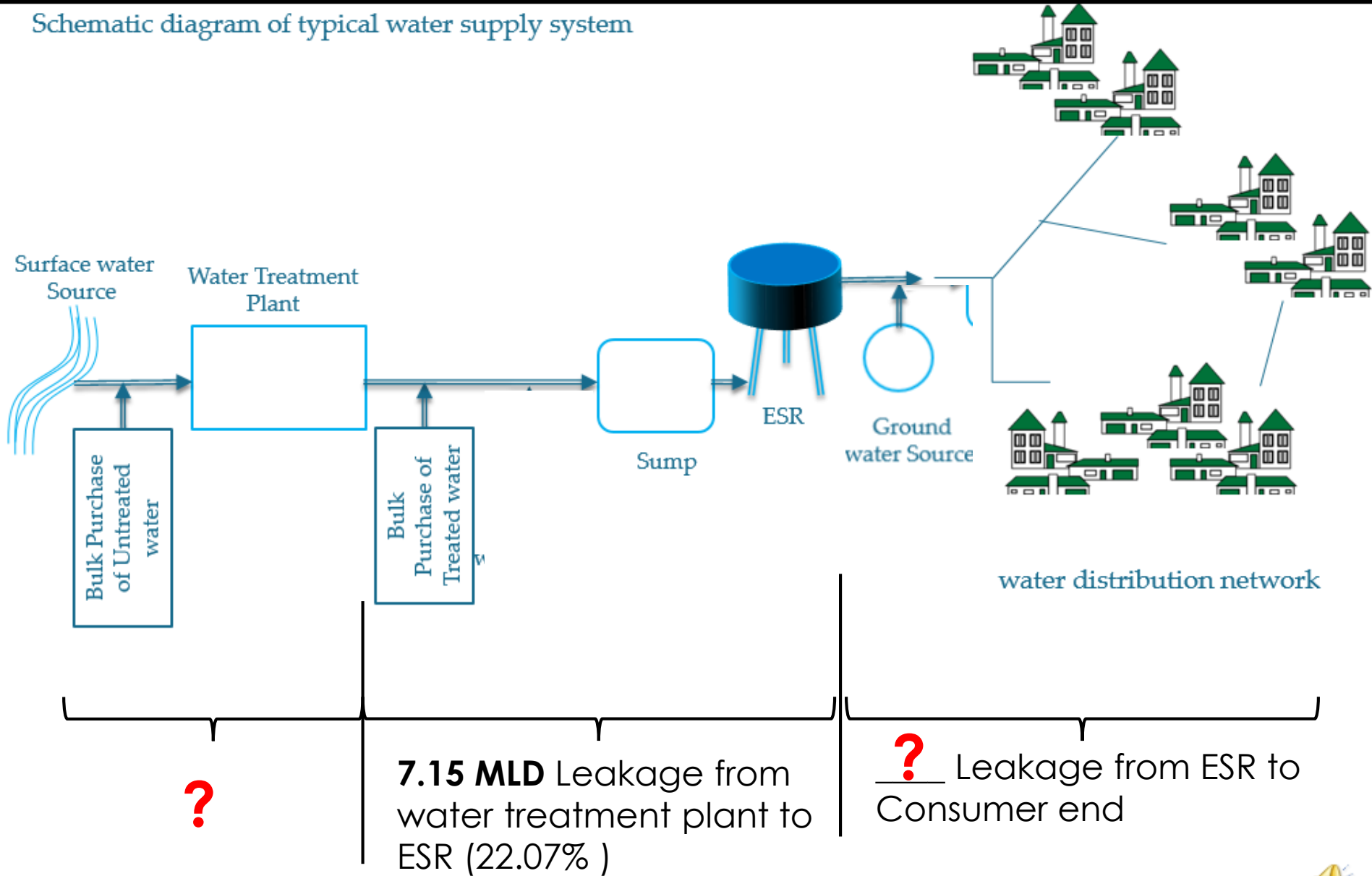


- Sukhapura Daferia Area



# Non Revenue Water

Schematic diagram of typical water supply system



# Water Supply (How performance is gauged?)



**success**

	Standard Benchmark	Mehsana
Coverage, Water Supply connections	100%	80.30%
Per capita supply of water	135 lpcd	112 lpcd
Extent of metering	100%	0
Continuity of water supply	24 hrs	2 hrs
NRW Reduction	20%	22% +Demand Side
Cost recovery in water supply services	100%	57%
Efficiency in collection of water charges	90%	73%
Quality of water supplied	100%	100%
Redressal of complaints	100%	100%



# Urban Water Supply Scenario - Mehsana

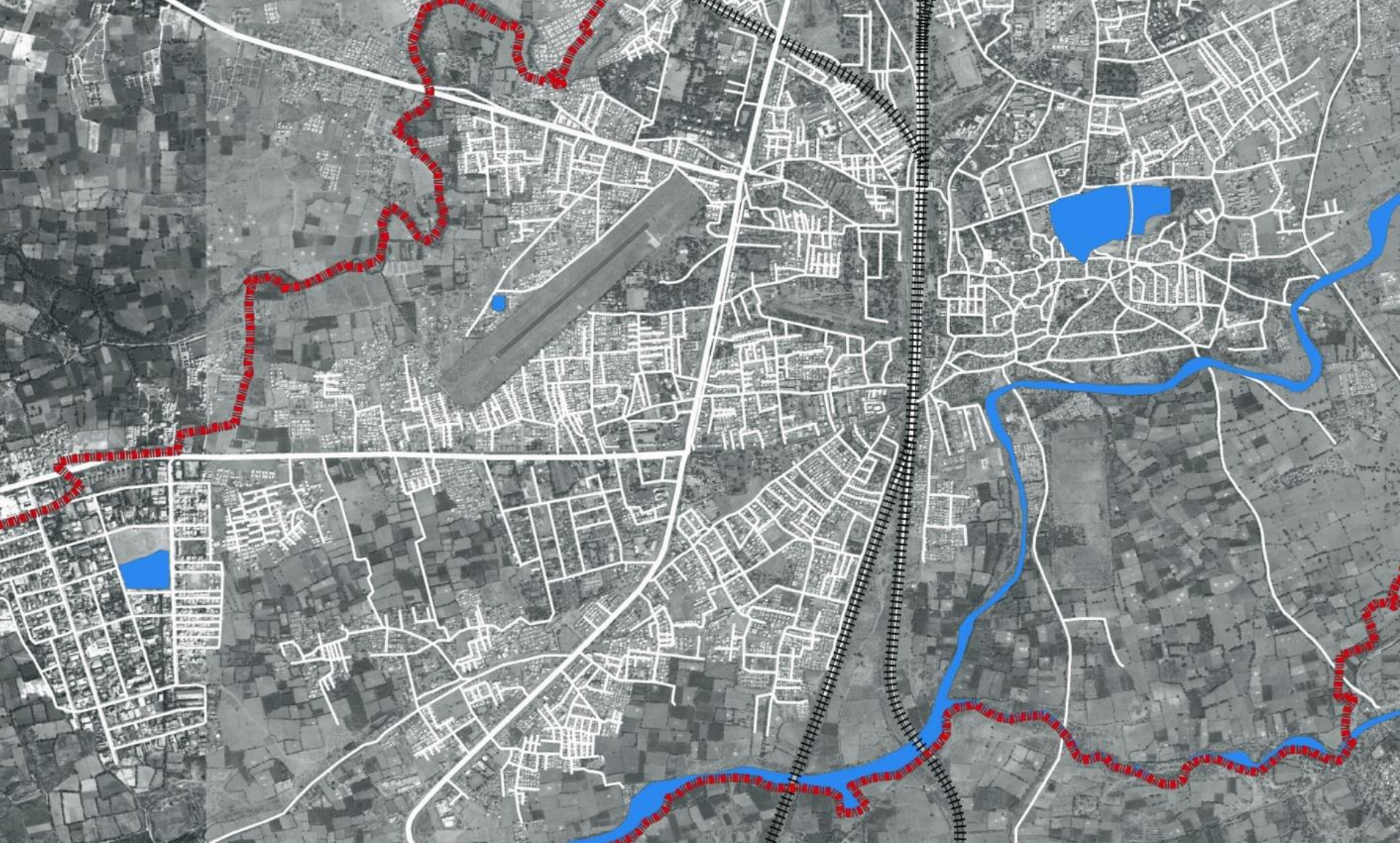
Desirable

Source Sustainability  
Universal access  
Efficiency in Supply  
Financial Sustainability  
24x7 supply

Ground Reality

High dependence on Narmada  
Medium Coverage  
High NRW and inefficiency  
Poor cost recovery  
Intermittent supply





# EXISTING SCENARIO OF WASTE WATER AND SANITATION



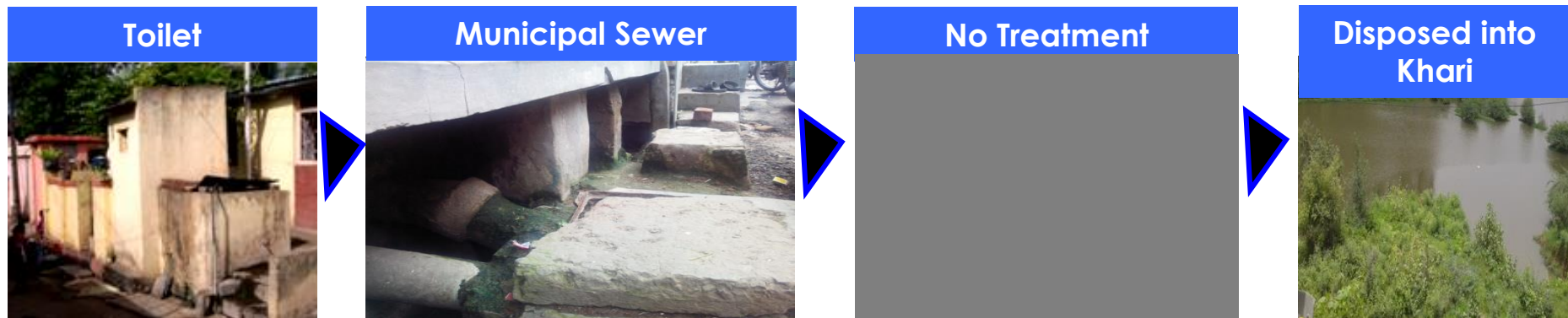
# Sanitation Chain

User interface → Collection → Conveyance → Treatment → Disposal/ Reuse

- Individual/Shared toilets
- Public/community toilets

- Toilets connected to **sewer lines**
- Toilets connected to **Septic Tanks**

- Sewage farm
- On site sanitation
- Disposed into Khari river





# User interface

## HOUSEHOLD within premises



**89.9% within premises**



**2.77% Public toilets  
( i.e. 1091 HH)**



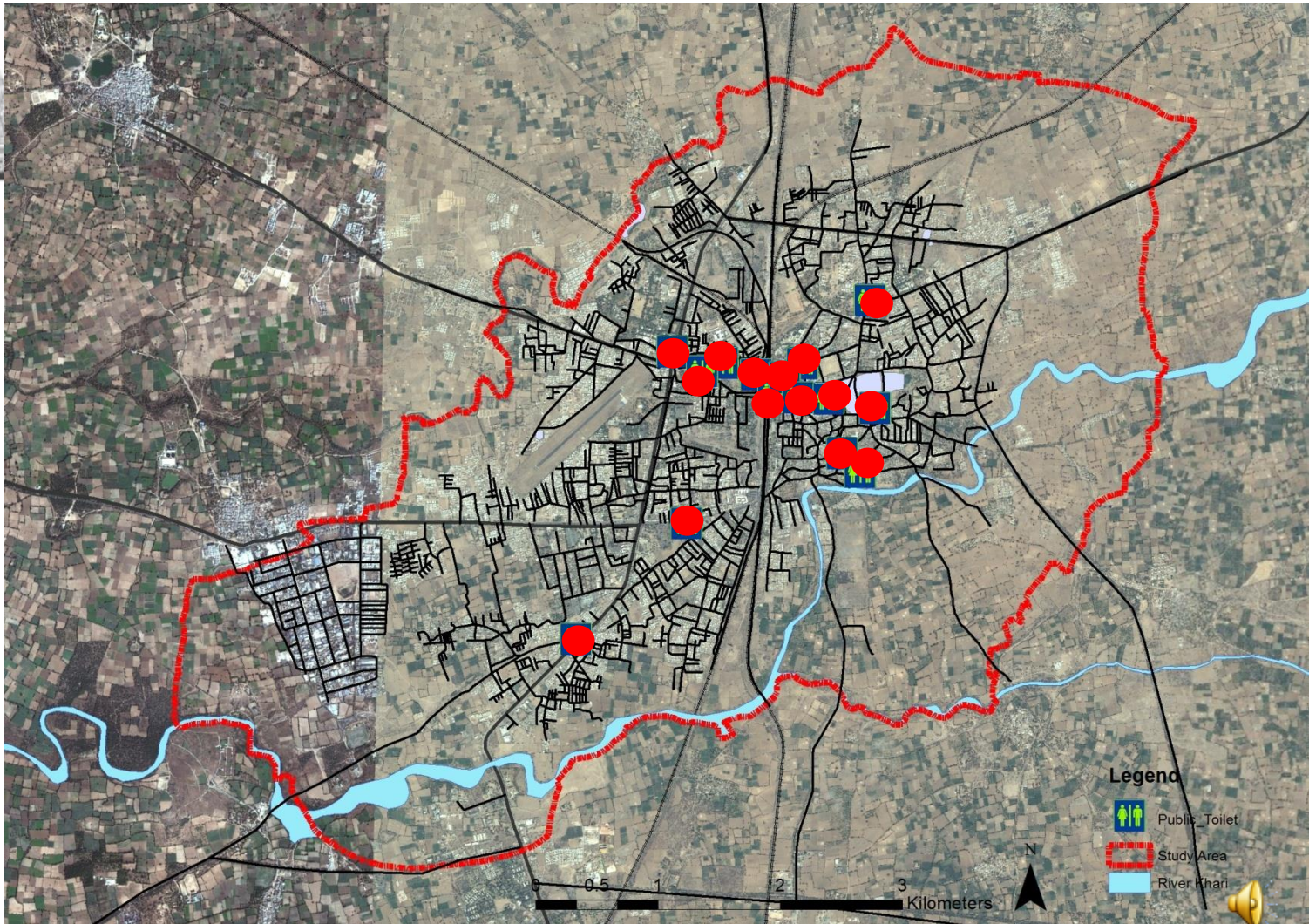
**7.34% Open Defecation**



# User interface



2.77% Public  
toilets  
(i.e. 1091 HH)



# Contract

## Construction and O&M Contracts

### Municipality (First Party) and Contractor (Second Party)

<b>Service provision clause</b>	Detailed site-plans and land free from all the disputes is by first party.
	Second party shall submit drawings, estimates and specifications and after approval construction shall take place.
	Second party should construct and shall regularly clean, maintain or repair if necessary for 20 years.
	IEC ,hoardings and signboards will be provided by second party.
	Availaibility of adequate quantity of water at suitable pressure
<b>Payment clause</b>	<b>Payment Phases:</b> (25%-plinth level, 25%-slab level, 25%-plastering and extra work, 25%- after completion)
<b>Monitoring Clause</b>	Neglect of second party to clean, maintain and repair regularly, first party shall <b>terminate</b> the agreement (Notice of two months.
	Notice of two months shall be given before.
<b>Charges</b>	Rs. 2 for WC and Rs. 3 for Bath per use shall be charged.



# Public Toilets



Along SH  
Well maintained  
**Maintained By:** 2 contractors (On contract by  
the Municipality)



# Public Toilets



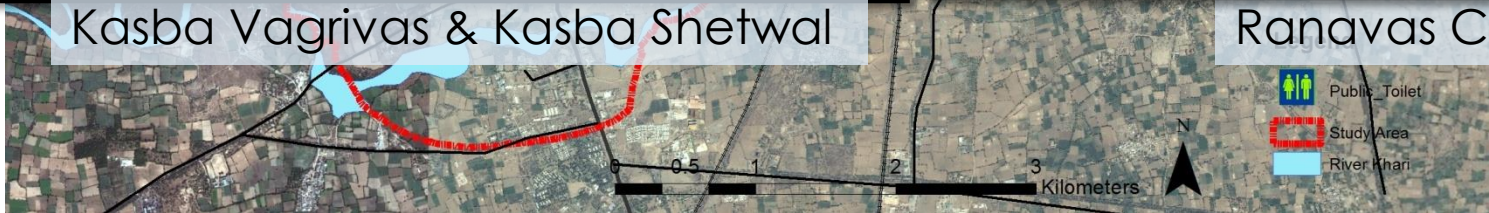
Legend

-  Public Toilet
-  Study Area
-  River Khari

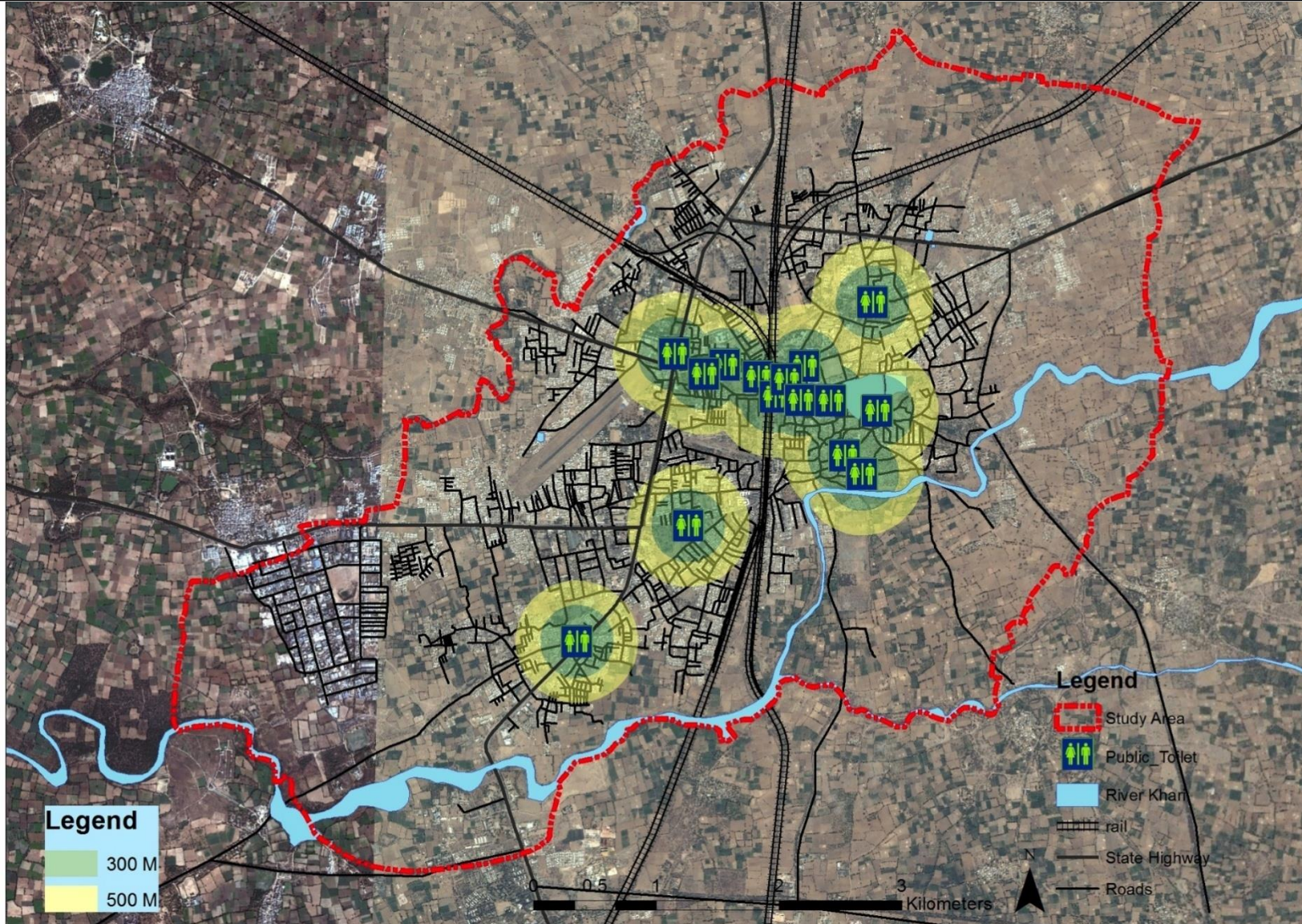
0 0.5 1 2 3 Kilometers



# Public Toilets

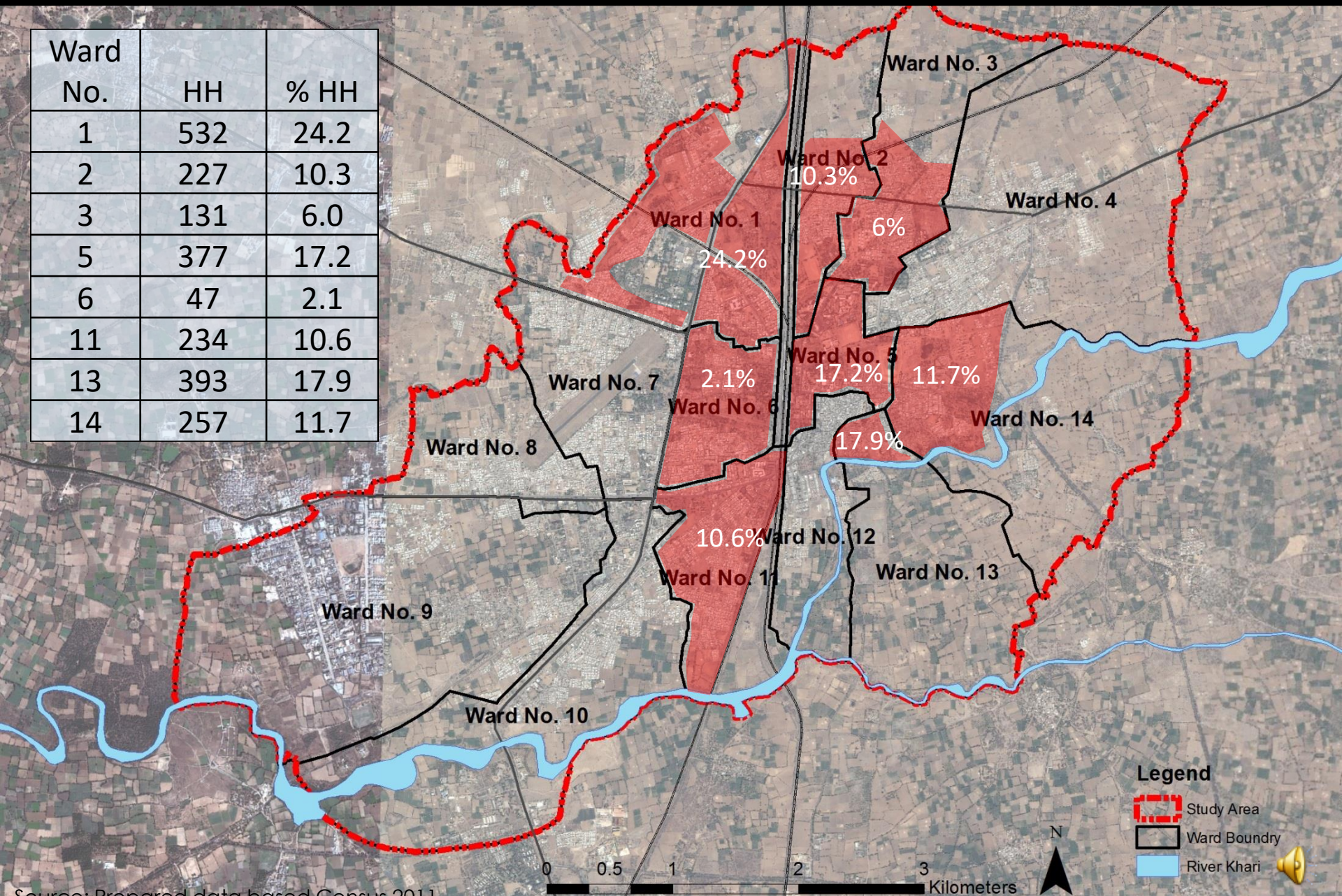


# Public Toilets Accessibility Buffer



# Open defecation

Ward No.	HH	% HH
1	532	24.2
2	227	10.3
3	131	6.0
5	377	17.2
6	47	2.1
11	234	10.6
13	393	17.9
14	257	11.7



Source: Prepared data based Census 2011



# Open Defecation



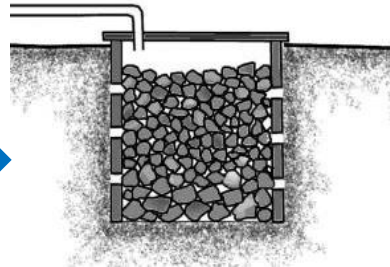
User interface

Collection & Conveyance

Disposal/ Reuse



38% Households are connected to municipal sewer



43.4% Households are connected to septic tanks + soak pits



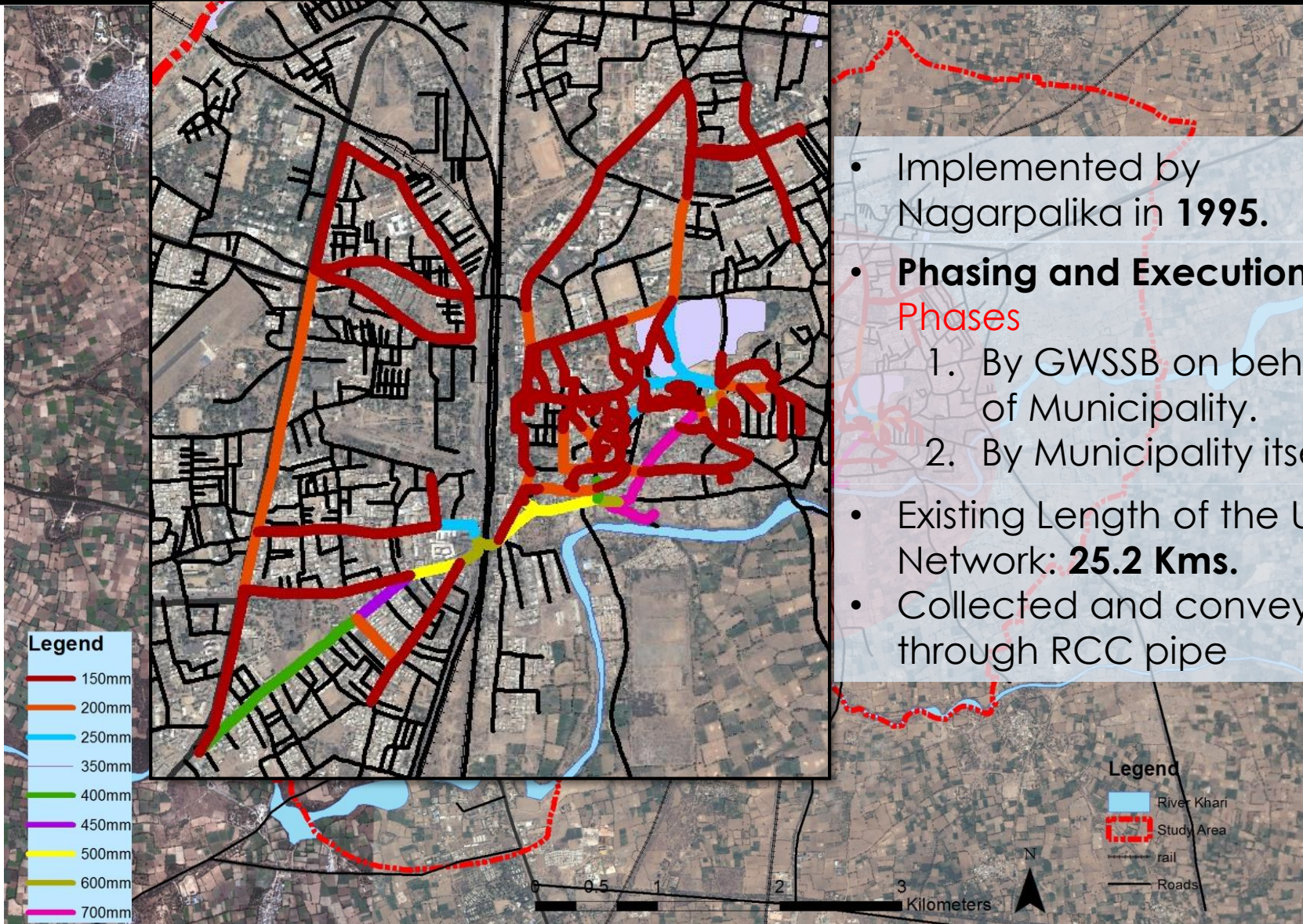
8.3% dispose into open drains with cover



10.3% dispose into open drains



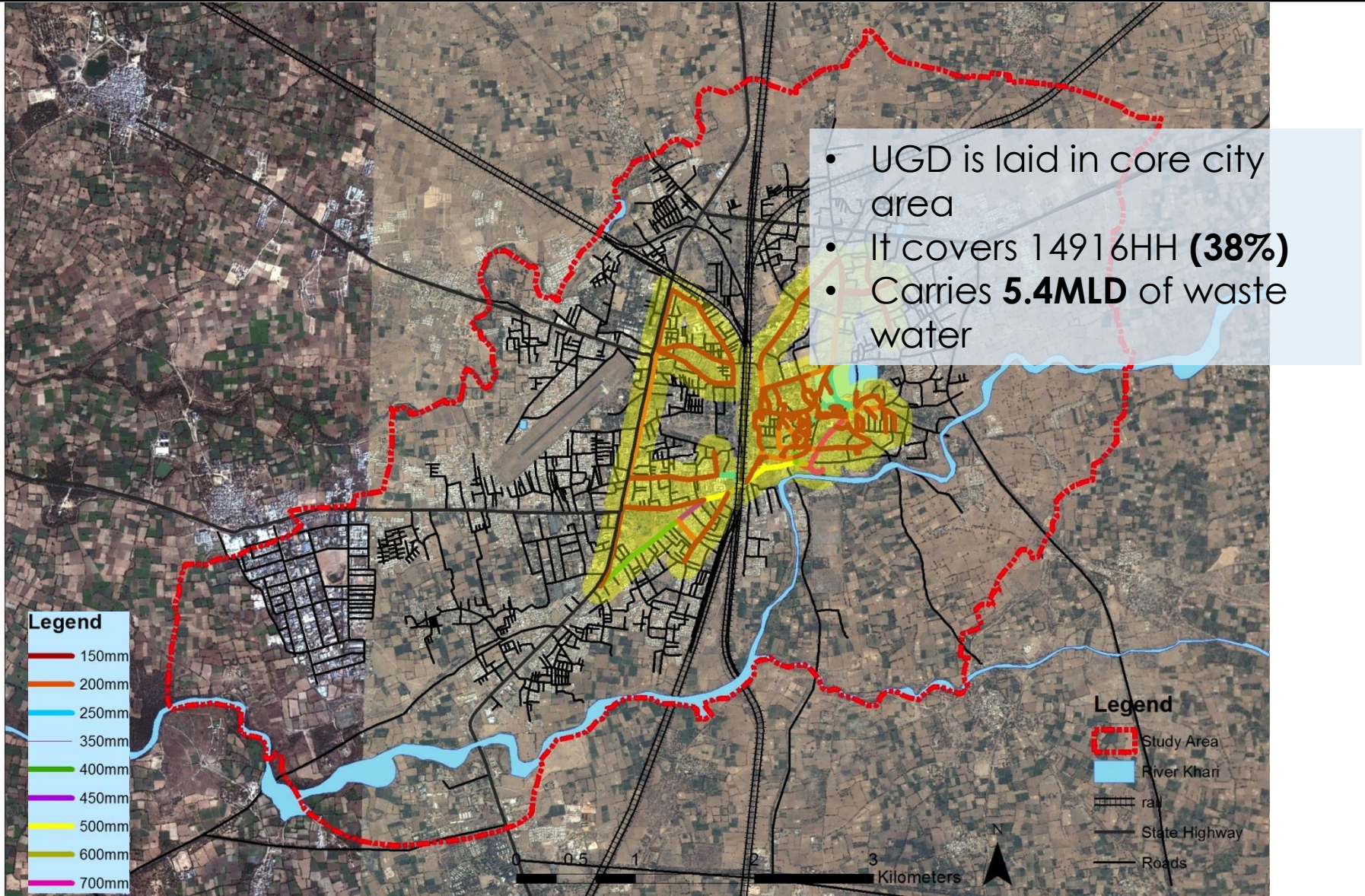
# Underground Drainage Scheme



- Implemented by Nagarpalika in **1995**.
- **Phasing and Execution: 2 Phases**
  1. By GWSSB on behalf of Municipality.
  2. By Municipality itself.
- Existing Length of the UGD Network: **25.2 Kms.**
- Collected and conveyed through RCC pipe



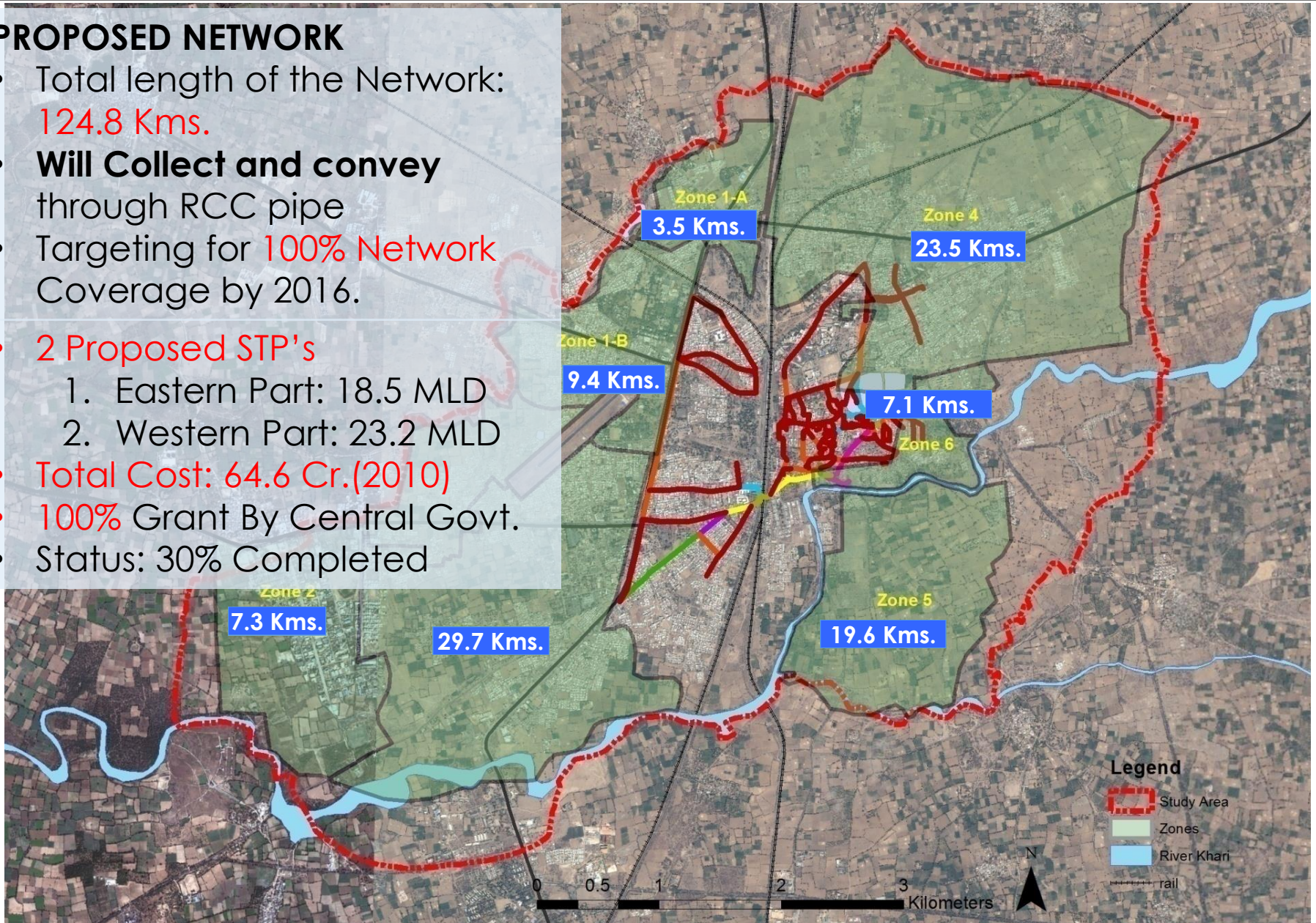
# Underground Drainage Scheme Coverage



# Proposed UGD Zones

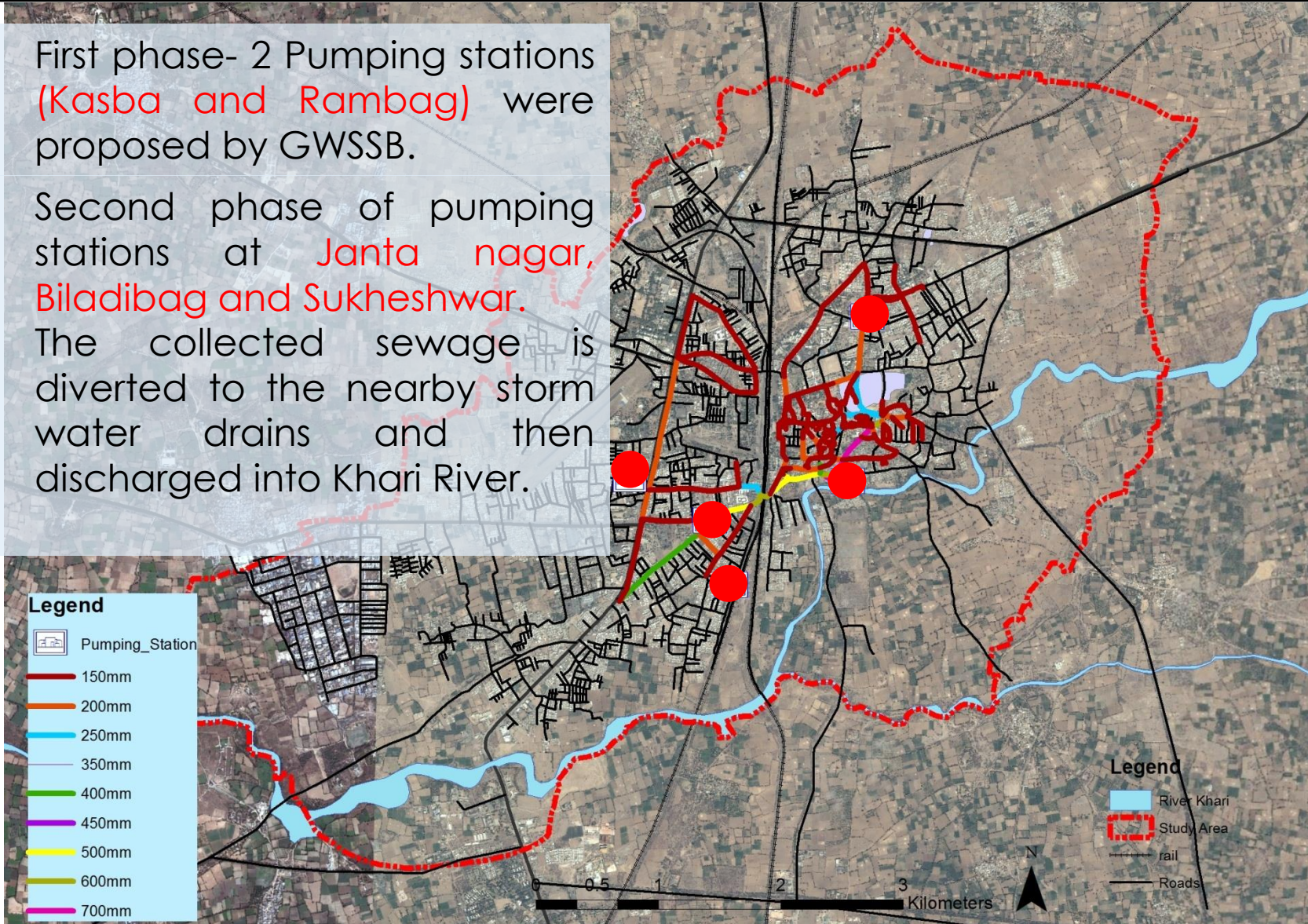
## PROPOSED NETWORK

- Total length of the Network: **124.8 Kms.**
- **Will Collect and convey** through RCC pipe
- Targeting for **100% Network Coverage** by 2016.
- **2 Proposed STP's**
  1. Eastern Part: 18.5 MLD
  2. Western Part: 23.2 MLD
- **Total Cost: 64.6 Cr.(2010)**
- **100% Grant** By Central Govt.
- Status: 30% Completed

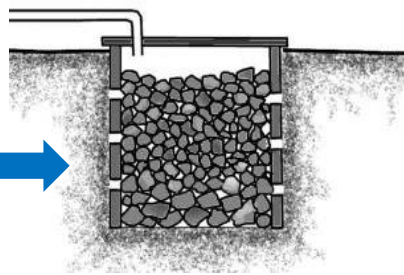
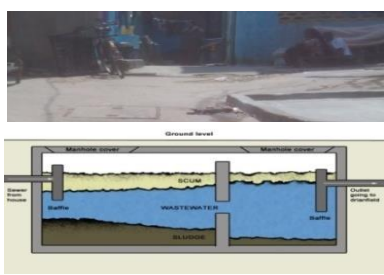


# UGD: Pumping Stations

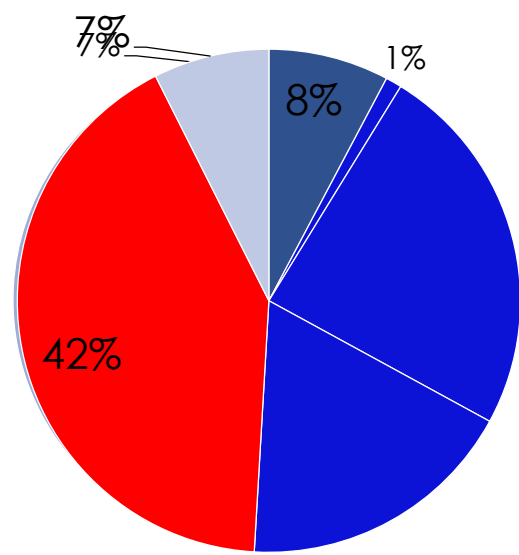
- First phase- 2 Pumping stations (Kasba and Rambag) were proposed by GWSSB.
- Second phase of pumping stations at Janta nagar, Biladibag and Sukheshwar.
- The collected sewage is diverted to the nearby storm water drains and then discharged into Khari River.



# Collection and conveyance



43.4% of Households are connected to septic tanks + soak pits



- 1. Municipality
- 2. Private agency licensed by municipality
- 3. Private contractor
- 4. Local labour
- 5. Don't get cleaned
- 6. Don't know

• The efficiency of the municipality in terms of mechanical systems like vacutug is low  
 • Only 8% of septic tanks are cleaned by municipality



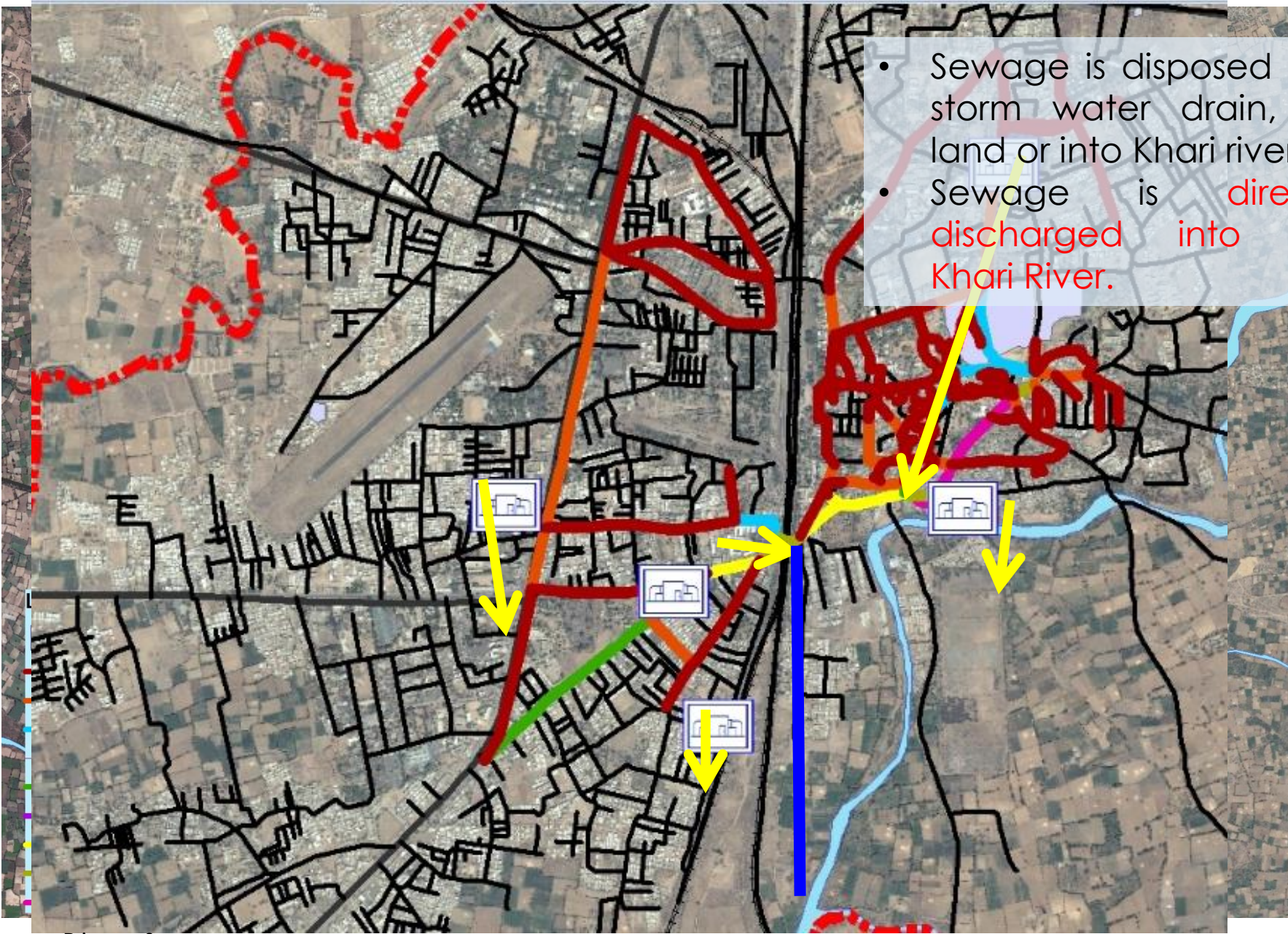
User interface

Collect

Disposal

ment

Disposal/ Reuse

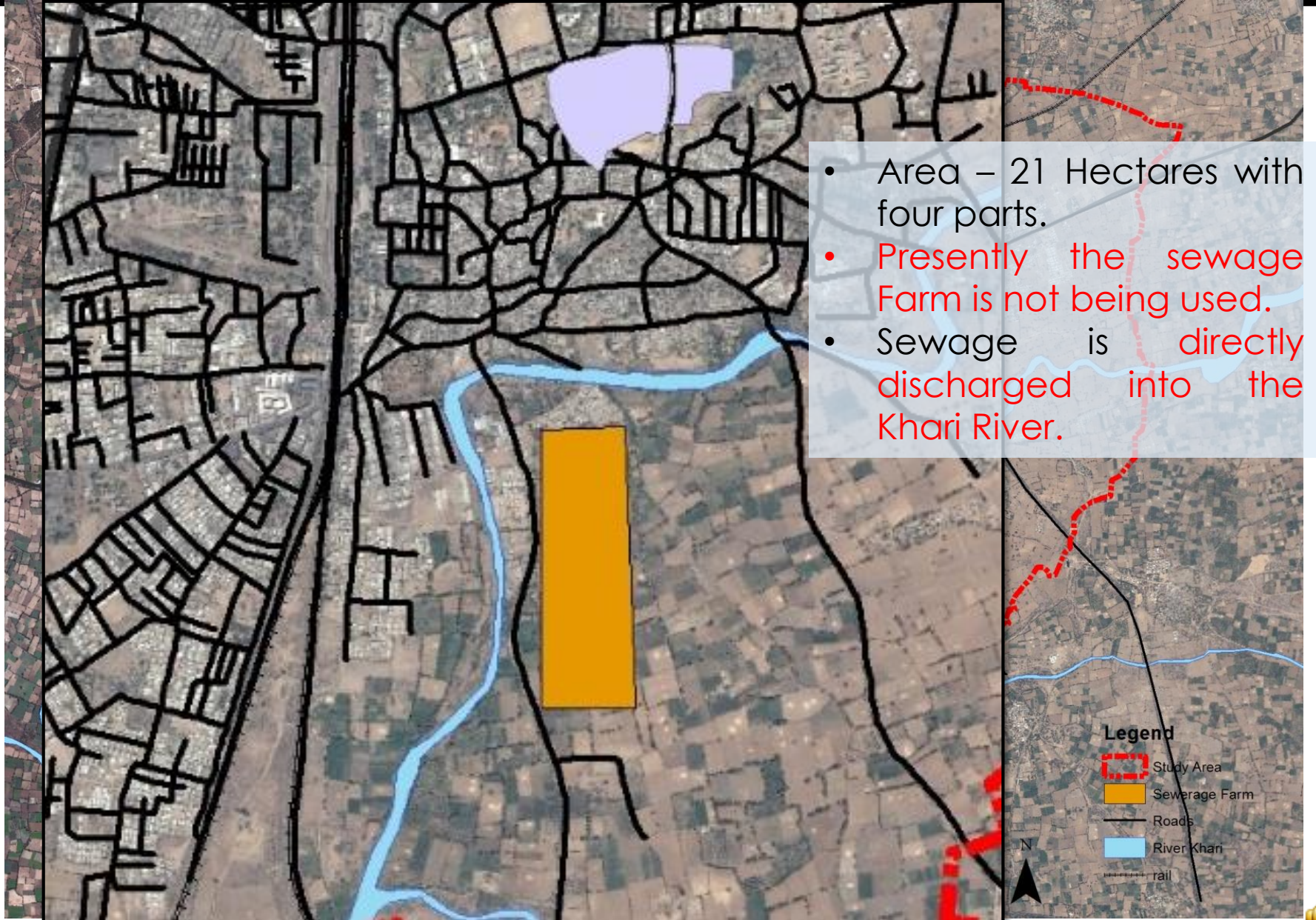


- Sewage is disposed into storm water drain, on land or into Khari river
- Sewage is directly discharged into the Khari River.





# Sewage Farm



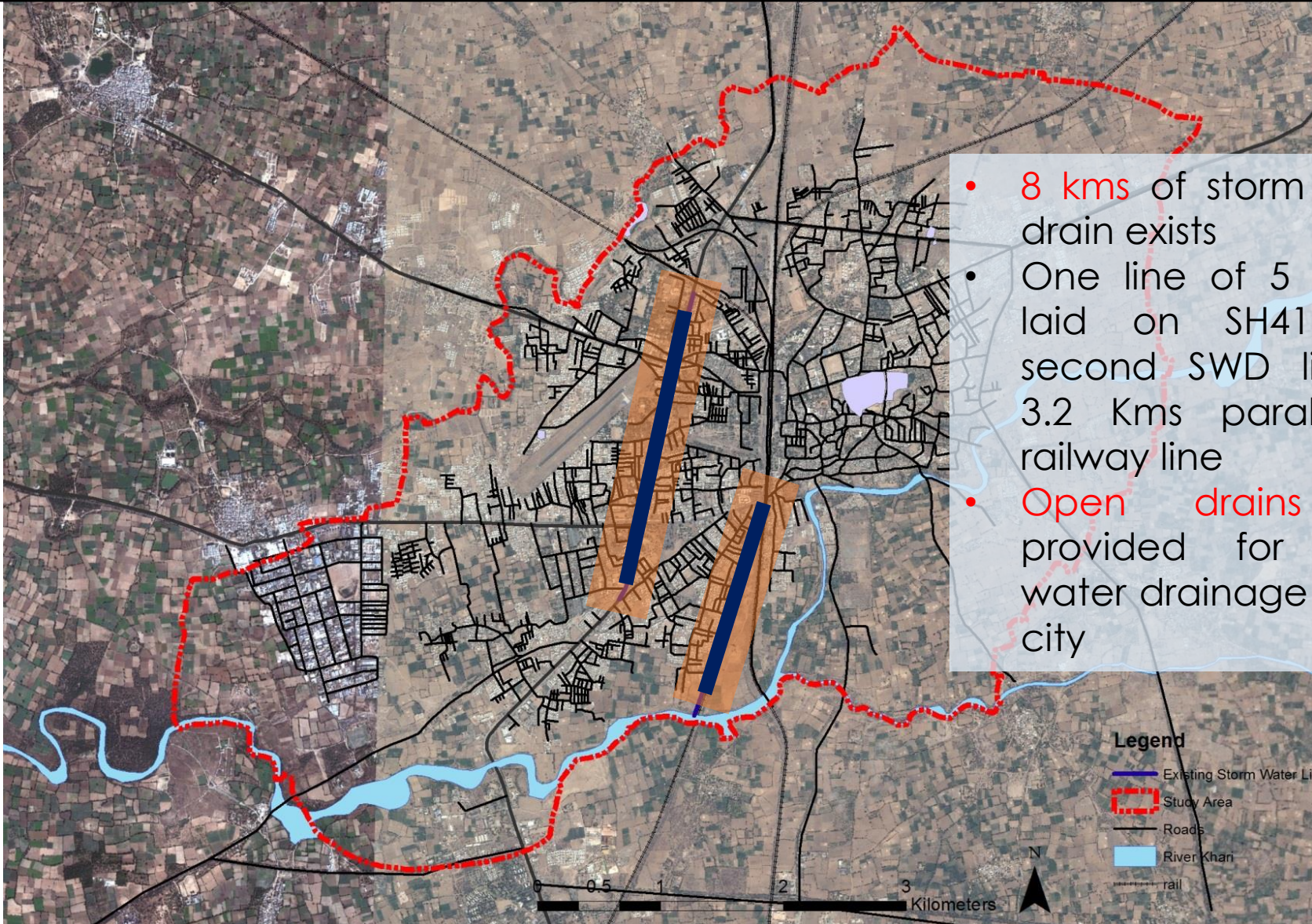
# Sewage Farm



From various parts of the city



# Storm Water Drainage



- 8 kms of storm water drain exists
- One line of 5 Kms is laid on SH41 and second SWD line of 3.2 Kms parallel to railway line
- Open drains are provided for storm water drainage in Old city

## Legend

- Existing Storm Water Line
- Study Area
- Roads
- River Khan
- rail



# Storm Water Drainage



# Open drains



- Locations of drains in old city which carry gray water.



# Choked Drains



- At some locations drains are either choked with **solid waste disposal**.
- **Lack of periodic cleaning and maintenance** causes choking and sometime overflows on roads.

**COMPLAINT  
AND REDRESSAL**

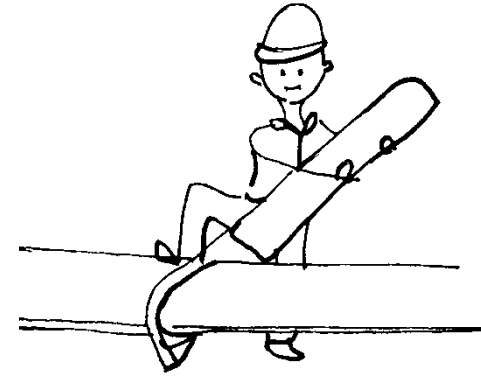
**REGISTRATION**



# Complaint Redressal Period

## Contract for UGD

- Yearly contract for O&M is offered by Municipality
- It is responsible to address complaints related to main underground sewerage system.



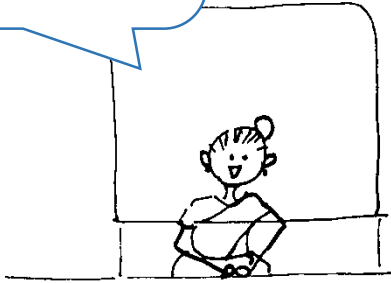
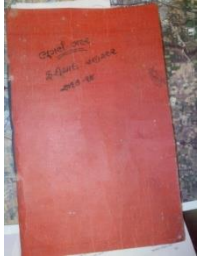
Complaints other than the main UGD, are addressed by plumbers

- Total 11 plumbers
- Generally they charge 15 Rs./feet for Connection which includes excavation.
- Charges has to be collected from customers.
- These plumbers can also work privately.

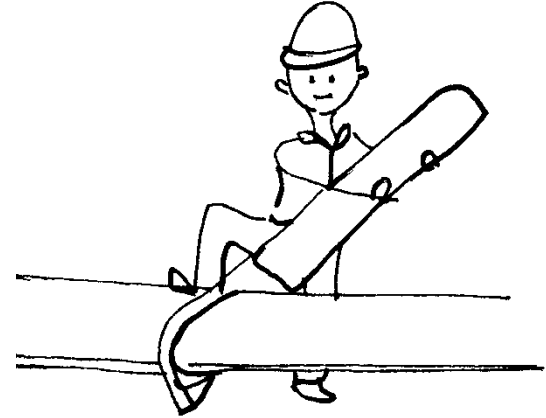




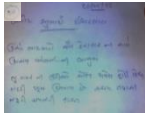
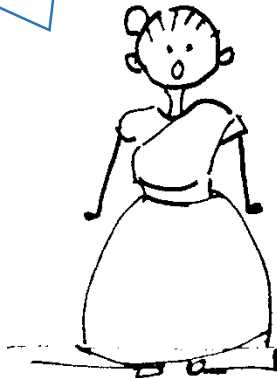
Sir, I will take down your complaint in the REGISTER. Please let me know name ,address and complaint details



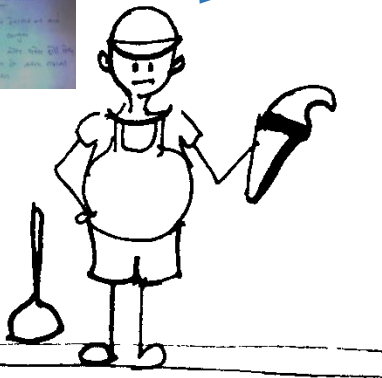
Where can I file my complaint?



Please take the details of the household



Okay Madam



Thank you for addressing the problem



My pleasure sir



Indicators	Benchmark	Mehsana
1. Coverage of toilets	100%	<b>92.6%</b>
2. Coverage of sewage network services	100%	<b>38%</b>
3. Collection efficiency of the sewage network	100%	<b>23.4%</b>
4. Adequacy of sewage treatment capacity	100%	<b>No STP Exists</b>
5. Quality of sewage treatment	100%	
6. Extent of reuse and recycling of sewage	20%	
7. Efficiency in redressal of customer complaints	80%	<b>80%</b>
8. Extent of cost recovery in sewage management	100%	<b>93.4%</b>
9. Efficiency in collection of sewage charges	90%	<b>84.8%</b>



# SLB for On-Site Sanitation Facility.....??

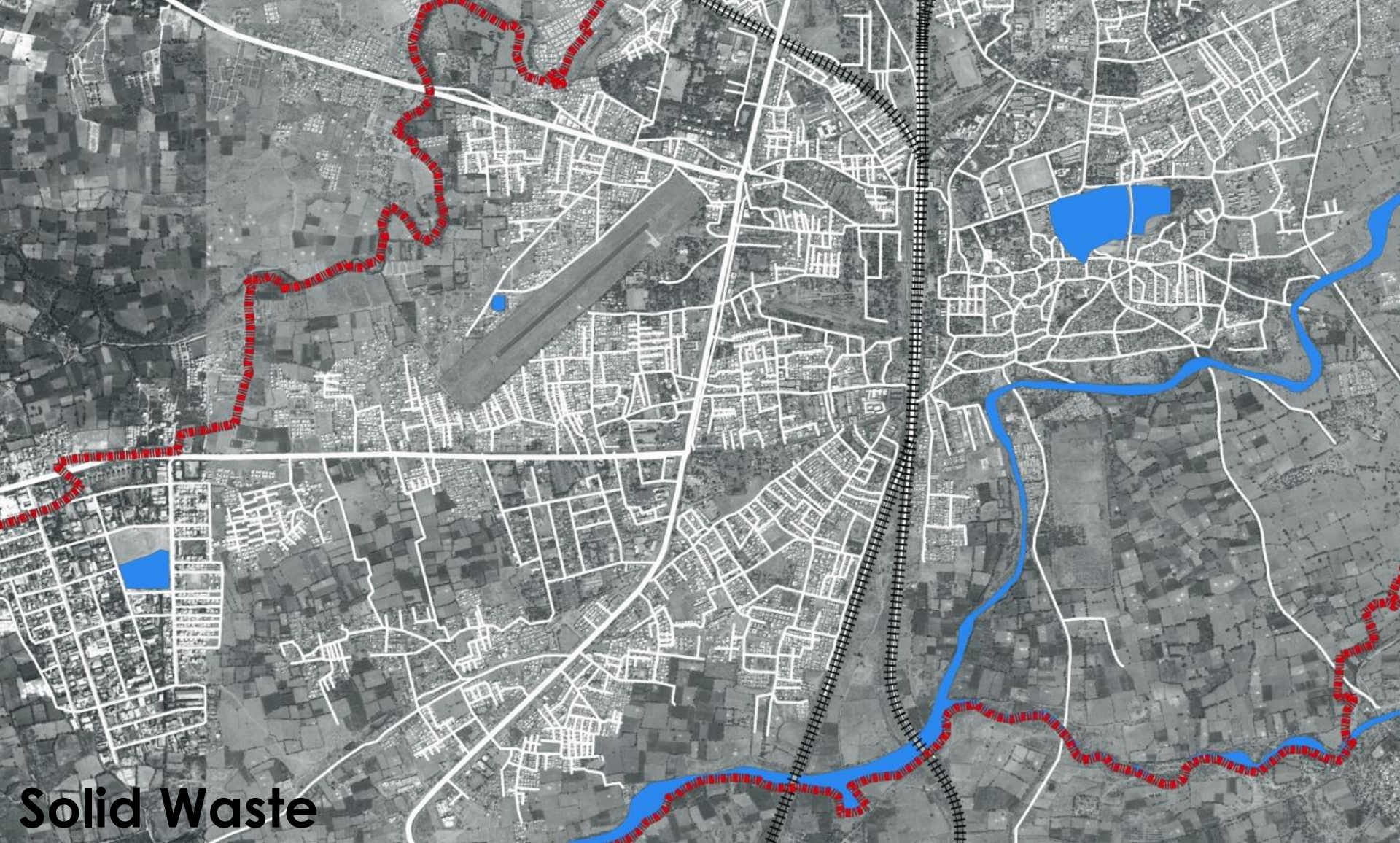
Indicators	Benchmark	Mehsana
1. Population using on site services	100%	<b>43.4%</b>
2. Collection efficiency	100%	<b>29.1%</b>
3. Adequacy of septage treatment	100%	<b>No Faecal Sludge Treatment</b>
4. Quality of septage treatment	100%	
5. Extent of reuse and recycling of septage	20%	



# Key Issues

1. Open defecation is around 7.5%
2. 90% HH's have access to improved sanitation facility
- 3. No provision for Waste water treatment (Missing Link)**
4. Cleaning and Maintenance issues of septic tanks/soak pits
5. All sewage is disposed into Khari river directly or indirectly
6. Operation and maintenance issues in case of open drains
7. Lack in implementation of GDCR regulations and monitoring.





# Solid Waste

## Contents

- 1. Solid waste scenario
- 2. Informal sector participation
- 3. Conclusion



# SWM on roads



# SWM on roads but still....

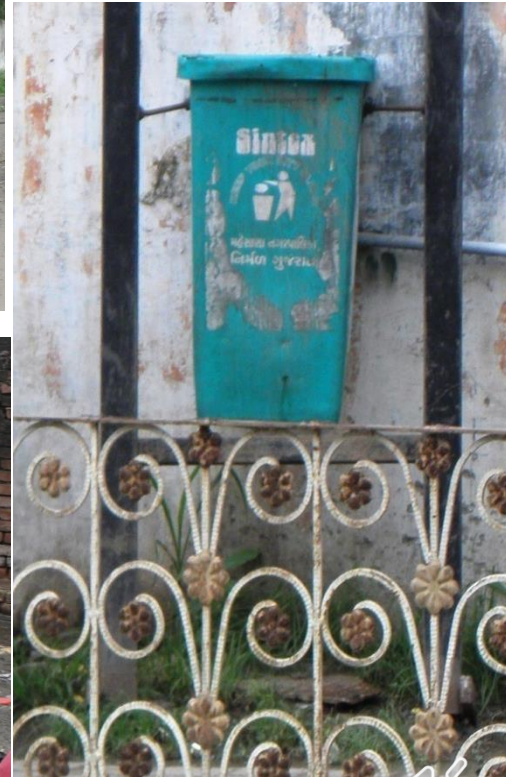


# SWM in residential & commercial condition





# SWM in residential & commercial practices



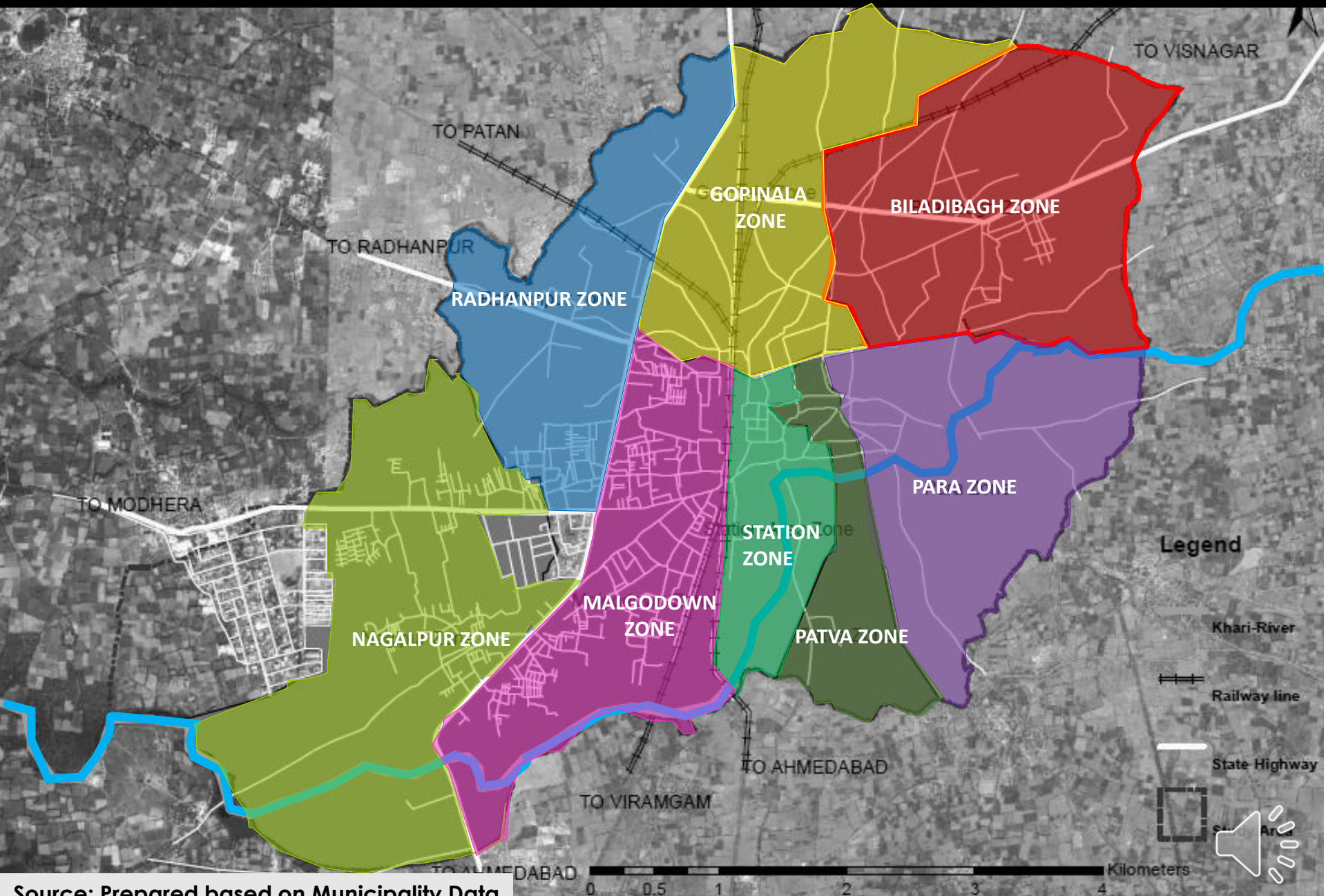
# SWM vehicles and transportation



# Solid waste dumping

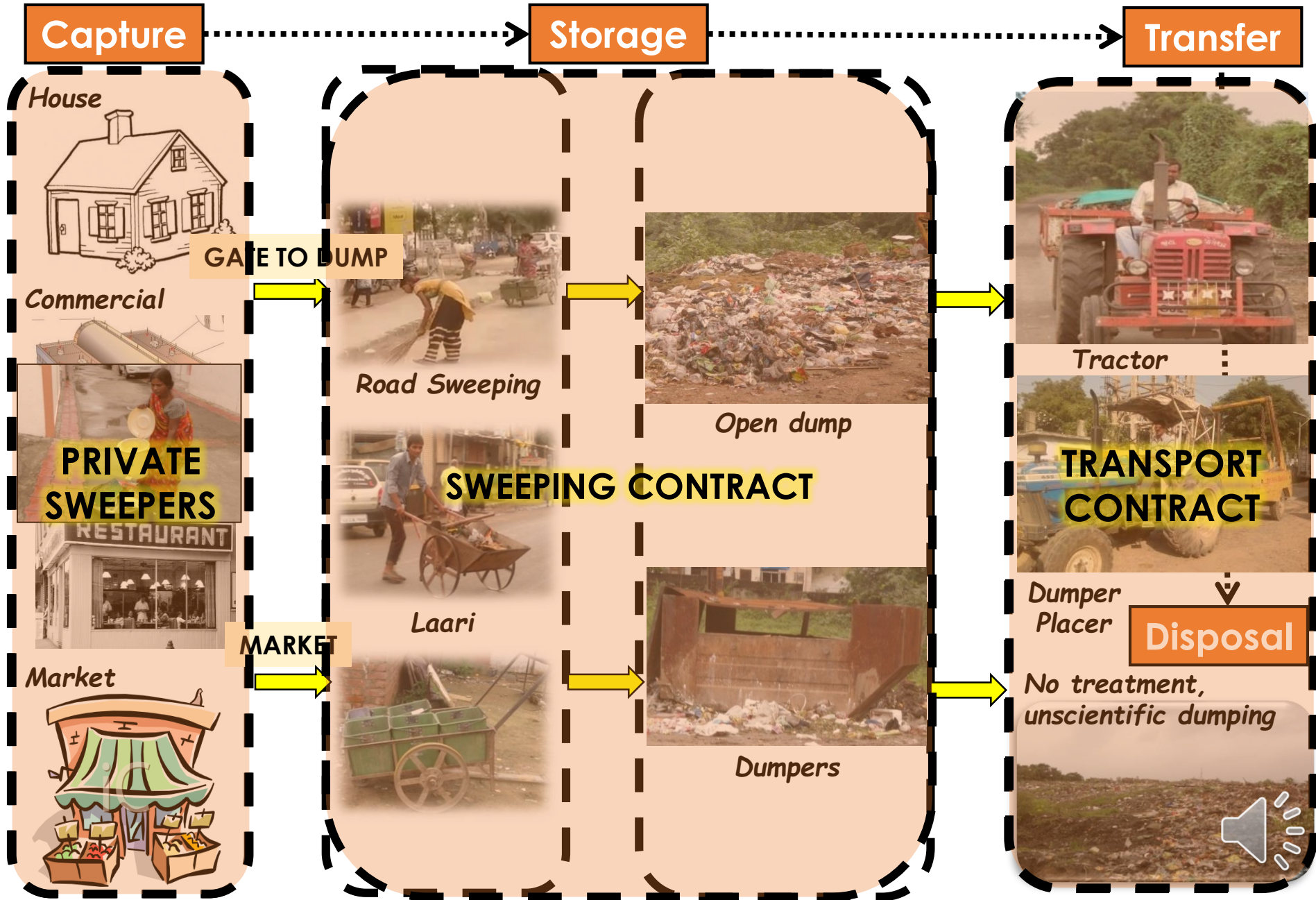


# Zone Map

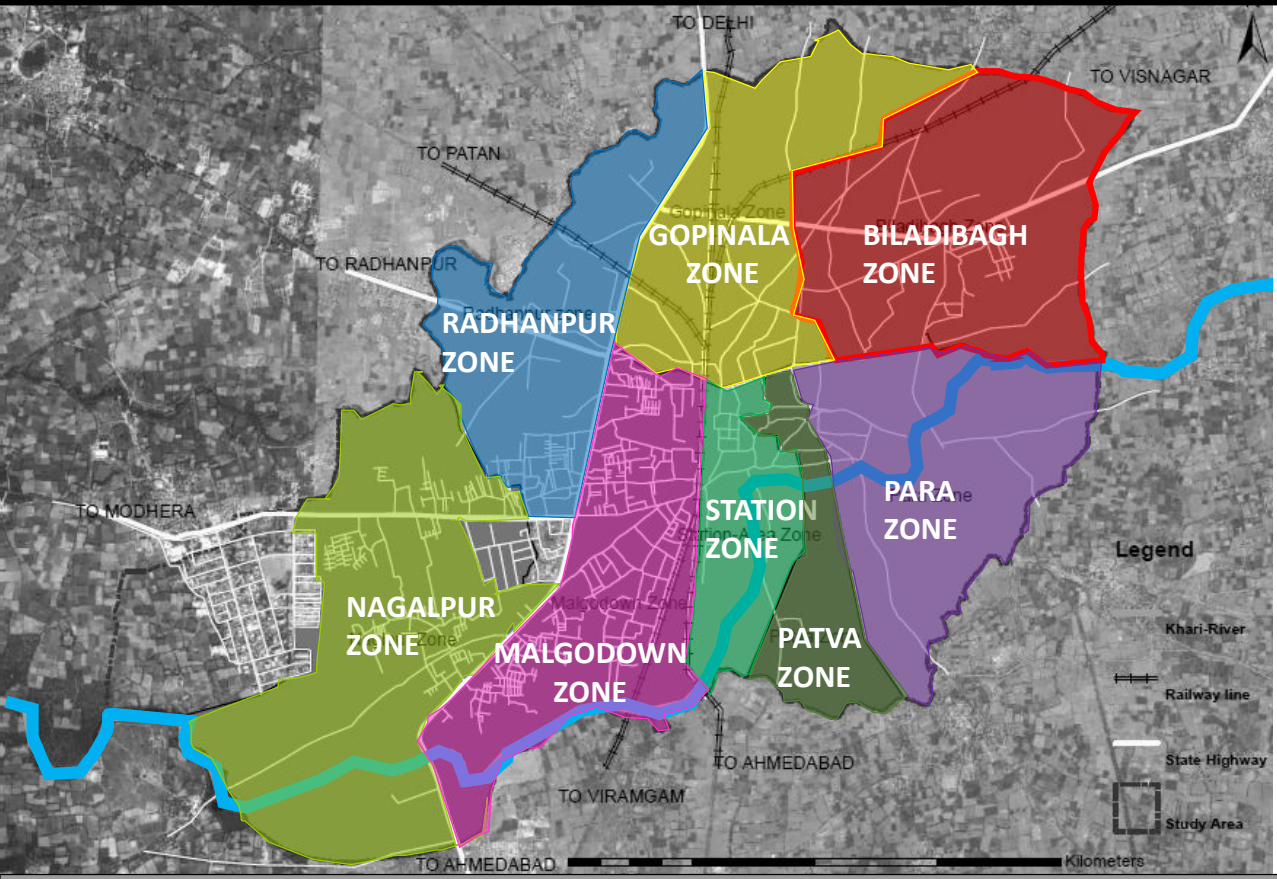


Source: Prepared based on Municipality Data

# Typical SWM Process of Mehsana



# Contract Detail



## Transportation contract

Jai Ambe  
Sai Krishna  
Satyam  
MJ

## Sweeping contract

DB enterprise  
Real enterprise  
S.R. Chaudhary  
Sai krishna  
Vikas

### CONTRACT PAY MENT TERMS

#### ❖ For Transportation

- minimum 4 trips per vehicle per day (with 4 people per vehicle)
- payment Rs.779 per vehicle per day for 4 trips

#### ❖ For Sweeping

- Each contract of 50 labor per ward
- Payment per person per day – Rs 145.70

Source: Prepared based on Municipality Data



# Bidding And Allotment Procedure For Contracts

C  
L  
E  
A  
N  
I  
N  
G

Minimum Safai Karamchhari in Ward	Rate Per /Worker/ Day	Total (A X B)
A	B	C
25	145.70	3642

- Mehsana municipality sanitation department has allocated 25 sweepers daily for waste Sweeping , collection & then disposing it at specified location .
- Contract will be given to the contractor, who will bid Min. amount above given amount.

## CONTRACT PRICE FOR ONE

T  
R  
A  
N  
S  
P  
O  
R  
T  
A  
T  
I  
O  
N

No. of Tractors	No. of Trips	Rate/Tra ctor/Trip	Total (E X F)
D	E	F	G
2	4	200	800

- Mehsana Municipality has allocated **1 driver and 3 labor** for every tractor for waste collection from all places and disposing at the dedicated area.
- Contract will be given to the contractor, who will bid Min. amount above given amount.



# Bidding And Allotment Procedure For Contracts-revised

Minimum Safai Karamchari in Ward	Rate Per /Worker /Day	Total (A X B)	No. of Tractors	No. of Trips	Rate/Tra ctor/Trip	Total (E X F)	Grand Total (C + G)
A	B	C	D	E	F	G	H
25	200	5000	2	8	200	1600	6600

$$5000 + 1600 = 6600$$

CONTRACT WILL BE GIVEN TO THE CONTRACTOR, WHO WILL BID MIN. AMOUNT ABOVE GIVEN AMOUNT.

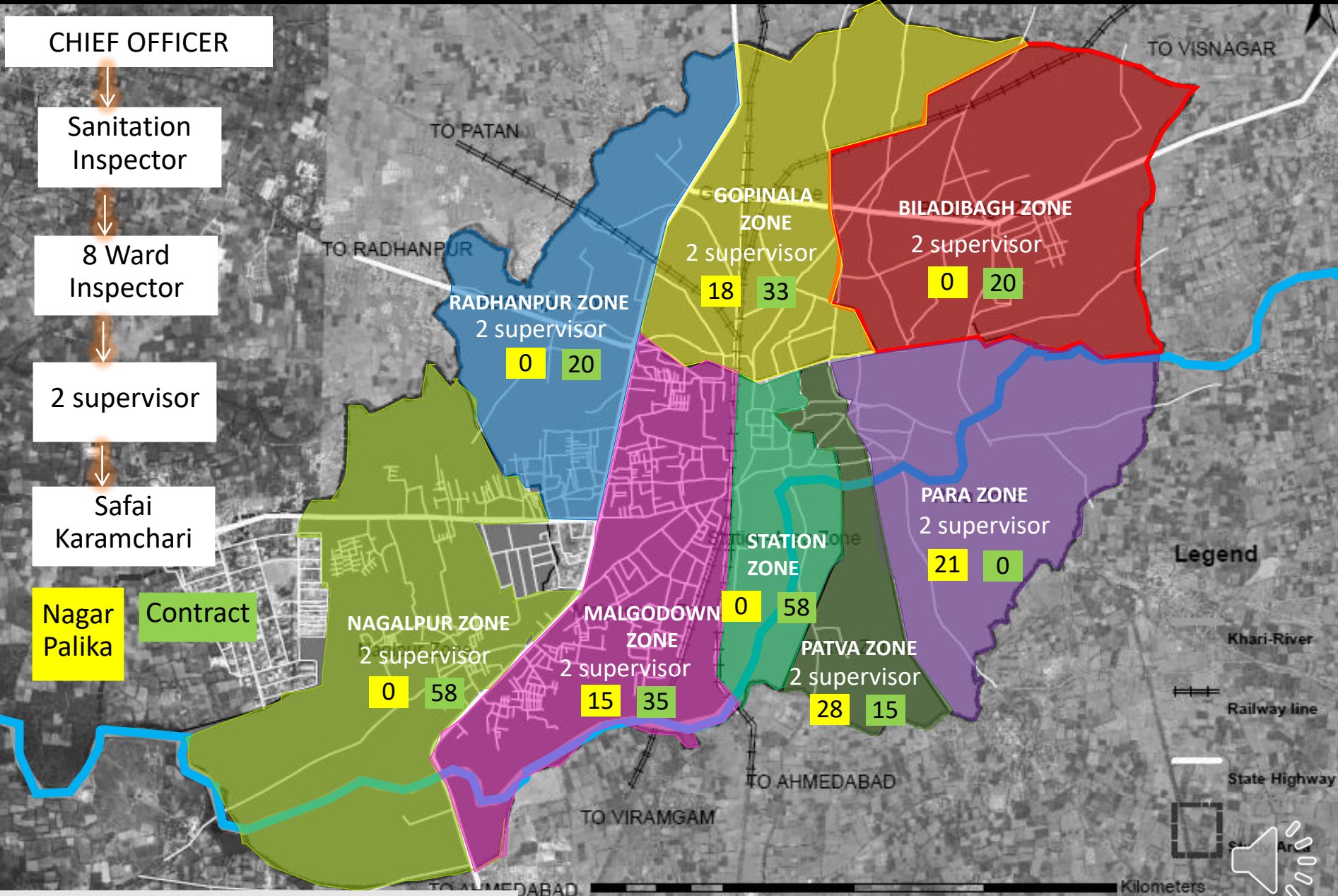
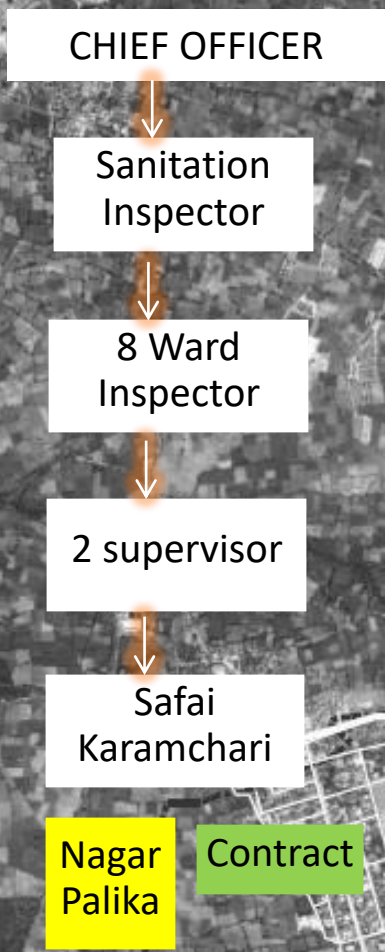




# Terms & Conditions

<b>Service provision clause</b>	<ul style="list-style-type: none"><li>• Contractor is liable to provide all kind of services regarding SWM.</li><li>• The Necessary equipment for transportation &amp; cleaning of SWM, the contractor is liable to provide sweepers.</li><li>• There will be no holiday for SWM work.</li></ul>
<b>Monitoring &amp; Management clause</b>	<ul style="list-style-type: none"><li>• All existing &amp; future Govt. rules should be followed by contractor.</li><li>• One person of contractor will resolve all complaints during office hours in sanitary office.</li><li>• The contractor has to give a mobile no. which must be accessible 24 X 7, would be permanent for complaints which should be solved.</li><li>• Contractor should follow rules regarding current pollution control board, MSW 2000 rules, Gumastadhara, minimum wage rules, Child labour Act. etc.</li><li>• To dispose solid waste at dumping site by a tractor, it will be required to issue a receipt from the ward &amp; will have to submit it to the authorized person at ward, at dumping site &amp; contractor.</li><li>• One Tractor-trailor must have minimum 3 labours &amp; 1 driver for a trip.</li><li>• Any agency will be allocated max. one sanitation ward contract.</li><li>• The ratio of lady sweeper should not be more than 20% per sanitation ward.</li><li>• Safai Karamcharis should be young &amp; Capable. Age should be between 18 to 45 years.</li></ul>
<b>Finance clause</b>	<ul style="list-style-type: none"><li>• Existing rate will be applied for two years. Contract will be renewed for One year afterwards with mutual agreement of both parties.</li><li>• All existing &amp; future, Govt. &amp; other tax should be paid by contractor.</li></ul>
<b>Penalty clause</b>	<ul style="list-style-type: none"><li>• There will be fine of Rs. 500 for dumping garbage on public road &amp; burning it. Fine will be collected by authorized officers of Municipality.</li><li>• No compensation of injury or death during cleaning by Nagarpalika.</li><li>• Work has to be started within 15th day after giving work order otherwise it will be done by other agency &amp; rate difference will be recovered from the security deposit of contractor.</li></ul>

# INSTITUTIONAL STRUCTURE OF MEHSANA SWM

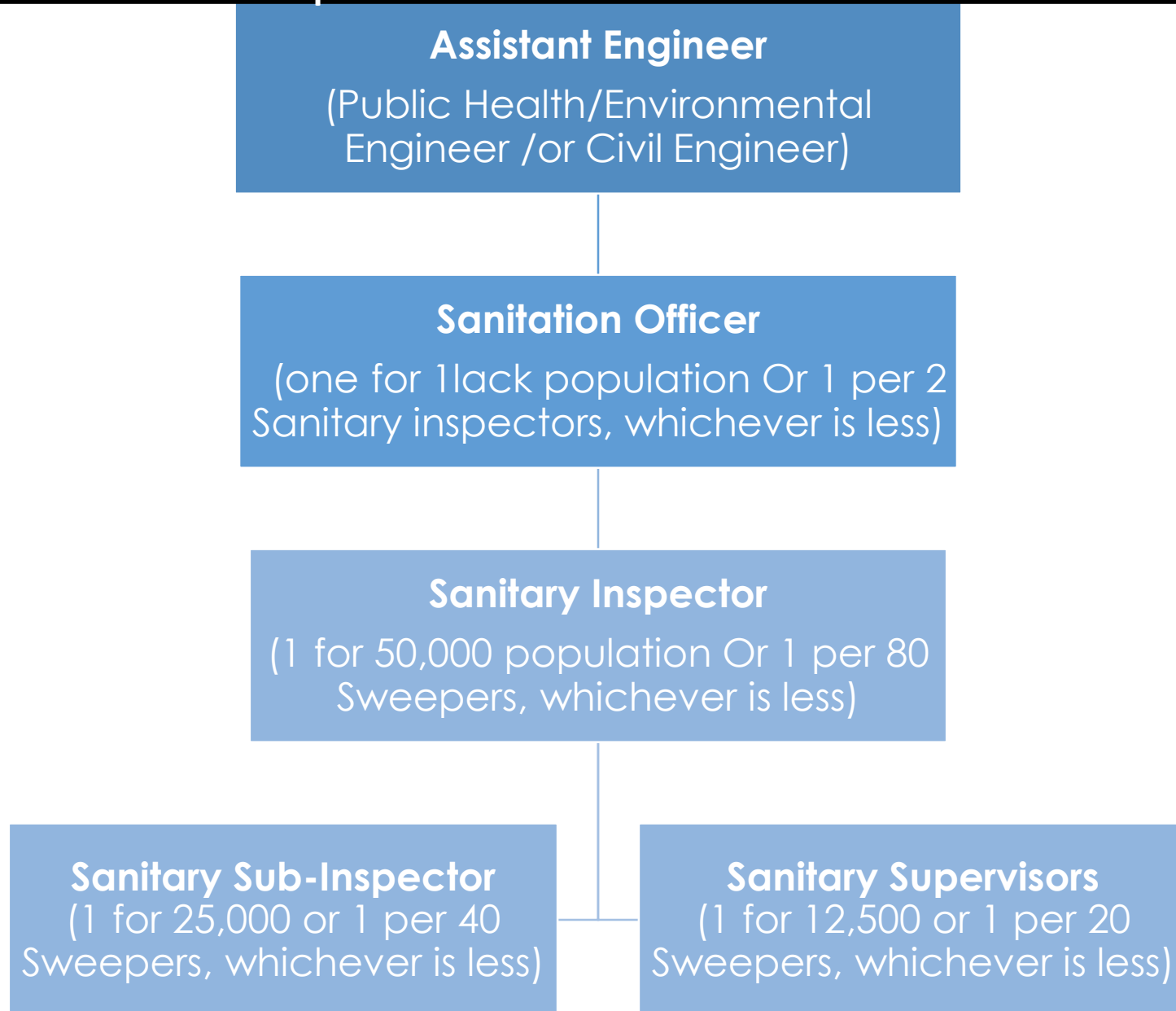


**Legend**

- Khari-River
- Railway line
- State Highway
- Scale: 0 to 4 Kilometers

Source: Prepared based on Municipality Data

# Institutional Structure As Per CPHEEO Of SWM-Cities Between 1 and 2 lack Population



# Existing Scenario of Staff Allocation

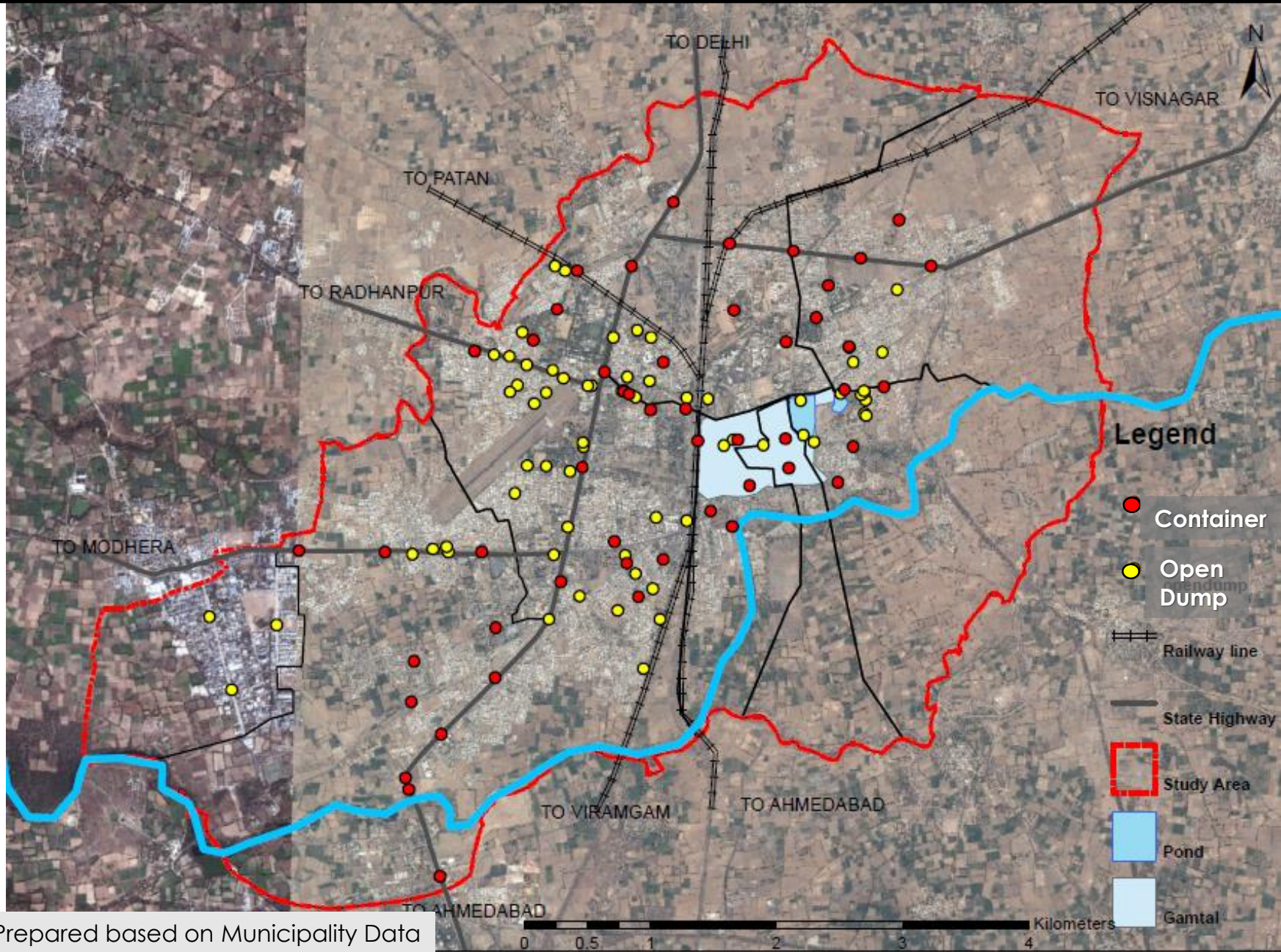
POST	STAFF ALLOCATION AS PER CPHEEO	STAFF ALLOCATION (MEHSANA MUNICIPALITY )	
		SANCTIONED	EXISTING
ASSISTANCE ENGINEER	1		
SANITATION OFFICER	2		
SANITATION INSPECTOR	4	2	1
WARD INSPECTOR	8	11	8
SANITORY SUPERVISOR	15		16
SAFAI KARAMCHARI	574	213+360(cont.)	90+236(cont.)
		573	390

## KEY ISSUES

- No Waste auditing
- No annual report of SWM
- No Regular training and skill development programs of employees

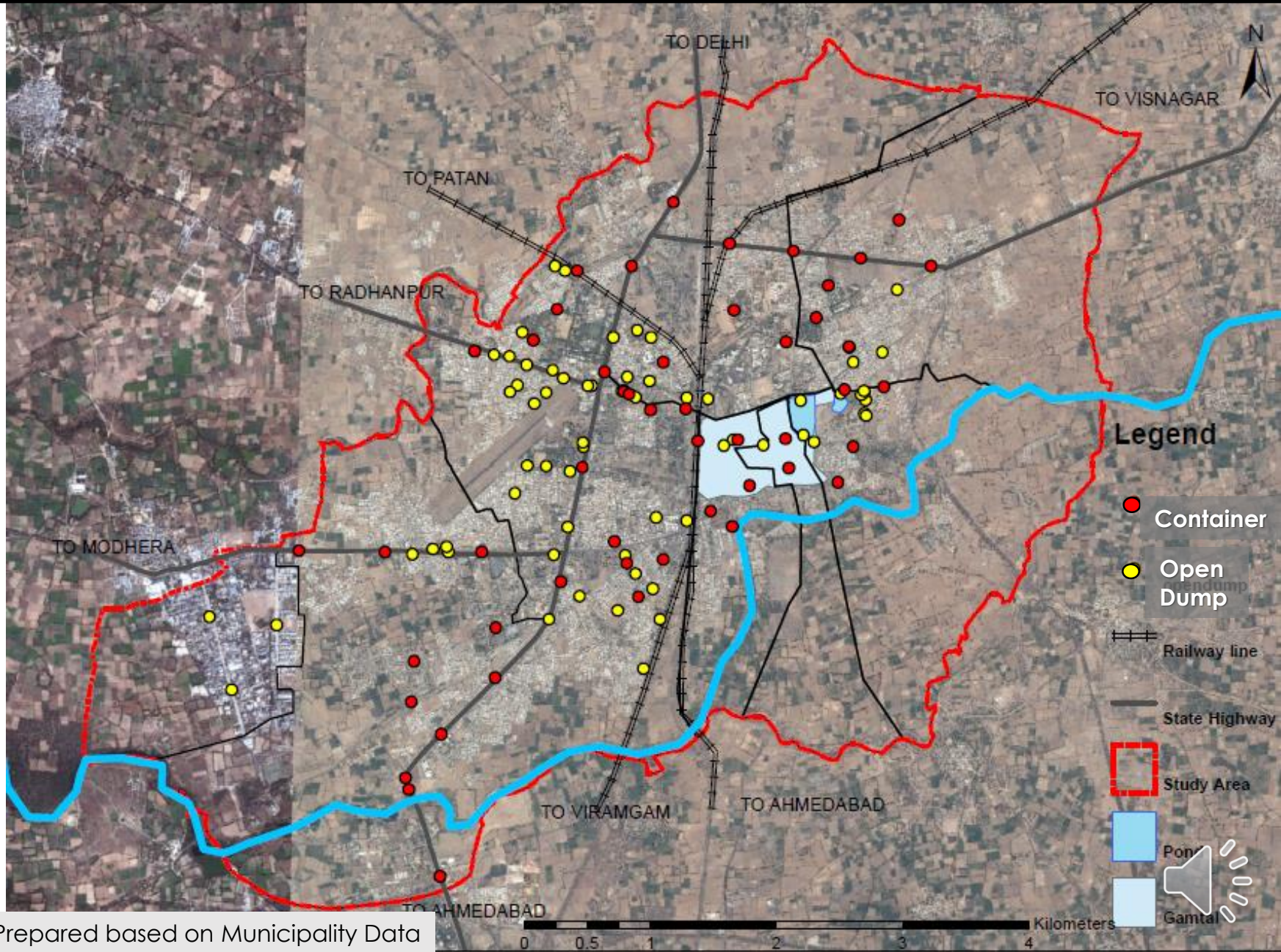


# Waste transfer Points - Bins



Source: Prepared based on Municipality Data

# Waste transfer Points - Bins



Source: Prepared based on Municipality Data

# Waste transfer Points - Bins

**Total waste generated per day (MT) : 76.6**

No. of dumpers : 46

Capacity of a dumper (MT) : 3.4

**Total waste collected from dumpers per day (MT) : 33.3**

No. of open collection points : 80

Total no. of tractors : 21

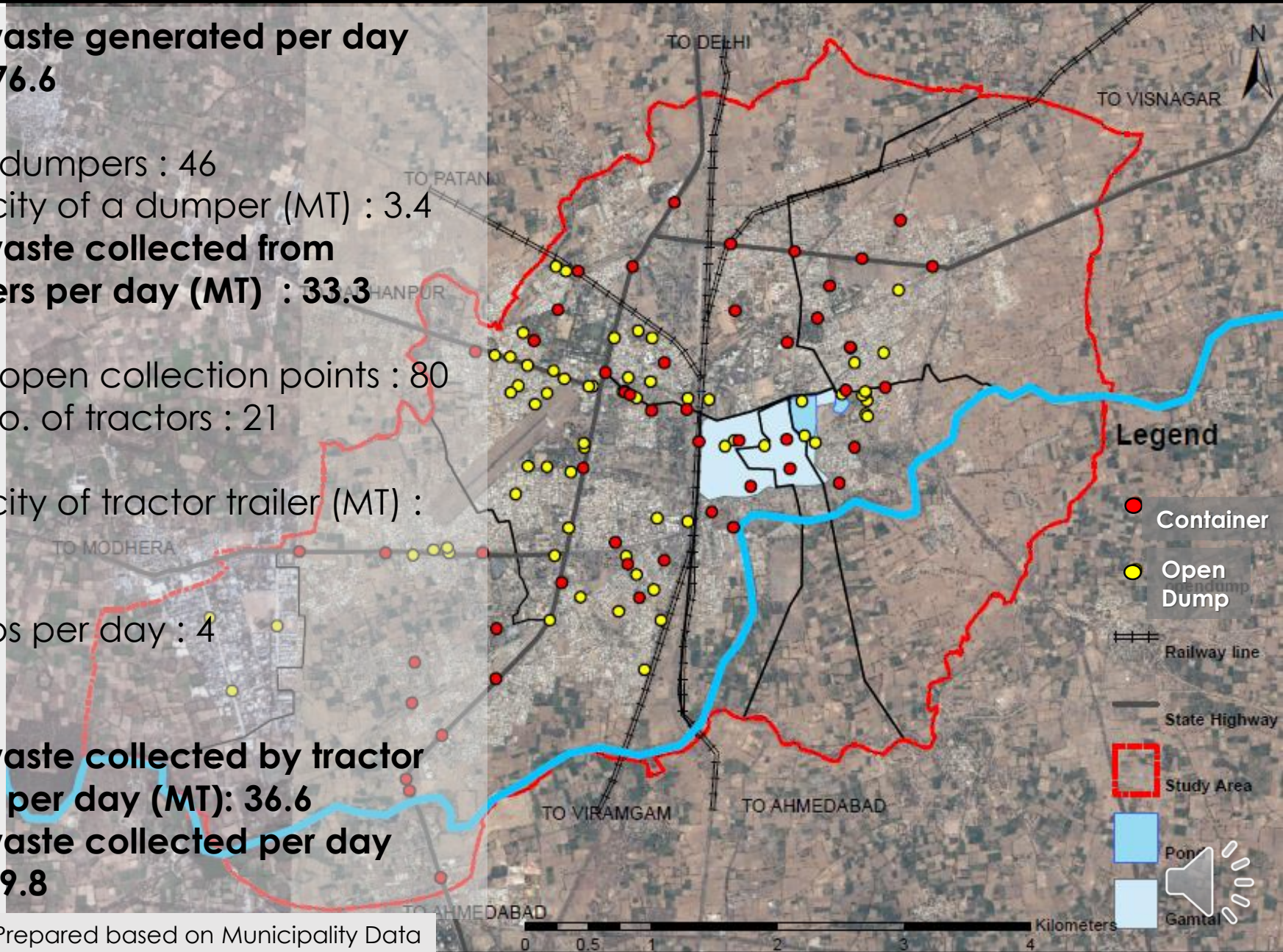
Capacity of tractor trailer (MT) : 1.75

No. trips per day : 4

**Total waste collected by tractor trailers per day (MT): 36.6**

**Total waste collected per day (MT): 69.8**

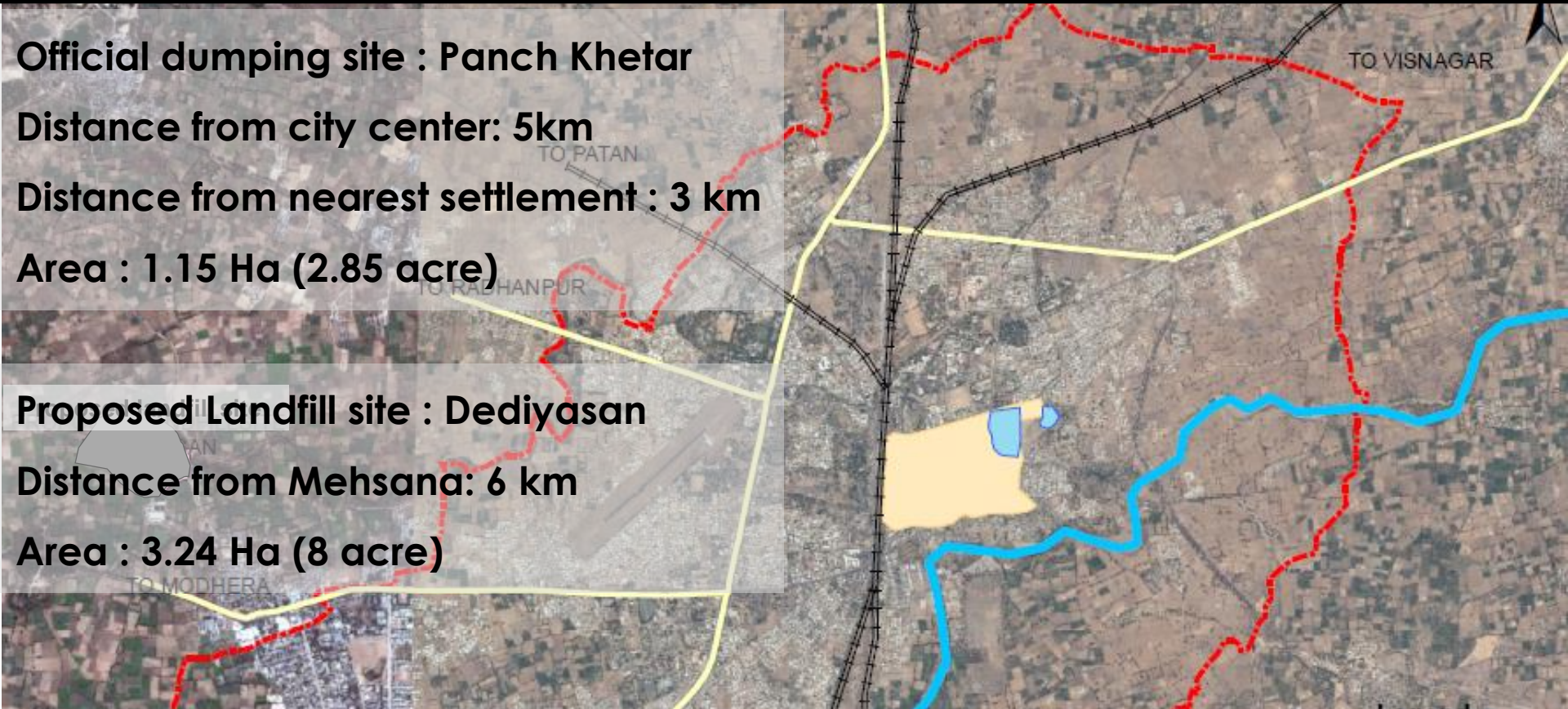
Source: Prepared based on Municipality Data



# Waste Disposal

Official dumping site : Panch Khetar  
Distance from city center: 5km  
Distance from nearest settlement : 3 km  
Area : 1.15 Ha (2.85 acre)

Proposed Landfill site : Dediyan  
Distance from Mehsana: 6 km  
Area : 3.24 Ha (8 acre)



## SLB Indicator

Mehsana Benchmark

Extent Scientific Disposal Of Municipal Solid Waste

0%

100%

## KEY ISSUES

- No scientific disposal of MSW



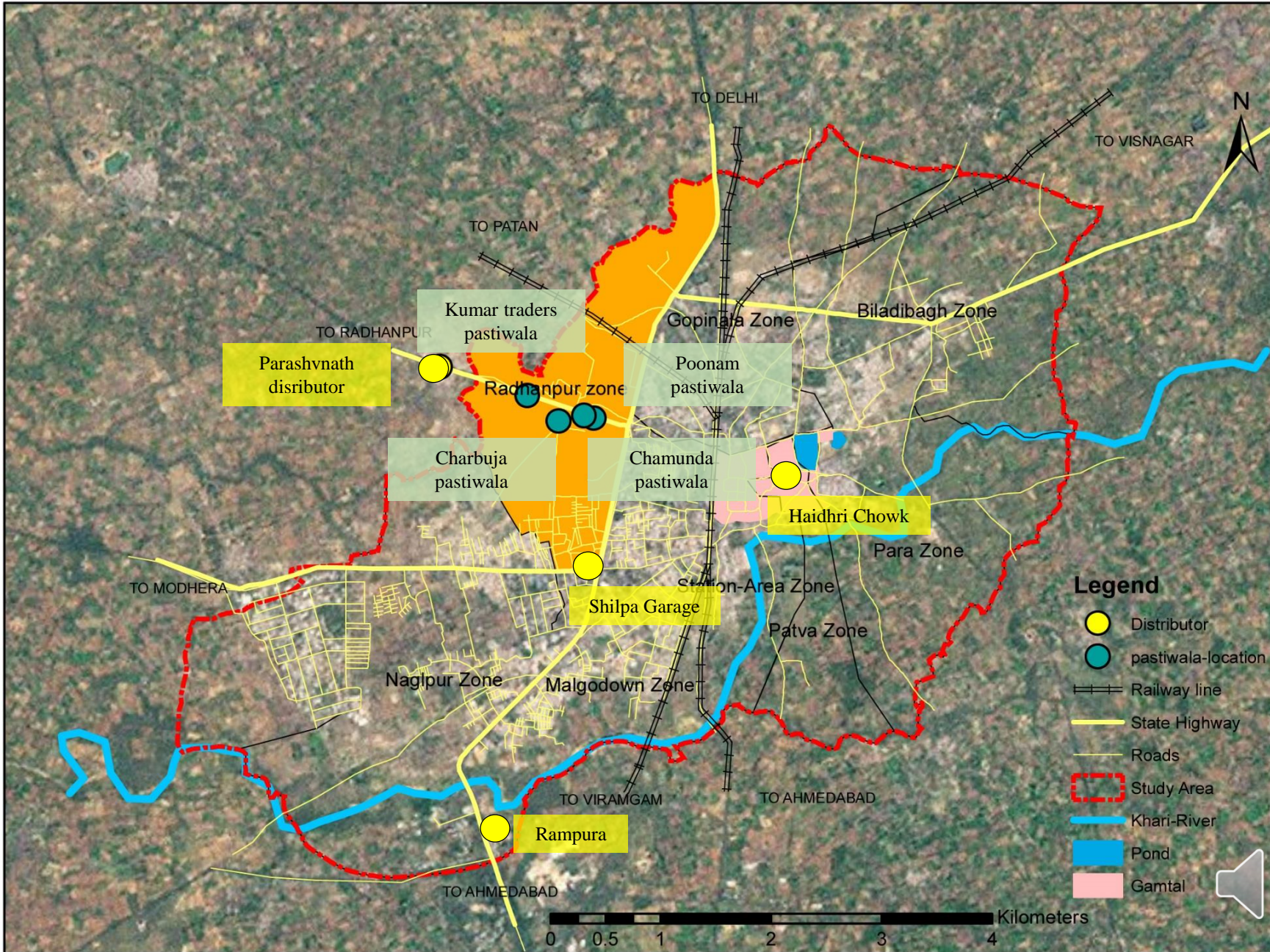


## Contents

1. Solid waste scenario
- 2. Informal sector participation**
3. Conclusion

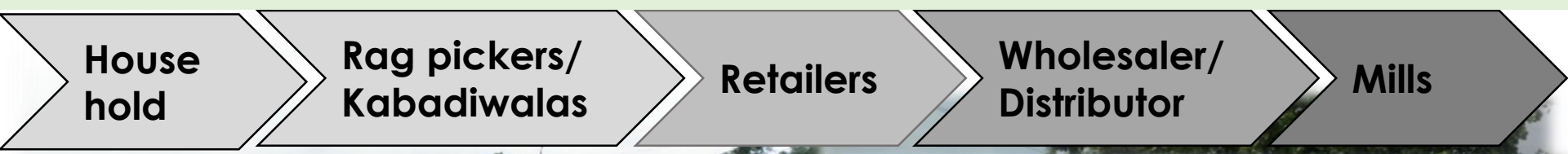


# Collection Mechanism by Informal Sector



# Collection Mechanism by Informal Sector

## Value chain in SWM



## KEY CONCERNS

- ❖ How to account this segregation & recycling which is being done by this informal sector in a systematic manner ???
- ❖ Exploitation, Health Hazards, Unsafe working condition and Lack of Social and Financial security...

## SLB Indicator

	Mehsana	Benchmark
Extent of Municipal Solid Waste processed/recycled	28.5%	80%

## Contents

1. Solid waste scenario
2. Informal sector participation
- 3. Conclusion**



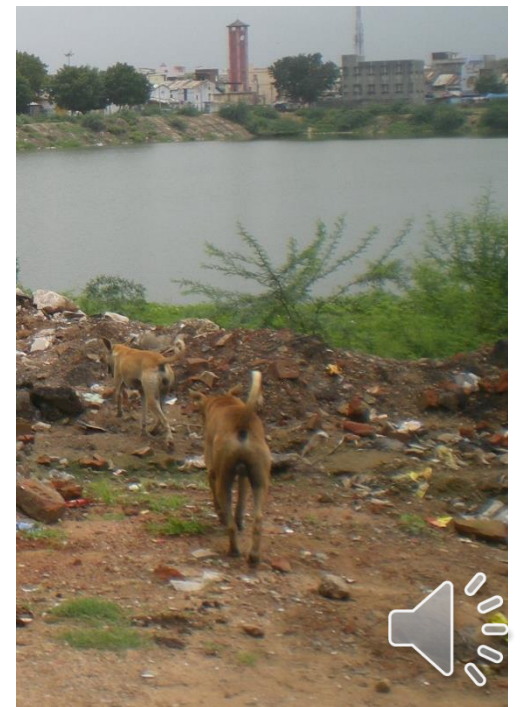


## BINS ALL OVER THE CITY





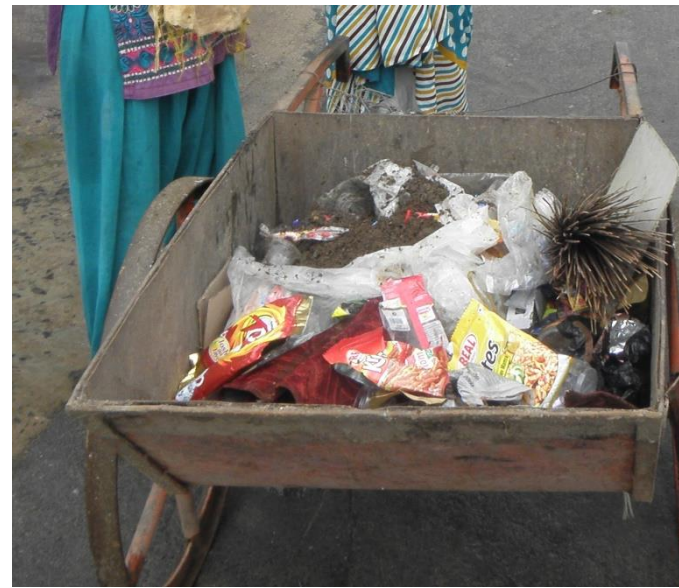
**DUMP SITE & BINS AS MAJOR NUISANCE POINT ATTRACTING SCAVANGERS**





# LACKS SCIENTIFIC WASTE DISPOSAL





**NO SEGREGATION OF WASTE**



**LACK OF AWARENESS**





# So summing up the major issues prevailing in the Mehsana are:

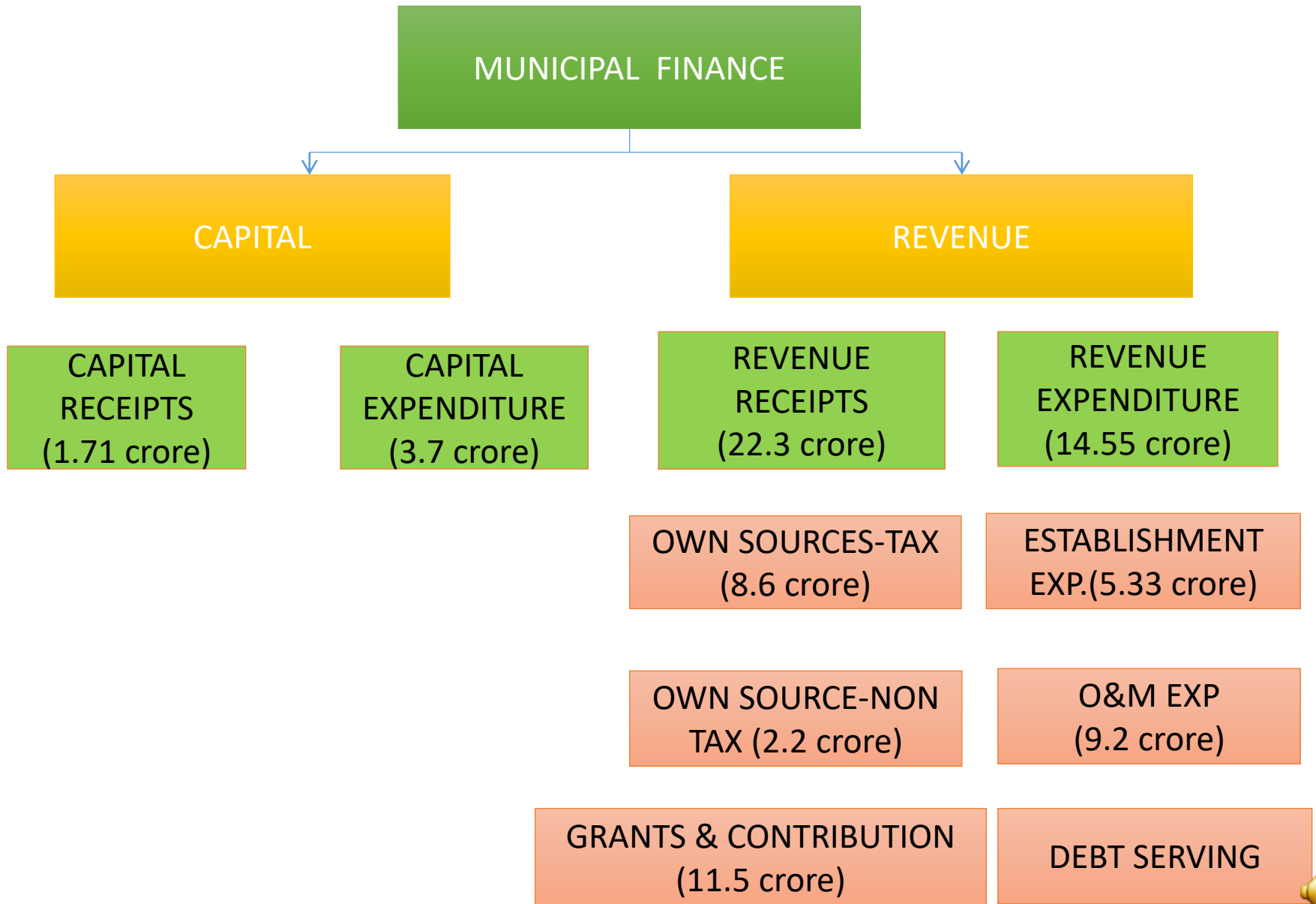
Key Performance Indicator	Benchmark	Mehsana
Extent of Segregation of MSW	100 %	0 %
Extent of Municipal Solid Waste processed/recycled	100 %	28.5%
Efficiency of Collection of MSW	100%	91.2%
MSW Recovery	80 %	0 %
MSW Processing	100 %	0 %
Extent of Scientific Disposal of MSW	100 %	0 %
Efficiency in redressal of customer complaints	80%	80%

## Further :

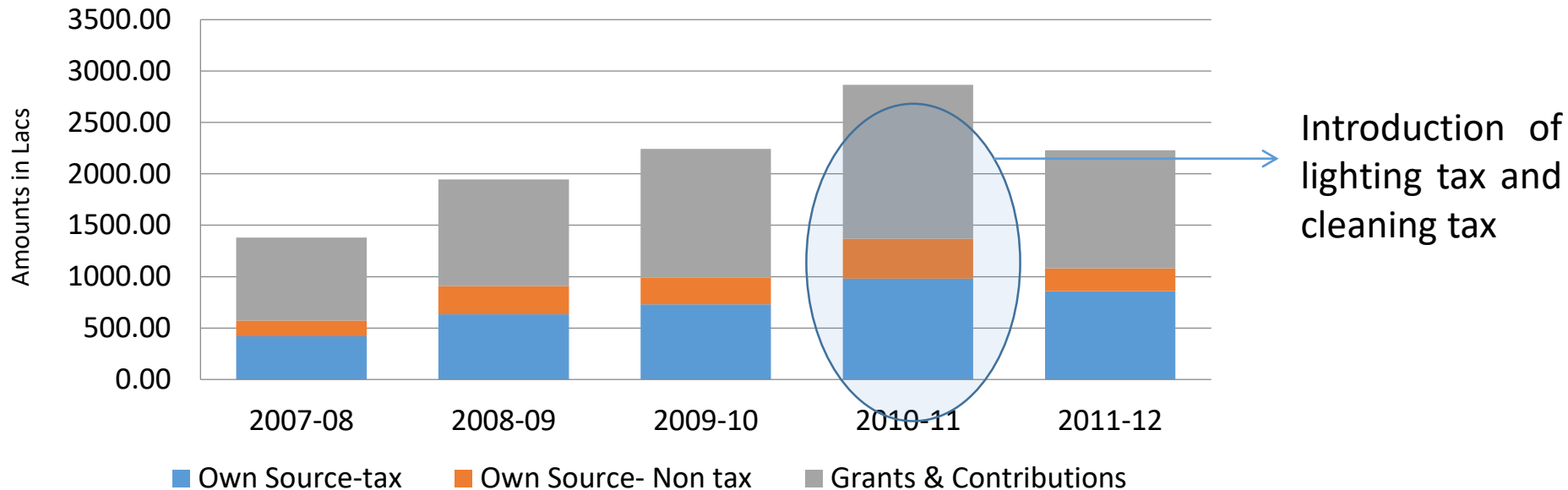
1. Negligence of the waste pickers
2. Lack of monitoring system and skilled manpower at the institutional level
3. Lack of regular IEC campaign.



# Understanding Municipal Finance



# REVENUE INCOME BREAKUP



## Own Source- Tax:

50% of taxes comes from consolidated tax, 40% from special water tax and rest from drainage tax. Consolidated tax doubled in 2008-09, showing an increase in the property tax rate.

## Own Source- Non Tax:

Major sources: Rent, T.P betterment charges, connection fee.

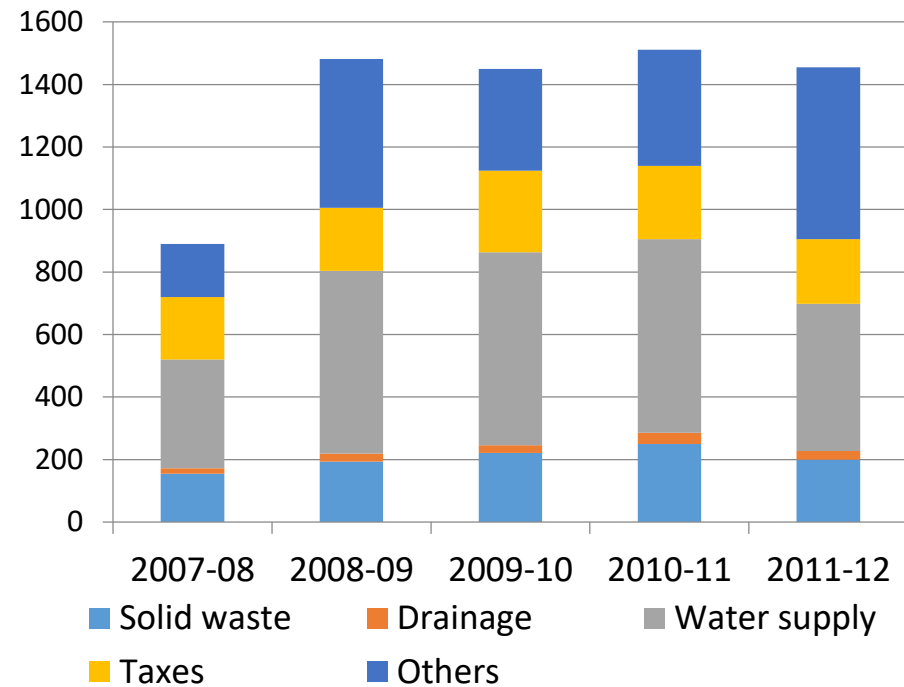
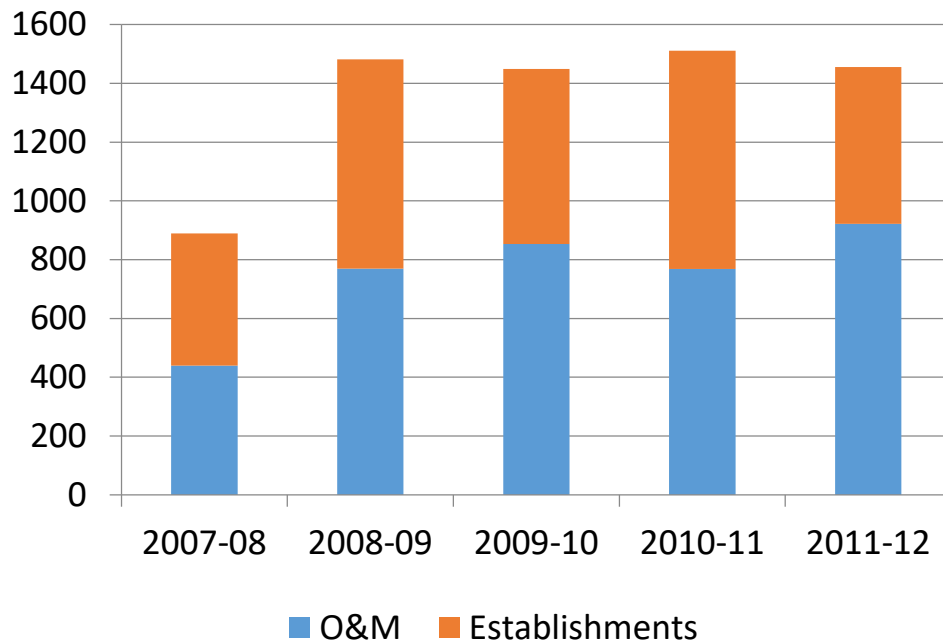
## Grants & Contributions:

Major contribution from octroi grant and service tax.

Octroi grant decreased over the years and service tax started in 2008-09.

SJMMSVY grant introduced in 2010-11 for augmentation of water supply and sewerage of the city. 📢

# REVENUE EXPENDITURE CATEGORISATION



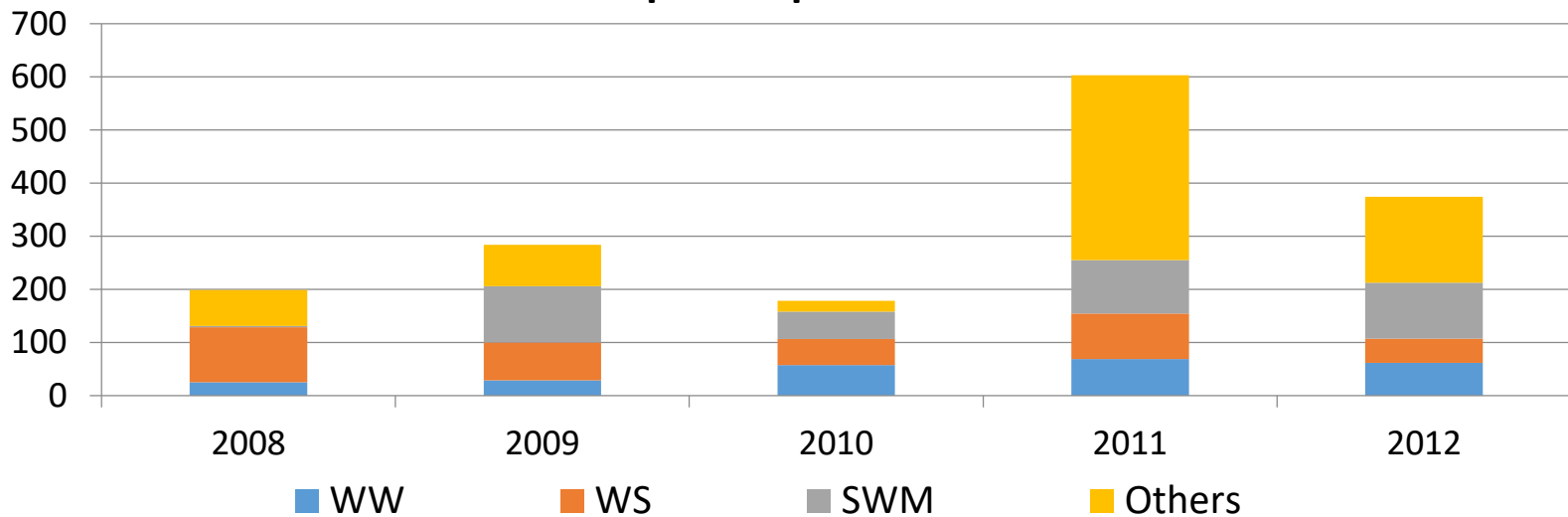
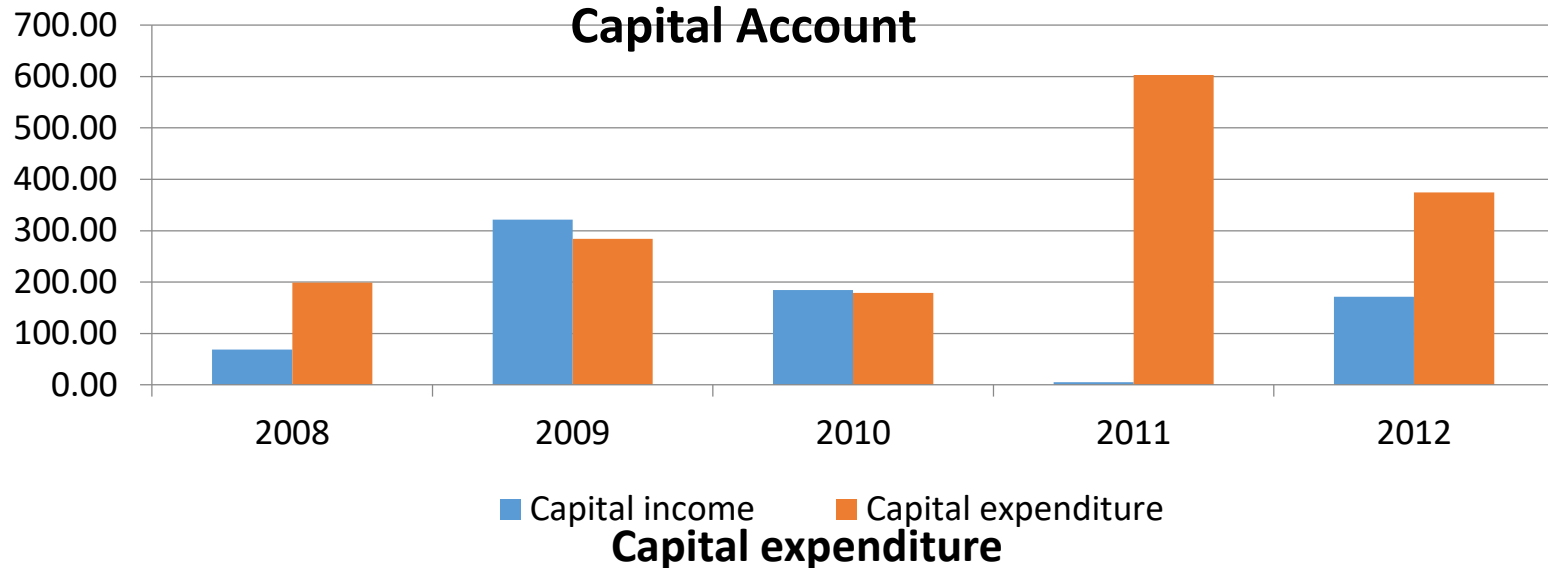
- The ratio of O&M expenditures and establishment expenditure remains constant.

## ***Sectoral Share:***

- Water supply: 45%
- Sewerage: 3%
- Solid Waster: 17%
- Water supply O&M expenses-95%
- Establishment costs in Solid waste management-77%



# CAPITAL ACCOUNT CATEGORISATION



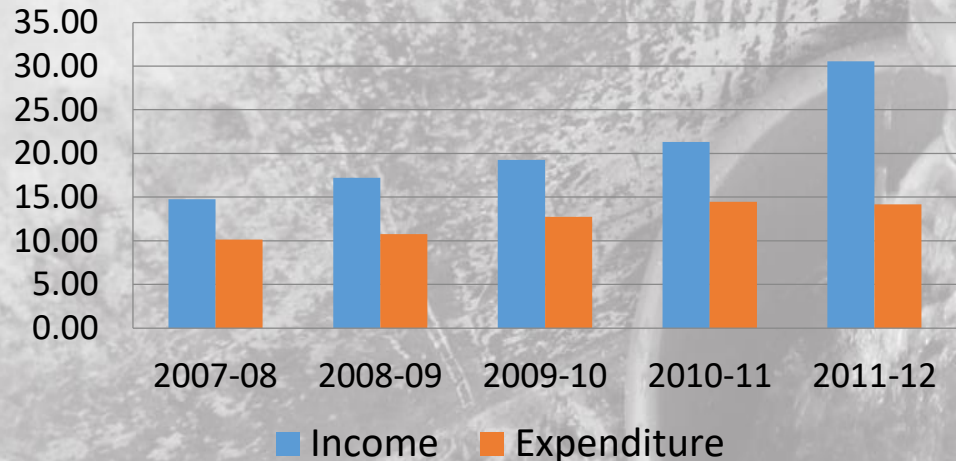
The capital expenditure is higher than the income, the deficit is covered by the excess revenue income.



# SECTORAL ANALYSIS

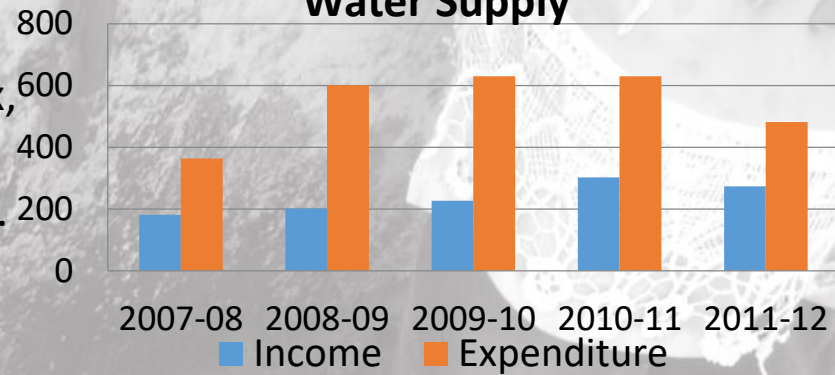
- Income for water comes from special water tax, water fee and connection fee.
- 95% of the revenue comes from special water tax.
- Major expenditures goes in O&M,

## Waste Water



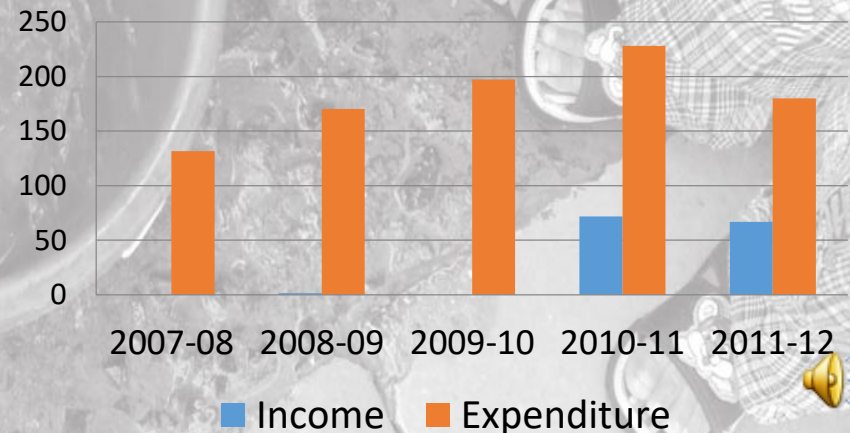
- 16% of the Total expenditure towards MSWM
- 80% of the expenditure as establishment costs. Rest O&M includes vehicle related costs.
- Income from cleaning tax. Low levels of cost recovery.
- Cleaning tax was started after 2007.

## Water Supply



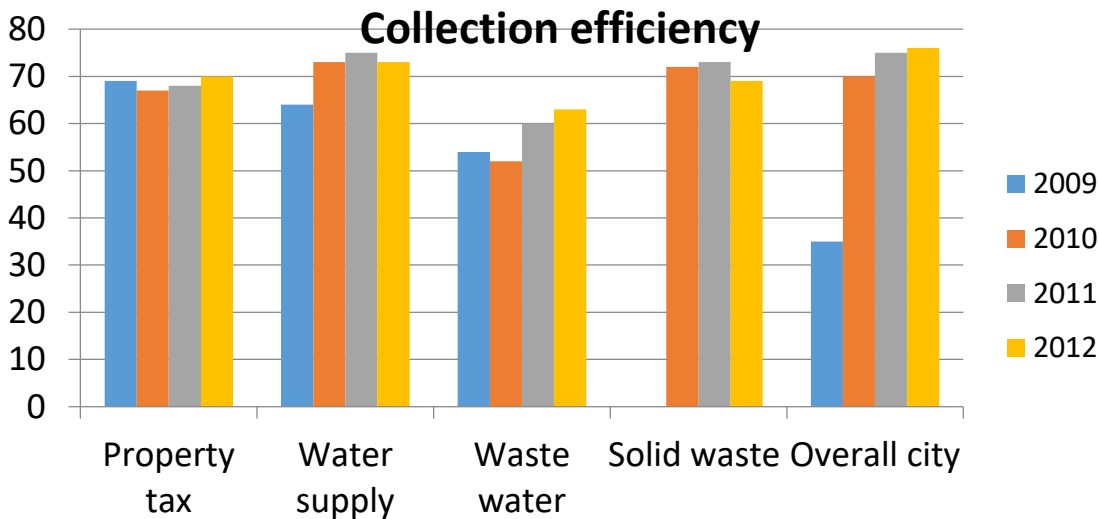
- Equal expenditure for both establishment and O&M is seen.
- Major O&M expenses-cleaning of latrines and petrol, diesel costs.
- Revenue from connection fee and drainage tax.

## Solid waste Management



# SUMMARY

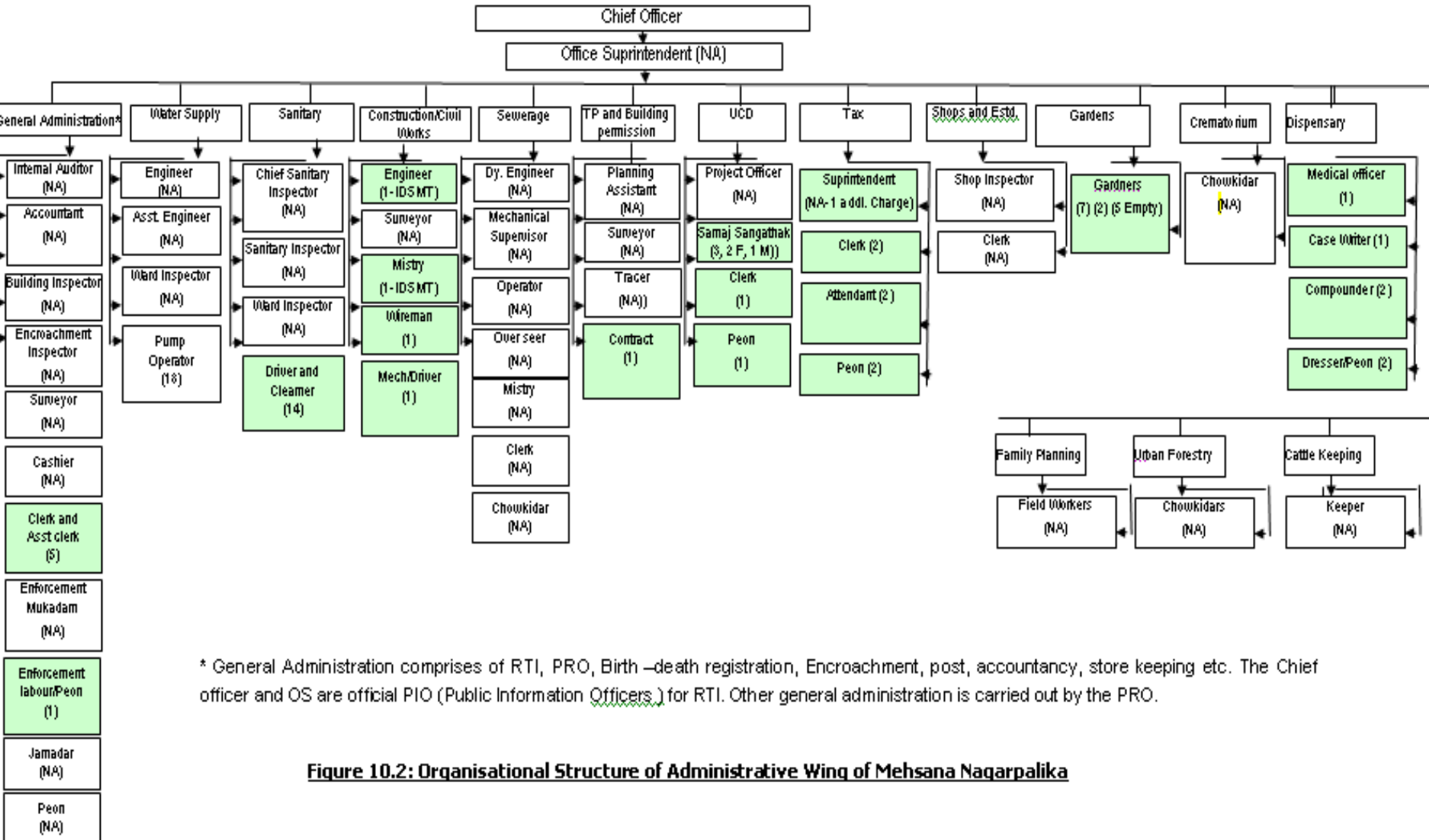
	2007-08	2008-09	2009-10	2010-11	2011-12
Operating Ratio	0.64	0.73	0.62	0.51	0.65
Property tax as share of revenue receipts	17%	21%	21%	22%	23%
Dependence on grants	59%	51%	37%	44%	52%
Cap Recpts to total Recpts	4%	13%	2%	8%	10%
CapEx to total Expenditure	15%	15%	11%	14%	17%
Capital Utilisation (Total)	290%	88%	99%	-	3431%



- Mehsana has good share of own source income.
- The capital income has been lower than the expenditure.
- Here, the operating ratio is low due to poor service delivery.
- The collection efficiency has increased.



# INSTITUTIONAL STRUCTURE



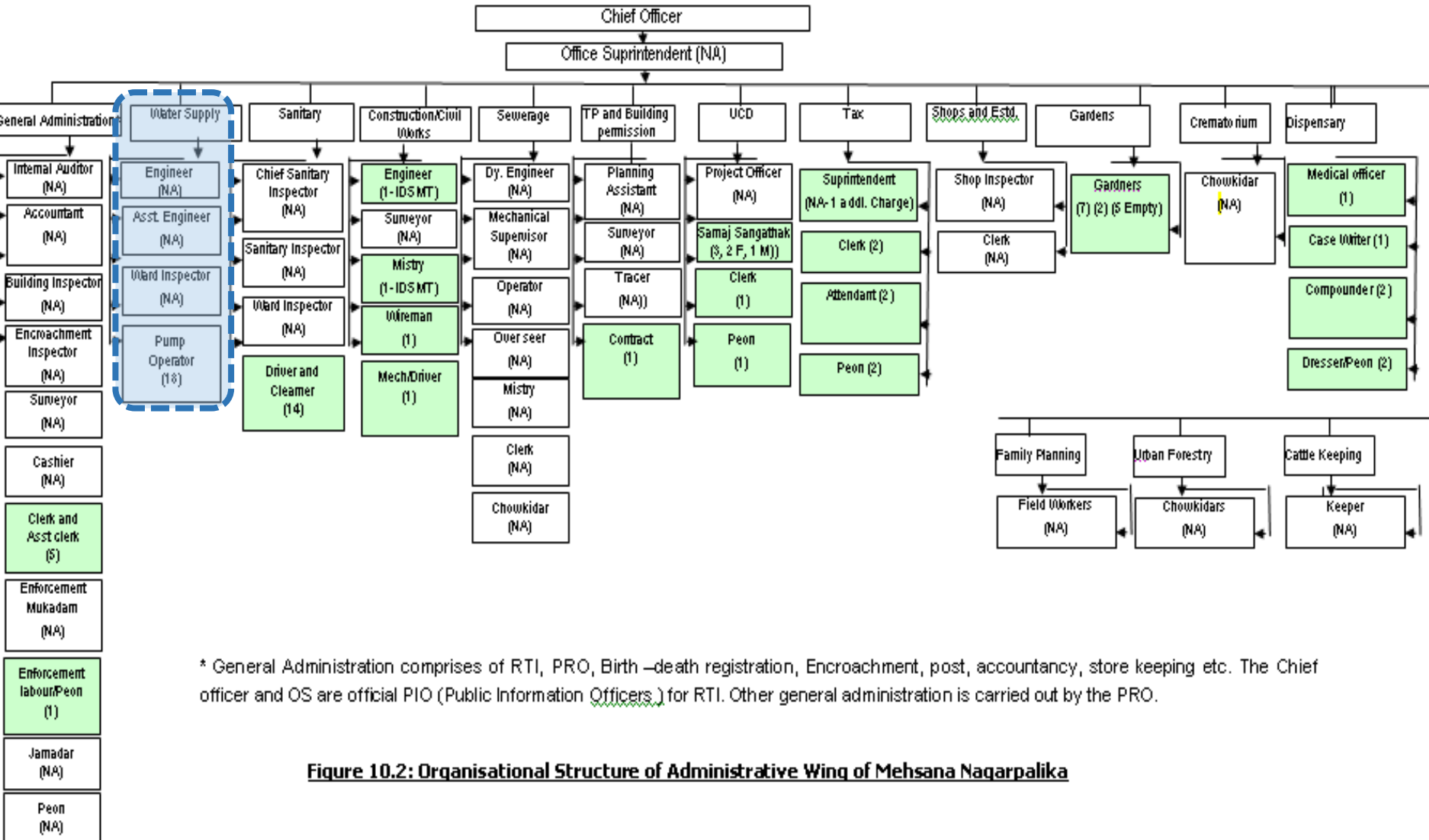
\* General Administration comprises of RTI, PRO, Birth –death registration, Encroachment, post, accountancy, store keeping etc. The Chief officer and OS are official PIO (Public Information Officers) for RTI. Other general administration is carried out by the PRO.

**Figure 10.2: Organisational Structure of Administrative Wing of Mehsana Nagarpalika**





# INSTITUTIONAL STRUCTURE

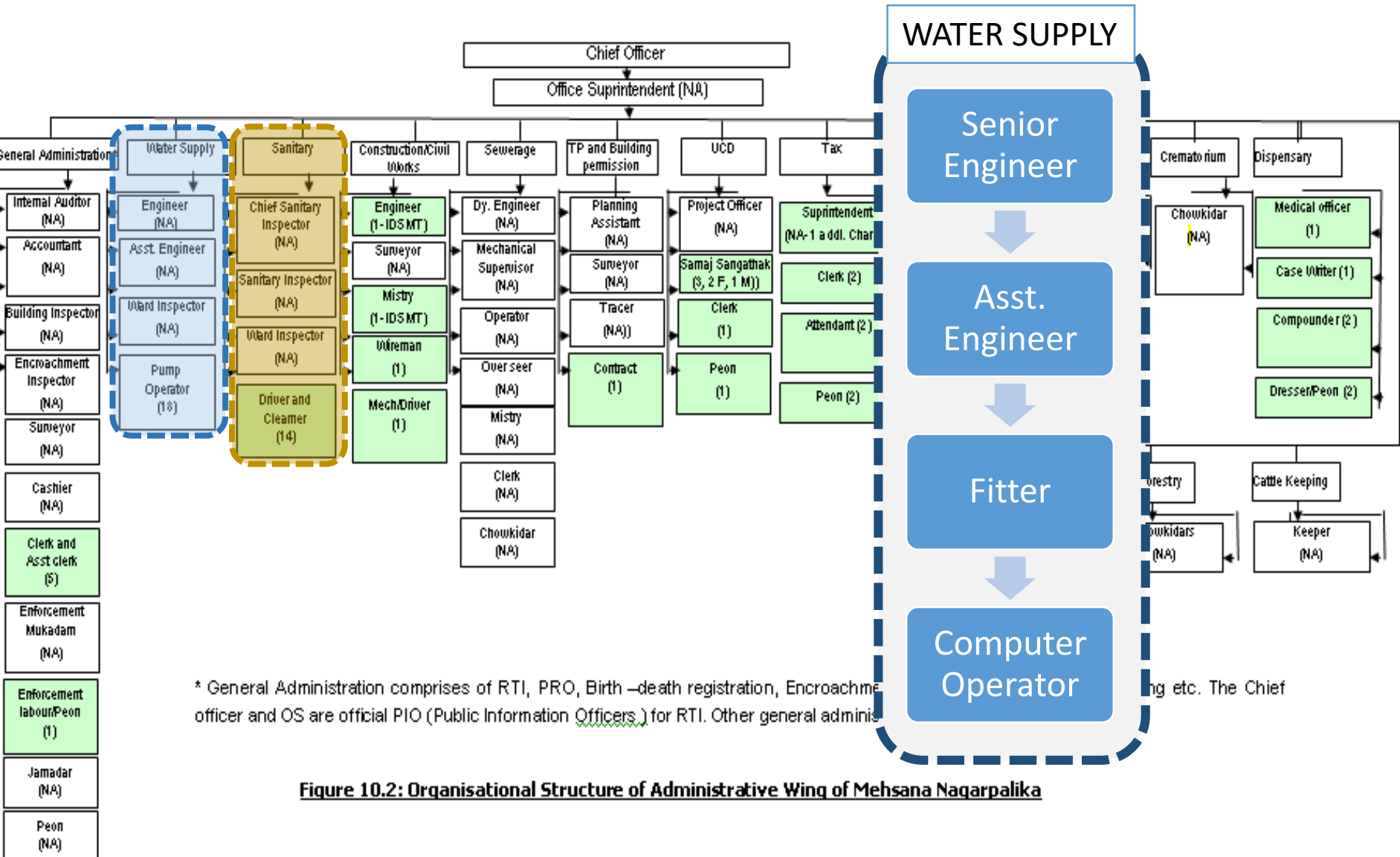


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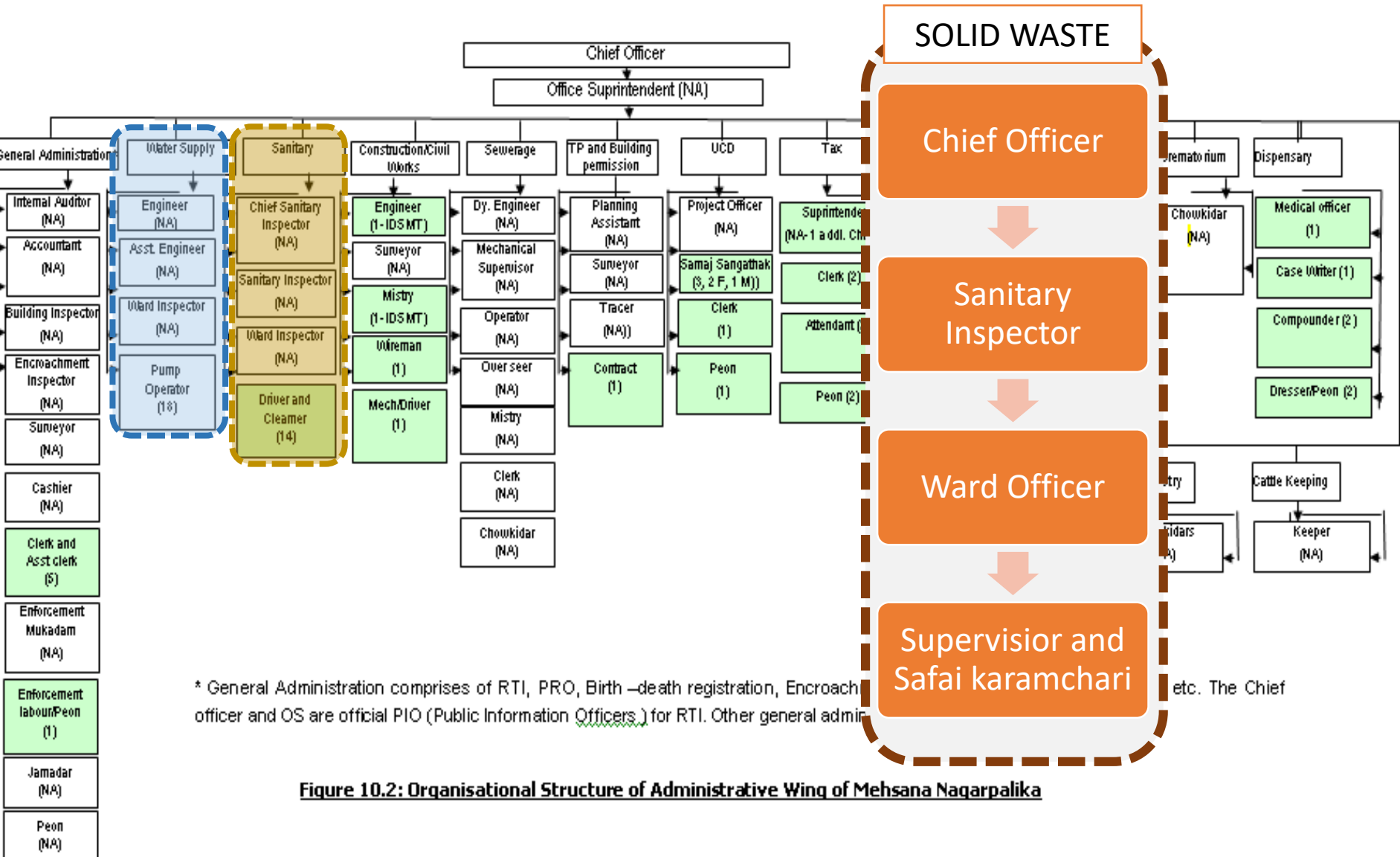


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**Figure 10.2: Organisational Structure of Administrative Wing of Mehsana Nagarpalika**



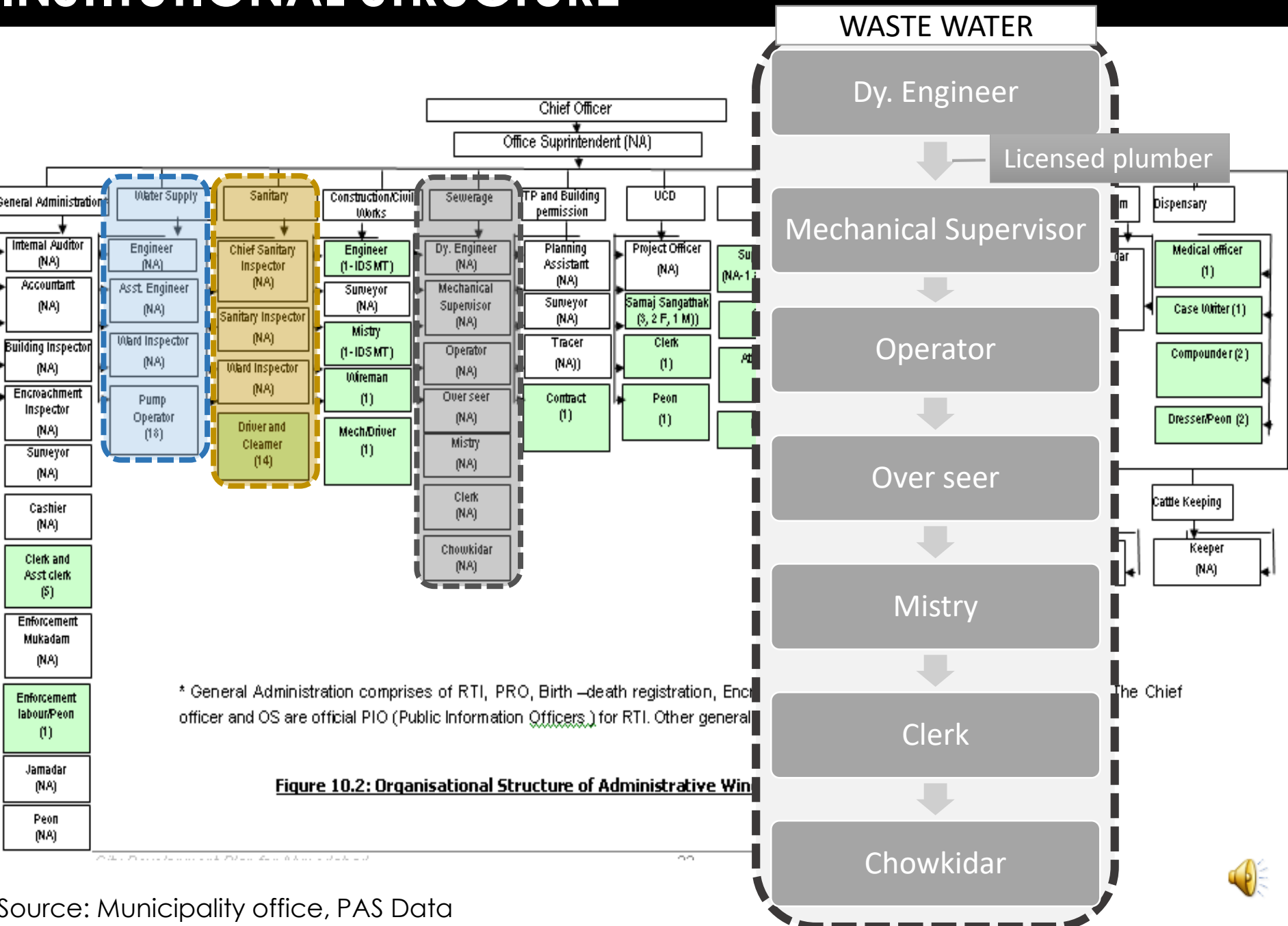
# INSTITUTIONAL STRUCTURE



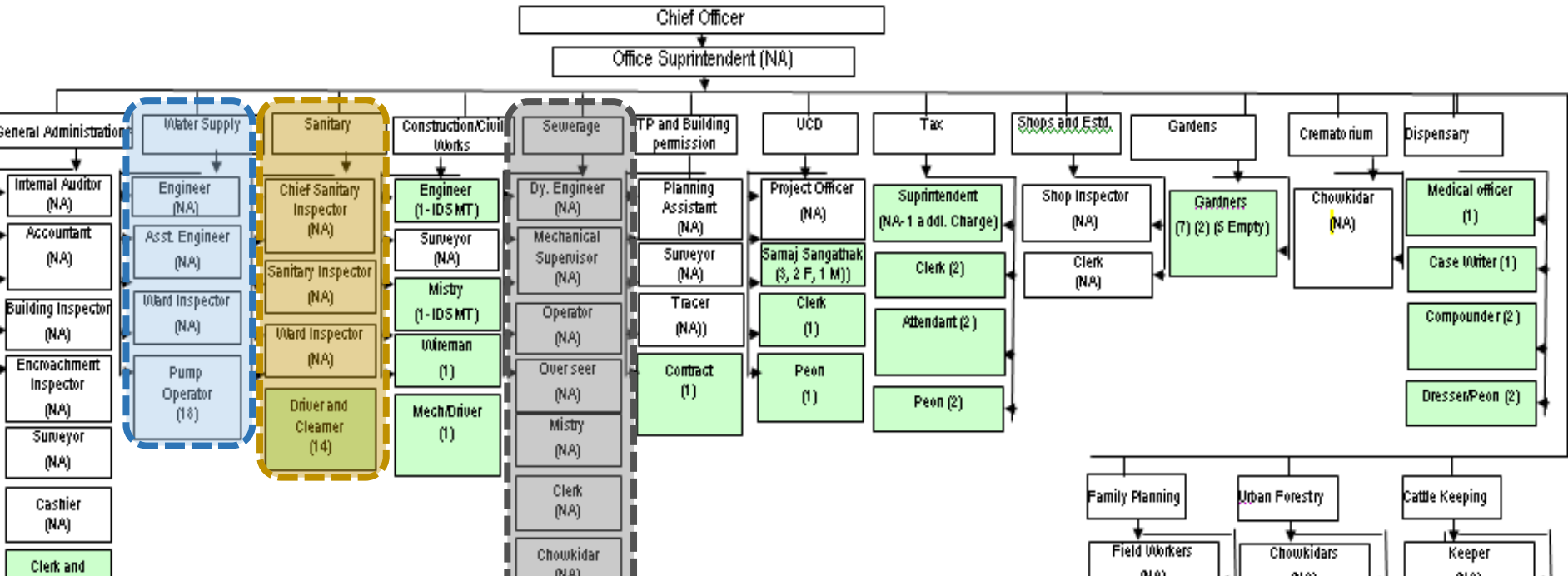
**Figure 10.2: Organisational Structure of Administrative Wing of Mehsana Nagarpalika**



# INSTITUTIONAL STRUCTURE



# INSTITUTIONAL STRUCTURE

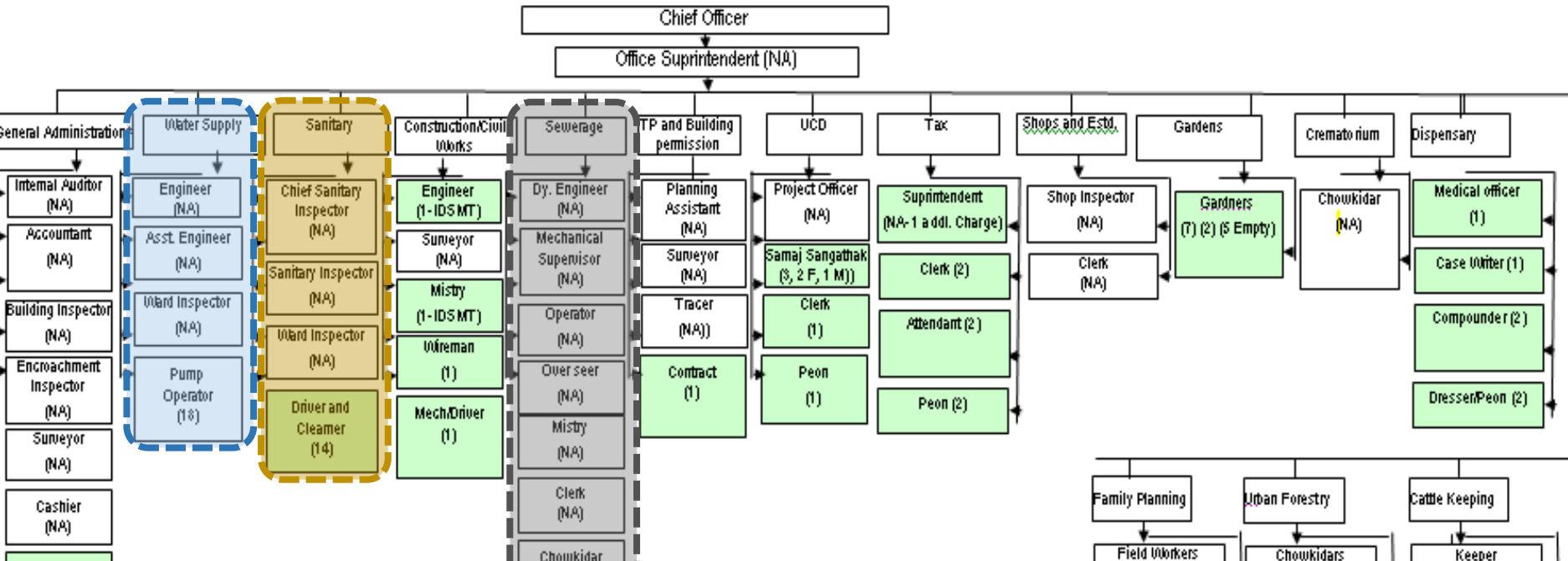


	Accounts dept	Engineering dept	Health officer	General Administration	Tax Dept	Health dept.	Water Works dept
Sanctioned	18	18	1	10	5	3	4

Peon (NA)



# INSTITUTIONAL STRUCTURE



	Water Supply & Waste Water	Solid waste
Sanctioned	50	573
Employed	50	390

accountancy, store keeping etc. The Chief carried out by the PRO.

arpalika



# KEY HIGHLIGHTS

**SPATIAL DISPARITY IN COVERAGE  
HIGH DEPENDENCY ON NARMADA  
HIGH NRW AND INEFFICIENCY  
POOR COST RECOVERY  
INTERMITTENT SUPPLY**

**7.5% OPEN DEFECATION  
NO PROVISION FOR WASTE WATER TREATMENT  
DISPOSAL OF WASTE WATER IN KHARI RIVER  
OPERATIONS AND MAINTANANCE ISSUES OF SEPTIC TANK AND OPEN DRAINS**

**NO SEGREGATION OF WASTE  
DUMPING SITE & BINS AS MAJOR NUISANCE POINT ATTRACTING SCAVANGERS  
ALL WASTE DISPOSED AT SAME SITE  
NEGLECTED RAG PICKERS**

**LOW COLLECTION EFFICIENCY  
CAPITAL INCOME LOWER THAN EXPENDITURE  
50% DEPENDENCY ON GRANTS**

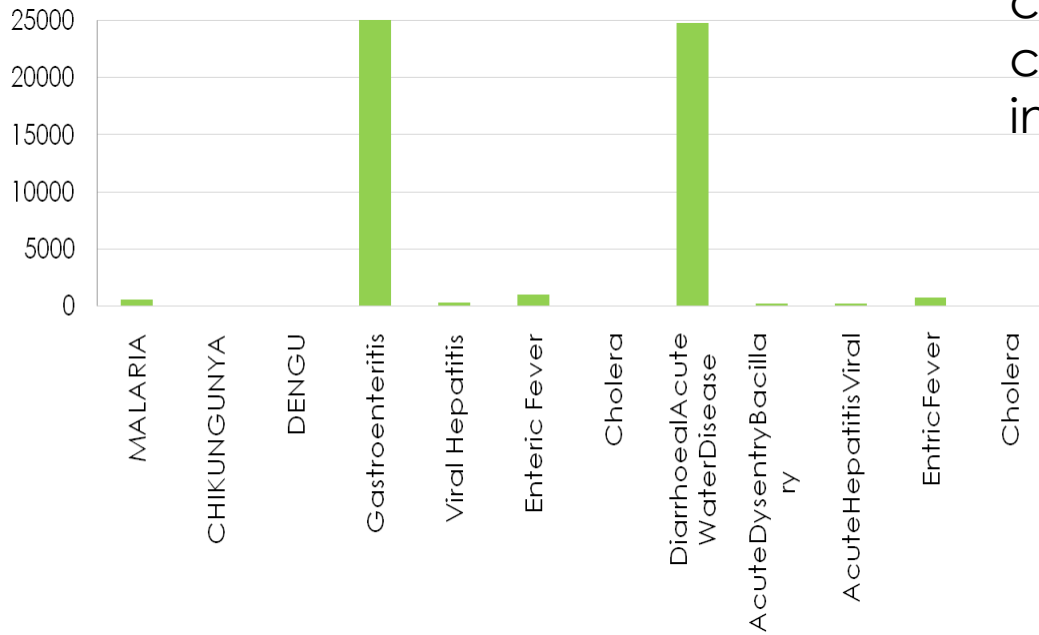


Poor water quality, sanitation and waste disposal management impacts the quality of the local environment and hence it is imperative for any city administration, not just to provide health facilities but also concentrate on improving the poor WSS scenario in order to achieve a better environment and a healthy city.





## IMPACTS DUE TO BAD WATER QUALITY



Source: The Times of India, dated 23-06-09, pg.3 city times

**Waterborne diseases**, including cholera, typhoid, and dysentery, are caused by drinking water containing infectious viruses or bacteria,



Mehsana has witnessed health related issues due to poor water quality at various pockets and people have suffered from Hepatitis E .Jaundice, Diarrhea, cholera, Fluorosis

- kasba wagriwaas
- Hyderi chowk
- babi vado
- faiz no vado
- siddhapur bazaar



# IMPACTS ON HEALTH DUE TO WSS

The **World Health Organization WHO** approaches recognizes “ The approach seeks to put health high on the political and social agenda of cities and to build a strong movement for public health at the local level. It strongly emphasizes equity, participatory governance and solidarity, intersectoral collaboration and action to address the determinants of health.”

SOURCE: World Health Organisation



# CITY SANITATION PLAN

## VISION:

Clean, Healthy and water sensitive city of Mehsana.

## OBJECTIVES:

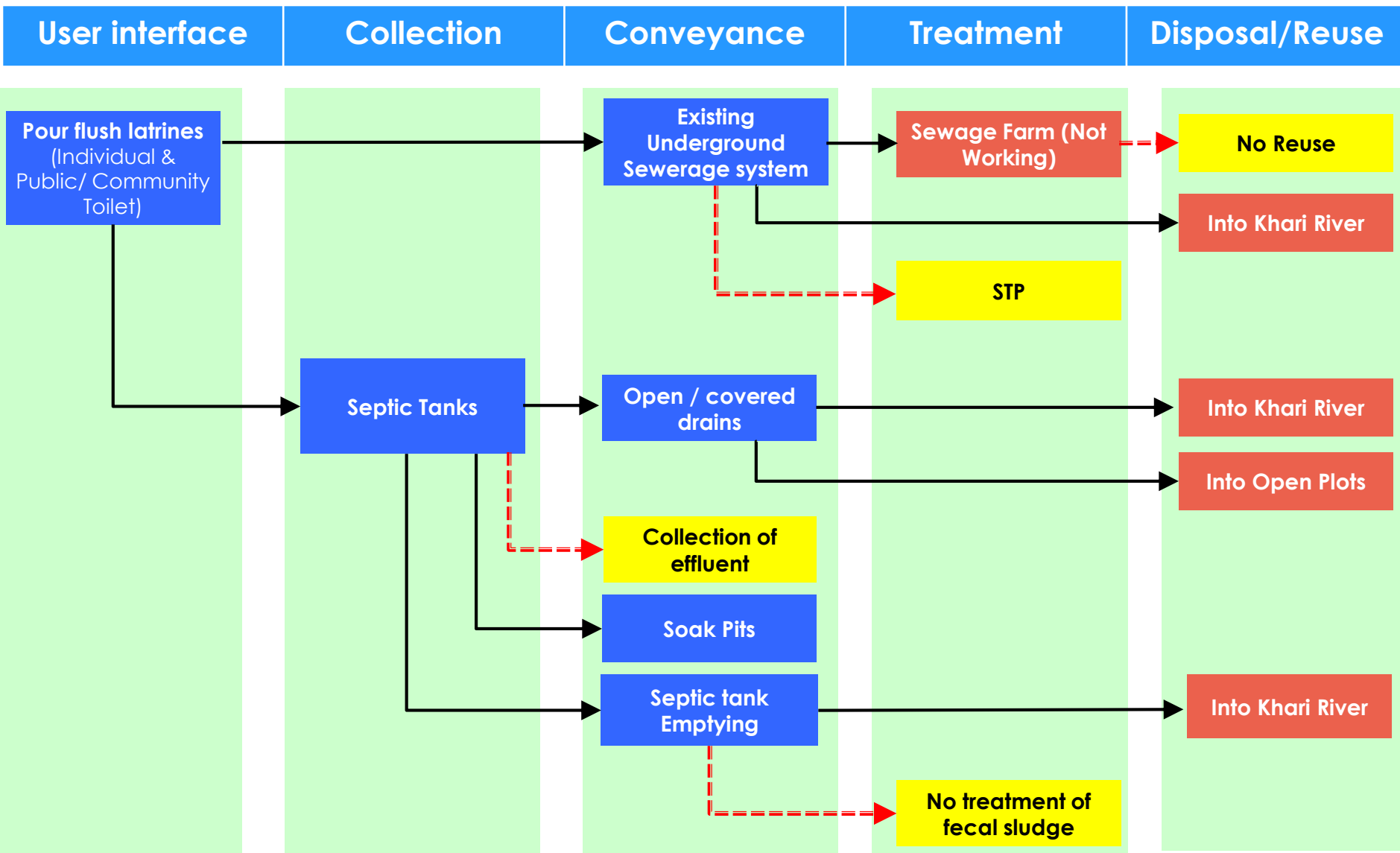
- To achieve 100% coverage in terms of water supply, sanitation and solid waste.
- To achieve efficiency and reliability in water and sanitation sectors.
- Treatment and reuse of water for resource management.
- To achieve financial sustainability.
- Public engagement and awareness programs for water harvesting and sanitation.





# **MEHSANA CITY: Waste Water and Sanitation PROPOSALS**

# Current Sanitation Chain and Missing Links



— Existing Links  
- - - Missing Links

# Sector Objectives and Actions

## Objectives:

1. To make Mehsana OD free city & providing improved sanitation facilities to all
2. Waste water management
3. To restore & protect Khari River

## Actions:

1. Construction of Community toilets (intermittent solution)
2. Provision of STP and septage farm
3. Rejuvenation of Khari
4. Modifying existing GDCR
5. Awareness campaigns

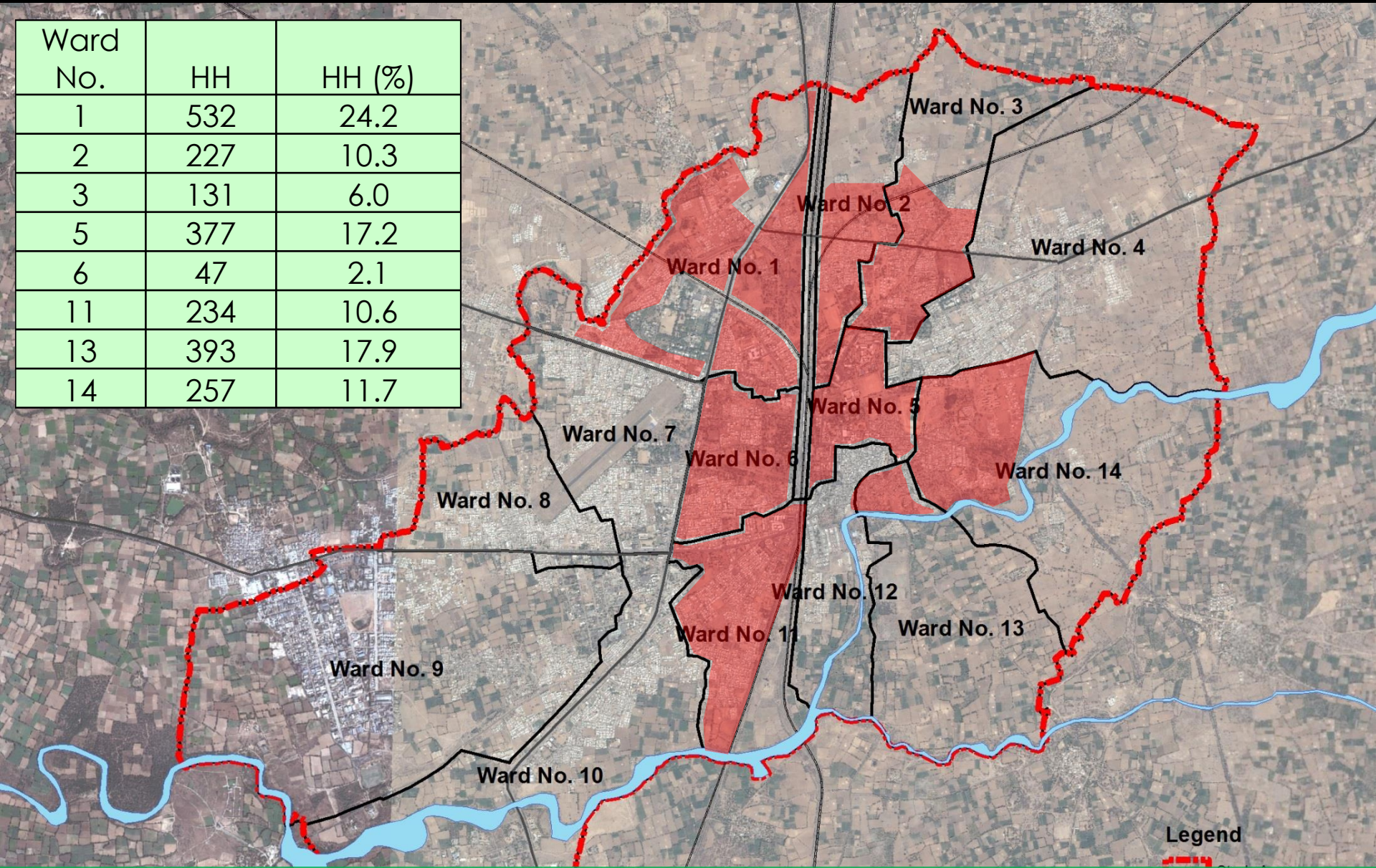
# Open Defecation free Mehsana

## **Actions:**

- 1. Making Mehsana OD free city.**
- 2. Program/schemes to subsidies individual toilets.**

# Ward Wise - OD

Ward No.	HH	HH (%)
1	532	24.2
2	227	10.3
3	131	6.0
5	377	17.2
6	47	2.1
11	234	10.6
13	393	17.9
14	257	11.7



**Legend**

- Study Area
- Ward Boundry
- River Khari

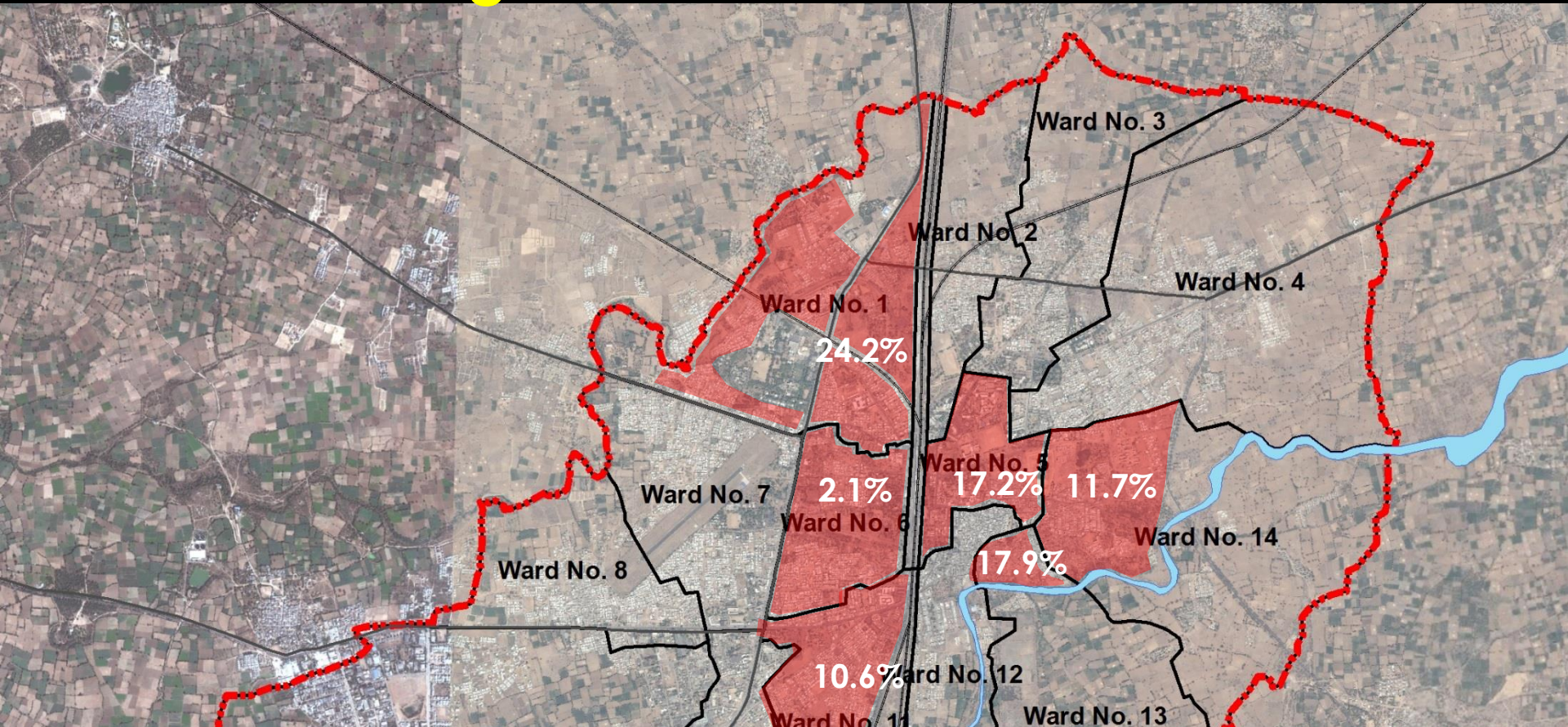
**MEHSANA – 7.5% OPEN DEFECACTION**

Source: Census 2011, Census office Gandhinagar

0 0.5 1 2 3 Kilometers



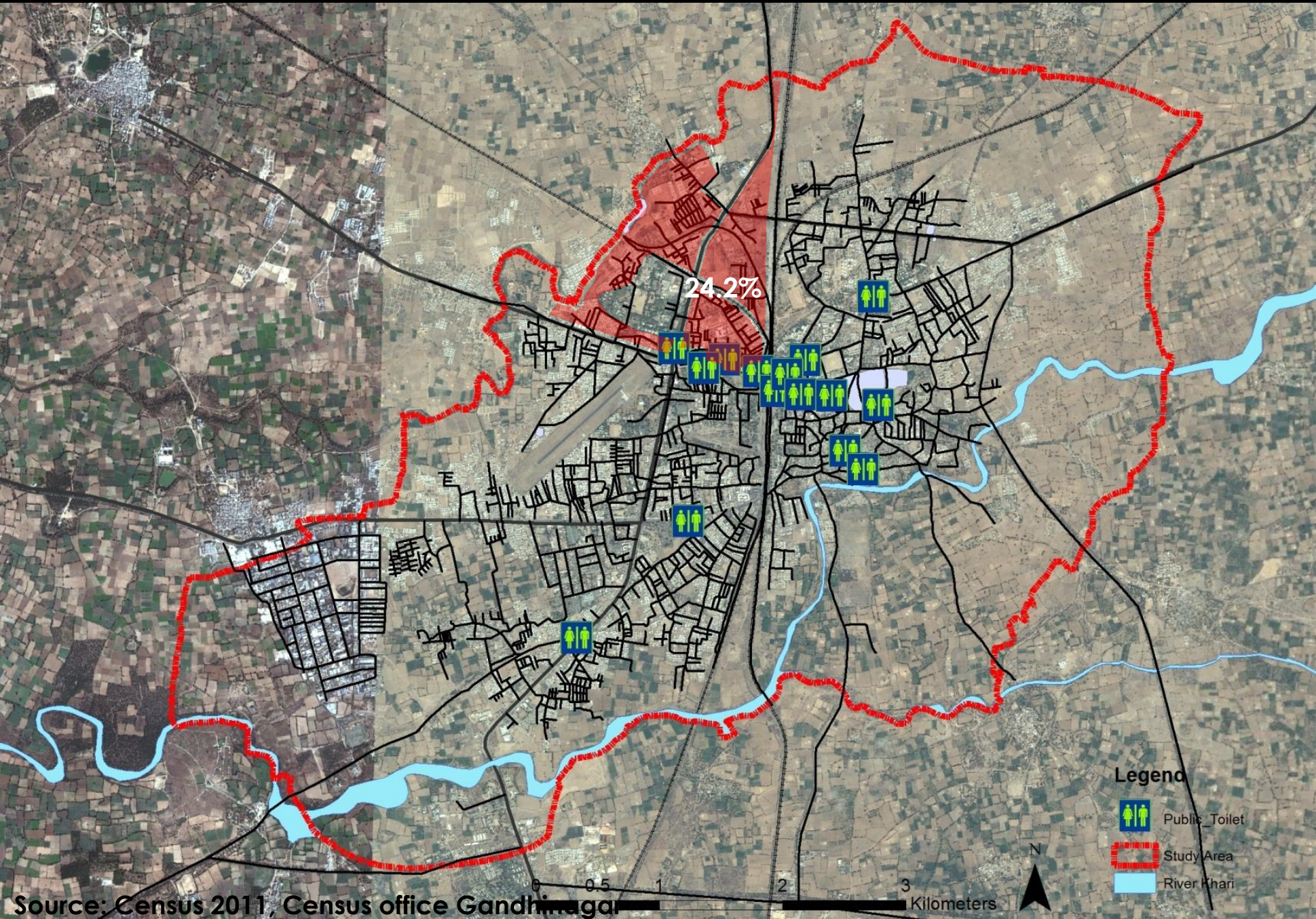
# Wards resorting maximum OD



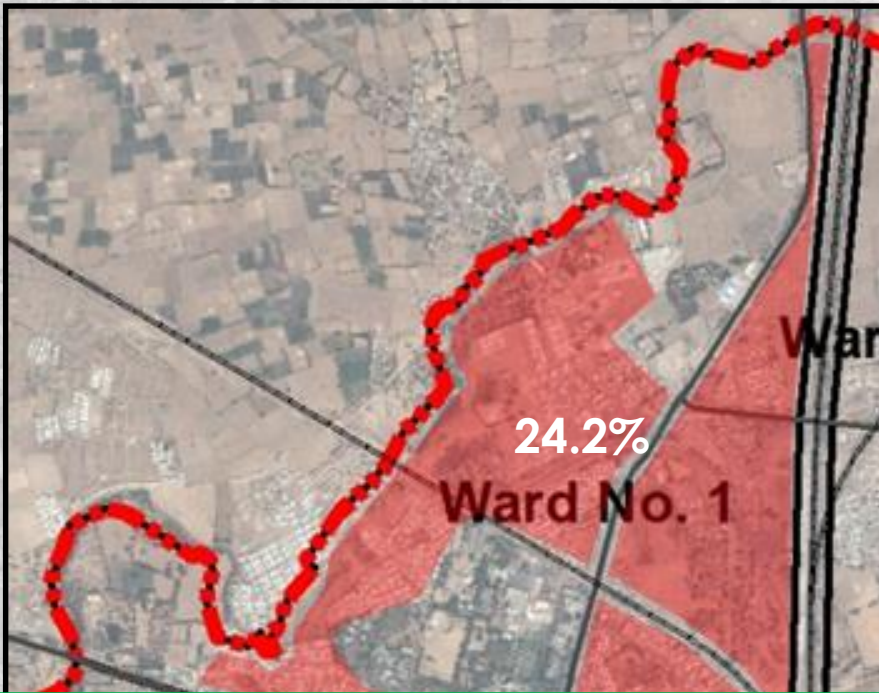
## Reasons for OD

1. Lack of space for construction of Individual Toilets
2. Access to the public toilet
3. High Density leading to overloading in existing public toilets

# Ward wise analysis for Open Defecation



# Ward 1 – Open Defecation



2660 people  
defecate in open

3 Existing public  
toilets

LOAD PER WC – 125

**OVERLOADED**

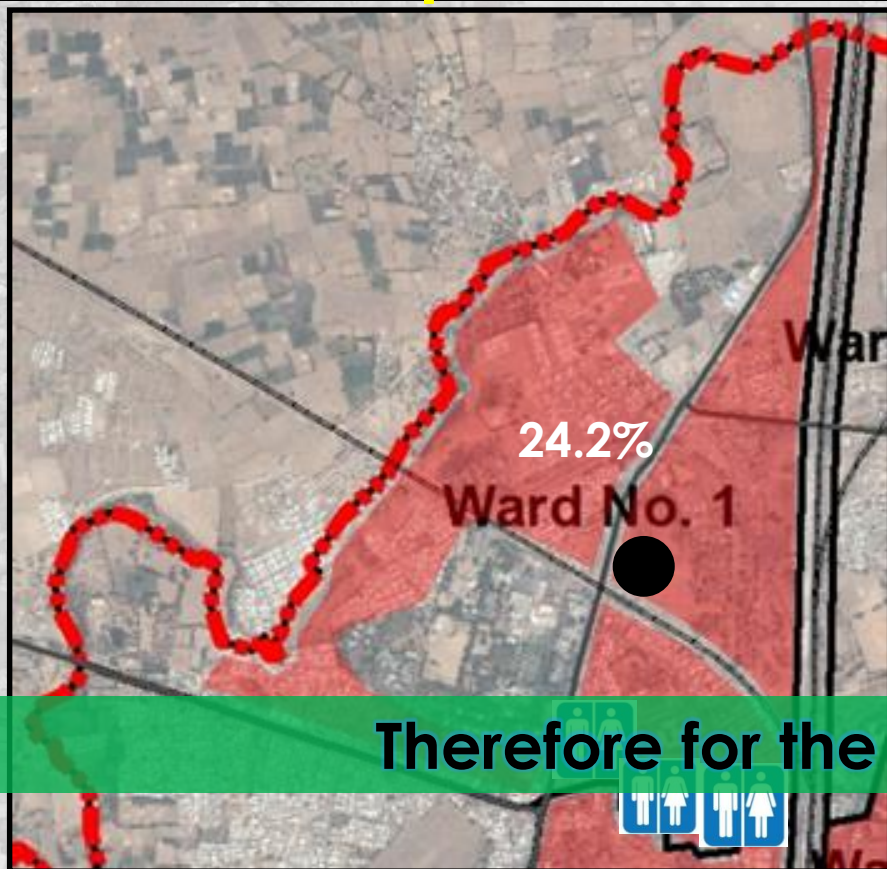
LOAD WHICH EXISTING TOILETS CAN  
ACTUALLY TAKE – 1050 PEOPLE

Therefore for the other 1610 people

## Options for reducing OD

1. Increasing the capacity of existing toilets
2. Providing shared or community toilets
  - Type of housing
  - Land ownership
  - How are the toilets distributed spatially

# Ward 1 – Open Defecation



2660 people

defecate in open

3 Existing public

toilets

LOAD PER WC – 125

**OVERLOADED**

LOAD WHICH EXISTING TOILETS CAN  
ACTUALLY TAKE – 1050 PEOPLE

Therefore for the other 1610 people

**DESAI  
NAGAR**

Source:  
Primary Survey

**INCREASING CAPACITY OF EXISTING  
3 TOILETS  
CONSTRUCTION OF 1<sup>ST</sup> FLOOR WITH 7  
W.C. EACH (4MEN, 3WOMEN)**

No. Of HH with no  
toilets

VRINDAVAN

RABARI

20

63

Total persons

100

315

**PROPOSED COMMUNITY TOILET  
11 WC**

# Proposal for Toilets

**REOPENING THE ABANDONED TOILETS**

**INCREASING CAPACITY OF EXISTING TOILETS**

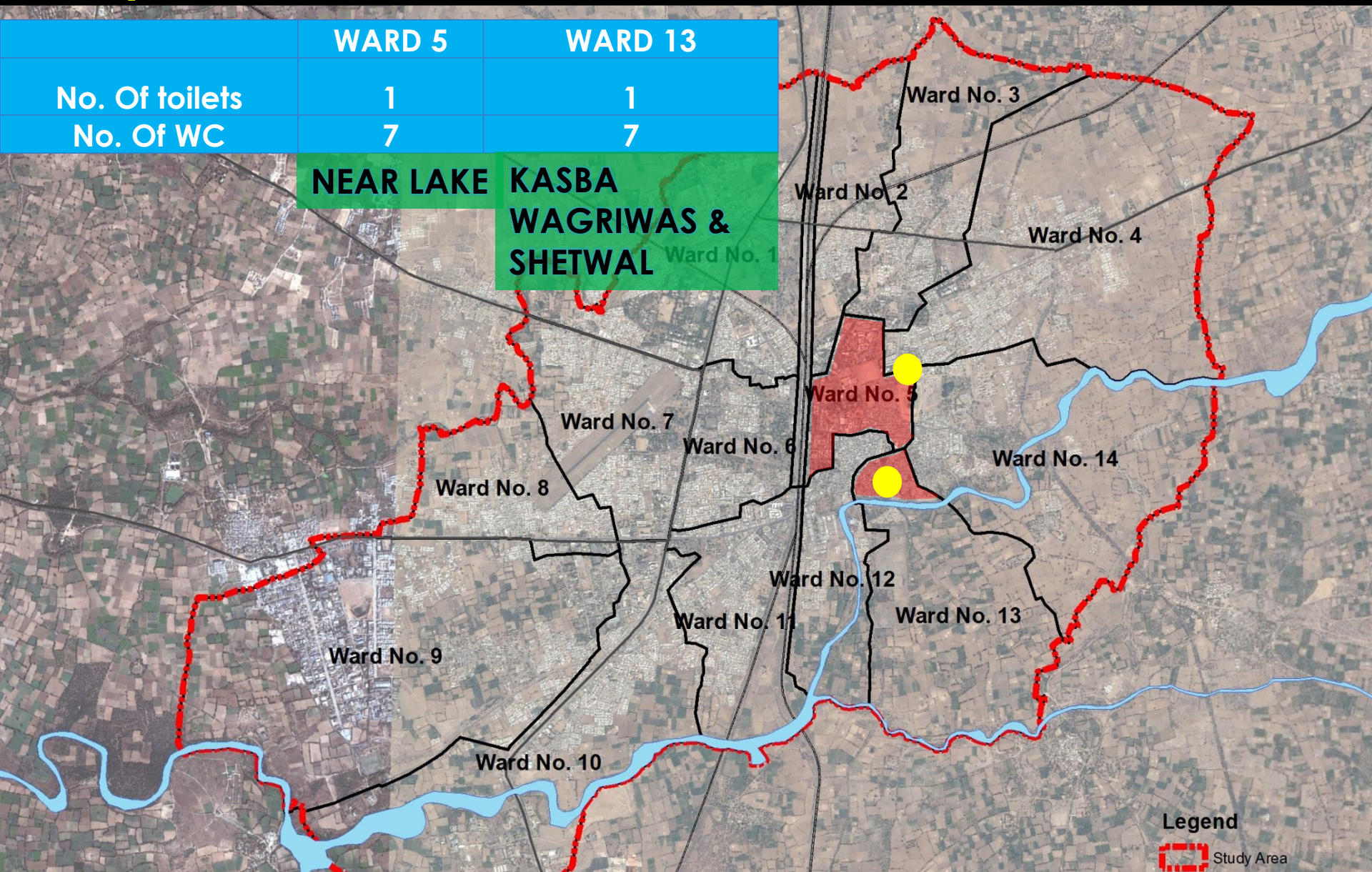
**NEW PUBLIC TOILET CONSTRUCTION**



# Proposal

	WARD 5	WARD 13
No. Of toilets	1	1
No. Of WC	7	7

**NEAR LAKE KASBA WAGRIWAS & SHETWAL**  
Ward No. 1

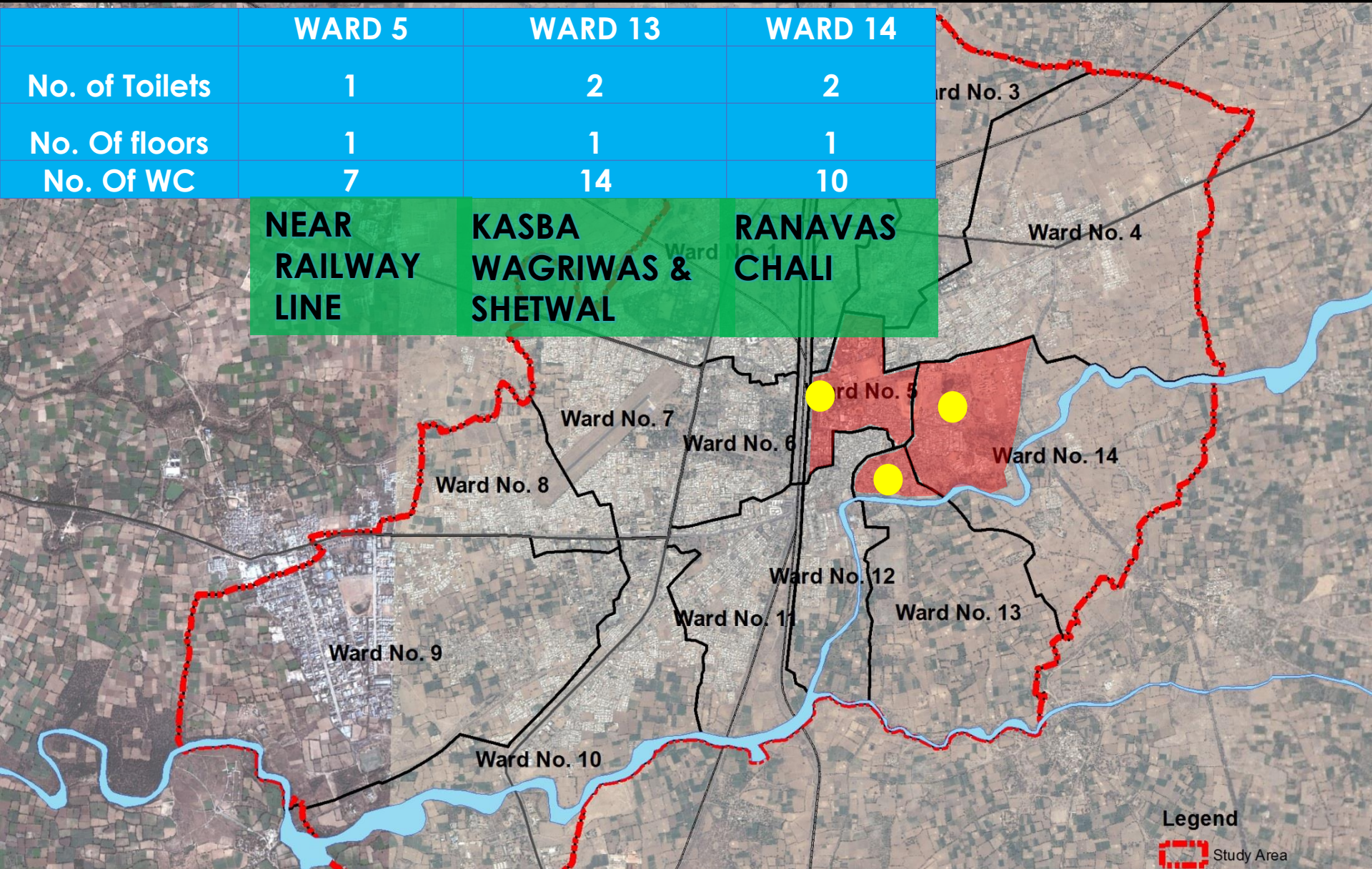


## REOPENING THE ABANDONED TOILETS

# Proposal

	WARD 5	WARD 13	WARD 14
No. of Toilets	1	2	2
No. Of floors	1	1	1
No. Of WC	7	14	10

**NEAR RAILWAY LINE**      **KASBA WAGRIWAS & SHETWAL**      **RANAVAS CHALI**

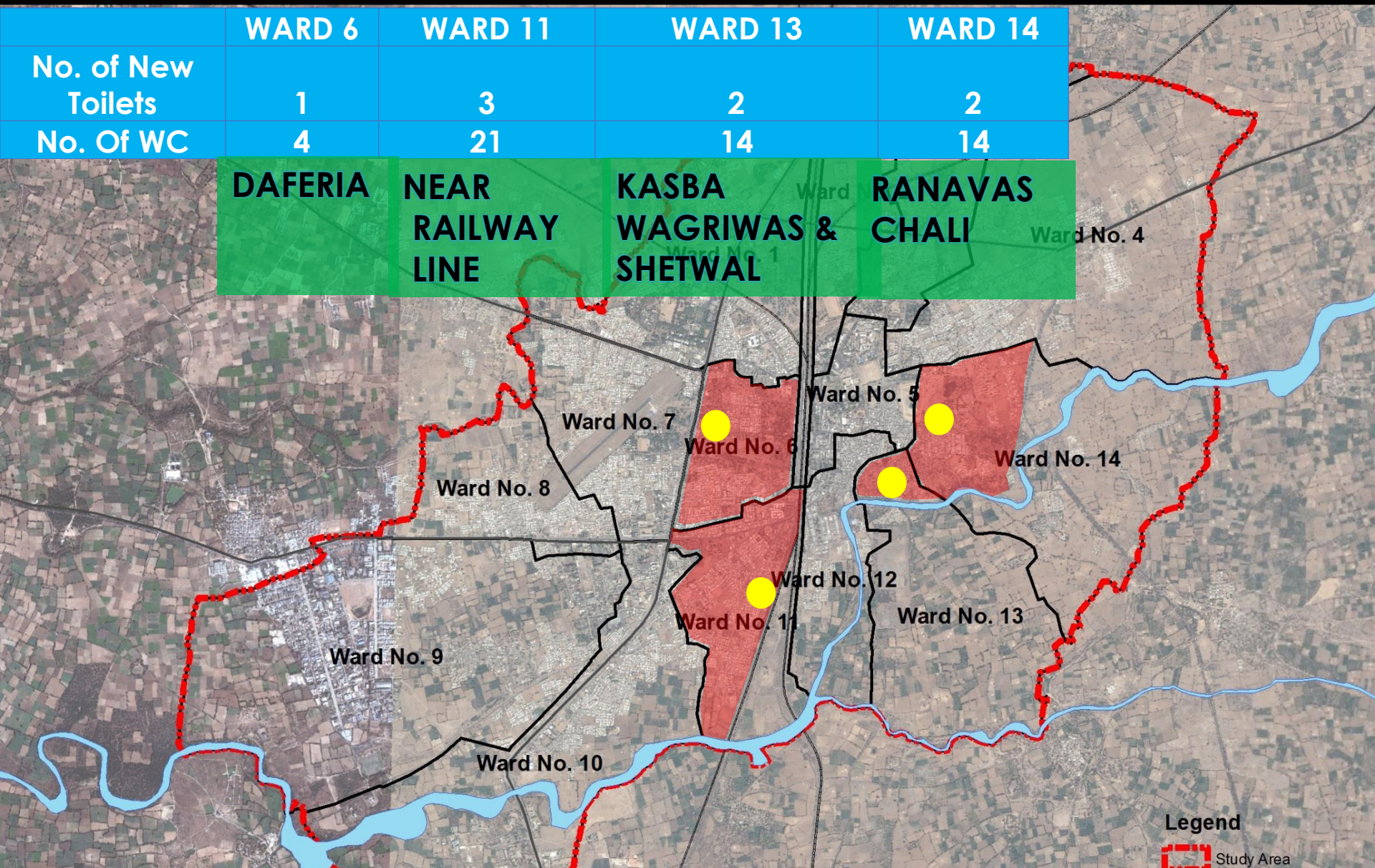


## INCREASING CAPACITY OF EXISTING TOILETS

# Proposal

	WARD 6	WARD 11	WARD 13	WARD 14
No. of New Toilets	1	3	2	2
No. Of WC	4	21	14	14

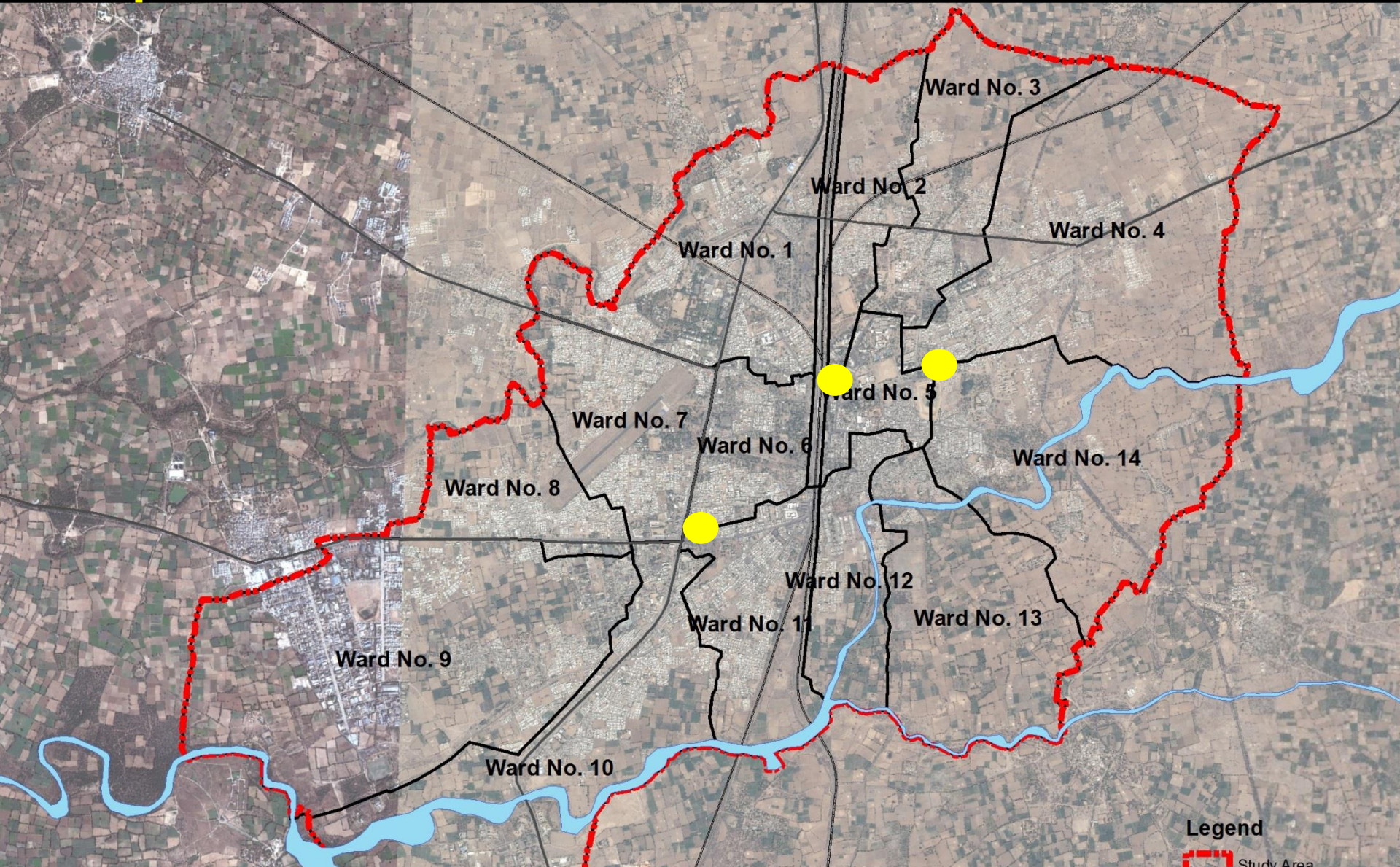
**DAFERIA**    **NEAR RAILWAY LINE**    **KASBA WAGRIWAS & SHETWAL**    **RANAVAS CHALI**



## NEW PUBLIC TOILET CONSTRUCTION



# Proposal – Urinals



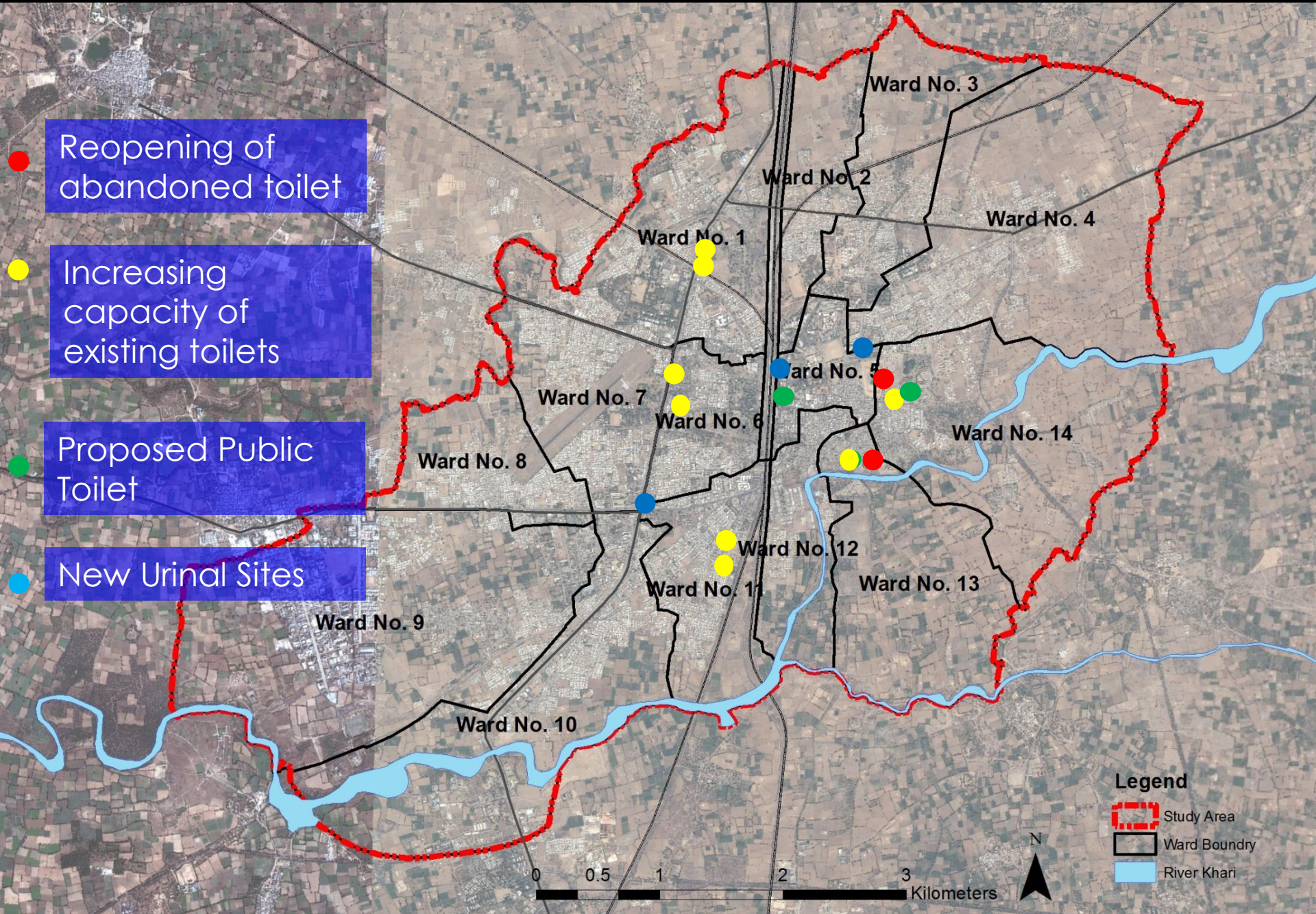
## New Urinal Sites

3 Kilometers



- Legend**
-  Study Area
  -  Ward Boundry
  -  River Khari

# All Proposals



● Reopening of abandoned toilet

● Increasing capacity of existing toilets

● Proposed Public Toilet

● New Urinal Sites

**Legend**

- Study Area
- Ward Boundary
- River Khari



# Cost Estimates

## Abandoned Toilet

REOPENING OF ABANDONED TOILETS		
	1. Pond area	1,00,000
	2. Shetwal area	1,00,000

## Urinals

URINALS IN THE CITY	PLACES	COST
	1. Modhera C/R	2,50,000
	2. Pond Area	2,50,000
	3. Near Gopi Nala	2,50,000

After referring the GMFB Pay & use Progress Report, CSP's and existing contract the average cost of constructing ONE PUBLIC TOILET with all facilities is approximately 5.5 lakh rupees.

# Cost Estimates

## Construction of Public Toilet for community use

AREA	NO OF TOILETS	COST
DESAI NAGAR	2 with 11 WC	8,50,000
DAFERIA	1 with 4 WC	4,50,000
SHETWAL & VAGRI VAS	2 with 14 WC	11,00,000
RANAVAS NI CHALI	2 with 14 WC	11,00,000
WARD NO. 11	3 with 21 WC	16,50,000
<b>TOTAL</b>		<b>54,50,000</b>

## Increased Capacity for existing Public Toilet

No. of toilet	Per Toilet Cost	TOTAL
8	3,00,000	24,00,000

**TOTAL COST**

**85,00,000**

After referring the GMFB Pay & use Progress Report, CSP's and existing contract the average cost of constructing ONE PUBLIC TOILET with all facilities is approximately 5.5 lakh rupees.

# Scheme for Individual Toilets

**2002 -2007**  
**Urban Low Cost Sanitation Programme**

**2007 Onwards**  
**Nirmal Gujarat Sanitation Programme**

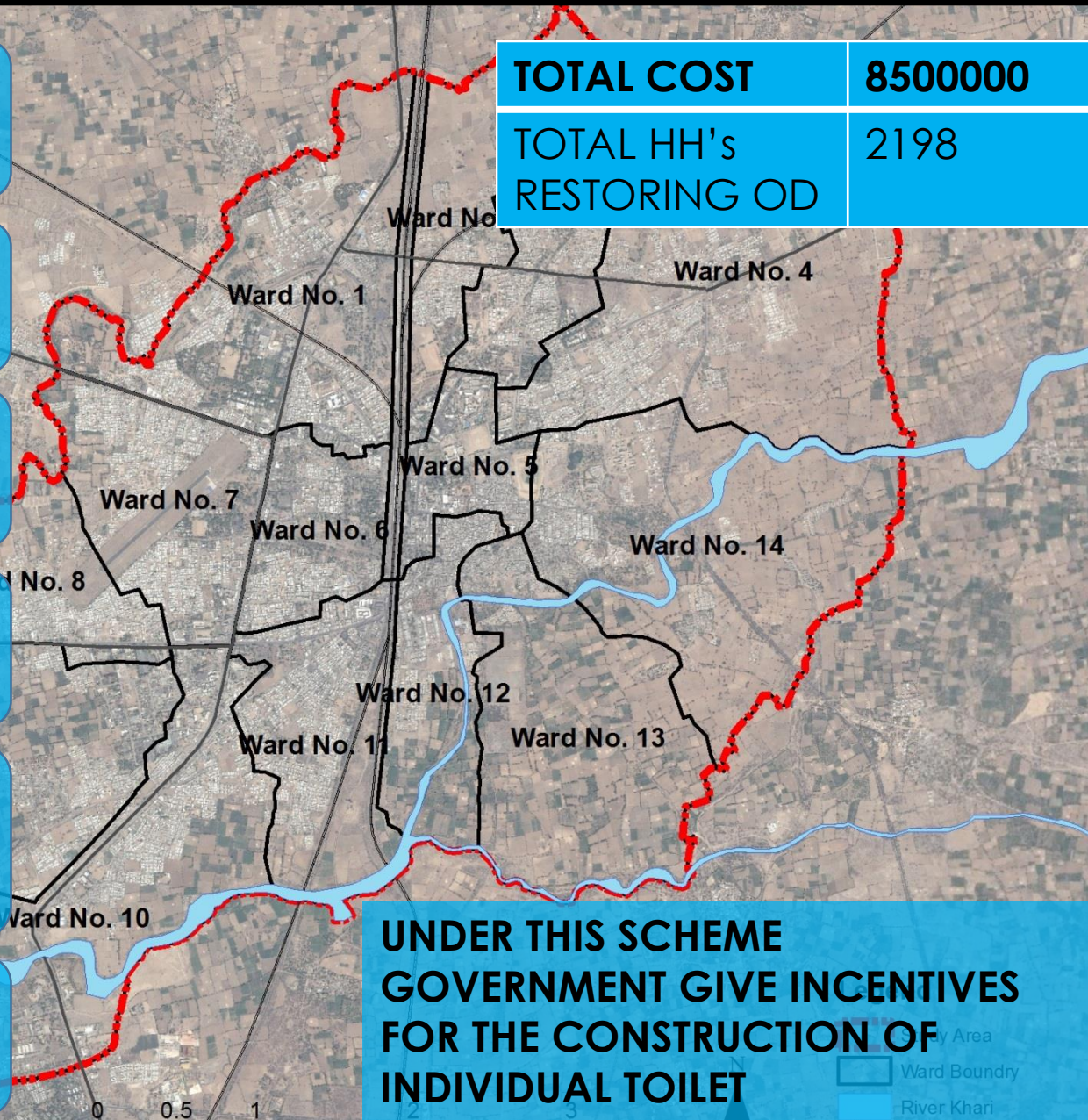
**Municipal Corporations at city level have been asserted responsible**

**In 2008**  
**Under this scheme Rs 4500 was paid as subsidy**

**In 2012**  
**Under this scheme Rs 6000 was paid as subsidy**

**In 2013**  
**Under this scheme Rs 8000\* was paid as subsidy**

<b>TOTAL COST</b>	<b>8500000</b>
<b>TOTAL HH's RESTORING OD</b>	<b>2198</b>

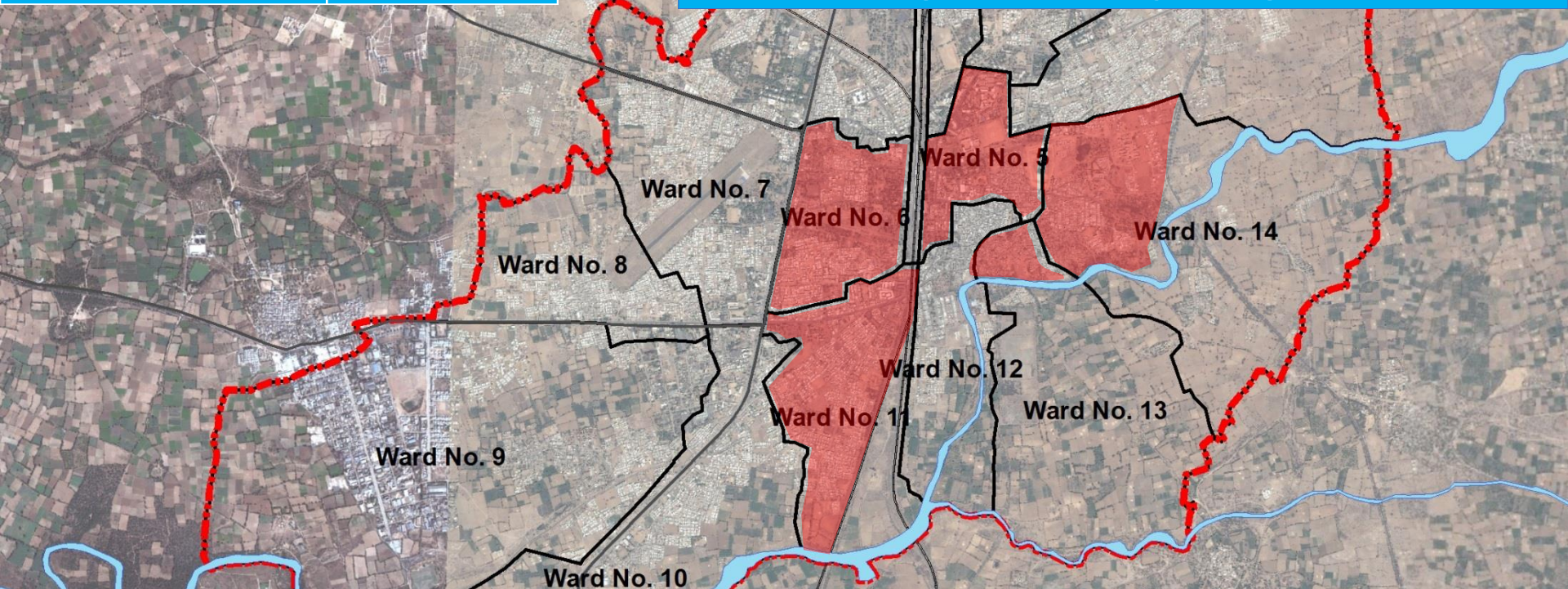


**UNDER THIS SCHEME GOVERNMENT GIVE INCENTIVES FOR THE CONSTRUCTION OF INDIVIDUAL TOILET**

# Individual Toilets or Public Toilets?

TOTAL COST	8500000
TOTAL HH's RESTORING OD	2198
PER HH COST	Rs. 3868

**WARD 5 AND WARD 6**  
**HIGHLY DENSE AREA WITH LESS/NO SPACE FOR INDIVIDUAL TOILET**



**WARD 11, WARD 13 AND WARD 14**  
**BASED ON DETAILED SURVEY, INDIVIDUAL TOILETS CAN BE PROVIDED**

**Legend**

- Study Area
- Ward Boundry
- River Khari

- **STP**
- **O&M Cost implications**
- **Treatment and reuse of waste water**
- **Not all the people take connections**

## **Waste Water Management**

- 1. Optimizing UGD**
- 2. Facilitating septage management.**

# Action: **Optimizing UGD**

1. **Maintaining existing infrastructure:** Repairing broken pipes and Connecting Pumping stations to treatment facility
2. **Completing the network**
3. **Provision of Sewage Treatment Plant**
4. Awareness programs to encourage people to take connection



# Action: Initiatives for optimizing UGD

## 1. Initiative by ULB to encourage & incentivize people:

- All government building should be provided with UGD.
- **Awareness campaign** by ward counselor/community preferably to utilize the improved facility.
- Door step connection service, if needed.

**2. Intervention point:** After the completion of UGD, sewer connection should be compulsion for BUP.

# Provision of STP

# Sewage Treatment Plant (STP)

Years	Water Supply (MLD)	Waste (MLD)
2013	28	22.4
2031	41	33.1
2041	52	41.6

- As 38% HH's are covered with UGD, there is need of Sewage Treatment Plant to treat the generated waste water.
- As the city will be covered with 100% UGD by 2016, STP will require to treat much more higher load.
- 2 STPs are already proposed:
  1. **Eastern Part: 18.5 MLD**
  2. **Western Part: 23.2 MLD**
- **At the priority basis, ULB should plan for a STP** with the capacity of 23.2 MLD and later second STP with 18.5 MLD.

# Alternatives for STP

## Different types of STP:

- Up-flow/Ward Anaerobic Sludge Blanket (UASB)
- Activated Sludge Process (ASP)
- Facultative Lagoons (FAL)
- Oxidation Pond
- Sequential Batch Reactor (SBR)

Treatment process	USAB	ASP	FAL	Oxidation Pond	SBR
Land req. Ha	4.64	6.96	16.24	27.84	1
Capital Cost (Excluding Land Cost) (Rs. crore)	18.56	13.92	10.44	3.71	19

# STP: Best Suitable Option

Sr. No.	Parameters	Units	Sewage Characteristics	Treated Sewage Characteristics			
				UASB	ASP	Extended Aeration Process	SBR
1	BOD	mg/l	200 to 250	< 30	< 30	< 20	<5
2	COD	mg/l	400 to 450	< 250	< 250	< 250	<50
3	TSS	mg/l	200 to 250	< 100	< 50	< 50	<10
4	Total Nitrogen (as N)	mg/l	45	No Treatment	No Treatment	No Treatment	<10
5	Overall Plant Odour/Nuisance value comparatively			Very High	Medium to higher	Medium to higher	Odourless, Not creating any nuisance value

The best suitable option seems to be **Sequential Batch Reactor (SBR)** because of following reasons:

- Low Capital and Operating Cost
- 50 % Power Reduction in Power Consumption
- 50 % Reduction in Land Requirements
- 50 % Reduction in Man-Power
- Reduction in Maintenance Cost

# Phase-1

- STP with SBR technology with the design capacity of 23.2MLD
- Land Requirement: 1.0 Ha
- Capital cost: 19 Crore
- O&M cost: 3- 5% of capital cost that will be 57 lakhs to 95 lakhs



# Phase-2

- STP with SBR technology with the design capacity of 18.5 MLD.
- Land Requirement: 0.85 Ha
- Capital cost: 15.2 crore
- O&M cost: 3- 5% of capital cost that will be 46 lakhs to 75 lakhs



# Reusing Options

**Option 1:** To use the treated waste water for various purposes like Landscaping, community toilets and public toilets for flushing.

For community toilets: **Tankers will carry water from the source.**

- **Average water used in flushing per day** : 40 lpcd (CPHEEO). But in case of public toilet, number of users are not defined.
- **For Mehsana:** 2 tankers per day (Survey)
- **Cost of Tanker with capacity of 5000 liter:** 450 for 1 trip (Pvt. Contractor)
- **Number of trips per month**=600 trips
- **Cost per month**= 2,70,000 Rs.

**Cost for existing number of Public Toilets** :  $13 * 270000 = 35,10,000$  Rs.

**Proposed Public Toilets:**  $11 * 270000 = 29,70,000$  Rs.

**Total:** 64,80,000 Rs.

**Treated Water as a substitute for flushing purpose in Public Toilets ????????**

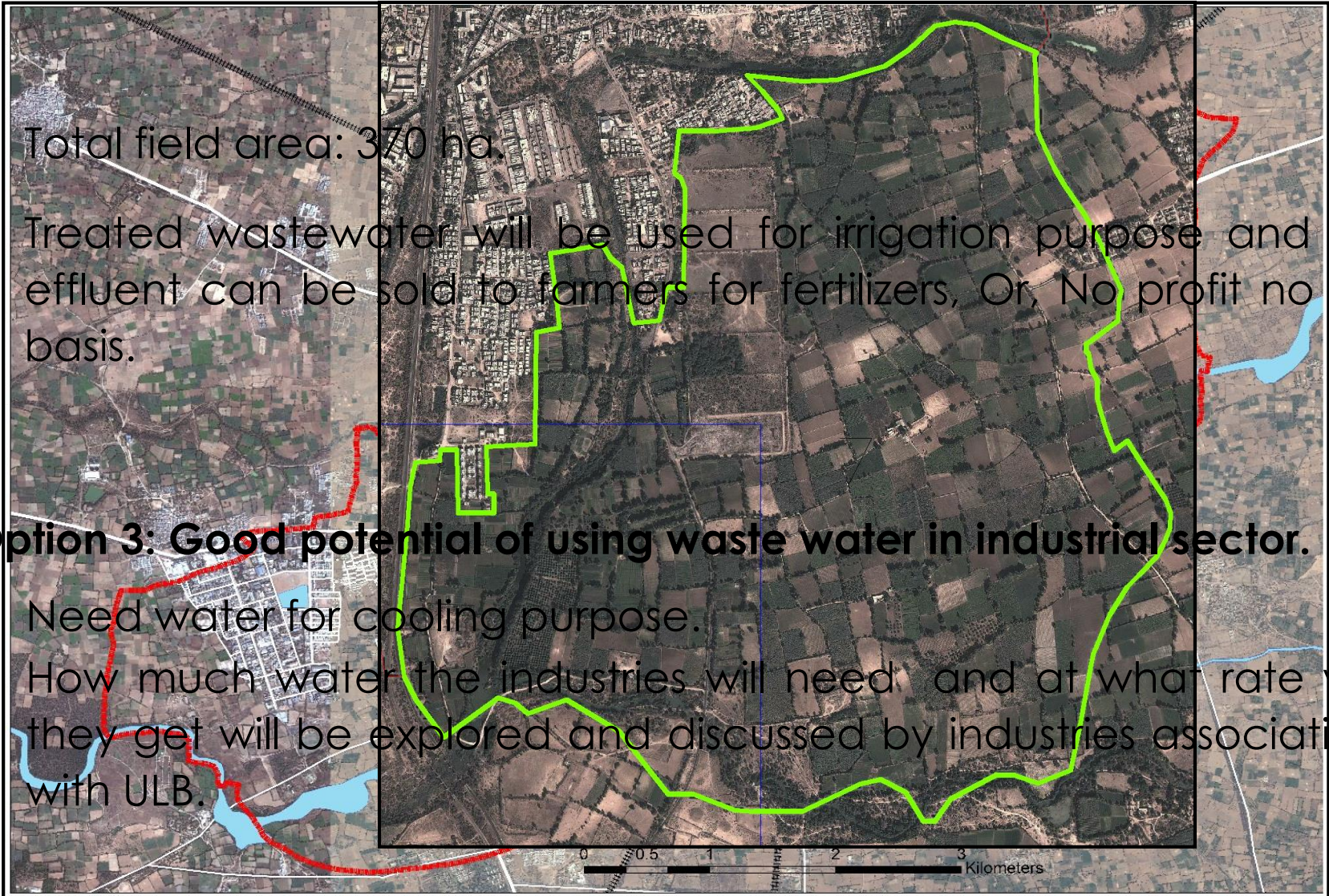
# Reusing Options

## Option 2: To dispose the treated waste water in the near by fields.

- Total field area: 370 ha.
- Treated wastewater will be used for irrigation purpose and the effluent can be sold to farmers for fertilizers, Or, No profit no loss basis.

## Option 3: Good potential of using waste water in industrial sector.

- Need water for cooling purpose.
- How much water the industries will need and at what rate will they get will be explored and discussed by industries association with ULB.





**After network completion people are likely to shift to UGD.**

- 1. As UGD network is still not completed**
- 2. 43% HH's have Septic tanks+ Soak Pits**
- 3. Apprehension of Water availability in Mehsana**
- 4. No pollution by soak pits as GW tables are low**
- 5. O&M implications of UGD network and STP**

**As there are so much investment required to make Under ground sewerage system work..... (64\*+ 35+ O&M)**

**and also**

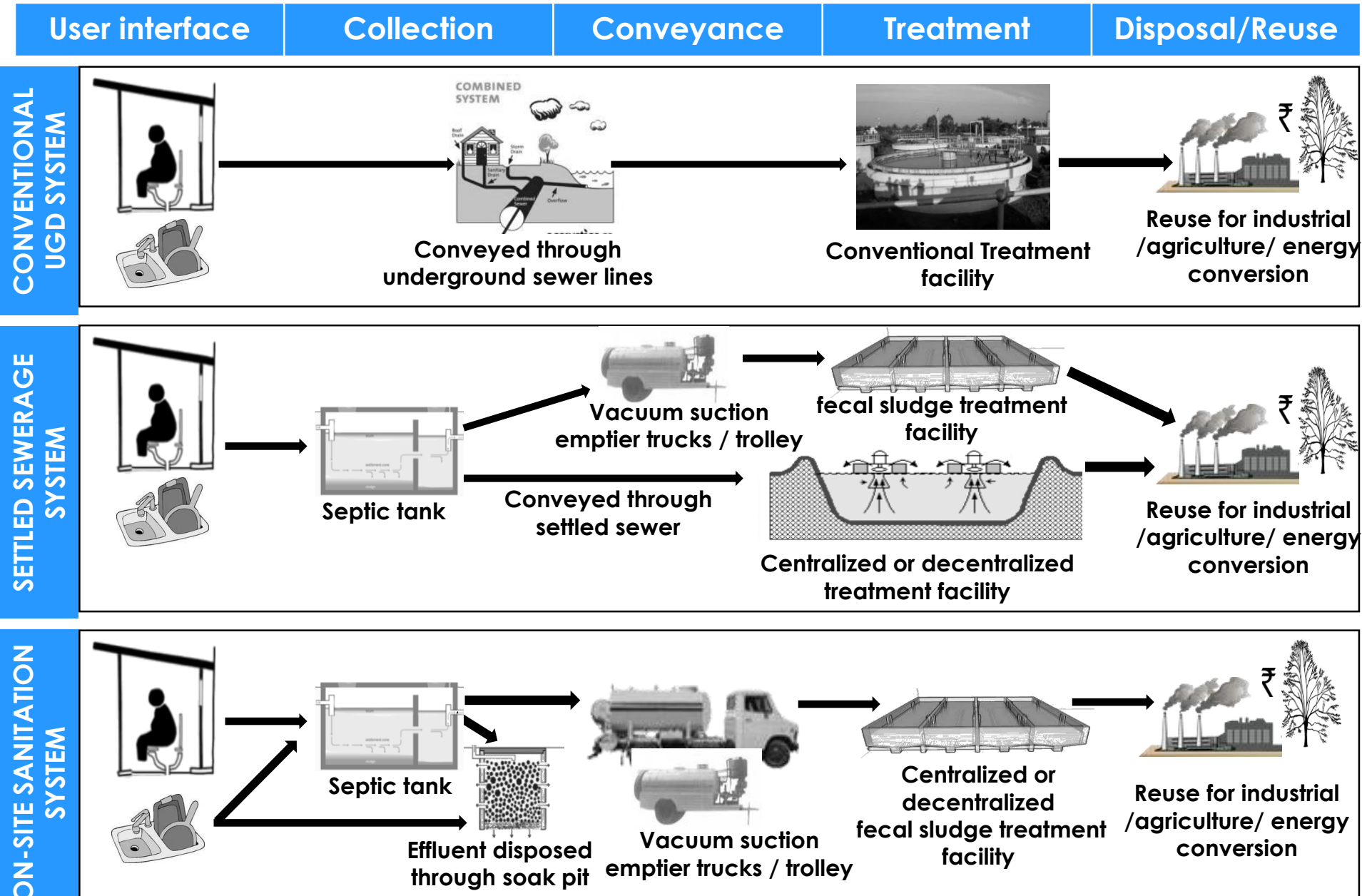
**Where do these piped dreams end?**

# Where do piped dreams end?



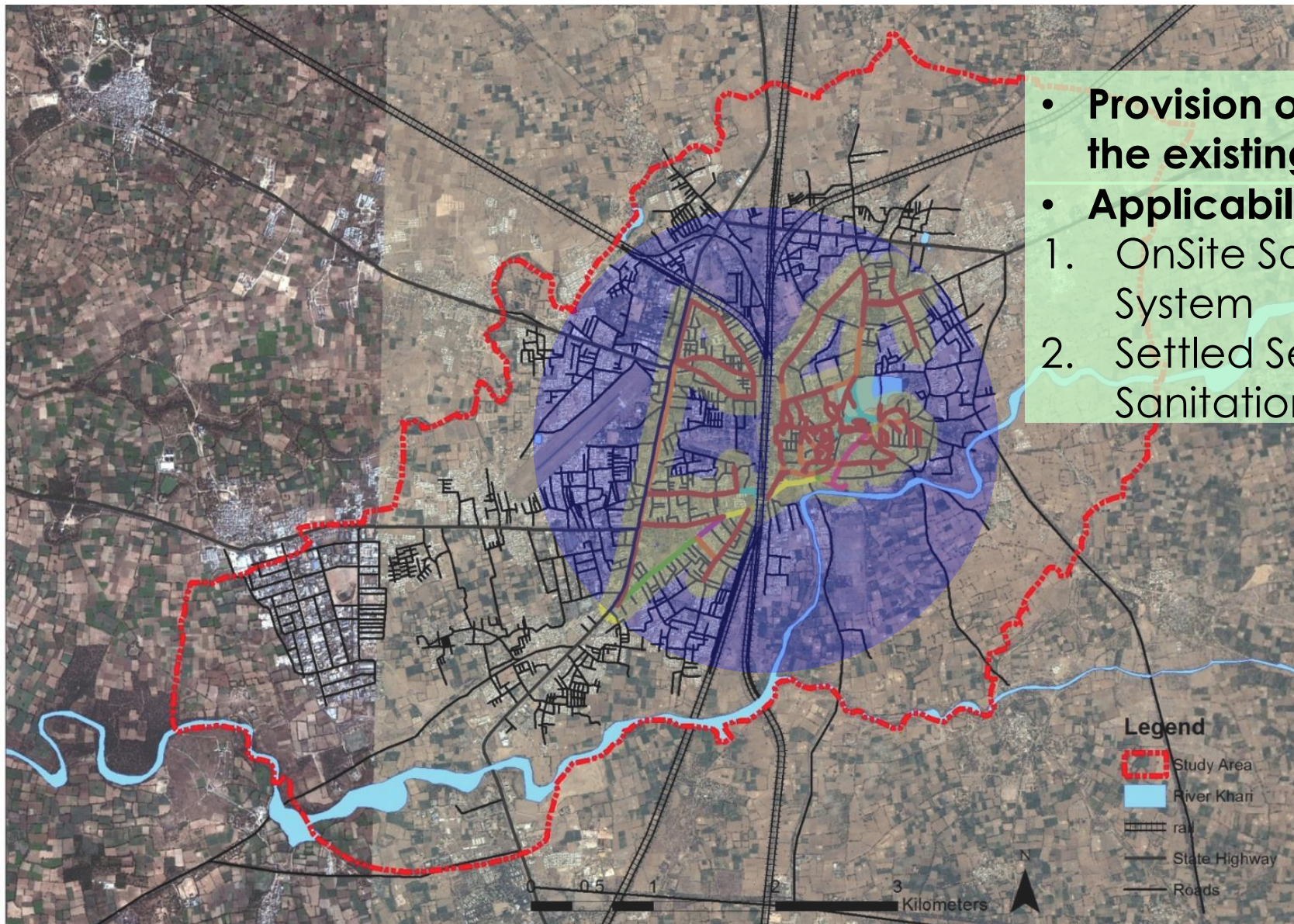
**What other sustainable alternatives could have been considered for wastewater disposal & treatment?**

# Conventional & Non-Conventional Systems



# Applicability of Other sanitation systems in Mehsana

- Provision of STP for the existing UGD
- Applicability of
  1. OnSite Sanitation System
  2. Settled Sewer Sanitation System



## Legend

- Study Area
- River Khari
- rail
- State Highway
- Roads

# ONSITE SANITATION SYSTEM

# OnSite Sanitation System

- Septic tanks/soak pits at household /community level:
  - Upgradation from pit to septic tanks, and refurbishment of septic tanks if/as needed
  - Provision of soak pits for effluent and grey water
- On regular basis ensuring **septic tank emptying** (minimum once in two/three years).
- Regulated service and phasing of de-sludging.
- **Fecal sludge treatment** facility and **reuse** of treated septage
- Potential to outsource different activities
- Good **monitoring and regulatory** mechanisms
- **Promotion program**



# Emptying of Septic tanks: Vehicles



Capacities varies from 2,000 upto 12,000 litres. Cities which have proper access roads, a larger vehicle maybe adopted.



Vacutug capacities varies from 200 upto 2000 liters. For septic tanks located in narrow lanes or those that are not accessible by large vehicles, smaller vehicles maybe adopted. The Vacutug is mounted on wheels and can be attached to a small vehicle.

**“Yearly desludging of septic tank is desirable**, but it is not feasible or economical and if there is difficulty to find labor for desludging, **small domestic tanks should be cleaned at least once in 1 to 2 years**, provided the tank is not overloaded due to use by more than the number for which it is designed” Pg 9-22, CPHEEO Manual

# Vacuum Suction Emptier Trucks/ Trolley

## Vacutug machine Lorries: Mechanical Cleaning Of Septic Tanks

- No. of HH's with Septic tanks- 19630 (49.8%)
- Septic tanks need to be cleaned once in 2 years. Hence the requirement septic tanks to be cleaned per year will be about 9830.
- Size of a typical septic tank- 2m\*1m\*1.25m (5 people/HH)
- Volume to be sucked out- 2.5 cu.m.
- Sewer lorry capacity – 6 cu.m.
- Time taken for onward, suction and return- 4 hrs.
- Number of septic tanks that can be cleaned in one trip- 2 no.
- Hours available for day shift- 8 hrs.
- Number of trips per day per lorry-  $2*2=4$  no.
- Lorry maintenance and down time days per year- 30 days
- Effective days per year per lorry-  $365-30=335$  days
- Number of septic tanks sucked by lorry per year-  $335*4=1340$
- Number of lorries needed per year-  $9830/1340=8$  No.
- Existing number of lorries- 1 No.
- Cost of Vacutug machine lorry: 8 lakh**
- Total cost for all lorries: 64 lakh**

### Investment and Its Phasing

Assumption: No one will shift to UGD

Year	2015	2019	2022	2024	2027	2029	2032	2041
Required Trollies	10	11	12	13	14	15	16	20
Addition to Base	9	1	1	1	1	1	1	4
Capital Cost (Lakhs)	72	8	8	8	8	8	8	32

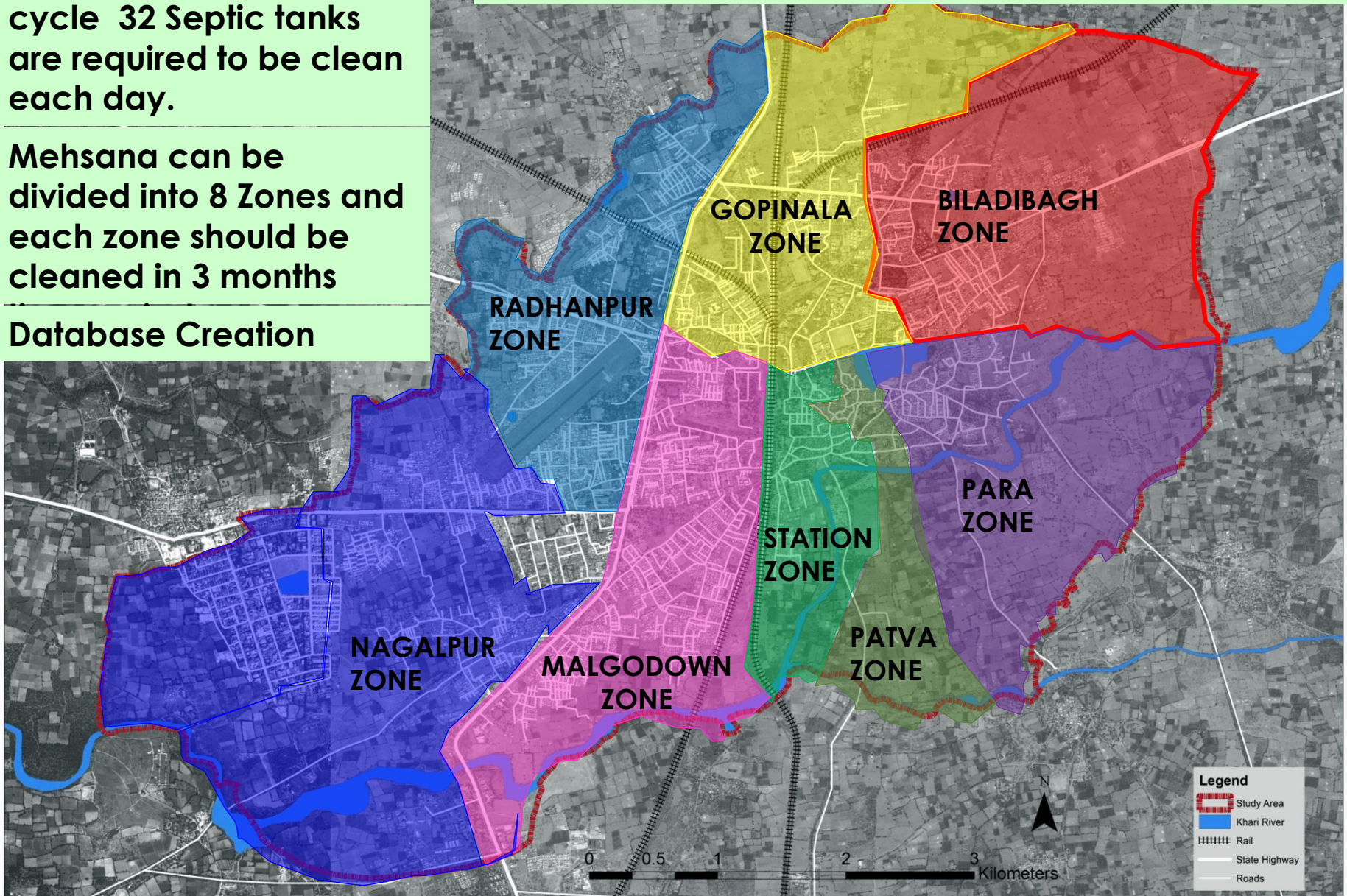
# Possible Phasing of De-Sludging Services

For maintaining 2 year cycle 32 Septic tanks are required to be clean each day.

Mehsana can be divided into 8 Zones and each zone should be cleaned in 3 months

Database Creation

Better Utilizing Existing Wardwise Institutional setup



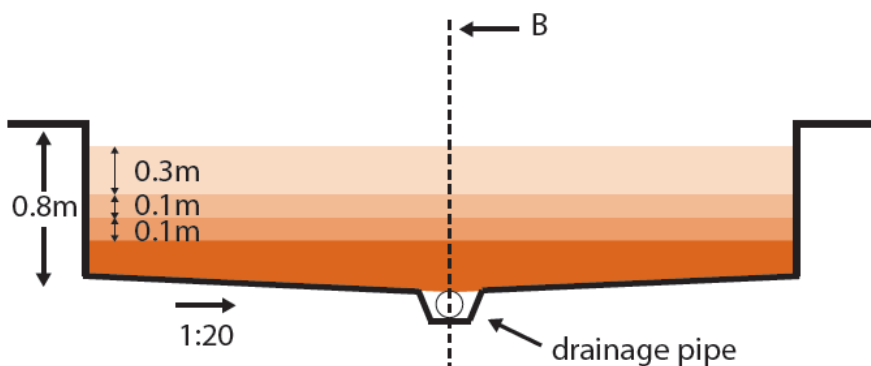
# FSM: Alternatives for Sludge drying beds



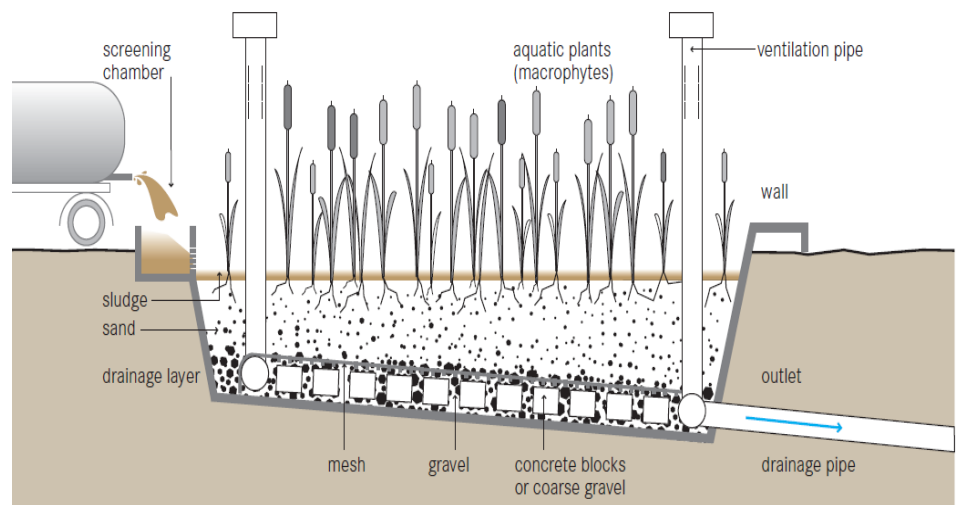
**Unplanted Sludge Drying Bed**



**Planted Sludge Drying Bed**



- Faecal sludge layer 30 cm
- Sand layer 10 cm;  $d=0.2-0.6$  mm
- Gravel layer 10 cm;  $d=7-15$  mm
- Gravel layer 20 cm;  $d=15-30$  mm



# FSM: Alternatives for Sludge drying beds

Unplanted Sludge Drying Bed	Planted Sludge Drying Bed
Dried sludge must be removed every 10 to 15 days	The sludge can be removed after 2 to 3 years

Treatment Plant Option 1 ( Unplanted Sludge drying Beds)			Treatment Plant Option 2 ( Planted Sludge drying Beds)		
1	Quantum of septage to be treated (cum/day) – HHs level	100	1	Quantum of septage to be treated (cum/day) – HHs level	100
2	Single Drying Bed area (12m x 12 m)	144	2	Single Drying Bed area (12m x 12 m)	144
3	Max. septage depth (m)	0.3	3	Max. septage depth (m)	1.5
4	Capacity per bed (cum)	43	4	Capacity per bed (cum)	216
5	Sludge drying cycle (days)	10	5	Sludge drying cycle (Years)	2
6	Total No. of sludge drying beds required (SDB)	30	6	Total No. of sludge drying beds required (SDB)	288
7	Total site area ( SD Bed area + 10% SD bed area + area of office and dried storage + area of ancillary units) (sqm)	13,250	7	Total site area ( SD Bed area) (sqm)	51650

Require Manpower for regular desludging and refilling of sand layer	Won't require manpower for regular desludging, as emptying cycle is 2 years
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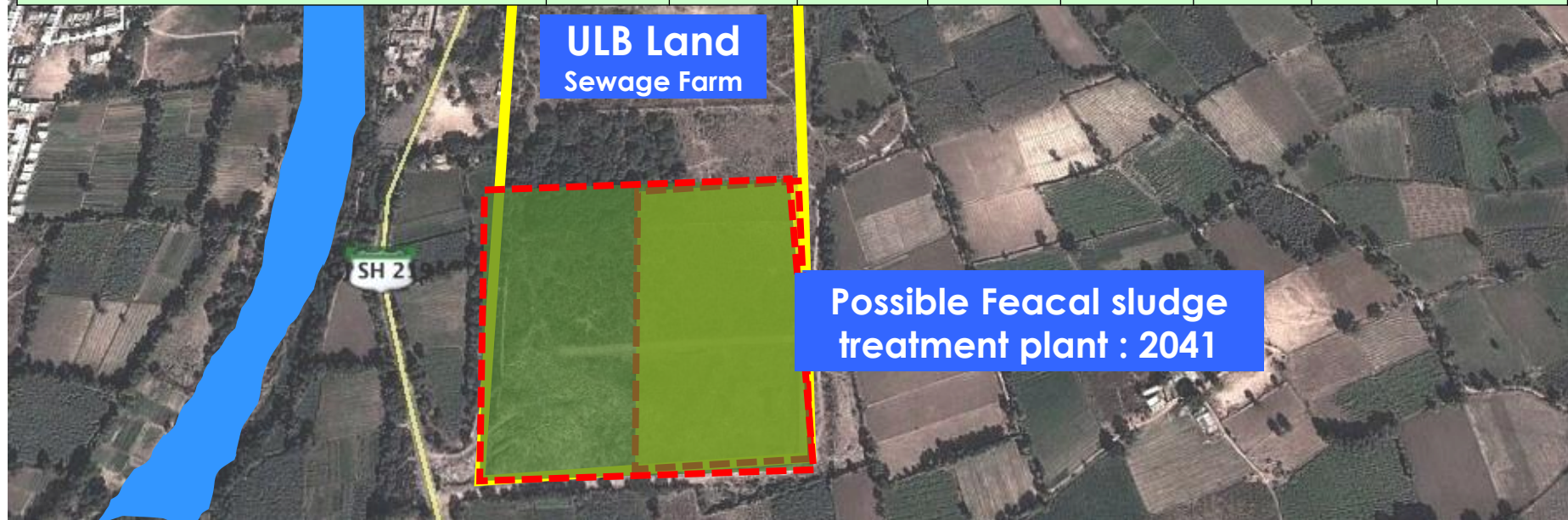
Output : Dried Sludge (treated Septage)	Output : Dried Sludge & Forage
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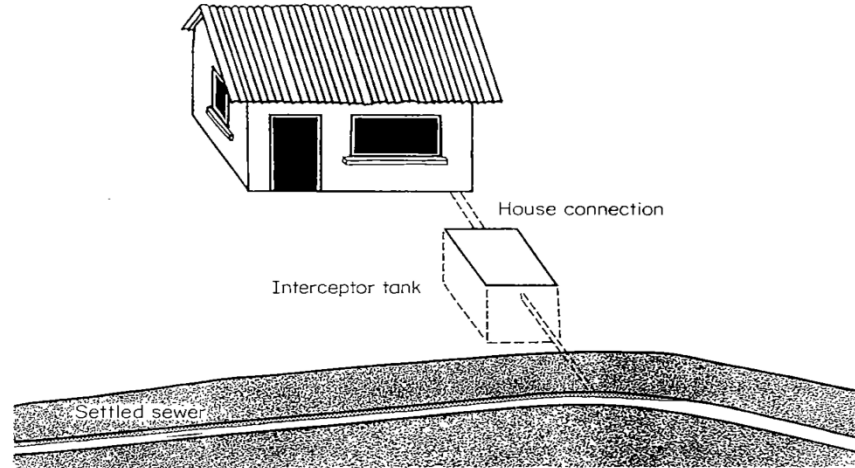
# Possible location of treatment facility

## Investment and Its Phasing

Assumption: No one will shift to UGD

Year	2015	2019	2022	2024	2027	2029	2032	2041
Septage Quantum (cu.m./Daily)	100	110	120	130	140	150	160	200
No. of Beds	24	26	28	31	33	35	38	47
Provided Beds	30	30	30	35	35	35	40	50
Land Area (Sq. Mt.)(Addition)	13250	0	0	750	0	0	750	1500
Capital Cost (Lakhs) (Excluding land cost)	23.4	0	0	4.0	0	0	4.0	8.0
Revenue (Lakhs/Year) (30% of septage is sold @ 50 paise/kg)	54.8	60.2	65.7	71.2	76.7	82.1	87.6	109.5





*Figure 2. Schematic diagram of settled sewerage. The interceptor tank can be shared between adjacent houses to reduce costs in peri-urban areas.*

# SETTLED SEWERAGE SYSTEM

## Septic tank + Small Bore

1. Reduced water requirements
2. Reduced excavation costs
3. Reduced materials costs
4. Reduced treatment requirements

1. Problem of awareness in people for not directly connecting toilets to settled sewer
2. Manholes not to be installed as it may introduce solids into system

# Punjab Rural Water Supply and Sanitation Project (PRWSSP)

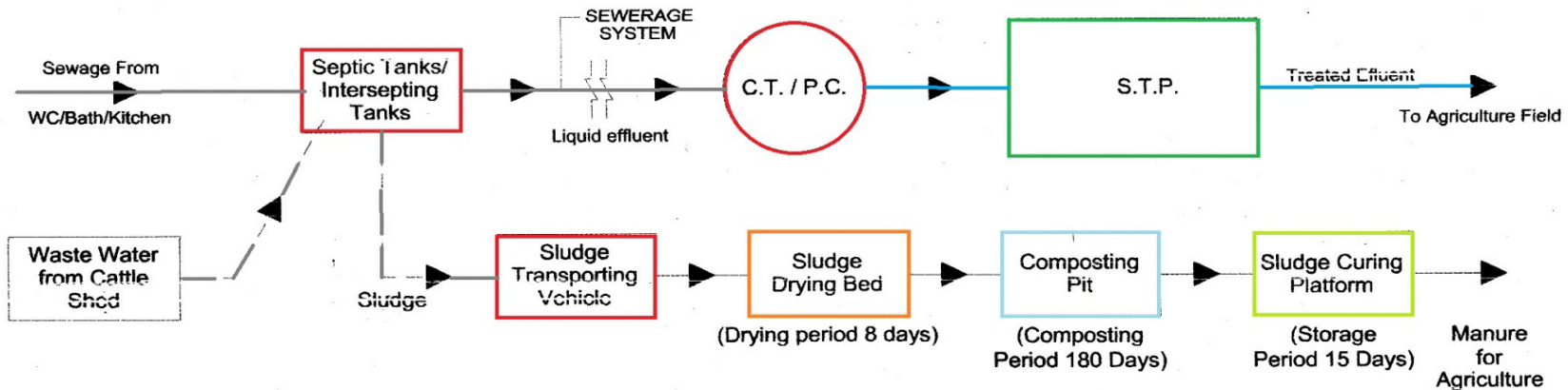


Figure: Schematic flow diagram of sewerage system and STP

**Aim:** To upgrade existing on-site sanitation in 100 villages by introducing off-site system.

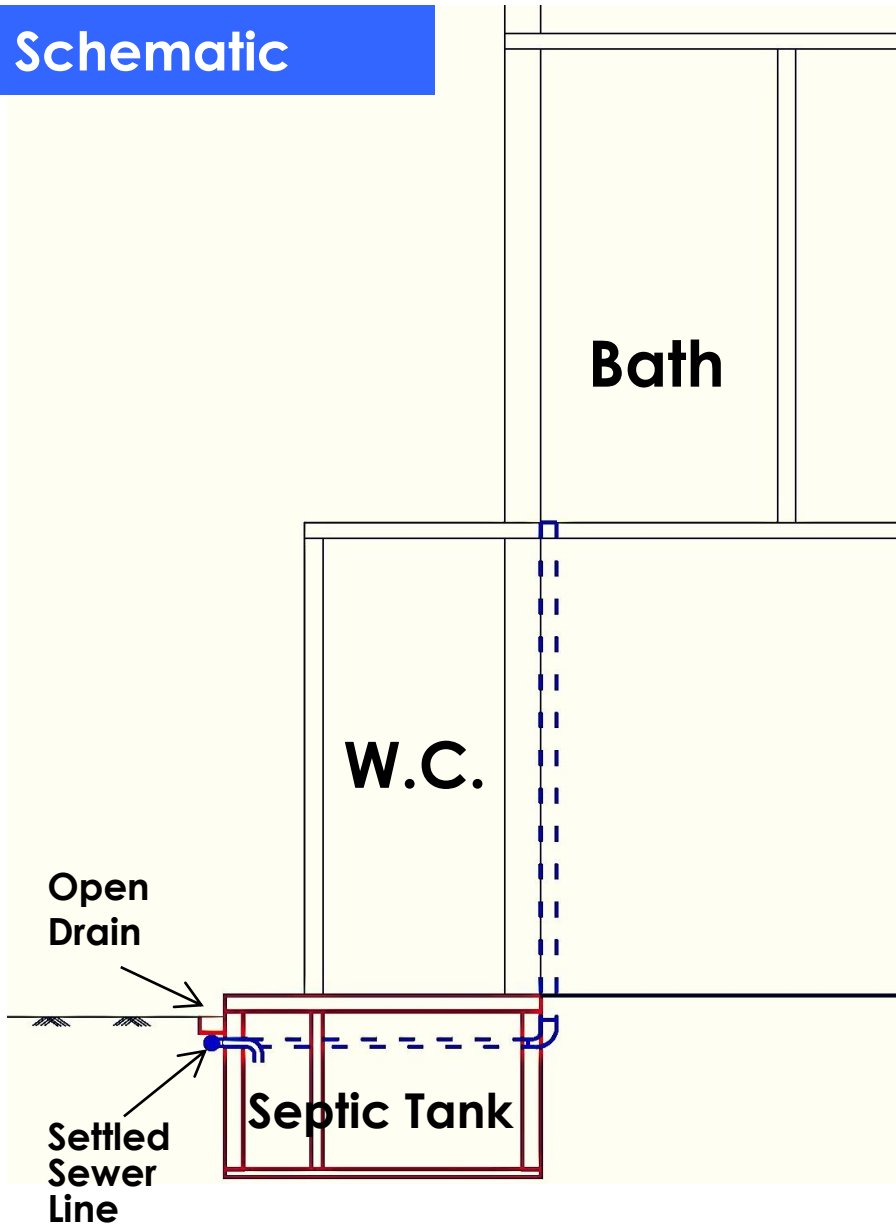
## Community sanitation pilots:

1. **Conventional sewerage** (Chawa, Gurdaspur district)
2. **Solids-free sewer with 100 mm minimum pipe size and connections.** O&M of the built system by the contractor for 3 years (Baba Bakala, Amritsar district)
3. **Solids-free sewer with 150 mm minimum pipe size and connections.** O&M of the built system by the contractor for 7 years (Khadoor Sahib, Goindwal Sahib etc.)



# Settled Sewerage System

## Schematic



# Comparative Assessment of Systems

Aspects	Option 1	Option 2	Option 3
Description	Conventional Sewer	Settled sewer	On-Site Sanitation
<b>Financial Aspects</b>			
Capital Costs	98.89 (64.6+34.2)	54.4**	2.0 (Excluding Land Cost)
O & M Costs (average/ annum)	4.0	1.53	0.10
<b>Other aspects</b>			
<b>Institutional*</b>	Required technical knowledge for implementation, operation and maintenance of this project.		
<b>Flexibility*</b>	Extension to new areas is difficult and expensive.	Can be easily extended to new areas. Possibility of Decentralized treatment.	
<b>Funding options*</b>	Financially unviable for ULB's. Grants are essential.	Grants may be required or ULB can provide funds.	ULB can fund related facilities.
<b>Water Requirement</b>	100 LPCD	40 LPCD	Even less than 30 LPCD
<b>GW Table Pollution</b>	NO	NO	NO (As Water Table is low)

Source: \*PAS Presentation on Citywide Sanitation System, 2013

**Note : Costs are in Rs. Crores**

\*\*Low Cost sewerage, Duncan Mara, 1996 and Australia's Most Successful Alternative To Sewerage, 2010

# Recommended Sanitation Chain

# Existing Sanitation Chain

User interface

Collection

Conveyance

Treatment

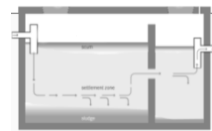
Reuse/disposal



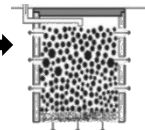
Toilets



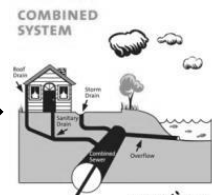
Kitchen + Bath



Septic tank



Effluent disposed through soak pit



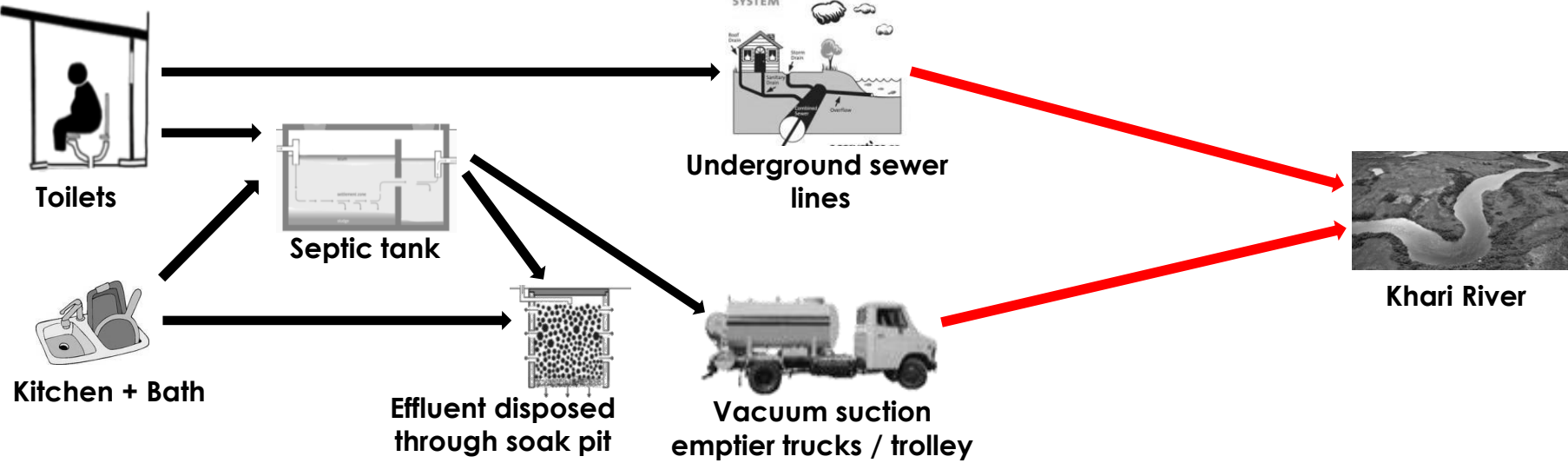
Underground sewer lines



Vacuum suction emptier trucks / trolley



Khari River



# Recommended Sanitation Chain

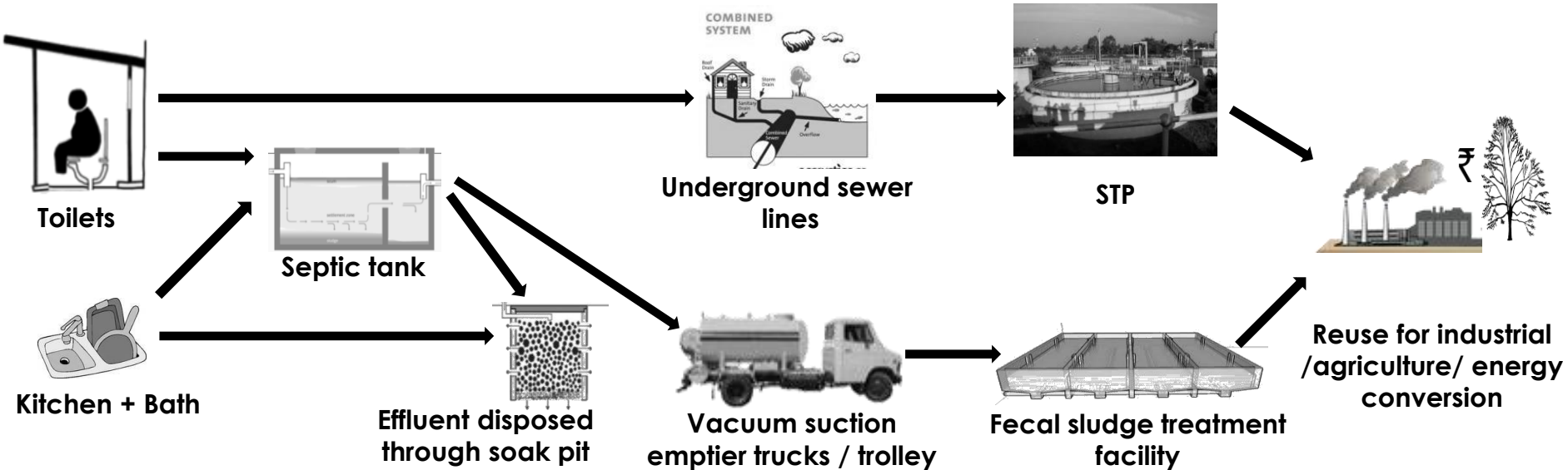
User interface

Collection

Conveyance

Treatment

Reuse/disposal



# Apprehension of Water Availability

Year	Population	Supply MLD	LPCD
<b>2011</b>	190753	20	105
2012	200864	20	100
2013	204789	20	98
2014	208713	20	96
2015	212637	20	94
2016	216562	20	92
<b>2021</b>	236183	20	85
2022	241345	20	83
2023	246506	30	122
2024	251668	30	119
2025	256830	30	117
<b>2031</b>	287800	30	104

As per CPHEEO Manual on Sewerage & Sewage treatment **“the conventional sewers shall be designed for a minimum sewage flow of 100lpcd or higher.”**

→ After NRW reduction

ULB should look into Water Resource Conservation/Sustainability, Water Reuse and RWH.

# Rejuvenation of Khari River.

# Restoration and Protection of Khari river

Broken Sewerage Line (UGD)= 5.4MLD

Open drain dispose into Khari= NA

Septic tank cleaning vehicles dump in Khari= 0.1 MLD

Pumping station indirectly dispose into Khari

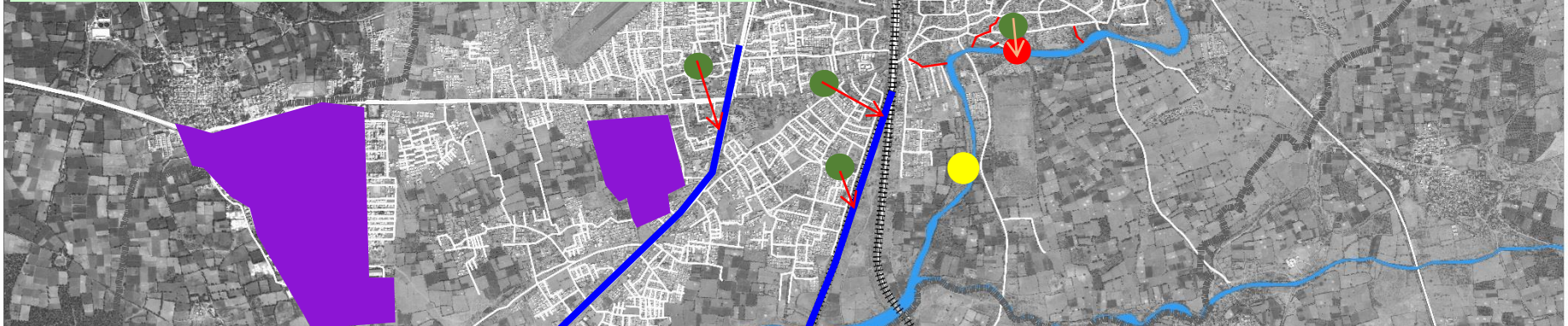
Illegal solid waste dumping

Industries Dispose Indirectly= .08 + .34 MLD

Repairing of broken pipe on immediate basis

Completing the Sanitation chain

Provision of STP and FSM



One time fund for cleaning Khari to be provided by the state.

State level program for river basin restoration & protection



# Initiatives by the Mehsana Municipality

**ULB capacity need to be strengthened which seems to be unlikely. So it is necessary to think of long term performance based contracts for the new system.**

**Actions:**

- 1. Monitoring for regular O&M of open drains**
- 2. Cleaning and Maintenance of septic tanks/soak pits (Intermittent Solution)**

# Monitoring- Regular O&M of open drains

1. **Identification of problematic area:** Identifying the areas where the problem of open drains exist.



2. **Monitoring and minor initiative:** Provided garbage storage facilities, street sweeping activities should be ensured.



3. **Intervention point:** Door to door collection.



4. **Safe disposal:** Collection of grey water/sewage from open drains and then safely transmitting to disposal/treatment site.



5. **Awareness :** Public awareness about the health impacts.

# Cleaning and Maintenance of septic tanks/soak pits

1. **Awareness:** Campaign to convey health and other benefits of cleaning.



2. **Inspection and data base creation:** Regular inspection of properties with onsite system by ULB and creating a master database.



3. **ULB initiative:**

- Responsibility to clean and maintain septic tank.
- Immediate response by increasing the vehicles and manpower.
- Ensuring safe collection, disposal and transportation of septage in order to ensure public health and environment



5. **Other alternatives: (Outsourcing)**

- Setting up one-time licensing or registration mechanism for service providers with an annual license fee.
- This would also build up a database of available facilities within designated service areas.
- Periodic interactions with the service providers would help in improving the septage management overtime.

# Modification & effective implementation of GDCR

# Effectively regulating in BCP/BUP.

- 1. Present regulations:** There is lack in implementations of GDCR and monitoring at municipality level for septic tank/ soak pits. Presently there are loopholes and additional reforms are also required.
- 2. Reforms and Regulating the reforms:** RWH structure, detail design of septic tank/soak pits and UGD connection as pre-requisite for new construction.
- 3. Technical assistance:** To offer technical guidance about the planning, design, construction and different methods for septic tanks ,soak pits and RWH tanks.
- 5. Effectively Monitoring the regulations:** Connections should be checked by the authority after it is constructed.

# Awareness Campaigns

# Public Awareness Campaigns

## City wide campaigns:

- About benefits of using Improved sanitation facilities and relatively initiated programs/schemes by ULB.
- Health impacts of unsafe disposal and transmission of grey water & sewage.
- Different techniques of safe disposal.
- About functions of septic tank, soak-pits and for the different techniques to reuse the effluent.
- In slums, about the health impacts OD.
- About the importance of RWH and about the cost effective methods of RWH.
- About offered technical assistance to people for RWH system design.
- Strict restrictions on manual cleaning of septic tanks.

## Capacity building:

Workshops for technical assistance to contractors and plumbers on construction of septic tanks, soak-pits, rainwater harvesting tanks.

# Public Awareness Campaigns: Methods



Painting on walls



Announcements



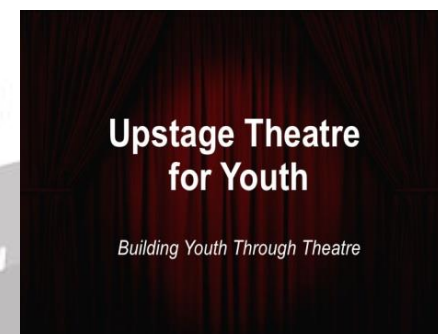
Road shows and rallies



Addressing people at gatherings



Joining hands with NGO & YUVA MANDAL



Theatre slides



Advertisements

**MEDIA:** Cinema theatre, TV channels, pamphlets



# Actions & Their Implementation Period

Actions		Years											
		Immediate Term		Short Term			Medium Term			Long Term			
		1	2	3	4	5	6	7	8	9	10		
Years	• Providing Community/ Public Toilets	█											
	• Cleaning and Maintenance of septic tanks/soak pits	█											
	• Regular O&M of open drains	█											
	• Implementation of regulations and monitoring by ULB			█									
	• Subsidies to provide individual toilets	█											
	• Septage disposal and treatment	█											
	• Awareness campaigns	█											
	• Restoration and Protection of Khari river	█											

# **CHAPTER 4 : SOLID WASTE**

**4.1 MEHSANA SOLID WASTE PROFILE**

**4.2 LITERATURE REVIEW**

**4.3 CASE STUDIES AND CONCEPTS**

**4.4 PROPOSALS**

**4.5 ANNEXURE**

# **MEHSANA SOLID WASTE PROFILE**

# **4.1 MEHSANA SOLID WASTE PROFILE**

**4.1.1 ZONE DISTRIBUTION**

**4.1.2 TYPICAL SWM PROCESS**

**4.1.3 INSTITUTIONAL SET UP (CONTRACT DETAILS)**

**4.1.4 WASTE GENERATION, COLLECTION AND DISPOSAL AT  
DUMPING SITE (CALCULATIONS)**

**4.1.5 RECYCLING BY INFORMAL SECTOR**

**4.1.6 CONCLUSIONS AND ISSUES**

**4.1.7 SECTORAL STRATEGIES AND PLANS**

# SWM on roads



# SWM on roads but still....



# SWM in residential & commercial condition



# SWM in residential & commercial practices





# SWM in slums



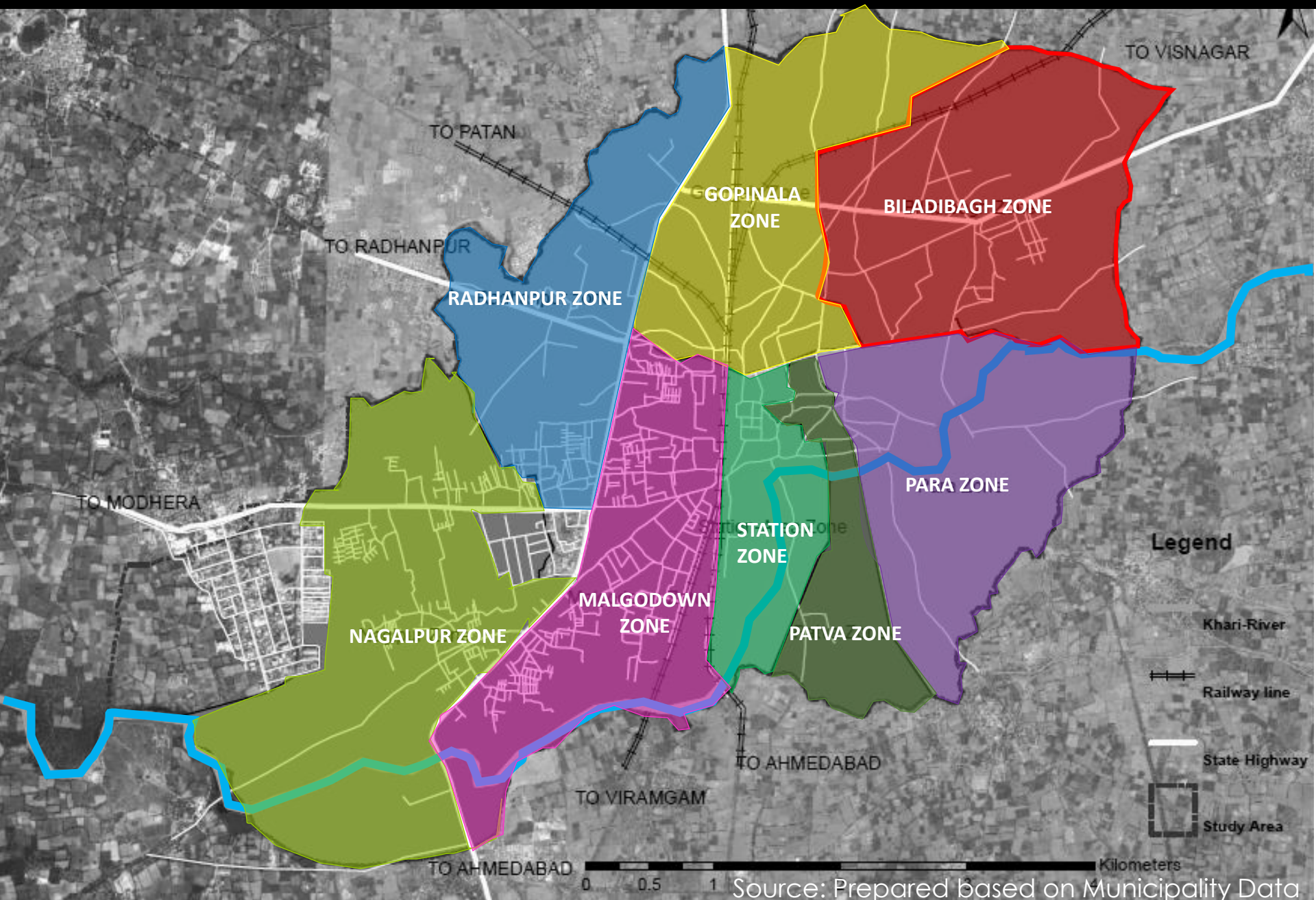
# SWM vehicles and transportation



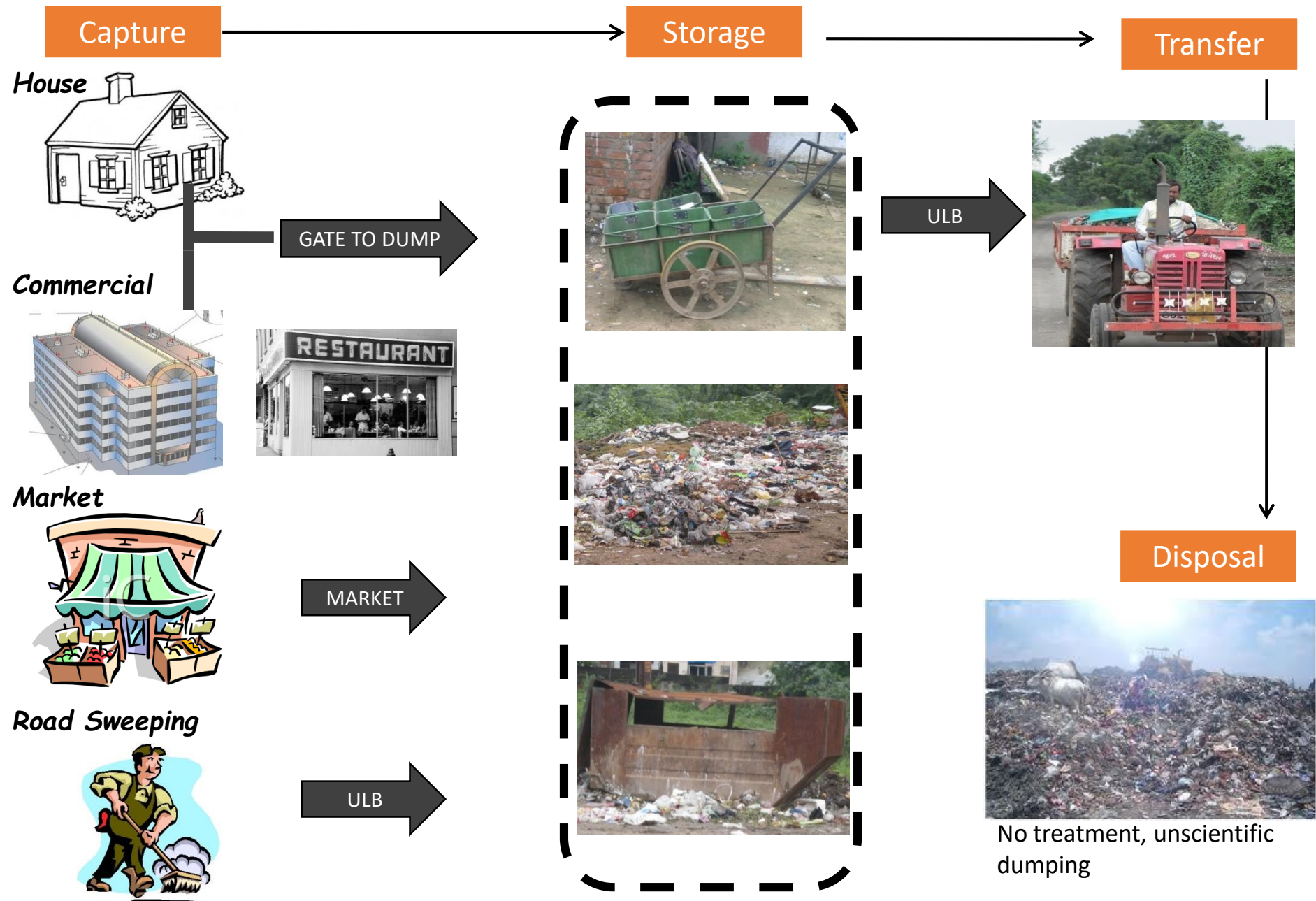
# Solid waste dumping



# 4.1.1 ZONE DISTRIBUTION MAP



# 4.1.2 TYPICAL SWM PROCESS OF MEHSANA



# 4.1.3 BIDDING AND ALLOTMENT PROCEDURE FOR CONTRACTS

C  
L  
E  
A  
N  
I  
N  
G

Minimum Safai Karamchari in Ward	Rate Per /Worker/ Day	Total (A X B)
A	B	C
25	145.70	3642

• Mehsana municipality sanitation department has allocated 25 sweepers daily for waste Sweeping , collection & then disposing it at specified location .

• Contract will be given to the contractor, who will bid Min. amount above given amount.

## CONTRACT PRICE FOR ONE DAY

T  
R  
A  
N  
S  
P  
O  
R  
T  
A  
T  
I  
O  
N

No. of Tractors	No. of Trips	Rate/Tra ctor/Trip	Total (E X F)
D	E	F	G
2	4	200	800

• Mehsana Municipality has allocated **1 driver and 3 labor** for every tractor for waste collection from all places and disposing at the dedicated area.

• Contract will be given to the contractor, who will bid Min. amount above given amount.

# BIDDING AND ALLOTMENT PROCEDURE FOR CONTRACTS-REVISED

Minimum Safai Karamchari in Ward	Rate Per /Worker /Day	Total (A X B)	No. of Tractors	No. of Trips	Rate/Tra ctor/Trip	Total (E X F)	Grand Total (C + G)
A	B	C	D	E	F	G	H
25	200	5000	2	8	200	1600	6600

$$5000 + 1600 = 6600$$

CONTRACT WILL BE GIVEN TO THE CONTRACTOR, WHO WILL BID MIN. AMOUNT ABOVE GIVEN AMOUNT.

# TERMS & CONDITIONS

## Service provision clause

- Contractor is liable to provide whole kind of services regarding SWM.
- The Necessary equipment for transportation & cleaning of SWM, the contractor is liable to provide sweepers.
- There will be no holiday for SWM work.

## Monitoring & Management clause

- All existing & future Govt. rules should be followed by contractor.
- One person of contractor will resolved all complaints during office hours in sanitary office.
- The contractor has to give a mobile no. which must be accessible 24 X 7, would be permanent for complaints which should be solved.
- Contractor should follow rules regarding current pollution control board, MSW 2000 rules, Gumastadhara, minimum wage rules, Child labour Act. etc all Acts & rules.
- To dispose solid waste at dumping site by a tractor, it will be required to issue a receipt from the ward & will have to submit it to the authorized person at ward, at dumping site & contractor.
- One Tractor-Trailor must has minimum 3 labours & 1 driver for a trip.
- Any agency will be allocated max. one sanitation ward contract.
- The ratio of lady sweeper should not be more than 20% per sanitation ward.
- Safai Karamcharis should be young & Capable. Age should between 18 to 45 years.

## Finance clause

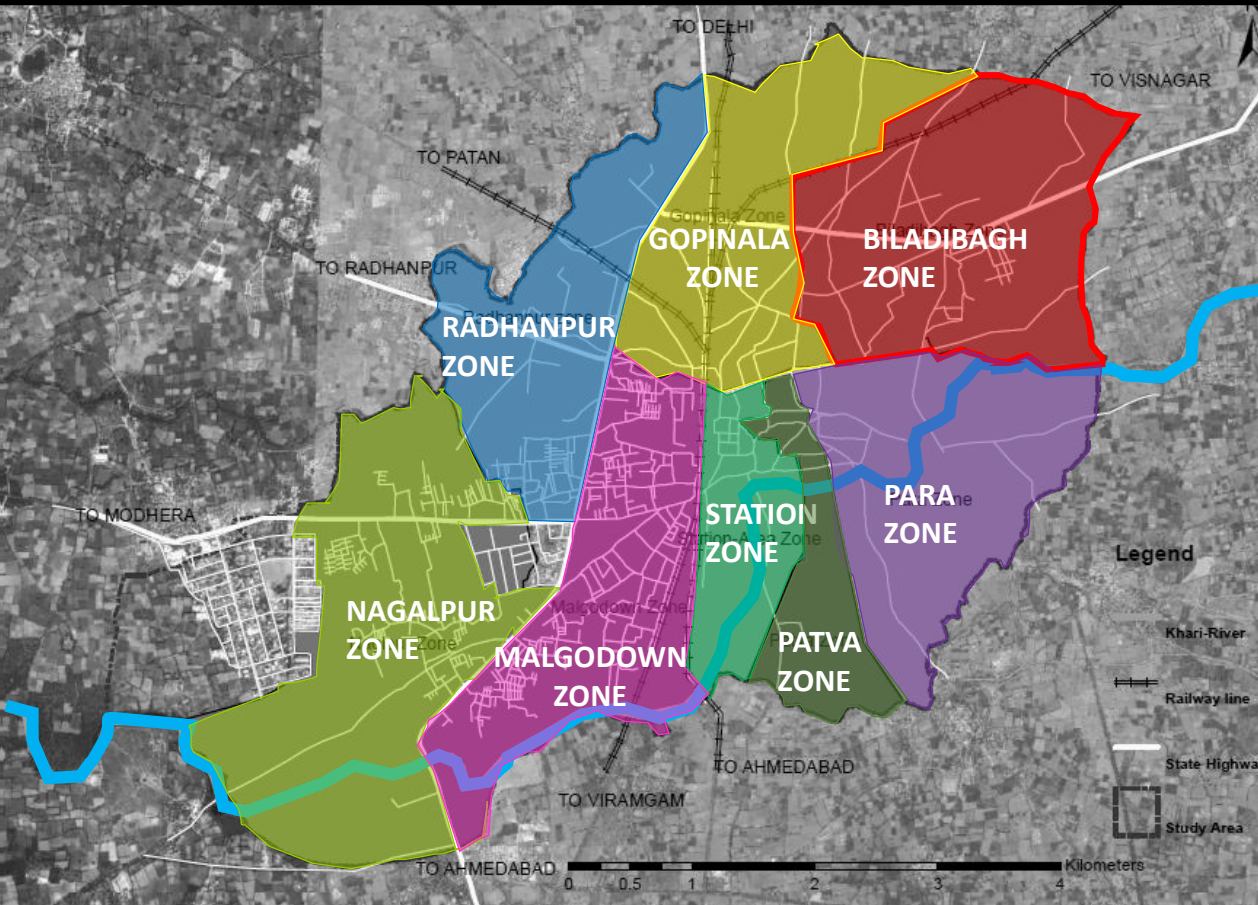
- Existing rate will be applied for two years. Contract will be renewed for One year afterwards with mutual agreement of both parties.
- All existing & future, Govt. & other tax should be paid by contractor.

## Penalty clause

- There will be find of Rs. 500 for dumping garbage on public road & burning it. Find will be collected by authorized officers of Municipality.
- No compensation of injury or death during cleaning by Nagarpalika.
- Work has been started within 15th day after giving Work Order otherwise it will be done by other agency & rate difference will be recovered from the security deposit of contractor



# CONTRACT DETAIL



## Collection contract

Jai Ambe  
Sai Krishna  
Satyam  
MJ

## Labour contract

DB enterprise  
Real enterprise  
S.R. Chaudhary  
Sai krishna  
Vikas

## CONTRACT PAY MENT

### ❖ For vehicle

- minimum 4 trips per vehicle per day (with 4 people per vehicle)
- payment Rs.779 per vehicle per day for 4 trips
- payment Rs.951 (Biladi bagh, Paara) per vehicle per day for 4 trips

### ❖ For labour

- Each contract of 50 labour per ward
- Payment per person per day – Rs 145.70

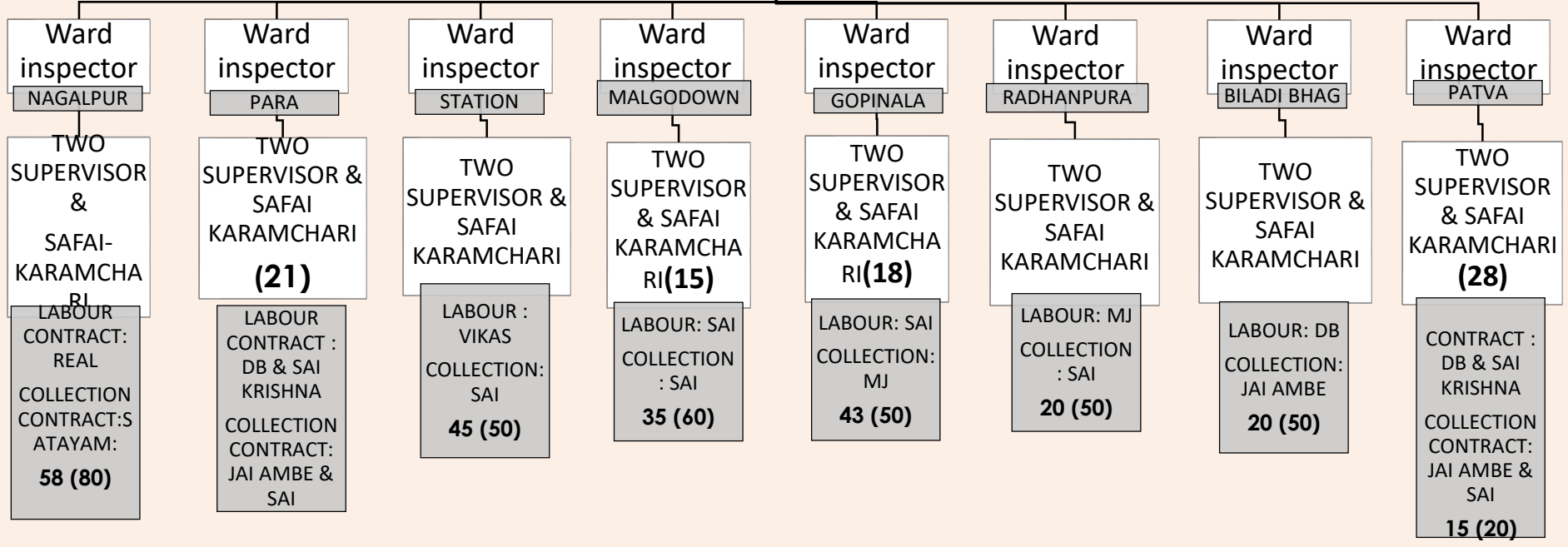
# INSTITUTIONAL STRUCTURE OF MEHSANA SWM

MEHSANA NAGAR PALIKA

**Chief officer**  
Mehsana Nagar Palika

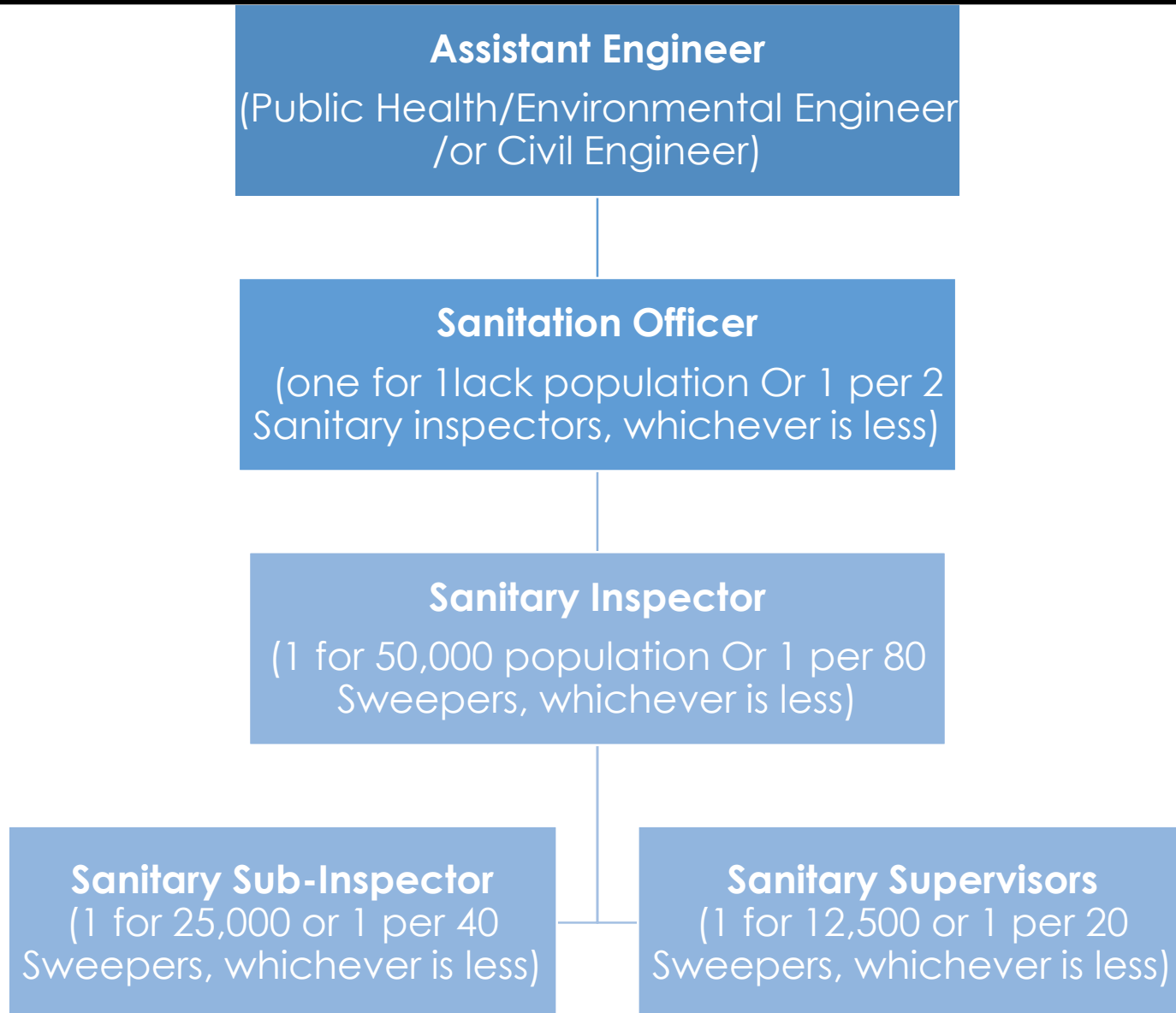
Sanitation Inspector  
Sanitation

EIGHT SANITATION WARDS



Source: Prepared based on Municipality Data

# INSTITUTIONAL STRUCTURE AS PER CPHEEO OF SWM-Cities between 1 and 2 lack population

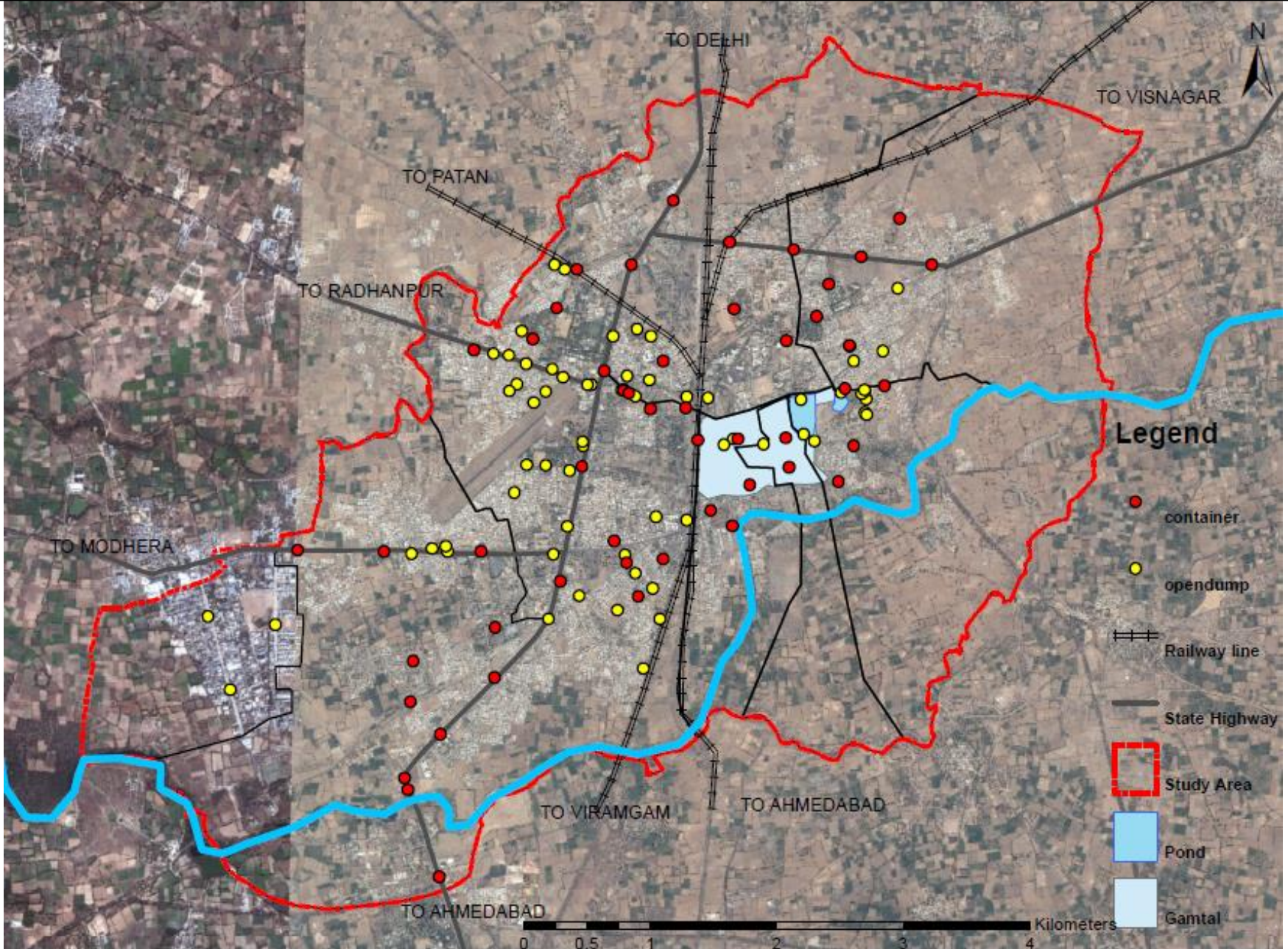


# EXISTING SCENARIO OF STAFF ALLOCATION

POST	STAFF ALLOCATION AS PER CPHEEO	STAFF ALLOCATION (MEHSANA MUNICIPALITY )	
		SANCTIONED	EXISTING
ASSISTANCE ENGINEER	1		
SANITATION OFFICER	2		
SANITATION INSPECTOR	4	2	1
WARD INSPECTOR	8	11	8
SANITORY SUPERVISOR	15		16
SAFAI KARAMCHARI	574	213+360(cont.)	90+236(cont.)
		573	390

Please refer Annexure 4.1.3a

# 4.1.4 WASTE TRANSFER POINTS - BINS



# WASTE GENERATION & COLLECTION

**Total waste generated per day (MT) : 76.6**

No. of dumpers : 46

Capacity of a dumper (MT) : 3.4

**Total waste collected from dumpers per day (MT) : 33.3**

No. of open collection points : 80

Total no. of tractors : 21

Capacity of tractor trailer (MT) : 1.75

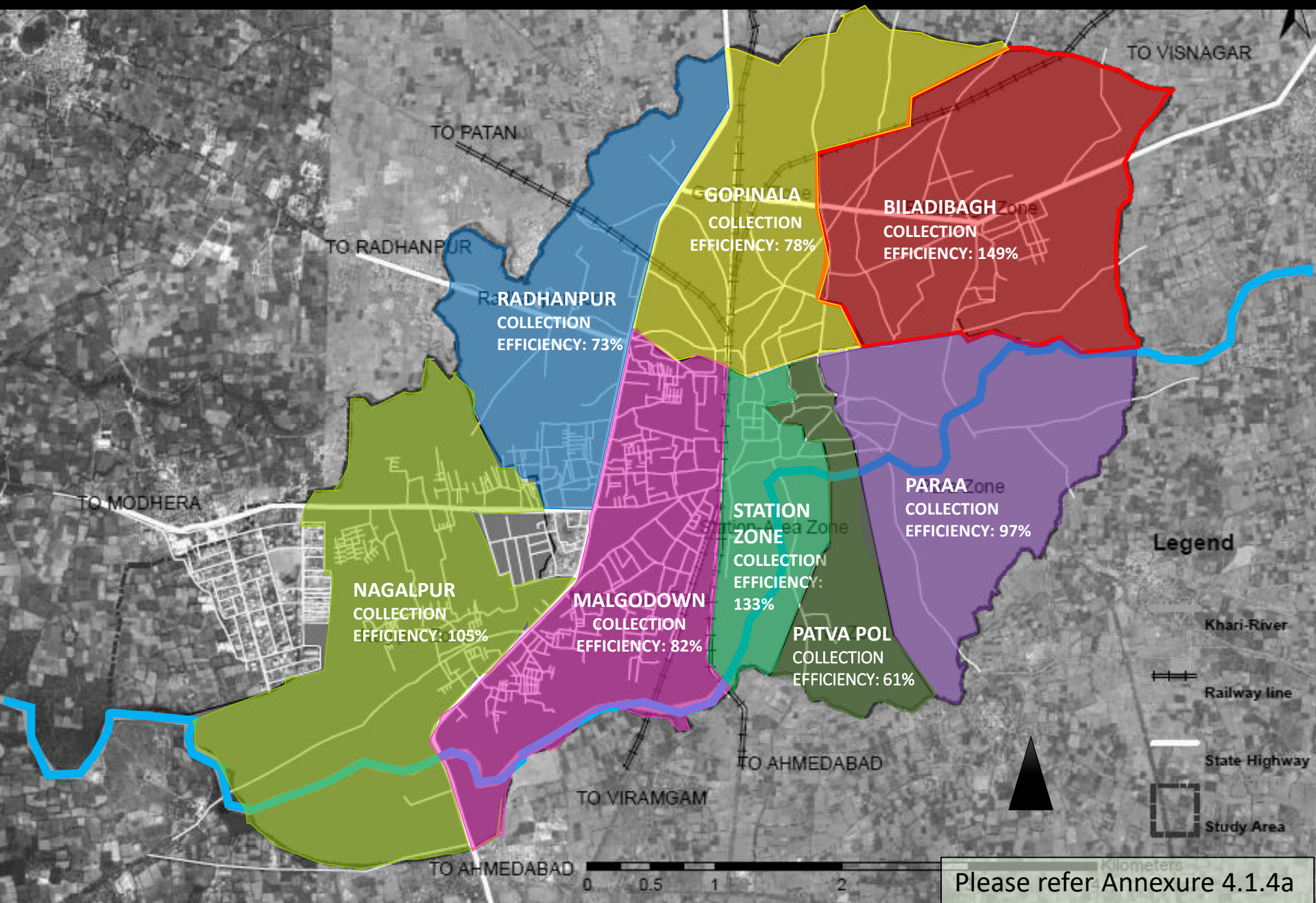
No. trips per day : 4

**Total waste collected by tractor trailers per day (MT): 36.6**

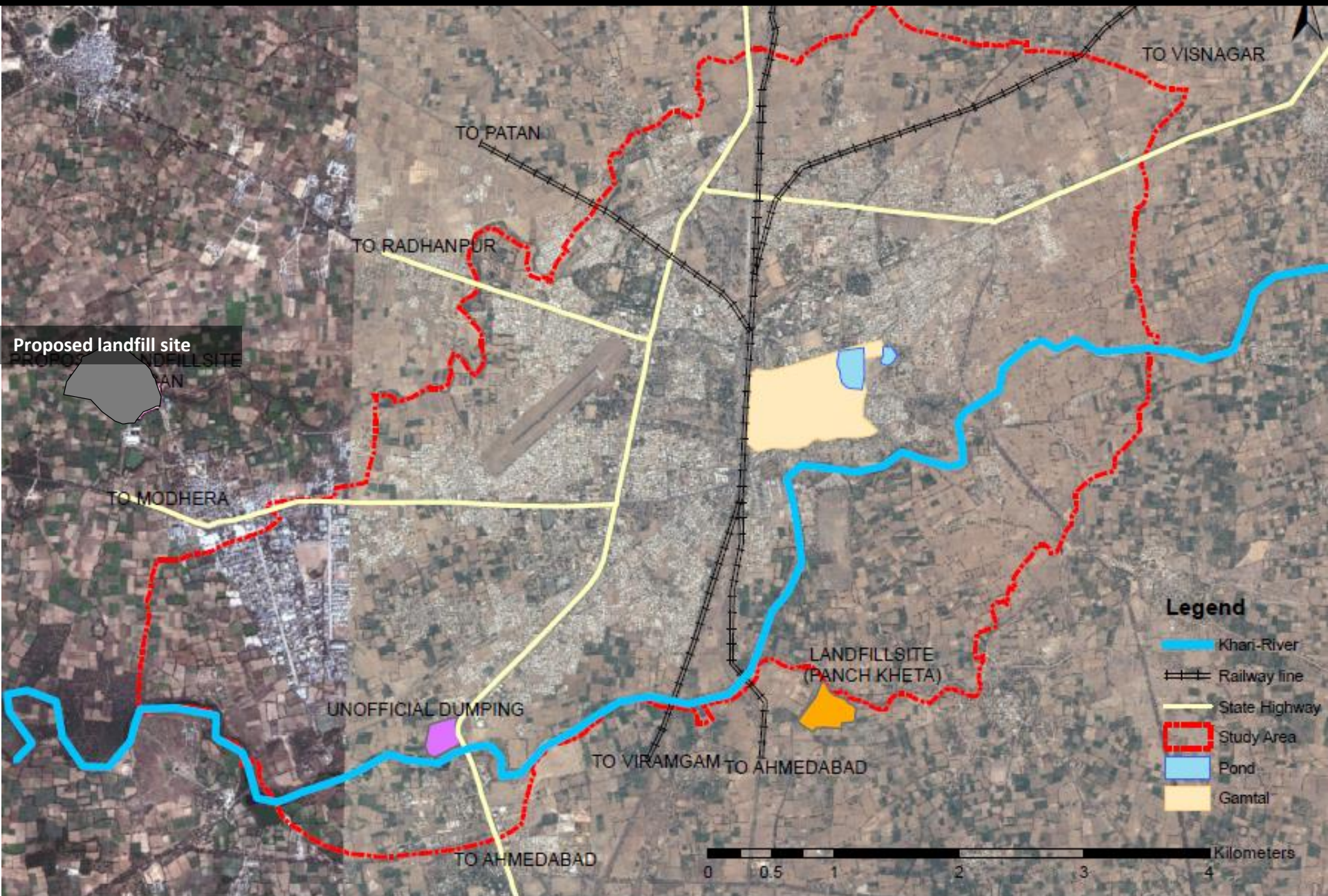
**Total waste collected per day (MT): 69.8**

SLB Indicator	Mehsana	Benchmark
Efficiency of collection of Municipal Solid Waste	91.2%	100%

# ZONE WISE COLLECTION EFFICIENCY



# WASTE DISPOSAL AT DUMPING SITE





# DETAILS OF DUMPING SITE

Official dumping site : Panch Khetar at Shobhasan road

Distance from nearest settlement : 3 km

Area : 1.15 Ha (2.85 acre)

Proposed Landfill site : Dediyan

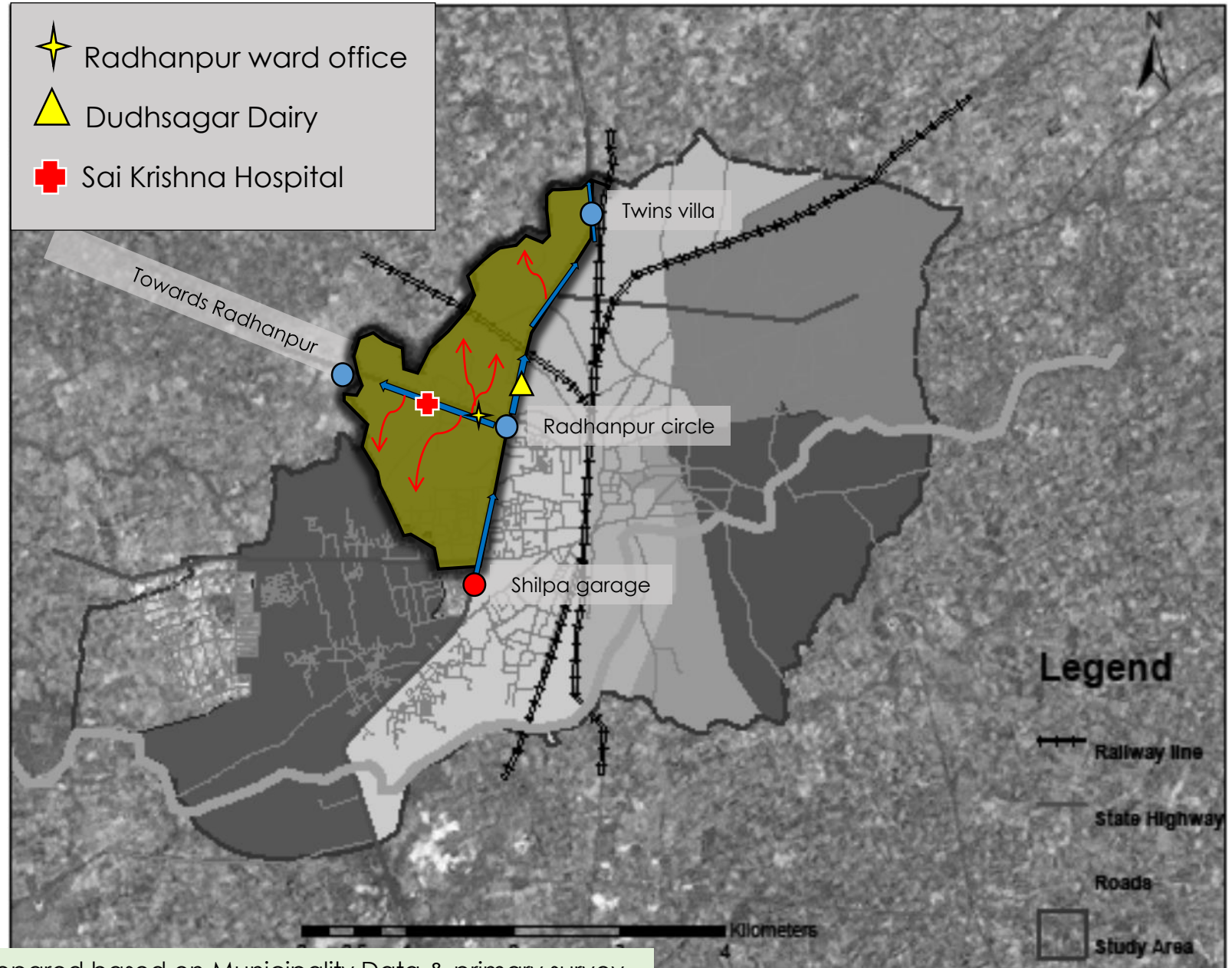
Distance from Mehsana: 6 km

Area : 3.24 Ha (8 acre)

SLB Indicator	Mehsana	Benchmark
Extent Scientific Disposal Of Municipal Solid Waste	0%	100%

Please refer Annexure 4.1.4b

# SW Mechanism - Radhanpur zone



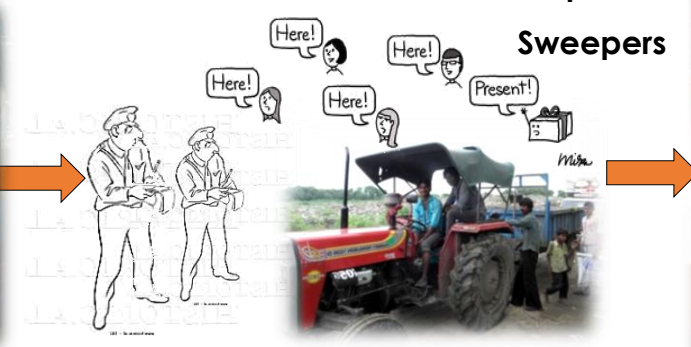
Source: Prepared based on Municipality Data & primary survey

# SWM Mechanism of Radhanpur Ward – Sweeping & Transportation Contract

Ward office

Ward officer-Amit Bharot & his supervisor

Sweepers



Entry marked in officers register

Sweepers sweep the allocated road, collect all garbage in a laari provided by ULB / Contractor & garbage from households is collected by private sweepers and they dump it into open dumps or containers Provided by ULB.

8:00am – all sweepers & 4 Kamdaars hired on contract (Sai Krishna Contactor & MJ Contactor hired by ULB resp.) reports to ward officer

- Length of stretch covered by street sweeper is **7Km.(20 Sweepers Per Day)**
- Collection of waste from bins/ collection point twice everyday
- **2 Supervisor** under ward officer who keeps track of each sweeper.

- Slum area under Radhanpur ward – Rail Nagar & Shankar Para
- Ward inspector gives the details to ULB at the end of the month and payment is released according to the no. of trips performed in month.



Finally tractor dumps all the garbage collected at Panch Khetar (official dumping site)



Tractor collects all garbage from various collection points & when one round is completed then Kamdaars reports again to officer & entry is marked in ward officers register as well as by Kamdaar.

# SWM Mechanism of Radhanpur Ward – Sweeping & Transportation Contract

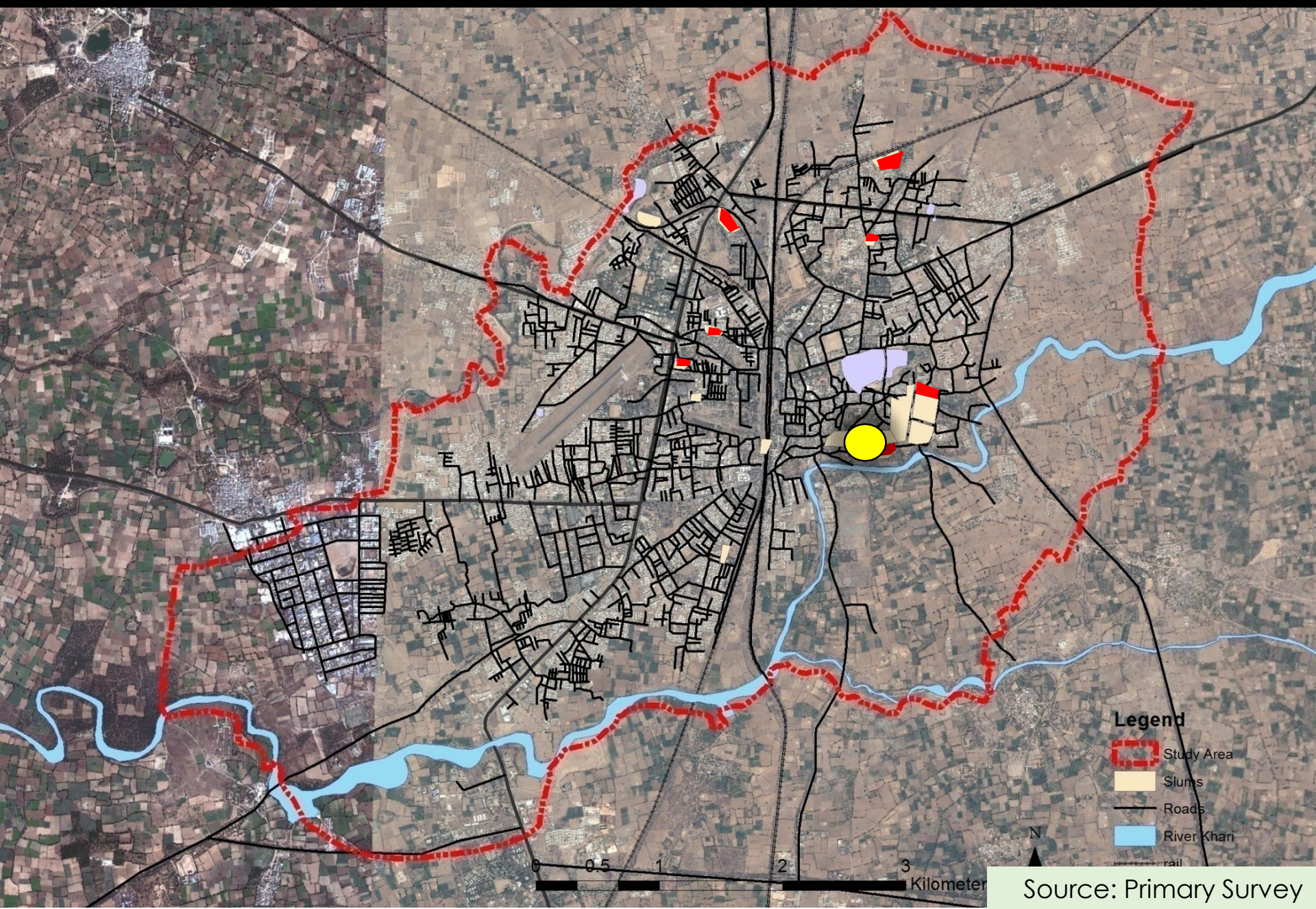
## Contract Payment- For Sweepers

- ✓ Each contract of 50 labor per ward
- ✓ Payment of each sweeper is round **150rs per day**
- Total **No. of tractor- 2 , Staff – 20(50) & Min. required – 45**
- First shift- **8:00am-12:00pm** & second shift- **14:30pm-18:00pm.**
- **Total waste generated– 11.67 MT per day**
- **Total waste collected – 8.54 MT per day**

## Contract payment-For Transportation

- ✓ Minimum 4 trips per vehicle per day (4 people per vehicle)
- ✓ Payment Rs.779 per vehicle per day for 4 trips

# SLUM LOCATION



Source: Primary Survey

# SWM Mechanism in Slums - Para & Patwa Pol (zone Kasba Wagri Vas)



Internal streets are clean



Dumping near public utilities



Road side dumping



Internal streets are clean

# KEY ISSUES

- Collection is done **once in a week**.
- **Open dumping** is happening.
- Road sweeping - **thrice in a week** only on the main road.
- Road side dumping.

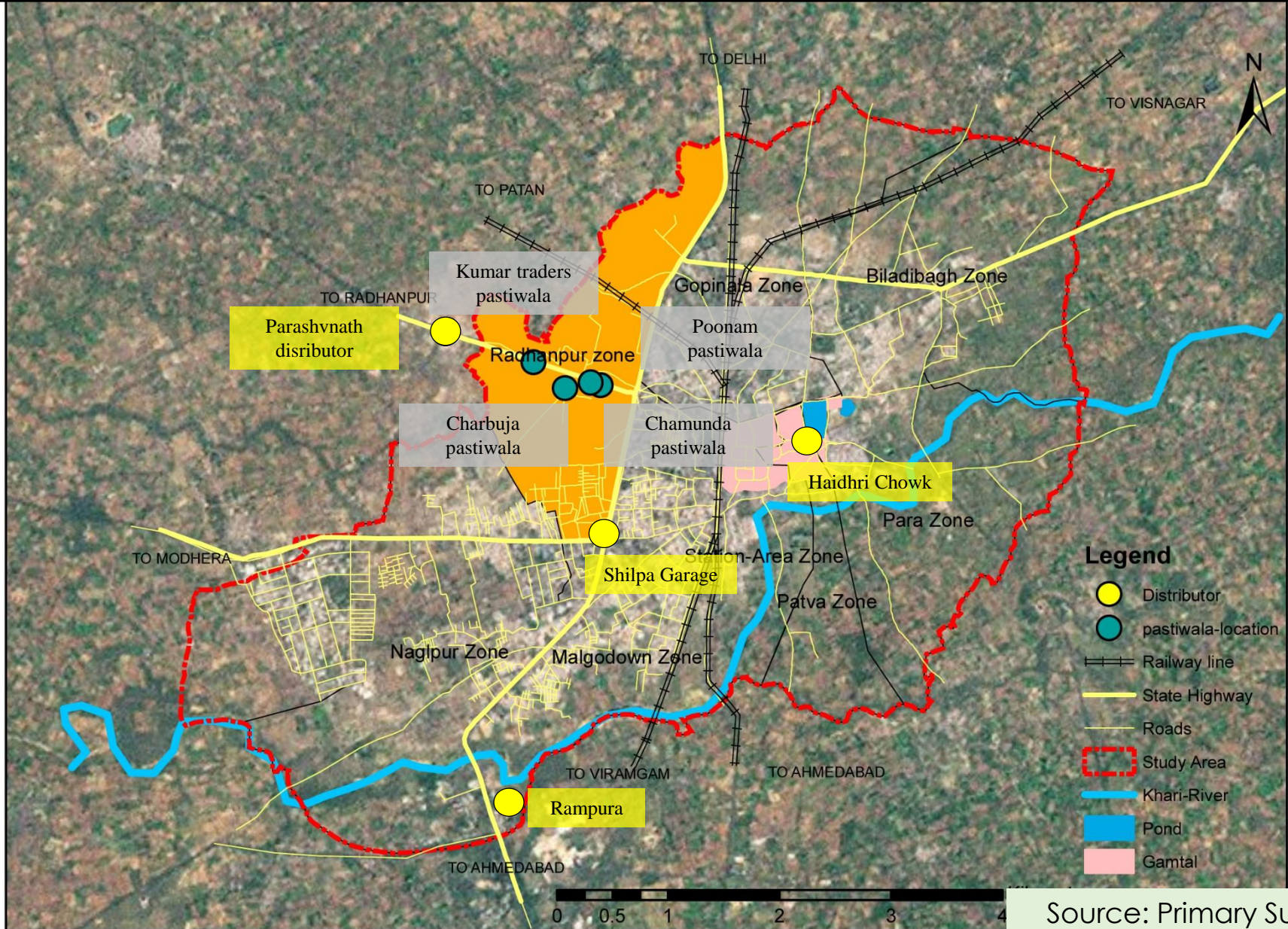
## Other slums

- Total No. of Slums: **6**
- **Rabari vaas, Amarpura, Magpara, Daferiya and Pradushan pura.**
- All slums have a problem of **open dumping on road side & on outer road.**
- **Condition of MSW is better in Magpara & Daferiya** as road sweeping is done **twice a week** where as in other slums sweeping is done **once in three days.**

## Issues

- Collection is not regular.
- Road side dumping due to **irregular sweeping.**
- **Lack of monitoring** system in slum area.

# 4.1.5 COLLECTION MECHANISM BY INFORMAL SECTOR



Source: Primary Survey



# COLLECTION MECHANISM BY INFORMAL SECTOR

House hold

Ragpickers  
/Kabadiwa  
las

Small  
shops

Wholesaler  
/Distributor

Mills



Rag picker

No. of rag pickers per day : **60**  
Waste segregation per picker/day: **6kg**  
(plastic bags, toys & bottles, glass bottles and metal products)  
Total waste collected/day: **0.36 ton (0.5%)**



Itinerant buyers



Pasti bhandar

No. of shops (Pasti bhandar): **100**  
Waste collected/day by various Kabadiwaalas ranges from : **0 – 300 kg**  
Total waste collected per day : **13.25 ton (avg.)**



Segregation of MSW



Wholesaler

No. of Distributors: **4**  
Waste collected per day by various distributors ranges from : **2500 - 3000kg**  
So, Total waste collected per day : **20 ton (28% of total waste collected)**



Segregated waste going mills



Source: Primary Survey

# KEY CONCERNS

SLB Indicator	Mehsana	Benchmark
Extent of Municipal Solid Waste processed/recycled	<b>28.5%</b>	80%

- ❖ How to account this segregation & recycling which is being done by this informal sector in a formalized manner ???
- ❖ Exploitation, Health Hazardous, Unsafe working condition and Lack of Social and Financial security...

## 4.1.6 CONCLUSION: Issues and challenges

Key performance Indicator	Benchmark	Mehsana
Extent of Segregation of MSW	100 %	0 %
Extent of Municipal Solid Waste processed/recycled	100 %	28.5%
Efficiency of Collection of MSW	100 %	91.2%
MSW Recovery	80 %	0 %
MSW Processing	100 %	0 %
Extent of Scientific Disposal of MSW	100 %	0 %
Road length per sweeper	400-600m	145
Sweepers per 1000 population	3	1.7
Efficiency in collection of solid waste charges and taxes	90%	73%
Coverage of household level solid waste services in slums	90%	0%

# KEY ISSUES

1. Lack of awareness in regards to waste as resource
2. Dumping of 42% organic waste which might have other use .
3. No segregation at source level which degrades the recyclable waste's value.
4. Waste pickers contribute to 28% waste collection which is getting recycled. But they suffer from occupational hazard, social insecurity, harassment and extortion by police & officials as they don't come under any labor union

1. Lacunae of regular monitoring system in SWM resulting in open dumping and littering.
2. Municipality is deficient of systematic data storage pertaining to SWM; which obscure the performance assessment of the system.
3. Negligence of capacitive building program resulting in poor performance of the system.

1. Lack of any regular IEC program related to awareness creation with regards to MSW.

# ISSUES AND OBJECTIVES

Key performance Indicator	Value chain	sectoral objectives
HH level coverage in slums	<b>collection</b>	<b>waste segregation</b>
Extent of Segregation of MSW	<b>Treatment</b>	<b>Scientific treatment of MSW</b>
Extent of Municipal Solid Waste processed/recycled		
MSW Recovery	<b>Reuse</b>	<b>Solid waste recovery</b>
MSW Processing		
Extent of Scientific Disposal of MSW	<b>Disposal</b>	<b>Disposal of MSW</b>

# LITERATURE REVIEW

## **4.2 LITERATURE REVIEW**

**4.2.1 Review of CSPs**

**4.2.2 Review of indicators**

**4.2.3 Service Charges & Taxes for SWM**

# 4.2.1 REVIEW OF CSP's

Particulars	Nashik	Varanasi	Raisen	Tirupati
Population	14,78,658	12,11,000	35702	2,27,000
Area	259 sq.km	79.79 sq,km	19.08 sq.km	16.07 sk.km
Total waste generated	421 MT	600MT	12.32 MT	145MT
Collected		450MT	6MT	145MT
Vision	<p>"To develop Integrated Solid Waste Management system to collect, segregate and scientifically dispose the Municipal Solid Waste by way of composting, scientific land filling and conversion of waste to energy in a sustainable manner." Considers 2 time horizons:-            Planning: 30yrs-            intermediate-10yrs,            ultimate-30 yrs ,            medium- 5yrs &amp; long 10 yrs</p>	<p>100% sanitation in accordance to the NUSP guidelines. It is envisaged that by 2020, the city shall have access to proper sanitation facilities for all its citizen.</p>	<p>"To provide sustainable sanitation management and delivery strategies and enhance the capacity of the urban local body (ULB) to achieve the goal of total sanitation, provide effective and inclusive sanitation services, and enhance the environmental and health status and of the city through stakeholder participation, awareness generation, improved service delivery and sustainable capital investments."</p>	<p>"To become and remain litter free through implementation of sustainable waste management practice."</p>



# REVIEW OF CSP's contd...

Particulars	Nashik	Varanasi	Raisen	Tirupati
<b>Issues</b>	Lack of source segregation and limited composting / waste recovery levels	absence of door to door collection	No institutionally organized	There is no scientific segregation.
	No Integrated Solid Waste Management Plan (ISWM) and very low O & M cost recovery	Lack of collection efficiency ,no scientific waste disposal site in the city	No segregation of waste	door to door collection is very low 8.0%
		River polluted by throwing puja waste and flowers.	No waste recovery mechanism	lack of segregation only 6.5%
		duped in the open areas		dumping of waste in drains.
		Machinery is very old and open dumper trucks		Lack of public awareness
		Lack of manpower Lack of awareness No segregation		
<b>Actions</b>	Prepare Integrated Solid Waste Management Plan with focus on reduce, recycle and reuse	Removing Waste Transfer Stations : alternnative approach, direct vehicle to vehicle transfer adopted.	Provision of two separate waste bins for dry and wet garbage at household level	door-to-door collection and source segregation with awareness campaigns
	To improve NMC's capacity & people participation: Initiate trainings on modern waste management technologies to NMC staff. NMC	Door to door collection(to divide ward in sub zone) with A toZ	Long Term - The option suggests treatment and disposal of bio degradable waste or perishable waste through composting on site.	Explore scope for using Self Help Groups and Local NGOs in door-to-door collection/segregation; implement pilot initiatives in select wards and scale-up/replicate the same city wide

# REVIEW OF CSP's contd...

Particulars	Nashik	Varanasi	Raisen	Tirupati
<p style="text-align: center;"><b>Actions</b></p>	<p>Engage local stakeholders in monitoring and oversight of SWM</p>	<p>Recycle waste collecting by rag pickers with help of NGO at household level</p>	<p>Windrow Composting</p>	<p>Improve coordination among health and engineering departments and create a separate SWM department to facilitate better accountability in the medium term</p>
	<p>O&amp;M cost recovery : i. Formulate ways for O&amp;M cost recovery incorporating door-to-door collection, source segregation and waste to energy initiative.</p>	<p>Segregation at source</p>	<p>Short term - The waste dumped in these bins will be directly taken to the landfill site and will be segregated before treatment.</p>	<p>Initiate a training initiative on modern waste management practices</p>
	<p>ii. NMC should implement user charges for SWM services; a transparent and independent city level regulatory cell should be charged with the responsibility of user charge fixation and revision.</p>	<p>Site specific waste collection systems</p>	<p>Door-to-door waste collection and transfer, processing activities (as mandated in GoMP Guidelines) , (contracts to specify employment of local rag pickers in O&amp;M activities by private operator)</p>	<p>Engage local stakeholders in monitoring and oversight of SWM activities</p>

# REVIEW OF CSP's contd...

Particulars	Nashik	Varanasi	Raisen	Tirupati
	<p>- NMC will give the citizens two bins – one for dry waste and another for wet waste.</p>	<p>Core area waste Collection:                      -Narrow lanes :Handcarts and cycle rickshaws                      Collector roads : Small tempos                      -Major roads :Large trucks cum compactors</p>	<p>Operation and maintenance of assets (e.g. wastewater treatment plants, landfill, composting facility etc.) created under CSP</p>	<p>Implement user charges for SWM towards achieving O&amp;M cost recovery</p>
<p><b>Actions</b></p>	<p>- NMC should launch an awareness campaign with public participation to complement door-to-door collection and source segregation initiatives.</p>	<p>Cleaning of Nalas: periodically cleaned with the help of scrapers. The nala has to be cleaned with the help of specialized machines, operated by trained operators with help of VMC and NGO</p>	<p>IEC Strategy: - Identification of Local NGO and Apex NGO. -Formation of Mohalla-level and Ward-level Sanitation Committees.                      -Organising Meetings and Discussions focusing on Sanitation Arrangements at Mohalla/ Ward level                      -School Sanitation Campaign                      -Street Plays                      -community level Campaign                      -use of Visual Media &amp; Local Newspaper                      -Publicity Material-handouts/posters</p>	<p>Leverage JNNURM and other state level grants available to implement an integrated PPP.</p>

# 4.2.2 REVIEW OF INDICATORS

MoUD (INDIA)		PAS		Scheinberg Wilson	
Proposed Indicator	Bench mark	Proposed Indicator	Bench mark	Proposed Indicator	Bench mark
Household level coverage of Solid Waste Management services	100%	Household level coverage of Solid Waste Management services	100%	waste collection coverage	100%
Efficiency of collection of municipal solid waste	100%	Efficiency of collection of municipal solid waste	100%		controlled disposal
Extent of segregation of municipal solid waste	100%	Extent of segregation of municipal solid waste	100%	recycling rate	100%
Extent of municipal solid waste recovered/recycled	80 %		Extent of municipal solid waste recovered/recycled	80 %	degree of user inclusivity
Extent of scientific disposal of municipal solid waste	100%	Extent of scientific disposal of municipal solid waste	100%	degree of provider inclusivity	100%
Extent of cost recovery in Solid Waste Management services	100 %	Extent of cost recovery in Solid Waste Management services	100 %		paying for collection
Efficiency in redressal of customer complaints	80%	Efficiency in redressal of customer complaints	80%	institutional coherence	100%
Efficiency in collection of SWM charges	90%	Efficiency in collection of SWM charges	90%		
Please refer Annexure 4.2.2a & 4.4.2b		HH level coverage of SWM services in slum settlement	80%	Source: MoUD, PAS & (Scheinberg et al., 2010;Wilson et al. 2012).	

## 4.2.3 SERVICE CHARGES & TAXES FOR SWM

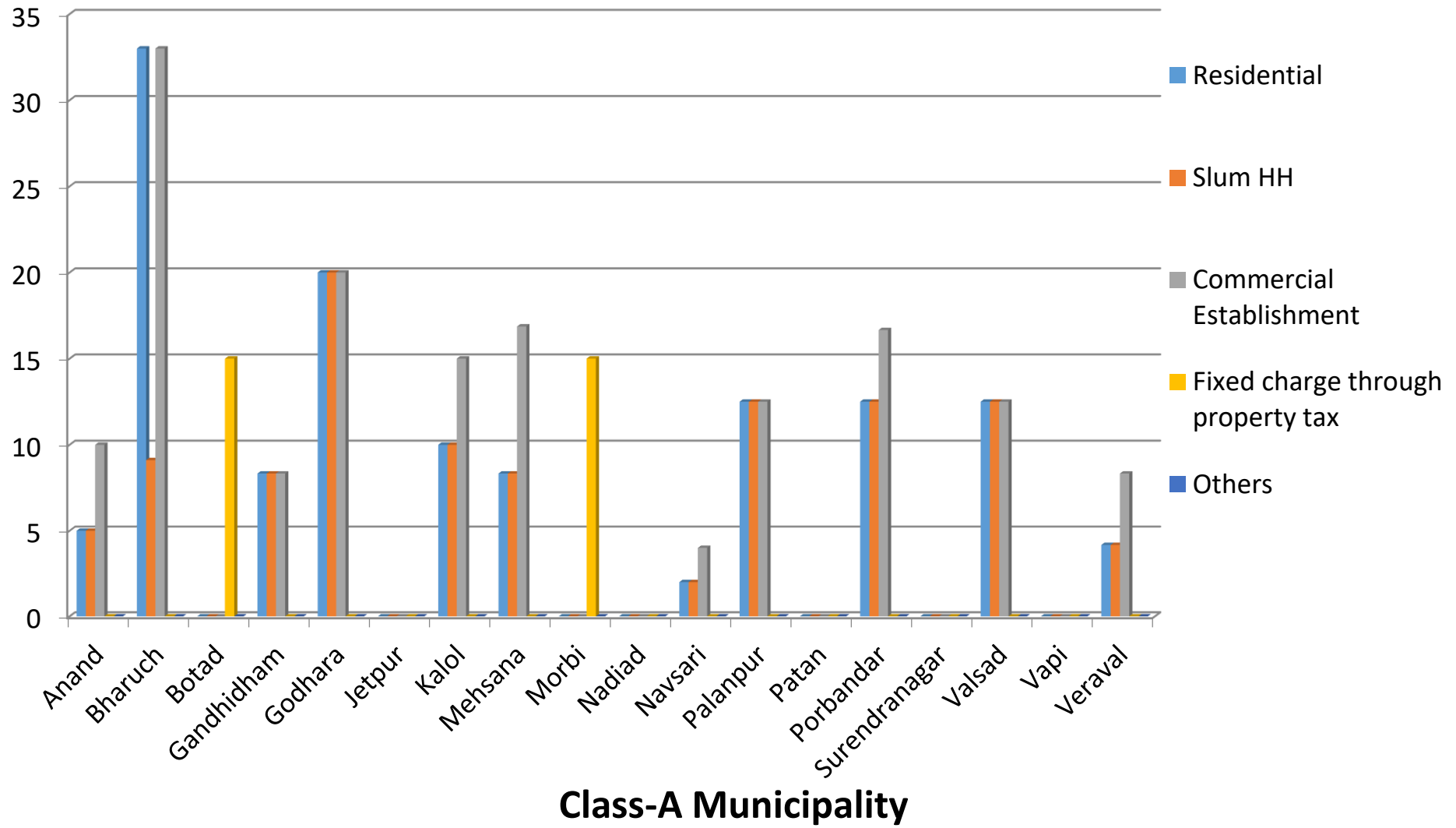
SWM is financed through local tax sources such as the property tax in India.

**Traditionally in public finance, there are four ways of financing SWM:**

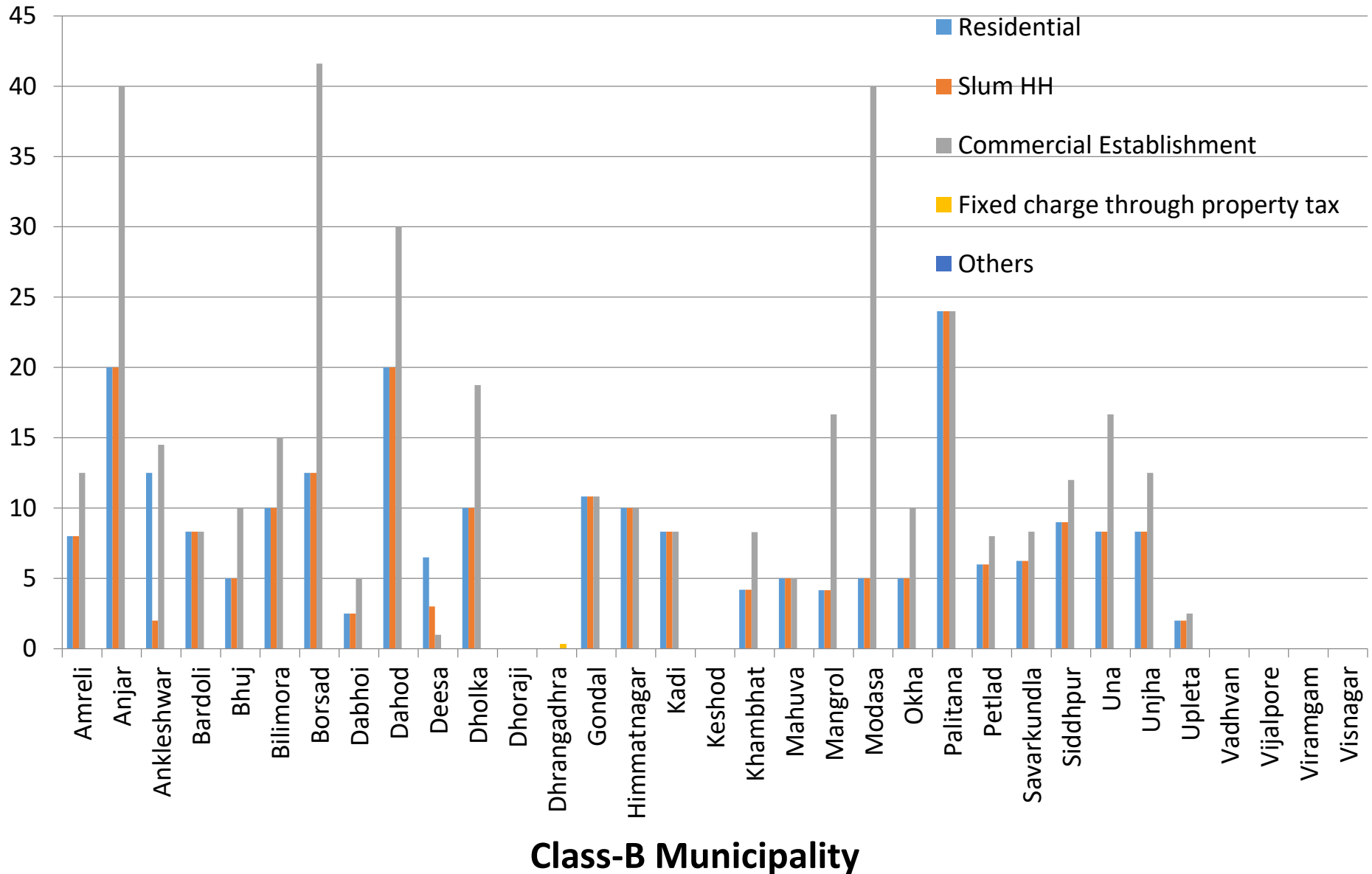
1. Local taxes such as the property tax.
2. User charges/ Conservancy tax which are levied on SWM
3. Grants from higher levels of government (Central, State Governments)
4. Loans from the Capital Market, from Government/Financial Institutions or international agencies like the World Bank.

**More than this, In some cities where solid waste collection is franchised/Contracted to private operators, households will pay the fee directly to the operator, where people contribute Rs.20 to Rs.50per household/month additionally.**

# SERVICE CHARGES & TAXES FOR SWM IN GUJARAT



# SERVICE CHARGES & TAXES FOR SWM IN GUJARAT



# SERVICE CHARGES & TAXES FOR SWM IN INDIA

- In Chennai pioneered the concept of a neighborhood organization carrying out
- street cleaning and primary collection in order to improve the local environment. To defray the costs, each household was asked to contribute Rs.20 to Rs.50 per month.
- In the SWM strategy in Kerala, rates of Rs 30 per month for households and Rs 50 to Rs 75 per month for shops and establishments were fixed.

## **Municipal Solid Waste Management Project in Asansol Urban Areas:**

RS.5 to 25 per month per household

Rs.25 to 50 per month in commercial areas

Up to Rs.4000 per month for larger units like hotels, shopping complex etc.



# **CASE STUDIES AND CONCEPTS**

# **4.3 CASE STUDIES AND CONCEPTS**

**4.3.1 BIN FREE AND ZERO WASTE**

**4.3.2 DECENTRALIZED SW TREATMENT**

**4.3.3 SEGREGATION**

**4.3.4 INFORMAL SECTOR**

**4.3.5 INTEGRATED SOLID WASTE MANAGEMENT**

## 4.3.1 BIN FREE CITY

### BIN FREE CONCEPT

Suryapur town in Andhra Pradesh. Population is 105000 as per 2011 census. Known as **Dustbin free and Zero garbage Town.**

### **Management related Action Point**

- Door to Door waste collection in segregated manner.
- Roadside bins were eliminated.
- Sweeping & Cleaning job in the ward has been contracted out to private contractor.
- Collection in segregated manner & separate system for collection through markets, restaurants, slaughterhouse.
- Waste is collected from ward & directly transported to the recycle unit.
- Training/awareness program for workers, residents.

## 4.3.1.1 BIN FREE CITY

### **Maintenance/Monitoring related Action Point**

- Monitoring committees for seeping, cleaning & collection.
- Work schedule & monitoring session for workers.
- Hierarchical Institutional Mechanism for better monitoring & management.
- Peoples organization for monitoring.

### **Revenue related Action Point**

- Due to segregation recyclables are available for sale.
- Revenue from treatment plant.

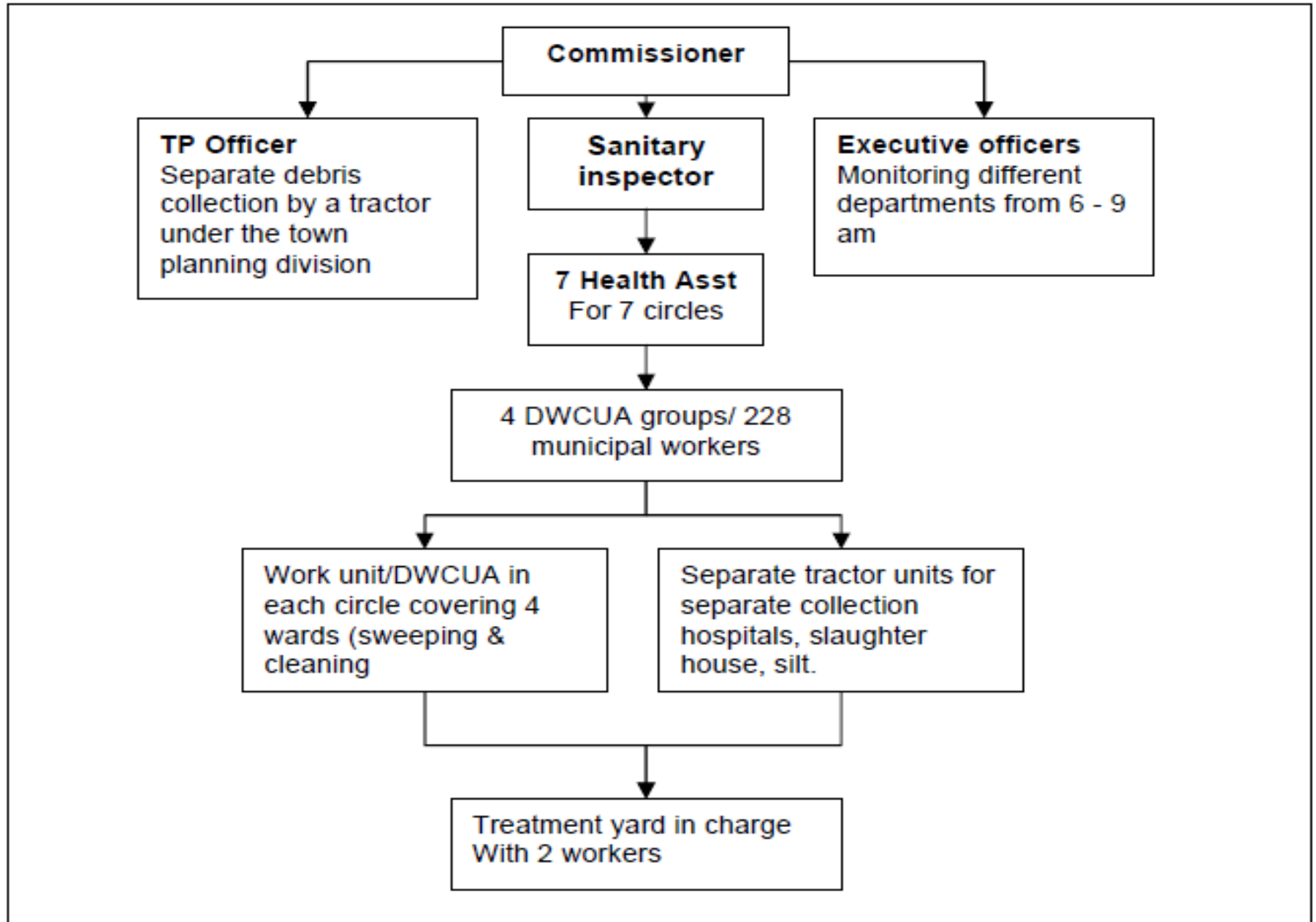
### **Investment related Action Point**

- Treatment Unit for Organic waste.
- Landfill site for inert waste.
- Providing two dustbins in each households for segregation of waste.

# TIME SCHEDULE FOR BIN FREE AT SURYAPETH

Time	Task
5:00 AM	attendance
5.15-10 am	door to door collection of segregated waste
8-8.30am	tea break
10-12pm	collection of segregated waste from commercial establishments
	collection of hospital waste
2-5 pm	lifting the drainage silt
Evening	collection of slaughter house
Arrangement is changed as per requirement as the vehicles are less	

# MONITORING MECHANISM BIN FREE AT SURYAPETH



## 4.3.1.2 ABOUT ZERO WASTE

The concept of Zero Waste aims to minimize use of resources and maximize the ongoing benefits of the essential value within the waste generated by society.

Zero waste is a philosophy that encourages the redesign of resource life cycles so that all products are reused. No trash is sent to landfills and incinerators.

**The 3 Rs are:**

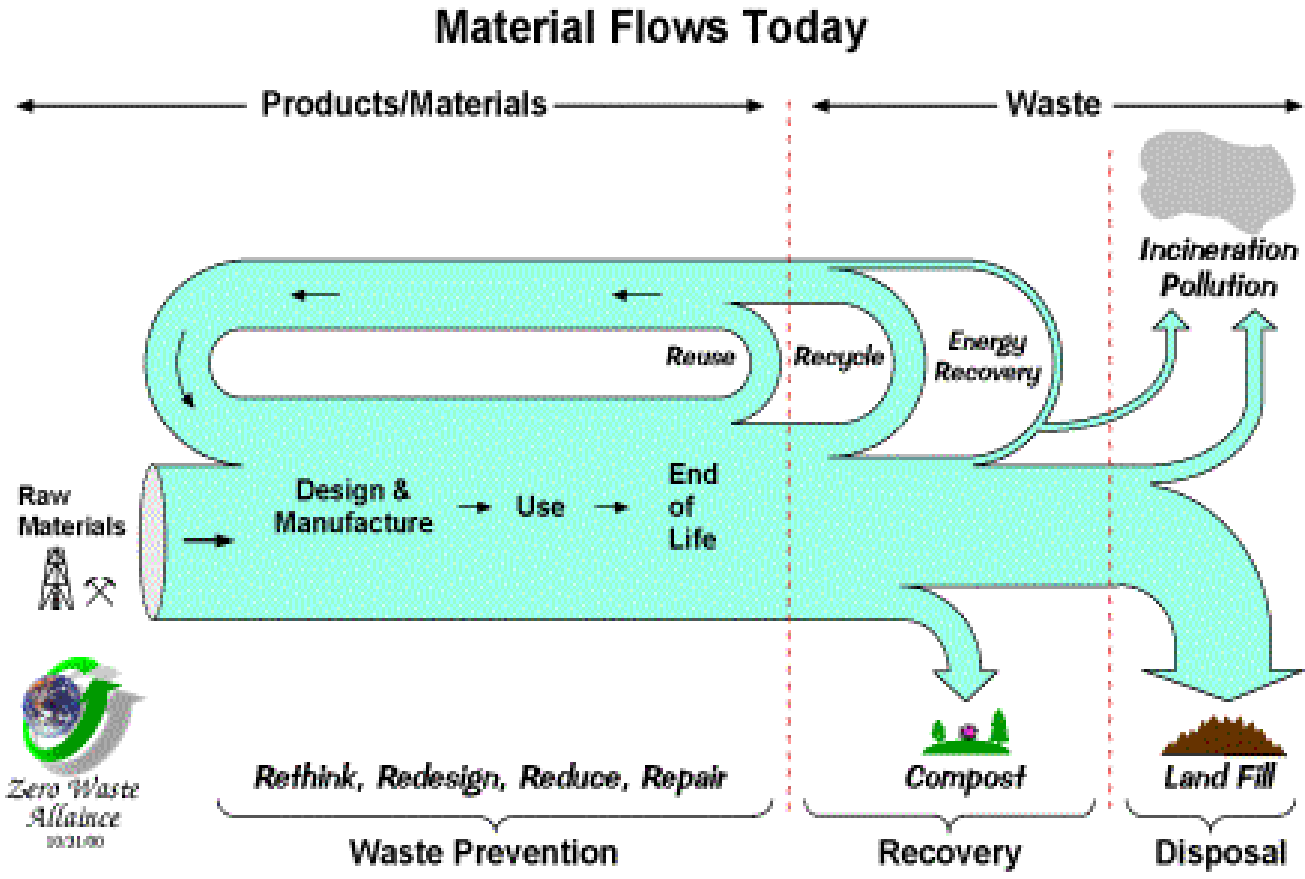
**Reduce** - reduce generation of waste at the source.

**Reuse** - maximise recovery of materials for reuse.

**Recycle** - maximise recycling of discarded material.

Rather than the linear '**cradle to grave**' process above, where a product has no use at the end of its life, we must think in cycles: '**cradle to cradle**'. At the end of the original life of a product, it should be used to begin as another product - just like our natural ecosystems.

# DEFINING "ZERO WASTE"

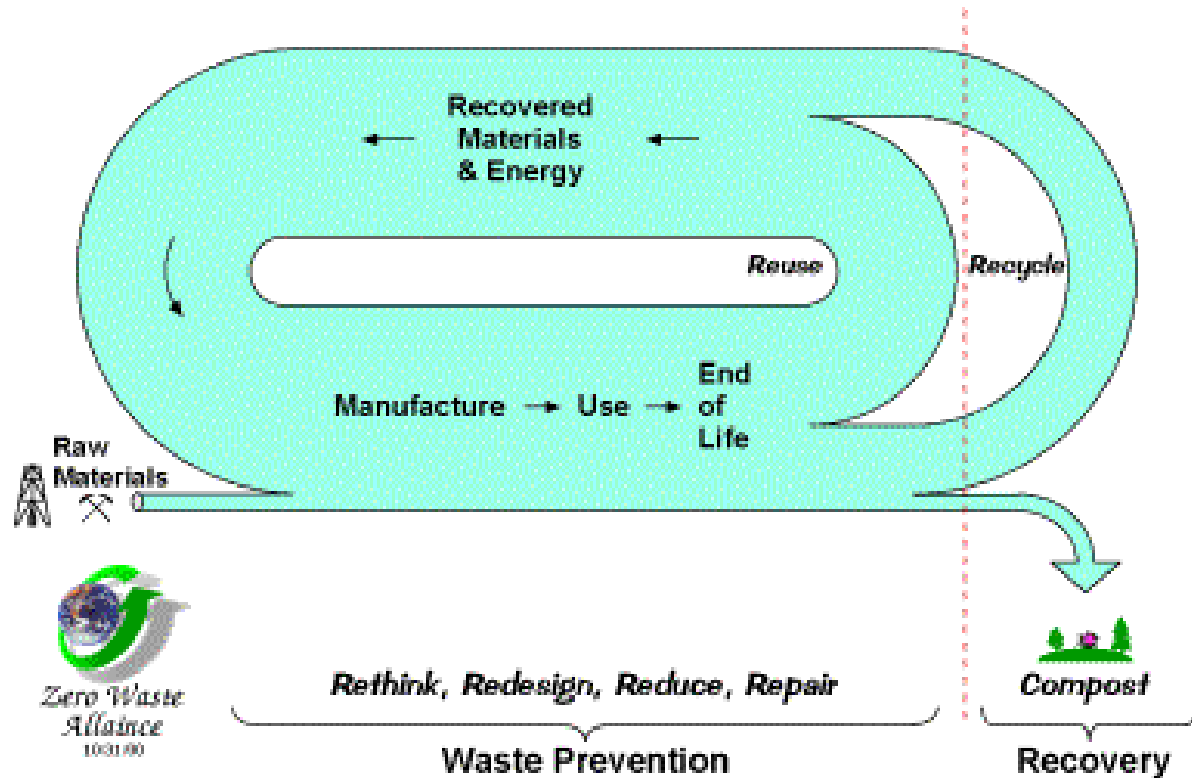


Source: [http://www.zerowaste.org/case.htm#virtual\\_tour](http://www.zerowaste.org/case.htm#virtual_tour)



# DEFINING "ZERO WASTE"

## Improved Material Flows



Source: [http://www.zerowaste.org/case.htm#virtual\\_tour](http://www.zerowaste.org/case.htm#virtual_tour)

## 3R STRATEGIES

1. Raising Awareness
2. Sharing Information
3. Incentives
4. Partnership between various bodies
5. Technological Development

- **Reduce - Reduce the amount of waste**
- **Reuse - Reuse resources**
- **Recycle - Recycle resources**
- **Refuse - Refused to receive unnecessary objects**
- **Repair - Repair things for their prolonged use**

3Rs

5Rs

# **LAWS-GUIDING TOWARD ZERO WASTE.....JAPAN**

**Containers  
and  
Packaging  
Recycling Law**

**Home  
Appliances  
Recycling Law**

**Food Wastes  
Recycling Law**

**Construction  
Waste  
Recycling Law**

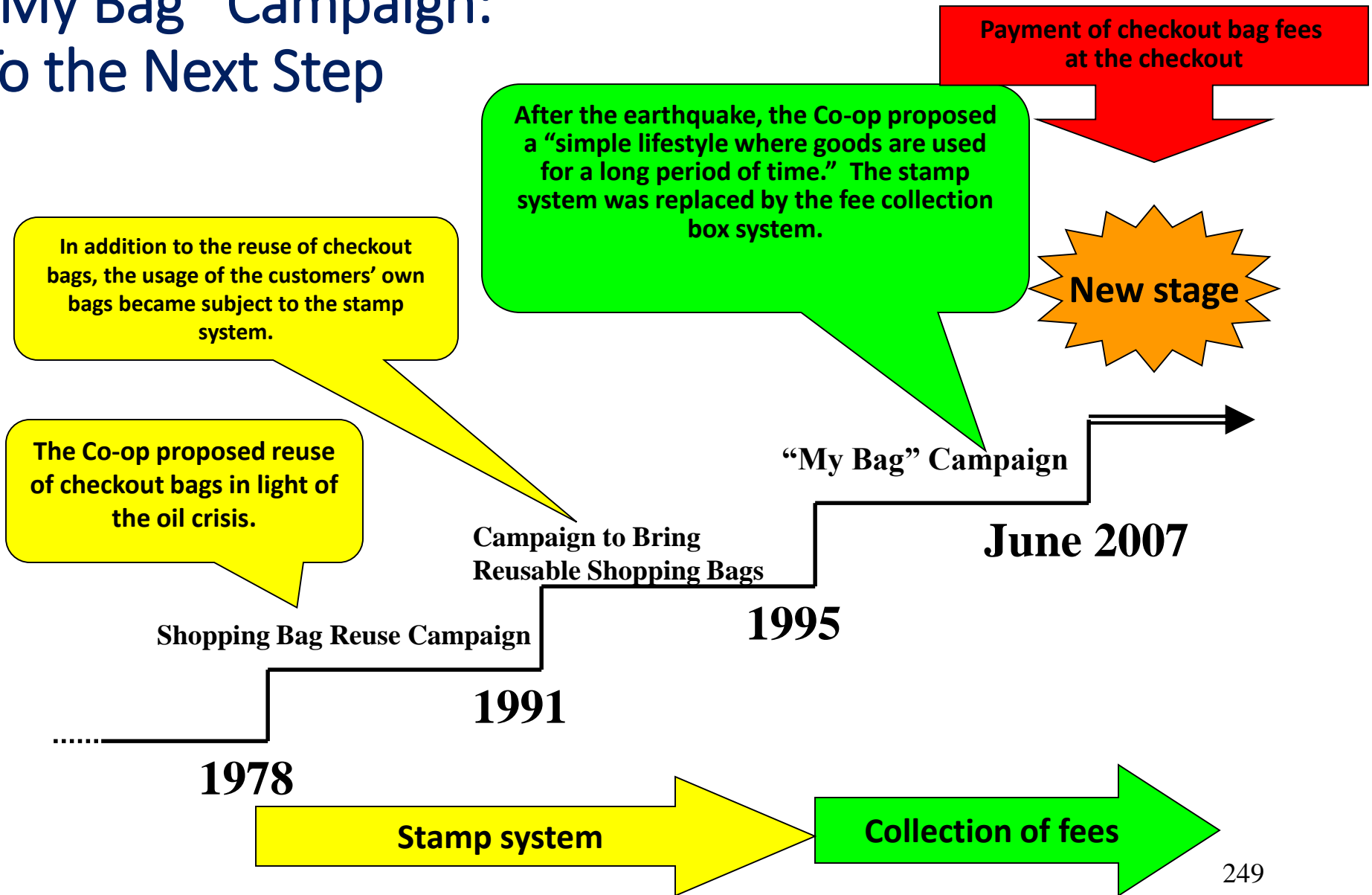
**Automobile  
Recycling Law**

- Expanded Producer Responsibility
- Faithful Activities Following Laws
- Cooperation With Municipalities
- Collaboration With Consumers
- Positive Recycling Activities
- Utilization of Their Technologies For Recycling

# TIMELINE TOWARD ZERO WASTE.....JAPAN

## “My Bag” Campaign: To the Next Step

### ECO FARM –CO OP KOBE



# ZERO WASTE MANAGEMENT .....AHMEDABAD

## TEN MAJOR GOLS FOR ACHIVING ZERO WASTE IN 2031

1. environmental protection
2. health and safety standards
3. dedicated institutional structures and governance arrangements
4. community awareness and ownership
5. segregation of waste streams
6. partnerships and collaborations
7. sustainable innovative infrastructure and technologies
8. education and awareness at all levels
9. investment in 3R infrastructure (eco-towns, science parks, eco-industrial zones)
10. implementation and systematic review process

# STRATEGIC OPTIONS FOR ACHIEVING 'ZERO WASTE' IN AHMEDABAD

Combined Method ensuring immediate **3Rs action in Short/ Medium Term**, while preparing for **Long Term vision of Sound Material Cycle**

2011

2031

Phase 1



Waste Management using 3Rs

Sound Material Cycle



Phase 2

Current SWM System

Zero Waste

# SOLUTION - ZERO WASTE CAMPUS / AREA.....AHMEDABAD

Zero waste is defined as *“a lifestyle where no waste is generated, i.e. any object that has completed its life-cycle can be re-consumed locally in any natural and/or industrial process without generating any solid, liquid or gaseous waste.”*



# ZERO WASTE CONCEPT - ADVANTAGES

- Full awareness among citizens
- Segregated organic waste collection & treatment
- Separate collection for residential & commercial waste
- De-centralized Biogas Generation
- De-centralized Composting
- Savings in transportation cost, great savings in natural resources, 80%
- Generation of green employment
- Will advance the development of resource recovery
- Promote recycling
- Will reduce carbon foot print and thus GHG emissions
- Eliminate waste or its consignment to landfill
- Promote ecological sustainability



# INTRODUCTION – CASE : PUNE CITY (SWACHH MODEL)

The solid waste is increasing in Pune city due to growth of population, urbanization, higher per capita income and standard of living, changing lifestyle and food habits. The solid waste created by the household units, shops, restaurant and commercial units are higher. Solid waste is inevitable task in urbanization process and it will increase in future. The collection, segregation, storage, transports and processing of solid waste needs planning and more investment. Clean city improves standard of living by reducing different diseases. Public private partnership is more useful in solid waste management. Government and Municipal Corporation must encourage local management through collection, transport and segregation and disposal of solid waste.

## HISTORY

### ❑ **The Kagad Kach Patra Kastakari Panchayat (KKPKP) 1993**

- Waste pickers are self employed workers but they are working for Municipal Corporation.
- Pick up and sell recyclable scrap from municipal solid waste.

### ❑ **Solid Waste Collection and Handling (SWACHH) 2008**

- Door to door collection by rag pickers.
- Community solid waste storage system is practiced in city (corporation area.)
- The PMC's ghanta trucks also collect garbage from households.

# WASTE CONDITION

## Nature of solid waste in Pune city

In Pune city, solid waste is mainly generated from the households, theaters, hospitals, hotels and restaurants. The commercial units and shops are also generating maximum solid waste in city.

Type of unit	Solid waste (Tonne a day)	Percent
Households	1985.02	76.28
Theaters	17.87	0.69
Hospitals	8.65	0.33
Hotel	64.32	2.47
Restaurants	435.20	16.72
Shops and Commercial units	91.11	3.50
Total	2602.17	100

**Solid waste in Pune Municipal Corporation (2011)**

Particulars	Total solid waste	Percent
Fermentable matter	1691.411	65
Paper	208.1736	8
Plastic, rubber, leather	182.1519	7
Metal	104.0868	4
Glass	156.1302	6
Inert materials	260.217	10
Total	2602.17	100

**Constituents of solid waste**

# MANAGEMENT OF SOLID WASTE

- **Regularly funds** are allotted for solid waste management in municipal corporation area.
- Responsibility of solid waste management is given to **health department**.
- The medical officer of health department of the municipal corporation is responsible for SWM (Therefore health department is accountable for collection storage, segregation, transportation, processing and disposal of solid waste.)
- **Health department employ sanitary inspectors** for solid waste management.
- There are more than 2000 sweepers, around 4000 rag pickers & these all appointed on 5 ghantagadis.
- The Pune Municipal Corporation has a **decentralized pattern** of solid waste segregation and disposal at its sources.
- **Dry waste is collected by the rag pickers and other NGO's** for recycling.

## Primary and secondary collection

Pune Municipal Corporation has put five areas for **door to door collection** where rag pickers collect waste from individual households. The PMC has provided **84 dumper placer** vehicles containers with about **1.0 to 1.5 tonnes of refuse-carrying capacity each**. They are used for collection and transport of solid waste from the collection points to the disposal sites. There are **two JCB loaders** meant for loading waste from open secondary collection points. There are **2690 bins** and they are insufficient therefore at source segregation and recycling is encouraged. Municipal Corporation is **employing NGO'S for solid waste segregation** at source and at disposal sites by using the services of **more than 4000 rag pickers** (PMC 2006).

# FUTURE FORECAST OF SOLID WASTE IN CITY

Type of unit	2011-12	2021-22	2031-32
Population	2034.83	2513.14	2783.84
Theaters	18.31	22.62	25.05
Hospitals	8.87	10.96	12.14
Hotel	64.32	83.59	92.51
Restaurants	435.20	565.66	625.98
Shops and Commercial units	91.11	118.4	131.05
Total	2662.42	3314.32	3670.58

## Policy implication

- Comprehensive policies from household to the dumping ground are required.
- Capacity and institutional Arrangement
- Take help of Ngo's, researchers, universities and colleges.
- Education campaign
- Scientific planning for collection and for transportation
- PPP model.

- The area of dumping ground is 43 acres.
- The second future land fill waste disposal site is located at Yewalewadi of 17.5 acres.
- The plan is to develop Urali Devachi 120 acres for waste processing and disposal facility.
- The funds are received from government of India under the scheme of Airfield town's project.
- The wet waste can be disposed by vermiculture.

# KOCHI DECENTRALIZED MODEL IN SOLID WASTE MANAGEMENT

## Introduction

Kochi city area is 330.02 sq. Km population, 1,138,413. More than 60% of the state revenue comes from the city of Kochi. It is also referred to as the state's commercial capital. According to COC records, around 33% of its total revenue expenditure is spent on SWM. The average cost of operations and management is rs 1887/ton in 2006. This is more than is spent in most Indian cities rs 500–1500/ton. COC does not recover a user fee for waste management.

The source for much of the revenue to cover this expenditure is property tax. **3158 upper-middle-class households, is practising source segregation.** In general, waste is not being stored at the source, with only around 35% of domestic sources, 50% of hotels and 20% of non-domestic sources having any storage. **The remaining waste is dumped in open drains, canals or other open areas as it is generated,** then either swept away or left to decay and decompose. **Around 40–45% of the waste is directly deposited in community bins and designated collection points.**

**Pachalam Division** covers 0.83 sq. km within Kochi and has a population of 7869. Most of the land use is residential. The population density is very high at 9482/sq. The Pachalam initiative started under the division councillor. **The project aim was to tackle solid waste in Pachalam at the point of generation as far as possible.**

<b>Kochi Total waste</b>	<b>400 Mt.</b>
Per capita waste	0.67 kg
Biodegradable waste	57..34%
Recycle waste	19.36%

# INITIATIVES

**Project finance** The Corporation budgeted Rs 1000 per biogas plant to be funded through plan funds. The beneficiary was responsible for Rs 1500 of the unit cost, and Bio-Oasis funded Rs 1350. The NGO funded its subsidies through donations and money it had collected. The projected total cost then comes to Rs 4850 per plant

## **Creating Public Awareness**

Around 50 students worked in the division for a month. the aim was to tackle waste as close to the point of generation as possible, existing resident associations groups of 100–200 families living in geographical proximity in the division were contacted. With the help of these associations, 23 programmes were conducted in different parts of the division.

Four At the time of inception of the scheme, there were only six resident associations. Efforts were then made to increase the number, and at present there are 16 resident associations in the division. These groups play a vital and important role in the project and are an important part of the overall strategy.

## **Project Initiation**

To learn about SWM, the division councillor met local experts in waste management and collected information. He then approached Rajagiri College through its outreach programme to ask for student assistance in conducting household surveys and creating

## **public awareness.**

Rajagiri College is run by a Christian charity and offers many types of courses. Groups of four students from the fourth semester in the Master's in Social Work degree programme conducted the survey as part of their course on research methods.

# PILOT STUDY

Biogas Plant installed at house hold level 100 households registered to receive partially underground

## Biogas Plants

**Rajagiri College installed 10 biogas plants at a unit cost of Rs 11,000.** The college offered to subsidize Rs 2500 of the unit cost. Agreements with the beneficiaries stated that the remaining Rs 8500 would be paid after installation. Waste use like a resource. There are around 2500 houses in Pachalam Division. Around 1000 families were willing to install small biogas plants on their property.

## Community Biogas Plants

The Corporation financed the construction of this plant, which caters to both market waste and a limited amount of excess community waste feeding capacity, 800 kg/day; construction cost, Rs 900,000.

## Waste Collection

Door-to-door Collection Initiative

**450 families participated in the in which a pushcart was used to collect mixed waste from residents, who were charged Rs 25/month for the service.** At present a group of five men are engaged in collection. A van was purchased to replace the pushcart, and most of the waste collected is segregated into organic waste, non biodegradable waste and recyclables.

The project aims to eventually transport the organic waste to communal biogas plants, and some locations have been strategically identified.

## Primary Collection Workers

Initially, Bio-Oasis trained the workers and provided them with uniforms. Gloves were subsequently purchased. Each team member typically earns around Rs 140/day after expenses

Bio-Oasis to collect the user fees directly and to introduce some form of employee benefits such as health insurance.

## Recycling

Rag pickers visit all households and collect recyclable waste, for which the residents are paid. Rag pickers also collect non-recyclable, non-organic waste from households not involved in door-to-door collection but do not pay the households for this material. Some low-quality recyclable waste still enters the daily collection stream. This is retrieved by the collection team and sold back to the rag pickers or to shops. The collection team estimates that around Rs 50–70/day can be made from these recyclables.

## Benefits

At the household level, residents indirectly attain a 'zero-waste' situation.

Waste generated at this level is reduced and reused through community mobilization awareness, and segregated recyclables are collected by rag pickers.

**Biogas units** recover fuel from organic waste while the slurry is used as fertilizer, and the remaining non-recyclable waste is handed to rag pickers for disposal. The SWM scheme in Pachalam Division has decreased the problems of uncontained waste and blocked drains, and thereby also decreased the problem of mosquitoes **The number of waste accumulation points in the division decreased from 26 to two (unauthorized) points**The division is thus literally bin-free.



## 4.3.3 SEGREGATION - Waste Management In Sweden

### Segregation:

1. household—segregate-(papers, electric waste, batteries, and bulk waste)---hold by waste management regulation, introduce systems for source-separation of food waste.
2. Waste prioritization--waste prevention, reuse, material recycling, recovery, and disposal.
3. Treated type: as maximal environmental and social benefits.

### Environmental objectives by Swedish parliament :

1. 50 percent reduction of waste going to landfills, excluding mining waste.
2. By 2010 minimum of 50% of household waste shall be recovered through material recycling, including biological treatment
3. By 2010 35 percent of food waste from households, restaurants, large-scale kitchens, and stores shall be recycled through biological.
4. By 2010 latest, food waste, and consequently also equivalent waste from food industries etc., shall be recycled through biological treatment.
5. By 2010 60 percent of phosphorus pollution in effluent shall be treated and used on productive lands, of which at least half should be used on arable land.

# BEST PRACTICE: WASTE MANAGEMENT IN SWEDEN

## Treatment methods used:

1. material recycling- (Recycle & reduce)
2. Biological treatment—(composting, anaerobic digestion)
3. waste-to-energy----(waste incineration)
4. landfill---(untreated waste, needs strict treatment framework)

## Laws & regulation involved:

1. Segregation laws at municipality level
2. Treatment method regulations
3. regulations on air and water emissions from waste incineration since the middle of the 1980's.

## Collection & transportation:

1. 650 recycling centers
2. At the recycling centers, the main part of households' bulky waste, hazardous waste and waste from electric and electronic equipment (weee) can be handed in.
3. The recycling stations have separate containers for newspaper and different types of packaging materials. Several municipalities have implemented curbside collection of material which falls under producers' responsibility, from apartment blocks and detached house properties, a collection system which is becoming more common.
4. Another collection system, which is used, is optic sorting of different colored bags that are put into the same container.
5. Collections with separate containers one for bio-waste and one for combustible waste, collections with a multi-compartment system, or through optical sorting of different colored bags that are placed into the same container.

# Best Practice: Waste Management In Sweden

## Collection & transportation:

1. back loading vehicles are still the most common when it comes to waste collection, but the technology for multi-compartmented vehicles is developing and becoming more and more
2. Manual handling of waste is being replaced by new technology and automated systems, such as refuse vacuum pipes and underground container systems.
3. two kinds of vacuum collection systems, a stationary system and a mobile system.
4. the containers are collected by hook-lift vehicles

## Material recycling:

1. part of material recycling which includes packaging, paper, electrical waste, as well as bulky waste collected as metal fraction in municipal recycling centers.
2. recycling centers for bicycles and garden furniture
3. Producers of packaging and paper and local authorities have made a joint agreement with increased recycling as the common objective. The joint agreement aims to provide clearer information, better methods of evaluating services, research and development, locally adjusted systems and better coordinated planning of the waste management as a whole.

# BEST PRACTICE: WASTE MANAGEMENT IN SWEDEN

## Waste treatments of different materials:

1. lead and cadmium can be recycled through the re-melting of batteries. toxic and persistent organic substances, such as pesticides and other hazardous chemical wastes, are incinerated at high temperatures
2. Contaminated soil can be decontaminated through biodegradation. Impregnated wood contains ecologically harmful substances such as arsenic, creosote, and copper. Collected wood is chipped and incinerated in specially licensed waste-to-energy plants.
3. collaboration means that local authorities assume responsibility for the collection of electrical and electronic waste and the producers are responsible for its treatment.
4. Plastic casings are incinerated in waste-to-energy plants, and metal is recycled in smelting plants.
5. the glass and metal contents are recycled, and methods enabling the recycling of the phosphorus powder with its mercury content, are being developed
6. through anaerobic digestion of biological waste, biogas, consisting of methane and carbon dioxide, is produced.
7. anaerobic digestion also produces digestate, which is an excellent fertilizer.
8. the compost produced at plants is mainly used as soil improver or in soil mixtures

# WASTE MANAGEMENT IN SWEDEN

## WASTE TO ENERGY:

1. household waste went to incineration with energy recovery. waste-to-energy accounts for 48.5 percent of the total amount of treated household waste. (a study on european waste to-energy production shows that Sweden has the highest rate of energy recovery from waste incineration)
2. waste incineration with energy recovery also takes place in plants which do not treat household waste
3. Part of the slag goes to landfills, while slag gravel may be used as substitute to natural gravel in, for example, road and landfill construction work.

## Landfill:

1. 2003 the environmental objective, to halve the waste going to landfills compared with 1994, was achieved.
2. landfill gas was recovered from 47 active sites. approximately 310 gwh was used for energy production, of which 24 gwh was used for electricity.
3. Landfill attend to the separation of waste materials going to treatment, to transport on to recovery and recycling, and to energy recovery.

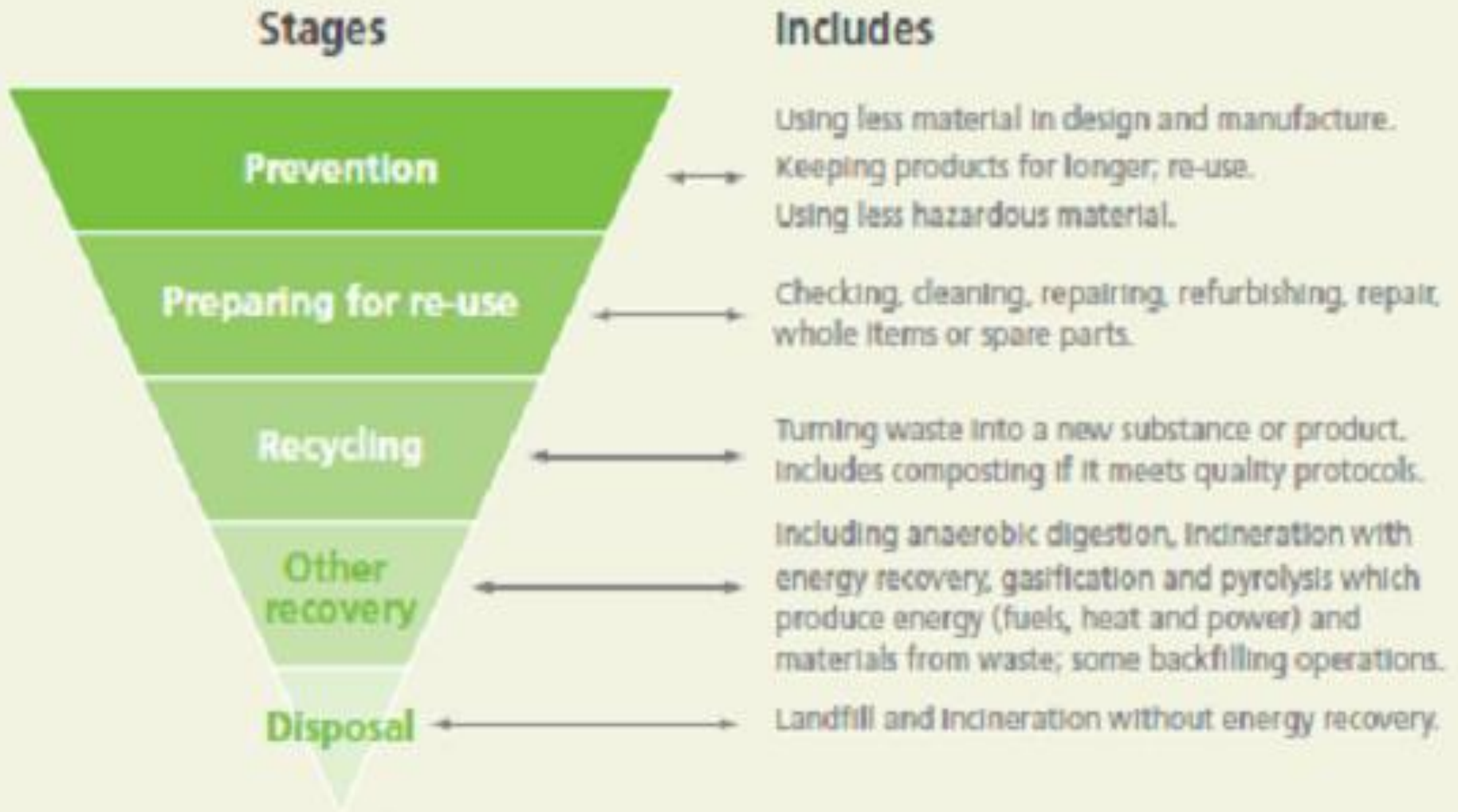
# BEST PRACTICE: WASTE MANAGEMENT IN UK

## EVOLUTION OF WASTE TO ENERGY

1. Landfill earlier incinerator not seen as good by public
2. incineration emission control 1989.
3. New plants by 1980-1993
4. mid 90's potential of waste management on environ was reorganized
5. diversion of biodegradable waste from landfill
6. landfill tax escalator
7. development of a new generation of energy from waste plants with energy generation in addition to waste management as a key part of their function and business model
8. emissions limit, monitoring, waste reception and treatment standards
9. Waste Incineration Directive
10. Industrial Emissions Directive
11. landfill should be last resort
12. waste prevention, re-use and recycling
13. employing more efficient technologies to maximize the energy we get out of it

# BEST PRACTICE: WASTE MANAGEMENT IN UK

## The Waste Hierarchy



# BEST PRACTICE: WASTE MANAGEMENT IN UK

## APPROACH AND REGULATIONS

1. market-led approach to infrastructure
2. residual waste for use in energy recovery can also be problematic, particularly for new technologies or less established companies
3. recycled are not currently, and go to energy recovery or landfill.
4. route which produces the lower volume of GHG
5. methane as GHG can escape from landfill site.
6. Waste Framework Directive: recovery should be used ahead of an alternative that is classified as disposal. R for recovery, D for disposal. In the current directive the classifications of particular relevance to energy from waste are:
  7. R1 – Use principally as a fuel or other means to generate energy
  8. D10 – Incineration on land
9. Waste may be exported for recovery.
10. Within this context a free market
11. Operates for the recovery of waste and waste derived fuels.



## 4.3.5 INTEGRATED SOLID WASTE MANAGEMENT

- Coordinated use of a set of waste management methods

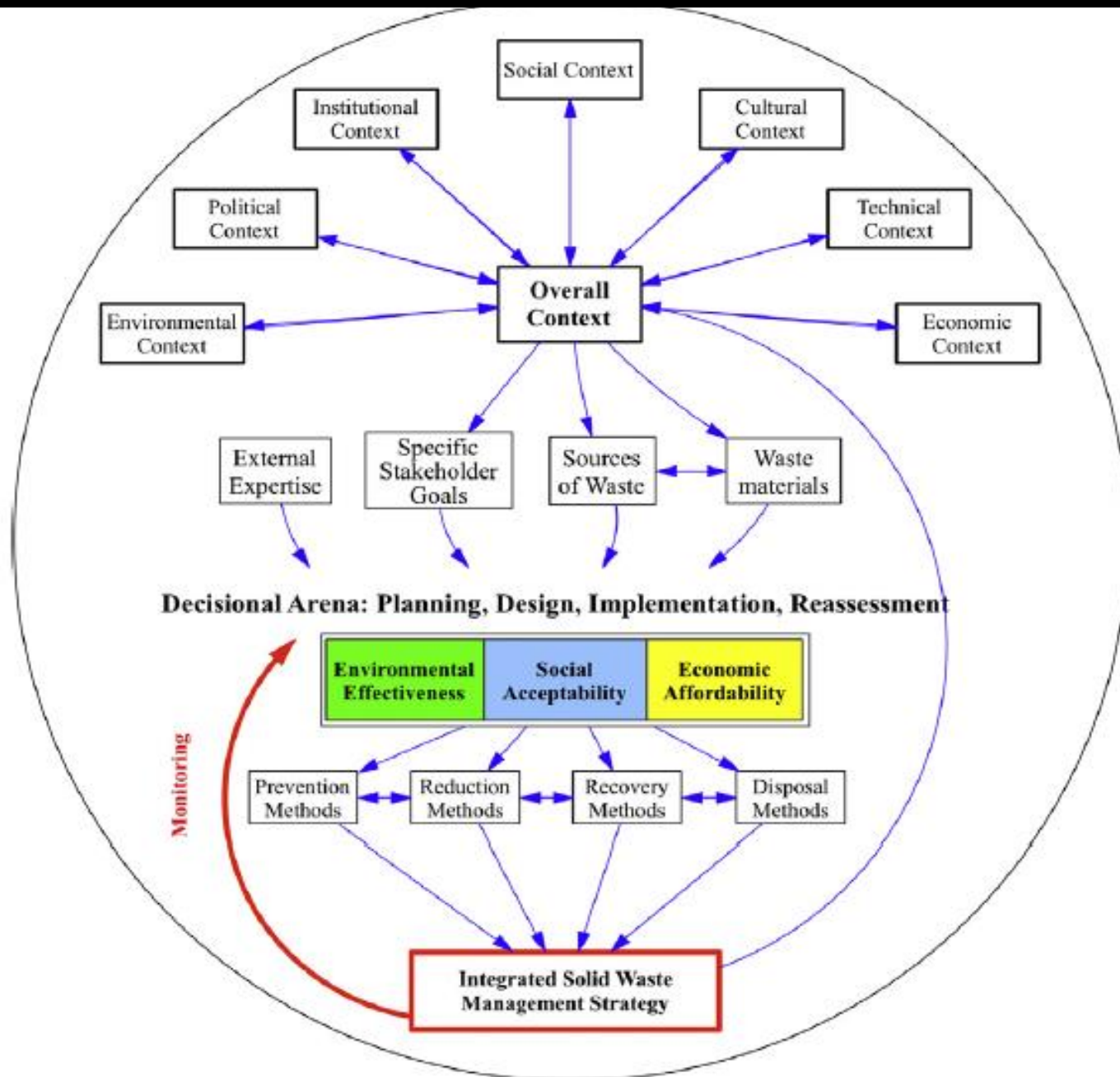
(Source: <http://www.gdrc.org/uem/waste/swm-glossary.html>)



- Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment.
- ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions.

(Source: <http://www.epa.gov/climatechange/wycd/waste/downloads/overview.pdf>)

# ISWM - PARADIGM



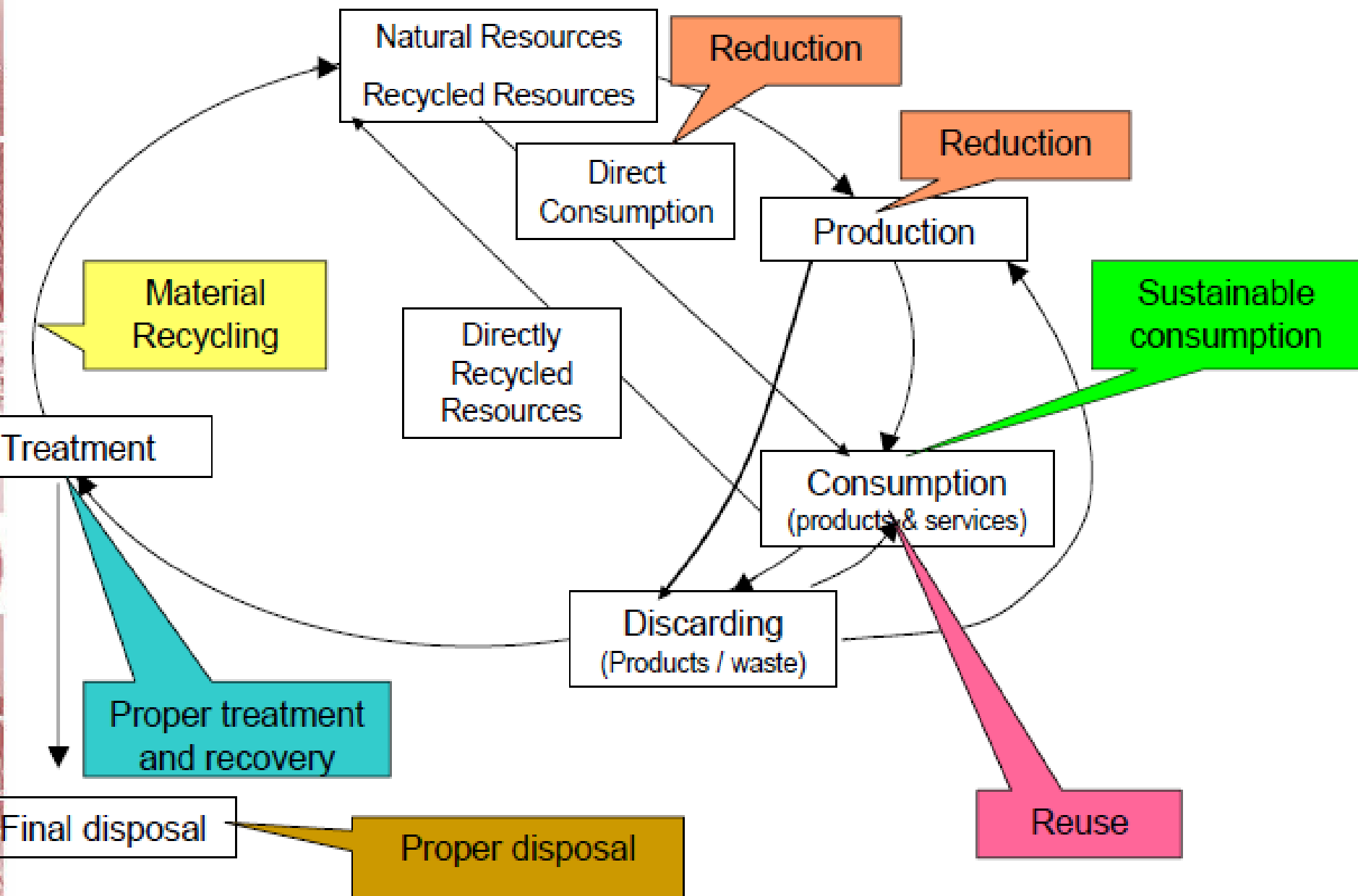
# ISWM PLAN

- An integrated approach to solid waste management, which will enable local/ national authorities to reduce the overall amount of waste generated and to recover valuable materials for recycling and for the generation of energy. This has the potential to augment the revenue of waste management activities, which will, in turn, help to compensate the expenditures for solid waste management.

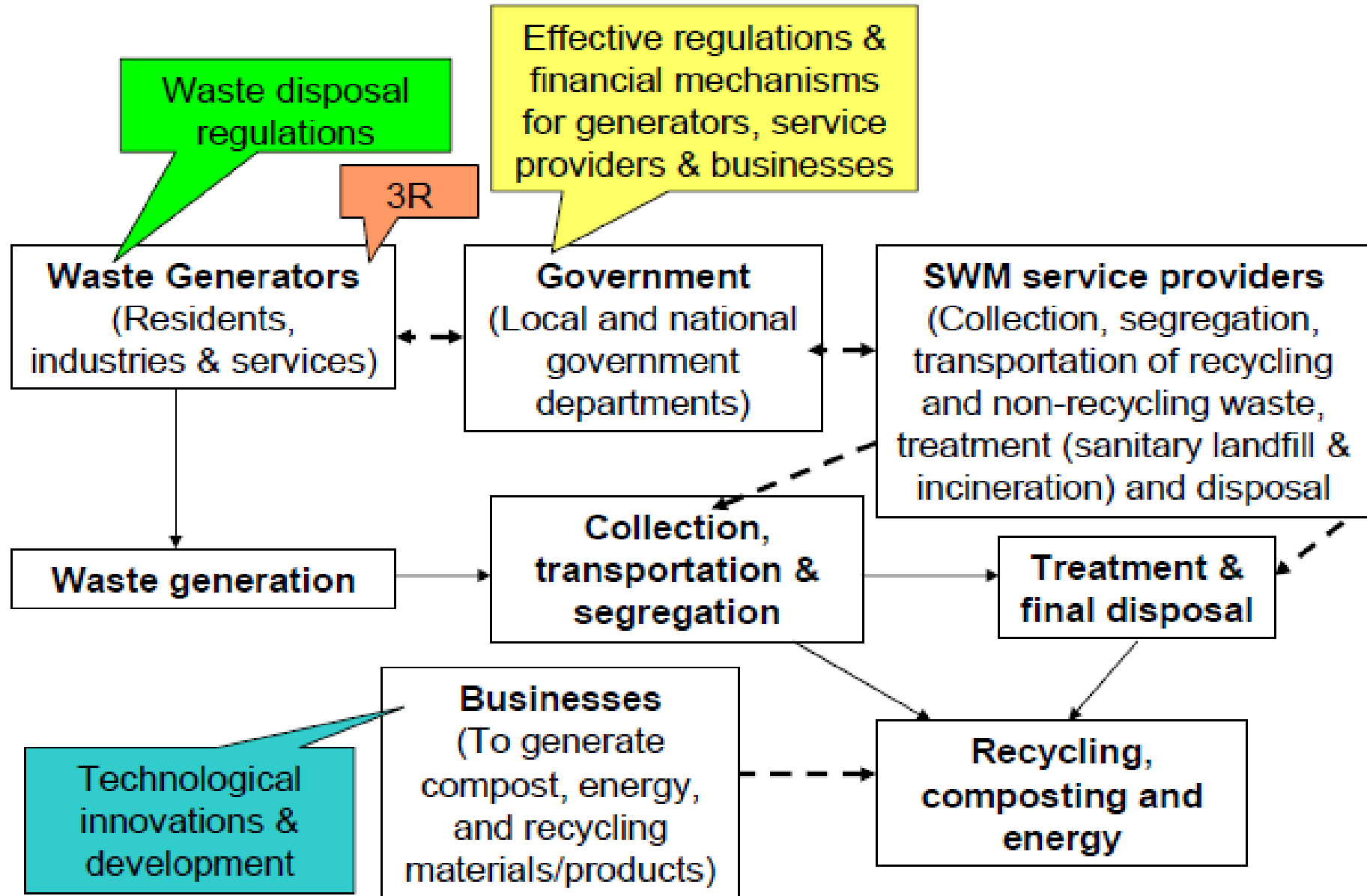
(Source: <http://www.unep.org/gpwm/FocalAreas/IntegratedSolidWasteManagement/tabid/56457/Default.aspx>)

- An ISWM Plan per se is a package consisting of a Management System including:
  - Policies (regulatory, fiscal, etc.),
  - Technologies (basic equipment and operational aspects)
  - Voluntary measures (awareness raising, self regulations)
- The concept of ISWM strives to strike a balance between three dimensions of waste management: environmental effectiveness, social acceptability, and economic affordability.

# ISWM – LIFE CYCLE PERSPECTIVE



# ISWM – STAKEHOLDERS/MANAGEMENT PERSPECTIVE



# BENEFITS & PROJECTS OF ISWM

## **BENEFITS**

- Cleaner and safe neighbourhoods
- Higher resource use efficiency
- Resource augmentation
- Savings in waste management costs due to reduced levels of final waste for disposal
- Better business opportunities and economic growth
- Local ownership & responsibilities / participation

## **IETC Projects on ISWM**

- ISWM Plan for Wuxi New District, PRC
- ISWM Plan for Pune City, India
- ISWM Plan for Maseru City, Lesotho
- ISWM Plan for Matale, Sri Lanka
- ISWM Plan for Novo Hamburgo, Brazil
- ISWM Plan for Nairobi, Kenya
- ISWM Plan for Bahir Dar, Ethiopia
- ISWM Plan for Pathum Thani, Thailand (on-going)
- ISWM Plan in Indonesia (starting soon)
- ISWM Plan for Addis Ababa (under consideration)

# 4.4 PROPOSALS

**4.4.1 APPROACH**

**4.4.2 VISION, OBJECTIVES & ACTION PLANS**

**4.4.3 Ideal service chain for SWM**

**4.4.4 BIN FREE**

**4.4.5 IEC Campaign**

**4.4.6 BIN FREE CENTRALIZED METHOD**

**4.4.7 BIN FREE CENTRALIZED METHOD**

**4.4.8 FINAL PROPOSAL – CENTRALIZED BIN FREE**

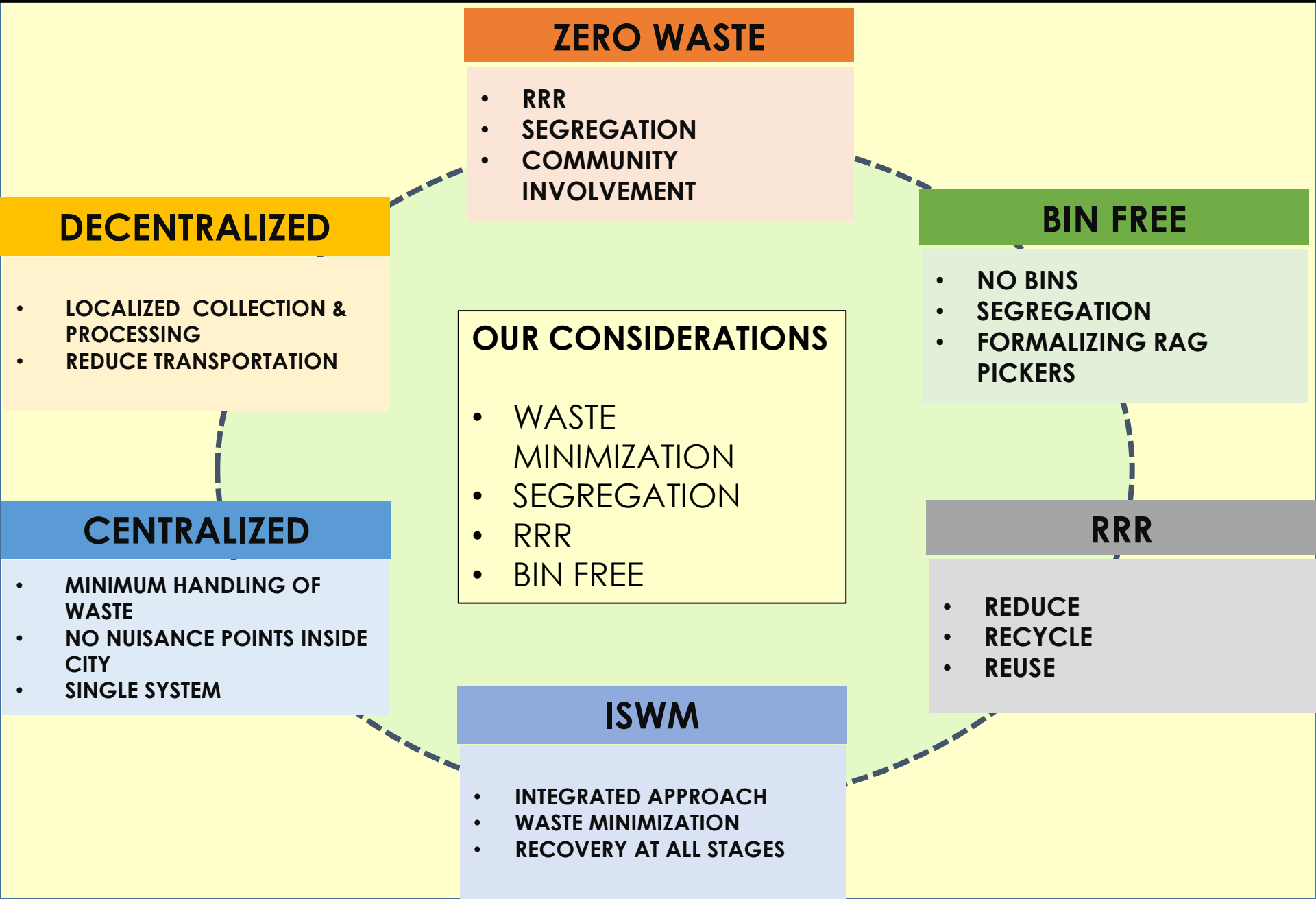
**4.4.9 MAINSTREAMING OF RAG PICKERS**

**4.4.9 PROJECT PHASING**

# PROPOSALS



# 4.4.1 APPROACH



## 4.4.2 VISION : ZERO WASTE

### Approach : Bin free – Centralized / Decentralized

***Objective : To develop Mehsana as a bin free city with recycle, reuse and reduce of MSW.***

- Segregation of waste at source level, through provision of bins for wet and dry segregation.
- Transportation of waste to treatment unit in segregated manner.
- Establish treatment facility for biodegradable waste.
- Incorporating informal sector for recycling of solid waste.

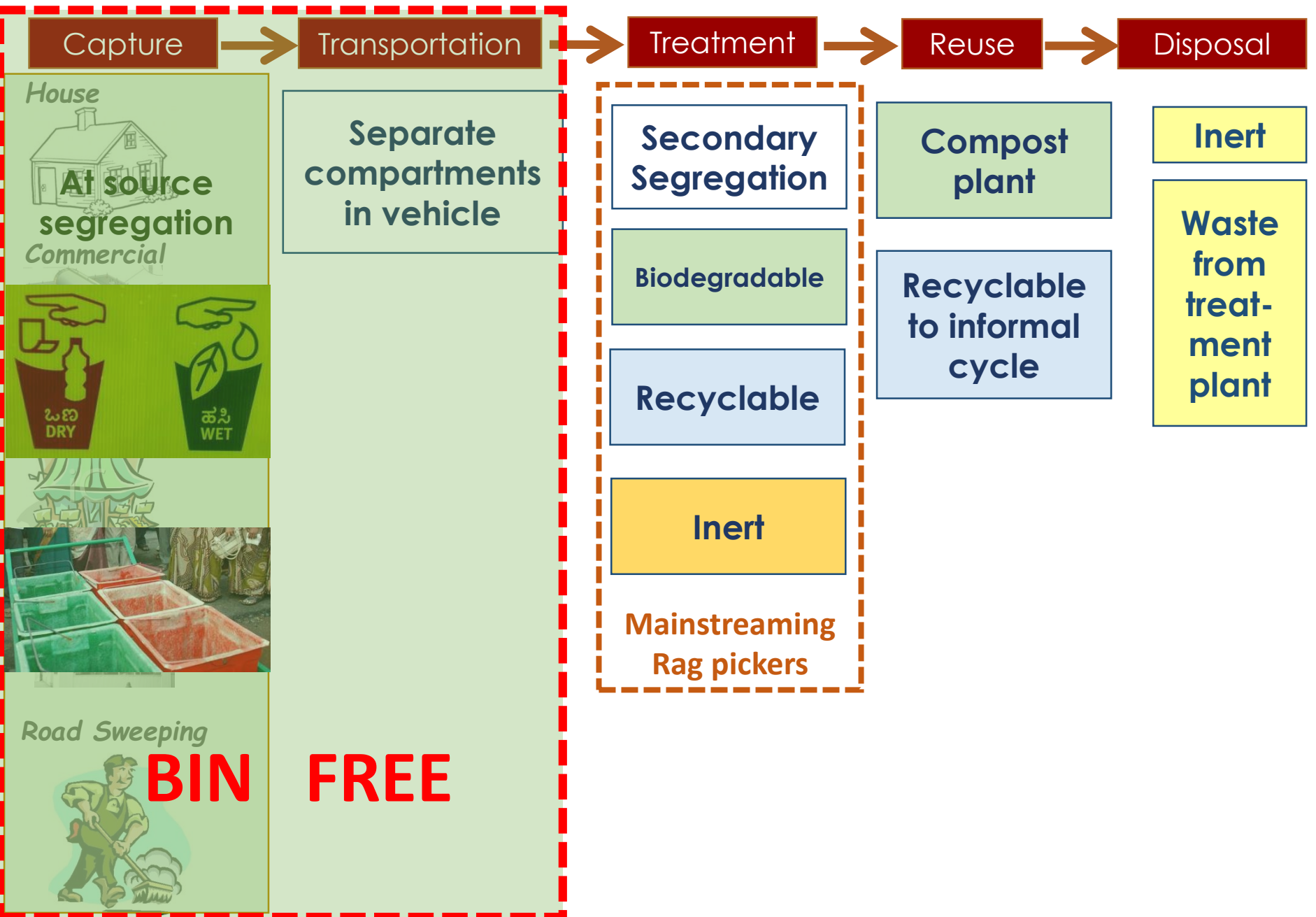
***Objective : To improve institutional capacity building.***

- Annual report of solid waste management in Mehsana.
- Waste auditing for solid waste management in Mehsana.
- Regular training and skill development programs of employees.

***Objective : To create public awareness and education regarding municipal solid waste***

- To introduce IEC campaign as a continuous procedure for the city Mehsana

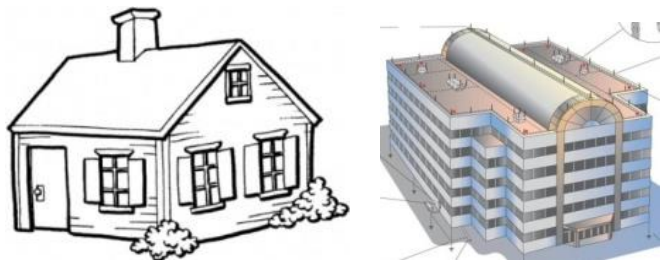
# 4.4.3 Ideal service chain for SWM



# 4.4.4 BIN FREE: CAPTURE AND TRANSPORTATION.

## SWEEPING, CLEANING & COLLECTION OF WASTE

Ward office



Collection of waste from houses, commercial & institutions in segregated manner



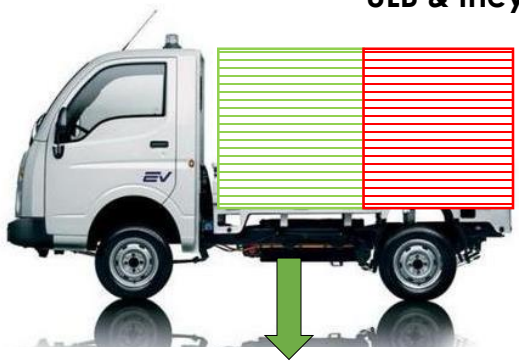
All sweepers hired by Contractor reports to ward officer



Segregated waste will be collected door to door in segregated manner by Tata Ace



Sweepers sweeps the allocated road, collects all garbage in a laari with two compartment provided by ULB & they dump it into tractor in segregated manner



Windrow composting Treatment Plant for **31MT/day** + Recyclable waste for resale

# 4.4.5 INFORMATION, EDUCATION AND COMMUNICATION (IEC)

## School Programs

- Children are strong communicators - message can be reinforced by holding essay, debates, slogan writings, drawing & painting competitions.
- Involvement of National Cadet Corps & National Social Service and Scouts - as part of their activities, they can be involved in awareness campaign



By organizing rallies



Sale of green & black bins

## Promotion at HH level

- Segregation at source
- Waste not to be thrown on road



## Street plays



Awareness among women through **mahila mandals & women associations.**



કચરો રસ્તા પર ફેંકશો તો દંડ થશે  
Penalty for littering on road

વારી-ગલ્વા-દુકાનવાળા કચરો રસ્તા પર ફેંકશે તો દંડ થશે  
Penalty for littering by handcarts/shop-keepers



ગાડીમાંથી કચરો રસ્તા પર ફેંકશો તો દંડ થશે  
Penalty for littering from moving vehicle

Mass communication: **print media, television, radio, internet and cinema theatres**

# INFORMATION, EDUCATION AND COMMUNICATION (IEC)

## Motivation & Training of Municipal Officials

- Awareness creation for strict monitoring
- By conducting training workshops
- Ward-wise rating: Once in a year
- Municipal officials should be involved in community participation project



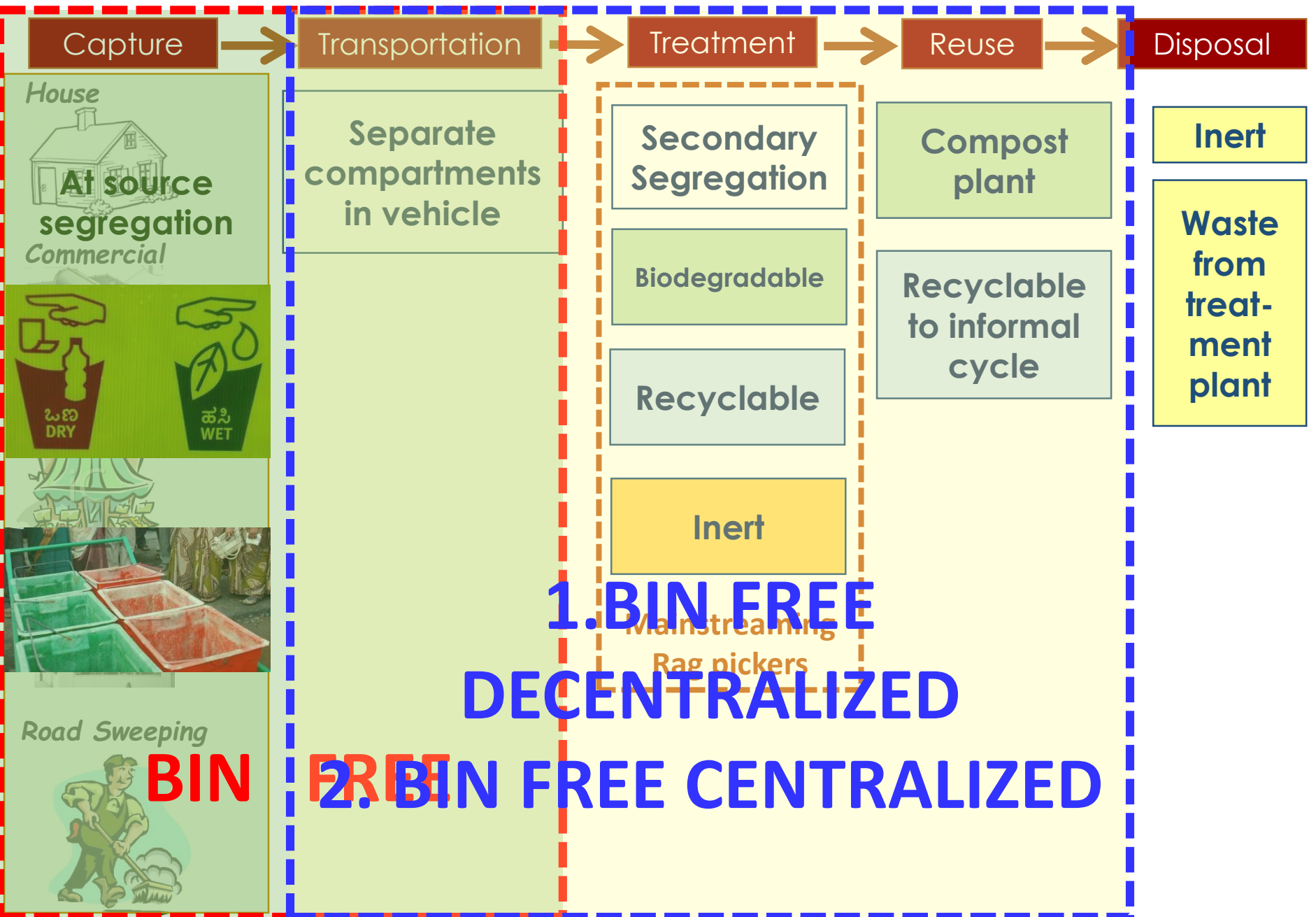
- Training & capacity building of **Local NGO's , CBO's, RWA's and other stake holders**
- By involving NGO's through tender advertisement & calls for taking up training assignment.

## Door to Door awareness & motivation campaign

- By asking people to segregate waste
- By clearing their doubts & asking questions about the project to kill any space for rumor mongering
- Distribution of Printed educational materials such as **posters, brochures and pamphlets** each house & commercial establishment, and the entire concept of segregation of waste is explained through materials.



# IDEAL SERVICE CHAIN FOR SWM



# BIN FREE

**Bin free**

**Centralized**

**Decentralized**

- Windrow
- Composting

- Biogas
- Vermi compost

- Cycle rickshaw
- Tata Ace

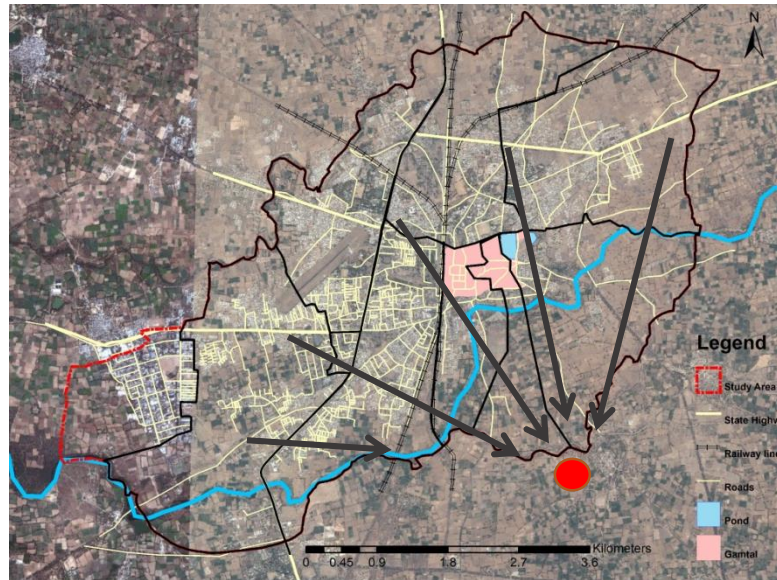
- Tata Ace for zone
- Tractor

Treatment

Transportation



# CENTRALIZED BIN FREE



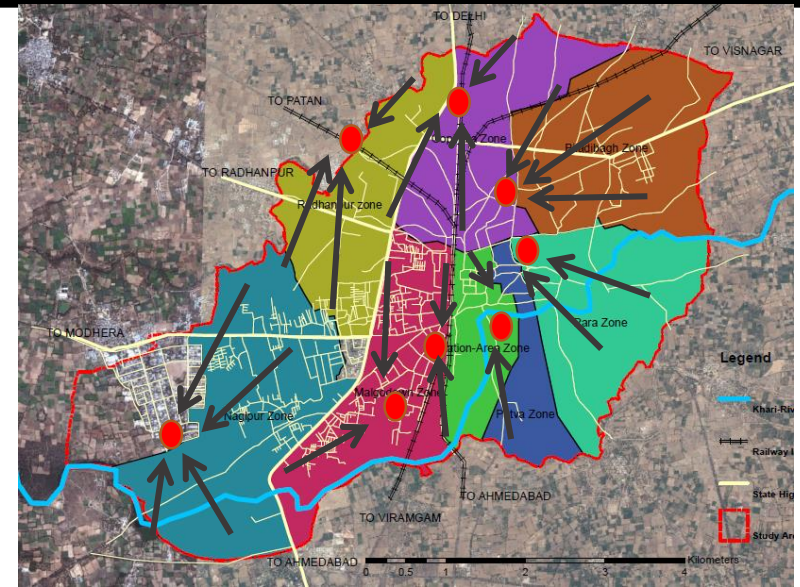
## Advantages:

- No nuisance points inside the city
- Easy to monitor
- Single overall system- less no. of stakeholders

## Limitations:

- Handling of segregated waste required

# DECENTRALIZED BIN FREE



## Advantages:

- Localized collection and processing of wastes.
- Transportation cost is less

## Limitations:

- Creation of nuisance points
- Identification of land pockets at many locations is difficult
- High level community participation

# TREATMENT TECHNOLOGY SELECTION

Quality of Waste

Quantity of waste

Availability

Capital, O&M and Cost recovery

Experience in Indian Scenario

Implementability

COMPOSTING

ANAEROBIC DIGESTION

INCINERATION

PYROLYSIS

RDF



- Applicable only for mixed waste
- Not widely applied in Indian Scenario
- Expensive and too advanced to be managed by the ULB
- High Environmental measures & Energy usage.

## CENTRALISED SYSTEMS

WINDROW COMPOSTING

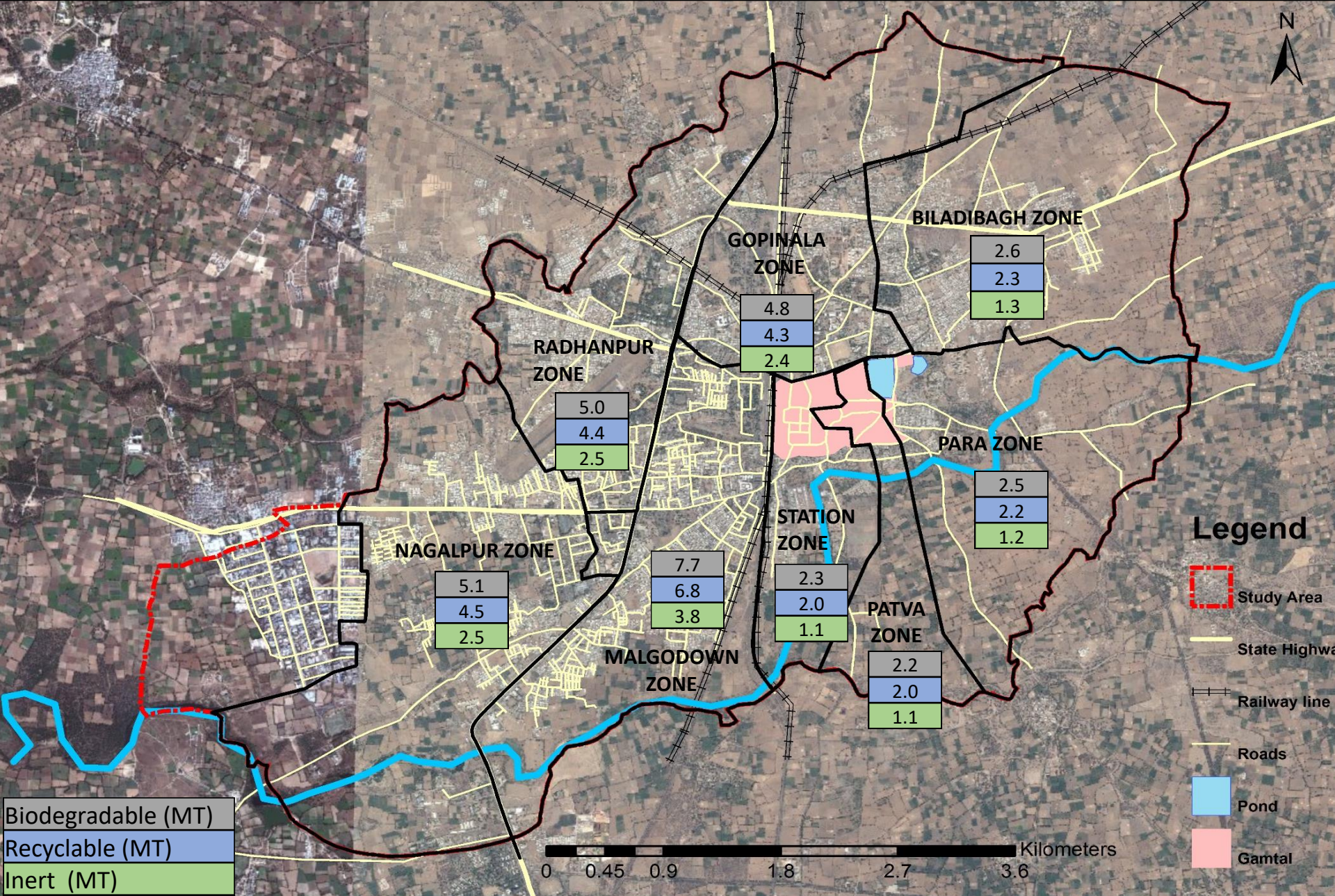
## DECENTRALISED SYSTEMS

BIO METHANATION

VERMI COMPOSTING

# 4.4.6 OPTION 1

# BIN FREE DECENTRALIZED SWM



# OPTION 1

# BIN FREE DECENTRALIZED SWM

	<b>Total</b>
<b>Population</b>	190453
<b>Area (Sq. Km)</b>	31
<b>Waste generated ward wise (MT)</b>	77
<b>Biodegradable (TPD)</b>	32
<b>Recyclable (TPD)</b>	28
<b>Inert (TPD)</b>	16

	<b>BIOGAS PLANT</b>	<b>VERMI COMPOST PLANT</b>
<b>Area (SQ.M.)</b>	536	2958
<b>Cost of plant (LAKH)</b>	295	235
<b>Total disposable waste (TPD)</b>	27	29
<b>Compost produced (TPD)</b>	21	19
<b>Cost per tonne (lakhs)</b>	9	7
<b>Area (Sq.m. per tonne)</b>	17	92

Please refer Annexure 4.4.6a

# OPTION 1

# BIN FREE DECENTRALIZED SWM

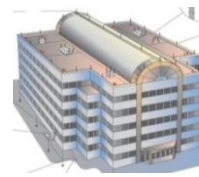
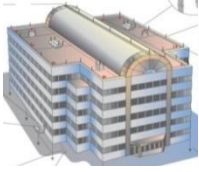
Total Population	190753
waste generated	76.57
No. of households in city	39419
No. of households covered by each Tata Ace	600
Possible no of Tata Ace if four trip/ Ace	16
Capital cost for Tata Ace(In Lakhs)	40
No of tractors/ No. of tata 407 (for inert waste)	5
Capital cost for Tata 407(In Lakhs)	31
<b>Total Capital Cost(In Lakhs)</b>	<b>71</b>
<b>total salary/ Month(In Lakhs)</b>	<b>6</b>
<b>O &amp; M cost/ Month (In Lakhs)</b>	<b>0.41</b>
<b>Cost/ household in city/ month (Rs.)</b>	<b>17</b>

# 4.4.7 OPTION 2 : BIN FREE CENTRALISED

## OPTION-1

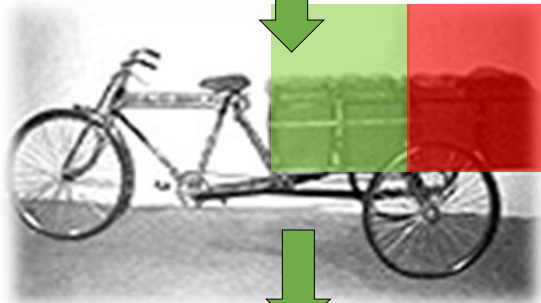
Total Household & commercial units **38283**

## OPTION-2



Segregated waste will be collected door to door & by sweeping in a segregated manner in tricycles

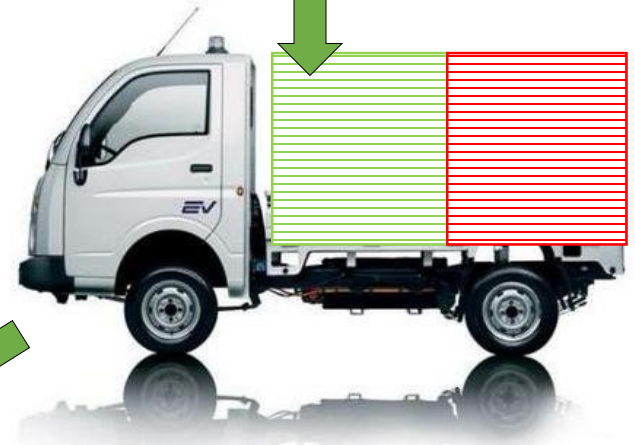
Segregated waste will be collected door to door & by sweeping in a segregated manner in Motorized Vehicle (Tata Ace)



No. of Tricycle required - **64**



No. of Tractors required - **12**



No. of Tata Ace required - **16**

Windrow composting Treatment Plant for **31MT/day** + Recyclable waste for resale

# OPTION 2:BIN FREE CENTRALISED

	Option-1	Option-2
Total Popl.	190753	190753
waste generated	76.57	76.57
No. of households in city	39419	39419
No. of househols covered by each rickshaw / No. of househols covered by each Tata Ace	228	600
possiable no of rikshaw if four trip/ rikshaw/ possiable no of Tata Ace if four trip/ Ace	64	16
Cost of rickshaw (In Lacks)	5.1	
No of tractors/ No. of tata Ace	12	16
Cost of tractor/ Tata Ace(In Lakhs)	112	40
<b>Total Capital Cost(In Lakhs)</b>	<b>112</b>	<b>40</b>
<b>total salary/ Month(In Lakhs)</b>	<b>5.28</b>	<b>3</b>
<b>O &amp; M cost/ Month (In Lakhs)</b>	<b>0.68</b>	<b>0.23</b>
<b>Cost/ household in city/ month (Rs.)</b>	<b>16</b>	<b>8</b>

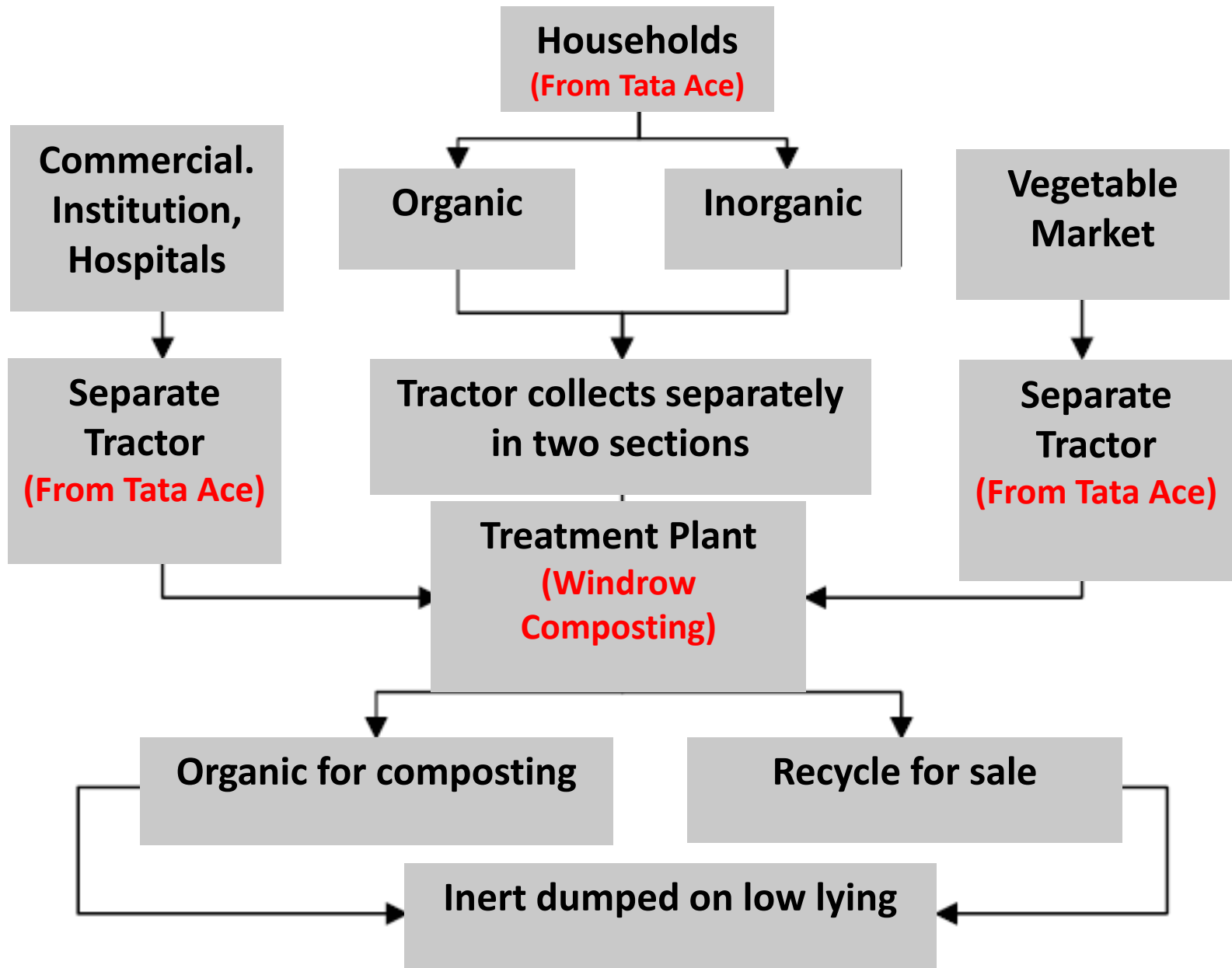
# OPTION 2: BIN FREE CENTRALIZED SWM

	<b>Total</b>
<b>Population</b>	190453
<b>Area (Sq. Km)</b>	32
<b>Waste generated ward wise (MT)</b>	76.57
<b>Biodegradable (TPD)</b>	31
<b>Recyclable (TPD)</b>	28
<b>Inert (TPD)</b>	16

	<b>WINDROW COMPOSTING</b>
<b>Area (Acre)</b>	1.3
<b>Cost of plant (LAKH)</b>	820
<b>Total disposable waste (TPD)</b>	27
<b>Compost produced (TPD)</b>	21
<b>Cost per tonne (lakhs)</b>	9
<b>Area (Sq.m. per tonne)</b>	17



# TRANSPORTATION & TREATMENT



# 4.4.8 PROPOSAL: DETAIL OF BIN FREE MECHANISM

**SWEEPING, CLEANING & COLLECTION OF WASTE WILL BE IN TWO SHIFT**

- MORNING TIME 8 am- 12 pm**
- EVENING TIME 2 pm – 6 pm**

**Timing- 11:30am to 12pm**  
 Segregated waste will  
 Transferred to treatment  
 Plant

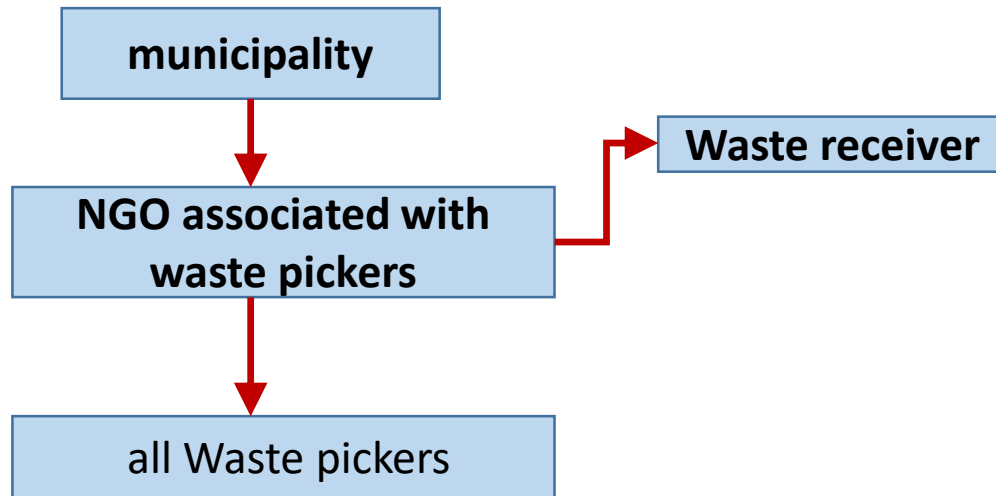


**Timing- 8am to 9:30am** Segregated waste will collected door to door & sweeping by segregated manner in Motorized Vehicle (Tata Ace)

**Timing- 9:30am to 10am** Segregated waste will Transferred to treatment Plant

**Timing- 10am to 11:30am** Segregated waste will collected door to door & sweeping by segregated manner in Motorized Vehicle (Tata Ace)

# 4.4.9 MAINSTREAMING RAG PICKERS



## Municipality to waste pickers

1. Acknowledge all reorganize the waste pickers
2. Prepare computerized detailed
3. Add new waste pickers

## NGO – WASTE PICKERS:

elected representative from waste pickers.

## NGO – MUNICIPALITY:

Ngo will report to the chief sanitary office of the municipality.

chief sanitary office will respond to requirements of the waste pickers via NGO

## Waste pickers NGO

1. Social obligation
2. Health and education obligations
3. Organize and distribute waste pickers
4. Acts as mediator b/w waste receiver and waste pickers.
5. Protect Rights of waste pickers
6. Prevention of child labor
7. Training and skill development

# Comparing Proposals

Treatment Plant	Decentralized	Centralized
	BIOGAS PLANT	WINDROW
Area requirement (Sq.m. per MT)	17	160
Total Area of plant (SQ.M.)	536	5260
Compost produced (TPD)	21	18.6
Total disposable waste (TPD)	27	28.4
Capital Cost per MT (lakhs)	9	3
Capital cost (Lakhs)	295	93
O & M cost (Lakhs)	20	6.51
<b>Transportation</b>		
Capital cost (Transportation) (Lakhs)	71	40
Staff (Transportation)	63	48
Establishment cost/ Year (Lakhs)	75	36
O & M cost/ Year (Lakhs)	5	2.8
Cost/ household / annum (Rs.)	204	96



# **ANNEXURES**

# Annexure 4.1.3a – CALCULATION OF ZONE WISE STAFFING

Ward name	Biladi bagh	Paraa	Patva pol	Station	Malgodown	Gopinala	Radhanpur	Nagalpur ambavadi	Total
Population	15719	14700	13230	13526	45731	28794	29553	30161	<b>190753</b>
Area (Sq. Km)	5	4	1	2	4	4	3	6	<b>29.0</b>
Density	3144	3675	13230	6763	11433	7199	9851	5027	<b>6600</b>
Road length (Km)	<b>6</b>	5	2	5	12	4	7	12	<b>53.0</b>
Tractor Staff	6	6	3	6	18	9	6	9	<b>63.0</b>
Permanent		4	1	2	1				<b>8.0</b>
Daily Contracted		21	28		15	18			<b>82.0</b>
Contractor's staff	20 (50)	0	15 (20)	45 (50)	35 (60)	43 (50)	20 (50)	58 (80)	<b>236 (360)</b>
Total Staff	<b>20</b>	<b>25</b>	<b>44</b>	<b>47</b>	<b>51</b>	<b>61</b>	<b>20</b>	<b>58</b>	<b>389</b>
Minimum labour as per CPHEEO	47	44	40	41	137	86	89	90	<b>574</b>
sweeper per 1000 population	1.27	1.70	3.33	3.47	1.12	2.12	0.68	1.92	<b>1.70</b>
Road length per sweeper (m)	300	200	45	106	235	66	350	207	163

Source: Prepared based on Municipality Data

Indicator	Mehsana	Benchmark
Road length per sweeper	<b>163m</b>	400-600m
Sweepers per 1000 population	<b>1.7</b>	3

# Annexure 4.1.4a - S W CALCULATIONS

Ward name	Biladi bagh	Paraa	Patva pol	Station	Malgodown	Gopinala	Radhanpur	Nagalpur ambavadi	Total
<b>Slums</b>	2	1	2	1	3	1	2	2	<b>14.0</b>
<b>Population</b>	14103	13956	5957	12874	40413	27397	22845	27951	<b>165495</b>
<b>Slum popl.</b>	1616	744	7273	652	5318	1397	6708	2210	<b>25918</b>
<b>Total Popl.</b>	15719	14700	13230	13526	45731	28794	29553	30161	<b>190753</b>
<b>Area (Sq. Km)</b>	1	1	1	2	4	2	3	5	<b>19.0</b>
<b>Tractor</b>	2		1						<b>3.0</b>
		2		2	6	3	2	3 (5)	<b>18.0</b>
<b>tractor trailer size( cu.m)</b>	3.5 cu.m. with uncompacted waste of 0.5 ton/cu.m. density = 1.75 ton per tractor trailer								
<b>waste collected per day (MT)</b>	3.5	3.5	1.7	3.5	10.4	5.2	3.5	5.2	<b>36.6</b>
<b>Dumpers</b>	8	3	2	5	6	5	7	10	<b>46.0</b>
<b>Dumper size (cu.m)</b>	4.5 cu.m. with compacted waste of 0.7 ton/cu.m. density = 3.4 ton per dumper								
<b>waste collected in dumpers (MT)</b>	6	2	1	4	4	4	5	7	<b>33.3</b>
<b>waste generated per day (MT)</b>	6.21	5.81	5.23	5.34	18.06	11.37	11.67	11.91	<b>75.6</b>
<b>waste generated in slums (MT)</b>	10%	5%	55%	5%	12%	5%	23%	7%	<b>14%</b>
<b>Total waste collected (MT)</b>	9.27	5.65	3.19	7.10	14.79	8.84	8.54	12.46	<b>69.8</b>
<b>Collection efficiency</b>	149%	97%	61%	133%	82%	78%	73%	105%	<b>92%</b>



# Annexure 4.1.3b- ESTIMATION OF EXISTING DUMP SITE

## CALCULATION FOR CURRENT LANDFILL SITE

Total waste collected (2006-2013) = 26189.33 tonn

Area required to dump the waste = 2618.933 sq.m = **0.84 acres** with land filled height of 10 m.

- **Proposed shift to sanitary landfill site by 2017**
- **How much waste generated and How much area it requires ?**

Total waste generated (2013-2017) = 19107.06 tonn

Area required to dump the waste = 1910.706 sq.m = **0.57 acres** with land filled height of 10 m.

**Total area required till 2017 at (panch-khetar) = 0.84+0.57=1.5 acre with 10 m height.**

# Annexure 4.2.2a – MoUD INDICATORS

Indicator	Definition	Frequency of measurement	Geographical jurisdiction for measurement
Household level coverage of SWM services through door-to-door collection of waste	Percentage of households and establishments that are covered by a daily doorstep collection system	Quarterly	Ward level
Collection efficiency	The total waste collected by the ULB and authorised service providers versus the total waste generated within the ULB, excluding recycling or processing at the generation point. (Typically, some amount of waste generated is either recycled or reused by the citizens themselves. This quantity is excluded from the total quantity generated, as reliable estimates will not be available for these.)	Monthly	Ward level
Extent of segregation of waste	Percentage of waste from households and establishments that is segregated. Segregation should at least be at the level of separation of wet and dry waste at the source. Ideally, separation should be in the following categories: biodegradable, non-biodegradable and hazardous waste. It is important that waste segregated at the source is transported through the entire chain in a segregated manner. Hence the indicator is based on measurement of waste arriving in a segregated manner at the treatment/disposal site, rather than at the collection point. Bulk waste belonging to a specific category (e.g. vegetable market waste, food waste from hotels and restaurants, construction and debris waste, paper and plastics from offices) can be readily segregated by ensuring separate collection and transportation of the same.	Monthly	ULB level

Indicator	Definition	Frequency of measurement	Geographical jurisdiction for measurement
Extent of recovery of waste collected	This is an indication of the quantum of waste collected, which is either recycled or processed. This is expressed in terms of percentage of waste collected.	Monthly	ULB level
Extent of scientific disposal of waste at landfill sites	The amount of waste that is disposed in landfills that have been designed, built, operated and maintained as per standards laid down by Central agencies. This extent of compliance should be expressed as a percentage of the total quantum of waste disposed at landfill sites, including open dump sites.	Monthly	ULB level
Efficiency in redressal of customer complaints	The total number of SWM-related complaints redressed within 24 hours of receipt of the complaint, as a percentage of the total number of SWM-related complaints received in the given time period.	Monthly	Ward level
Extent of cost recovery for the ULB in SWM services	This indicator denotes the extent to which the ULB is able to recover all operating expenses relating to SWM services from operating revenues of sources related exclusively to SWM. This indicator is defined as the total annual operating revenues from SWM as a percentage of the total annual operating expenses on SWM.	Annually	ULB level
Efficiency in collection of SWM charges	Efficiency in collection is defined as current year revenues collected, expressed as a percentage of the total operating revenues, for the corresponding time period.	Annually	Ward level

Source: MoUD

# Annexure 4.2.2b – PAS INDICATORS

SWM	Unit	Description
<b>Access and coverage</b>		
1. Household level coverage of SWM services	%	This indicator captures the door to door collection of MSW. This is relevant as it forms a major part in the quantum of waste that can be treated, and scientifically disposed.
		<i>Total no. of HHs and establishments with door to door collection of MSW to the total no. of HHs and establishments in the city.</i>
<b>Service levels and quality</b>		
2. Efficiency of collection of municipal solid waste	%	This indicator captures the total quantum of waste that is collected at the treatment and/or disposal sites. This is relevant as it forms a major part in the quantum of waste that can be treated/ disposed.
		<i>Quantum of waste that is collected at the treatment/disposal sites to the total quantity of waste that is generated in the city.</i>
3. Extent of segregation of municipal solid waste	%	This indicator captures the segregation of waste, typically as dry and wet waste, but ideally as bio-degradable and non bio-degradable waste. Segregated waste enables increased efficiencies in treatment, recycling and scientific disposal of waste.
		<i>Quantity of segregated waste received at treatment/ disposal sites to the total waste collected by the service providers.</i>
4. Extent of municipal solid waste processed/ recycled	%	This indicator captures the quantity of waste that is recycled or processed at the treatment plant.
		<i>Quantum of waste that is recycled or processed to the total waste that is collected by the service providers.</i>
<b>Financial Sustainability</b>		
5. Extent of cost recovery (O&M) in SWM services	%	This indicator captures the revenues (taxes, user charges, fees) recovered by the ULB against the expenses incurred. This denotes the cost control measures, if any, that need to be considered by the ULB, and also a critical factor in tariff charges.
		<i>Percentage of total operating revenues from SWM related charges to total operating expenses on SWM</i>

# Annexure 4.2.2b – PAS INDICATORS cont...

SWM	Unit	Description
<b>Efficiency in Service Operations</b>		
6. Extent of scientific disposal of municipal solid waste	%	This indicator captures the quantum of waste that is disposed in scientific engineered landfills. This is an important indicator as it assesses the amount of waste that is safely disposed as against waste that is disposed in open dumps.
		<i>Quantum of waste that is disposed in scientific/compliant landfills to the total quantum of waste disposed in compliant and open disposal sites.</i>
7. Efficiency in redressal of customer complaints	%	This indicator captures the number of complaints made by consumers that have been resolved by the ULB, as per service charter standards. It is an important indicator which directly assesses the consumer satisfaction level.
		<i>Total number of SWM related complaints redressed within time as stipulated in service charter of the ULB, as a percentage of the total number of SWM related complaints received in the year</i>
8. Efficiency in collection of SWM related charges	%	This indicator captures the extent of collection of revenues billed by the ULB. It denotes the revenues that are due to the ULB from taxes and charges.
		<i>Percentage of current year revenues collected from SWM related taxes and charges as a percentage of total billed amounts (for SWM)</i>
<b>Equity</b>		
9. HH level coverage of SWM services in 'slum settlements'	%	This indicator captures the number of HHs serviced by door to door MSW collection in slum settlements. This measures the service level provision to the urban poor.
		<i>Total households in slum settlements serviced by door-to-door collection of MSW as a percentage of total number of HHs in slums.</i>

# Annexure 4.4.6a- OPTION 1 BIN FREE DECENTRALIZED SWM

Ward name	Biladi bagh	Paara	Patva pol	Station	Malgodown	Gopinala	Radhanpur	Nagalpur	Total
Population	15719	14700	13230	13526	45731	28794	29553	30161	190453
waste generated ward wise (MT)	6	6	5	5	18	12	12	12	77
biodegradable (TPD)	3	2	2	2	8	5	5	5	32
recyclable (TPD)	2	2	2	2	7	4	4	4	28
inert (TPD)	1	1	1	1	4	2	2	3	16
<b>BIOGAS PLANT</b>									
Area (SQ.M.)	44	41	37	38	128	81	83	84	536
cost of plant (LAKH)	24	23	20	21	70	44	46	46	295
total disposable waste (TPD)	2	2	2	2	7	4	4	4	27
compost produced (TPD)	2	2	1	1	5	3	3	3	21
<b>VERMI COMPOST PLANT</b>									
area (sq.m.)	243	227	204	209	707	445	457	466	2958
cost of plant (LAKH)	19	18	16	17	56	35	36	37	235
total disposable waste (TPD)	2	2	2	2	7	4	4	5	29
compost produced (TPD)	2	1	1	1	5	3	3	3	19

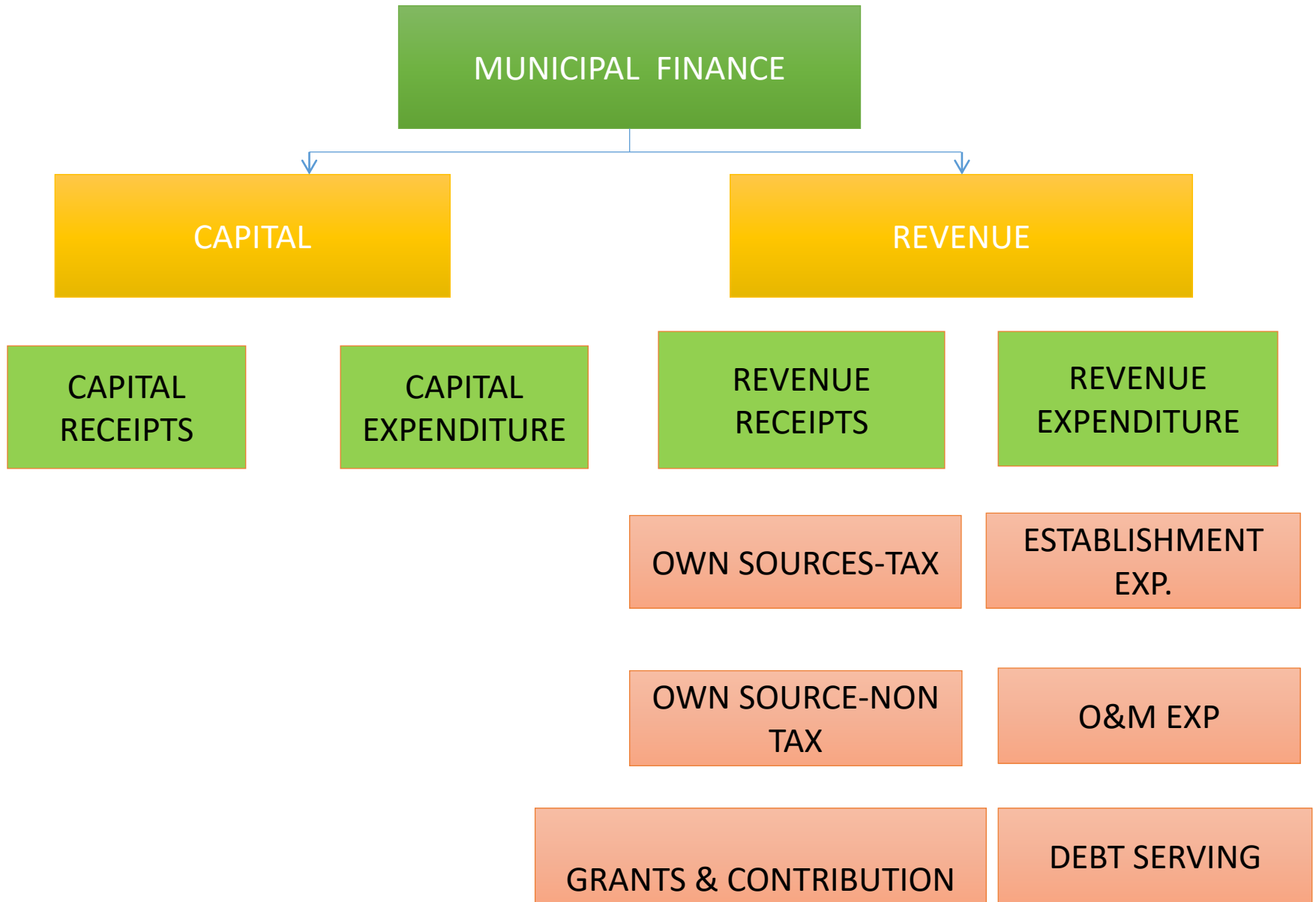
**FINANCE**

## **CONTENTS:**

- 5.1 Structure of municipal finance
- 5.2 Municipal finance analysis steps
- 5.3 Revenue Account
- 5.4 Capital Account
- 5.5 Sectoral Analysis
- 5.6 Projections
- 5.7 Capital Financing
- 5.8 Revenue Account Financing
- 5.9 Summary



# Structure of Municipal Finance



# Overview of Mehsana Municipal Finance

<b>REVENUE ACCOUNT</b>	2007-08	2008-09	2009-10	2010-11	2011-12
Revenue Reciepts	1,376.81	2,022.09	2,310.39	2,930.76	2,226.53
Revenue Expenditure	881.51	1,471.11	1,438.82	1,505.32	1,449.66
Operating ratio	0.64	0.73	0.62	0.51	0.65
<b>CAPITAL ACCOUNT</b>					
Capital Reciepts	68.55	321.47	179.93	-	10.92
Capital Expenditure	199.01	283.88	178.65	680.34	374.51
Capital Utilisation	290%	88%	99%	-	3431%
<b>EXTRA-ORDINARY ACCOUNT</b>					
Extraordinary Reciepts	303.28	218.84	151.96	178.07	114.88
Extraordinary Expenditure	248.89	187.67	144.33	131.21	92.12
<b>SUMMARY</b>					
Total Reciepts	1,748.64	2,562.41	2,642.28	3,108.83	2,352.33
Total Expenditure	1,329.40	1,942.66	1,761.80	2,316.87	1,916.28
Closing Balance	419.24	619.75	880.49	791.96	436.04

# Municipal Finance Analysis steps

Secondary Data collection



Data Recasting



Data analysis

મહેસાણા નગરપાલિકા મહેસાણા  
અર્થ વહીવટ  
EXPENSE FOR YEAR 2008-2009

ક્રમ નંબર	વર્ગ	વિગ્રહ	TOTAL for Apr. to June 2008	TOTAL for Apr. to September 2008	TOTAL for OCT., NOV., DEC. 08	TOTAL FOR APRIL TO DEC.08	TOTAL FOR JANU TO MARCH 09	TOTAL FOR APRIL TO MARCH 09
1	સામાન્ય સર્વિસ	સામાન્ય સર્વિસ કાર્યાલય	4400.00	4400.00	0.00	4400.00	2270.00	6670.00
		સામાન્ય સર્વિસ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		સામાન્ય સર્વિસ વાહી વાહન	1200.00	1200.00	0.00	1200.00	0.00	1200.00
		સામાન્ય સર્વિસ વાહીવહી વાહન	1658.00	3650.00	1740.00	5390.00	2328.00	7719.00
		સામાન્ય સર્વિસ વાહીવહી વાહન કુલ	0.00	7479.63	51644.00	126401.00	265563.00	1529973.00
		સામાન્ય સર્વિસ વાહીવહી વાહન કુલ	6419.00	17910.00	22910.00	40900.00	69000.00	69000.00
		સામાન્ય સર્વિસ વાહીવહી વાહન કુલ	0.00	21727.00	9778.00	31505.00	9350.00	40855.00
		સામાન્ય સર્વિસ વાહીવહી વાહન કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		<b>TOTAL (1)</b>	<b>396160.00</b>	<b>783540.00</b>	<b>545875.00</b>	<b>1329415.00</b>	<b>325602.00</b>	<b>1655017.00</b>
2	કાર્યકારી વહીવટ	કાર્યકારી વહીવટ	0.00	0.00	0.00	0.00	0.00	0.00
		કાર્યકારી વહીવટ કુલ	691311.00	1460387.00	631762.00	2092149.00	522439.00	2614588.00
		કાર્યકારી વહીવટ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		કાર્યકારી વહીવટ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		કાર્યકારી વહીવટ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		કાર્યકારી વહીવટ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		કાર્યકારી વહીવટ કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		<b>TOTAL (2)</b>	<b>691311.00</b>	<b>1460387.00</b>	<b>631762.00</b>	<b>2092149.00</b>	<b>522439.00</b>	<b>2614588.00</b>
3	મોડીયા કાર્ય	મોડીયા કાર્ય કાર્યાલય	9065.00	34165.00	1000.00	35165.00	12805.00	47970.00
		મોડીયા કાર્ય કુલ	0.00	0.00	0.00	0.00	0.00	0.00
		મોડીયા કાર્ય વાહીવહી વાહન	0.00	0.00	0.00	0.00	0.00	0.00
		મોડીયા કાર્ય વાહીવહી વાહન કુલ	0.00	0.00	0.00	0.00	10000.00	10000.00

મહેસાણા નગરપાલિકા મહેસાણા  
અર્થ વહીવટ  
INCOME FOR YEAR 2008-2009

ક્રમ નંબર	વર્ગ	વિગ્રહ	TOTAL for Apr. to June 2008	TOTAL for JULY, AUG., SEPT. 08	TOTAL for Apr. to September 2008	TOTAL for OCT., NOV., DEC. 08	TOTAL FOR APR 08 TO DEC. 08	TOTAL FOR JANU 09 TO MAR. 09	TOTAL FOR APR 08 TO MAR. 09
1	સુધારા કાર્ય	સુધારા કાર્ય	1017907.09	620041.10	1637948.19	29967867.67	31605916.86	10010430.00	41516345.86
		સુધારા કાર્ય કુલ	646133.72	415736.75	1061870.47	15218462.16	16280332.83	3528165.00	19808497.63
		સુધારા કાર્ય કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		સુધારા કાર્ય કુલ	40150.00	46025.00	86175.00	45050.00	131225.00	46225.00	177450.00
		સુધારા કાર્ય કુલ	59522.88	51238.00	110760.88	1244613.00	1355373.88	230984.00	1586357.88
		<b>TOTAL (1)</b>	<b>1763713.89</b>	<b>1133040.85</b>	<b>2896794.54</b>	<b>46476092.83</b>	<b>49372847.37</b>	<b>13815804.00</b>	<b>63188651.37</b>
2	આવક વહેંચણી કમી ઉપજ	આવક વહેંચણી કમી ઉપજ	37457.00	6090.00	43547.00	2612.50	46159.50	1100.00	47259.50
		આવક વહેંચણી કમી ઉપજ કુલ	15668.00	42500.00	58168.00	58250.00	116418.00	48050.00	164468.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	1100.00	1100.00	0.00	1100.00
		આવક વહેંચણી કમી ઉપજ કુલ	60600.00	64350.00	124950.00	45150.00	170100.00	44850.00	214750.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		આવક વહેંચણી કમી ઉપજ કુલ	17883.00	14989.00	32672.00	69869.00	102741.00	25255.00	127995.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		આવક વહેંચણી કમી ઉપજ કુલ	115877.00	95115.00	210992.00	179993.00	390985.00	725209.00	1116194.00
		આવક વહેંચણી કમી ઉપજ કુલ	681215.00	7963136.00	8644351.00	4169547.00	12813898.00	5239654.00	18053552.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		આવક વહેંચણી કમી ઉપજ કુલ	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>TOTAL (2)</b>	<b>928700.00</b>	<b>8186180.00</b>	<b>9114880.00</b>	<b>4526521.50</b>	<b>13641401.50</b>	<b>6083918.00</b>	<b>19725319.50</b>

- Expenditure and income statements from Mehasana municipality for the year 2007-2012.
- Translating data from Gujarati to English

# Municipal Finance Analysis steps



Categories for Recasting Budgets		
Function Group Code	Function Group	Includes
1	General Administration	Municipal body, Administration, Tax collection, Record keeping
2	Social Safety & Security	Fire services, Street lighting
3	Public Health & welfare	Water supply, Sanitation, Drainage, Storm water, SWM, Medical facilities, Welfare departments
4	Education	Education institutes, Library
5	Contribution	Towards PPF, Reserve fund, Sinking fund
6	Other departments	

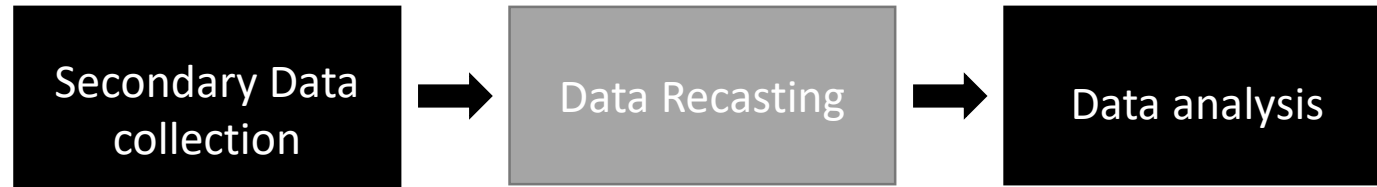
  

Sector Code	Sector	Includes
WS	Water Supply	
WW	Waste Water	Drainage, Gutters, Public toilets, Storm water
SWM	Solid Waste Mgmt.	SWM, conservancy, Street Cleaning/sweeping, Cattle Pounding, Veterinary Services, Burial/Cremation, Stray animals
G	Others	

Account Code	Account Details	Detail Code	
R	Revenue Receipts	1	Property tax
		2	Other taxes
		3	Water/sewerage benefit tax, Sub tax
		4	Special Charges
		5	Service charges
		6	Grants
		7	Others
R	Revenue Expenditure	1	Administrative & Establishment
		2	Bulk water
		3	Energy
		4	Other O & M
		5	Interest payment
		6	Miscellaneous
C	Capital Receipts	1	State tied grants (projects/schemes)
		2	State untied grants
		3	Central tied grants
		4	Central untied grants
		5	External funds
		6	Others
C	Capital Expenditure	1	Capital work in progress
		2	Principal repayment of external funds
		3	Others
E	Extra-ordinary Receipts		
E	Extra-ordinary Expenditure		

# Municipal Finance Analysis steps



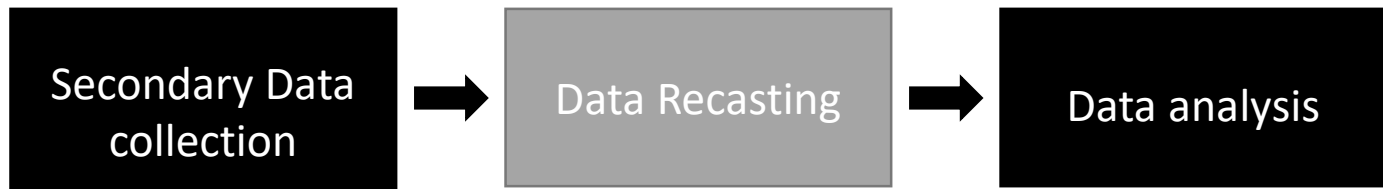
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E	Extra-ordinary Expenditure		

Data recasting done with the help of sample sheet provided by PAS, Ahmedabad.

# Municipal Finance Analysis steps



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E	Extra-ordinary Expenditure	

Data recasting done with the help of sample sheet provided by PAS, Ahmedabad.

## Reasons for Recasting

There is no clear distinction between the revenue, capital and the extra-ordinary accounts.

The budget therefore fails to give a clear idea of the operating expenses & its distribution, the capital works undertaken by the local body.

This becomes a major hurdle to analyze trends and project the revenues and expenditures of the ULB.

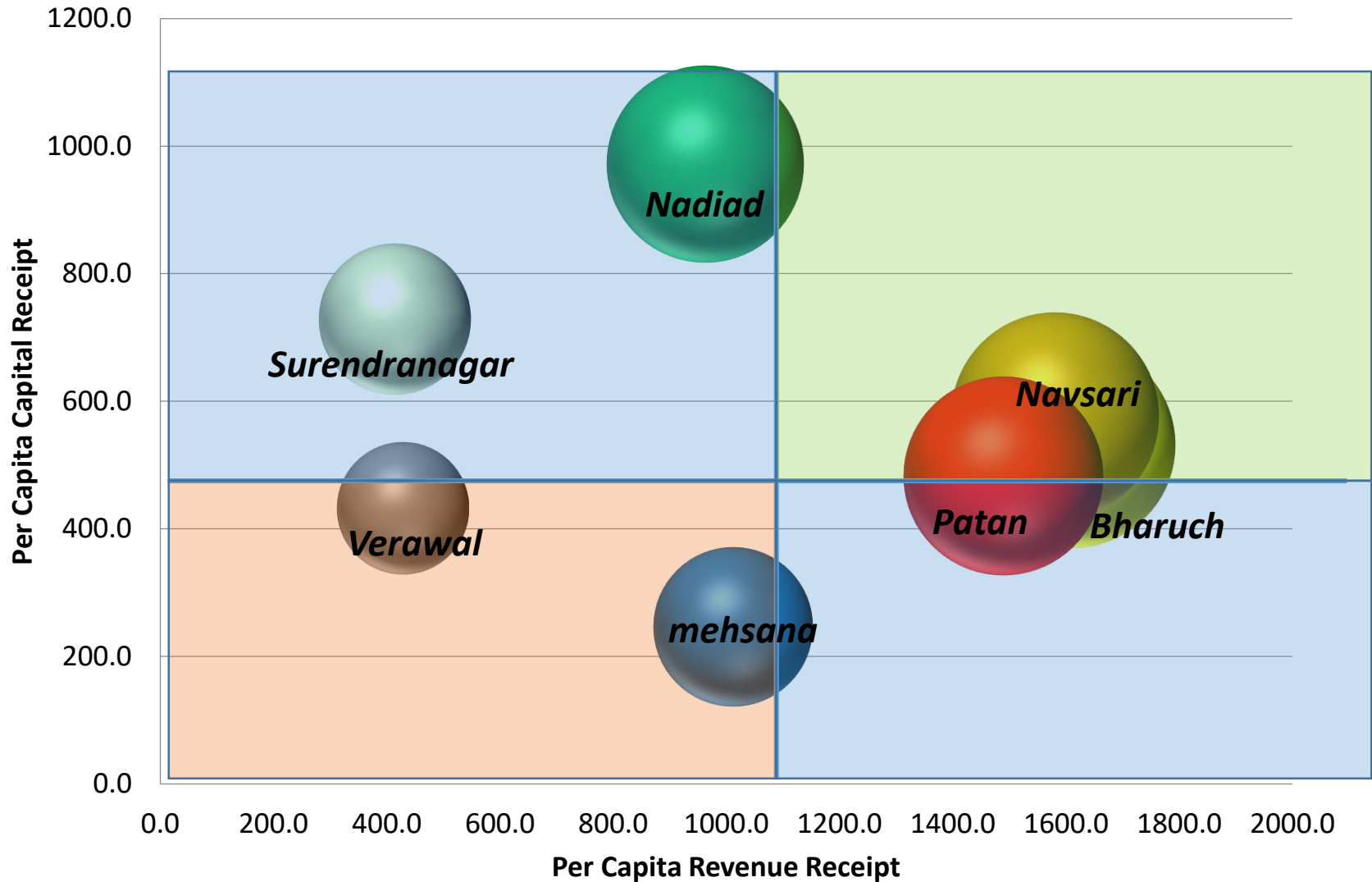
# Municipal Finance Analysis steps



	2007-08	2008-09	2009-10	2010-11	2011-12
Operating Ratio	0.64	0.73	0.62	0.51	0.65
Property tax as share of revenue receipts	17%	21%	21%	22%	23%
Dependence on grants	59%	51%	37%	44%	52%
Cap Recpts to total Recpts	4%	13%	2%	8%	10%
CapEx to total Expenditure	15%	15%	11%	14%	17%
Capital Utilisation (Total)	290%	88%	99%	-	3431%

- Property tax contributing to the major share of revenue income.
- The municipality covers half of its expenditures by grants from state and center, though the capital income is very less.
- Because the capital income is so low, capital utilisation ratio comes so high, while not many projects are proposed.

# MEHSANA & OTHER CITIES



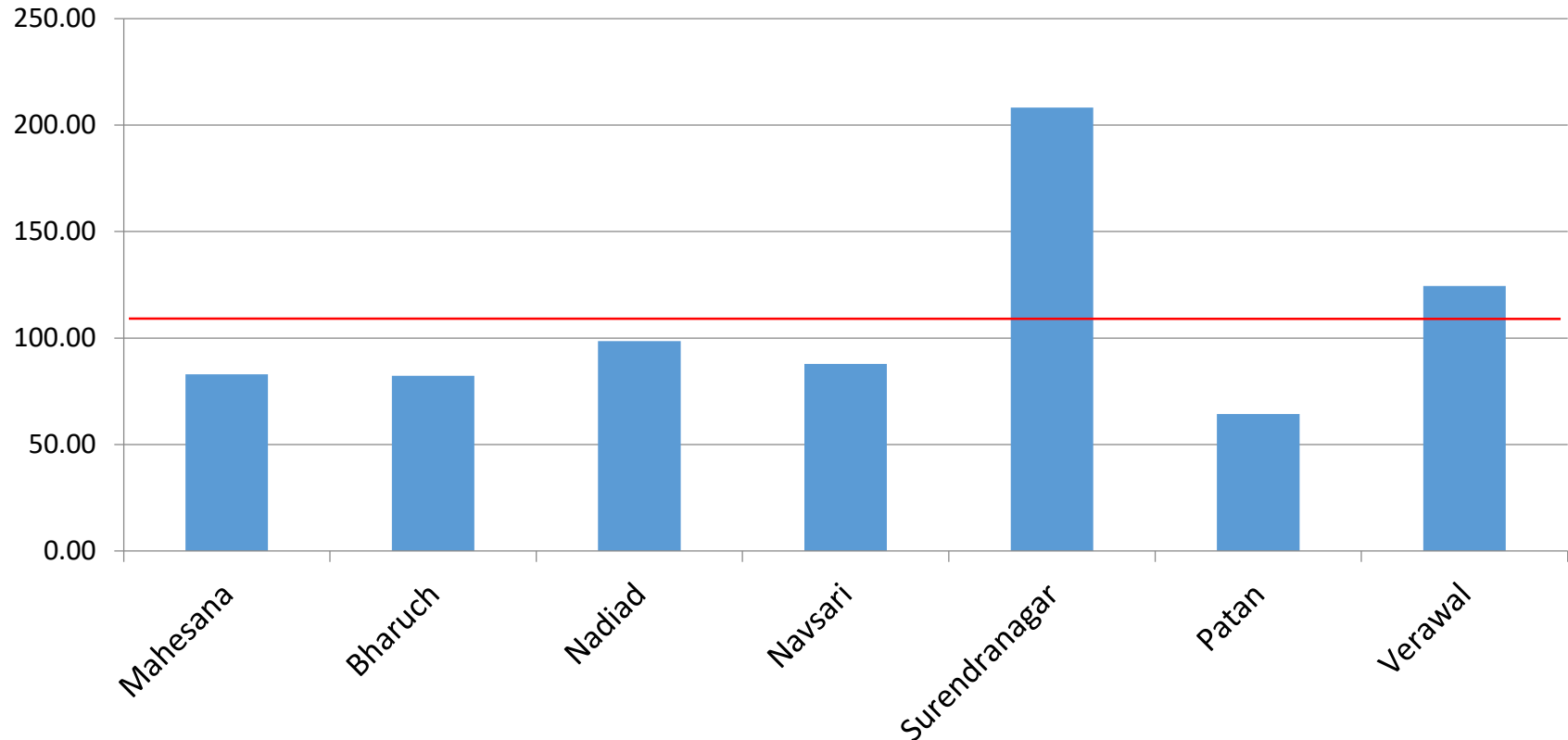
Size of the sphere correlates with the per capita income size

Mehasana	Bharuch	Nadiad	Navsari	Surendranagar	Patan	Veraval
1258	2157	1934	2157	1143	1972	861



# COMPARING MEHASANA WITH OTHER CITIES

Operating Ratio



$$\text{Operating Ratio} = \frac{\text{Revenue Expenditure}}{\text{Revenue income}}$$

O.R>1 indicates expenditures higher than the revenue income and vice - versa. The extra expenditure has to be met by loans/borrowings.

# OPERATING RATIO – A CATCH

$$\text{Operating Ratio} = \frac{\text{Revenue Expenditure}}{\text{Revenue income}}$$

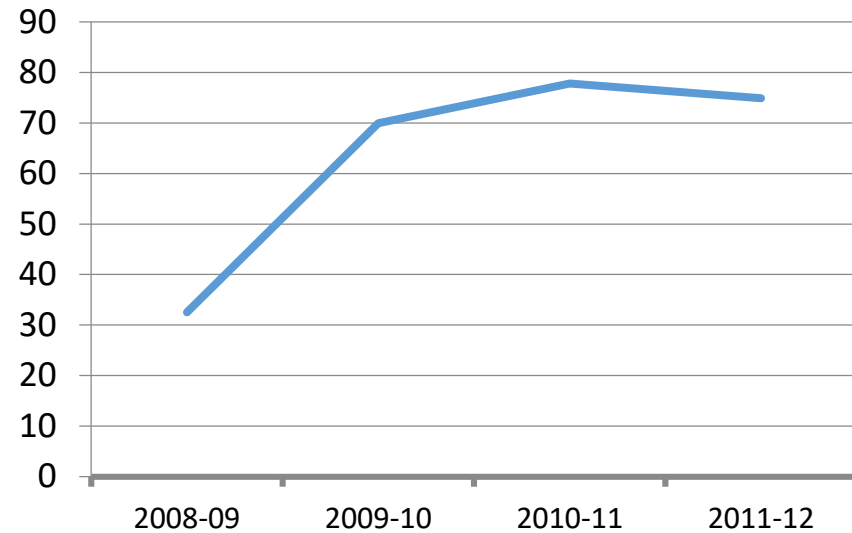
There can be two reasons for lower operating ratio

- Low levels of revenue expenditure
- **High levels of revenue income**

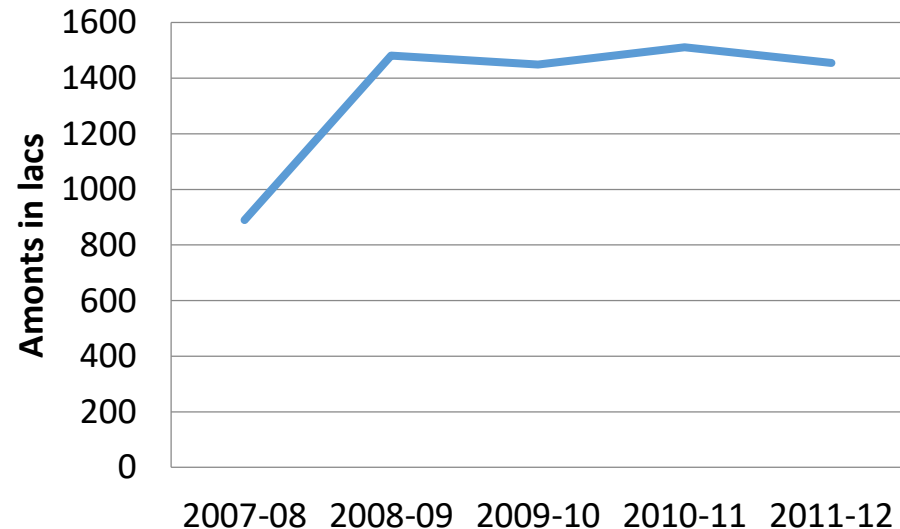
The graphs indicates increase in collection efficiency, hence an increase in revenue income.

The revenue expenditure is almost constant, resulting in a low O.R.

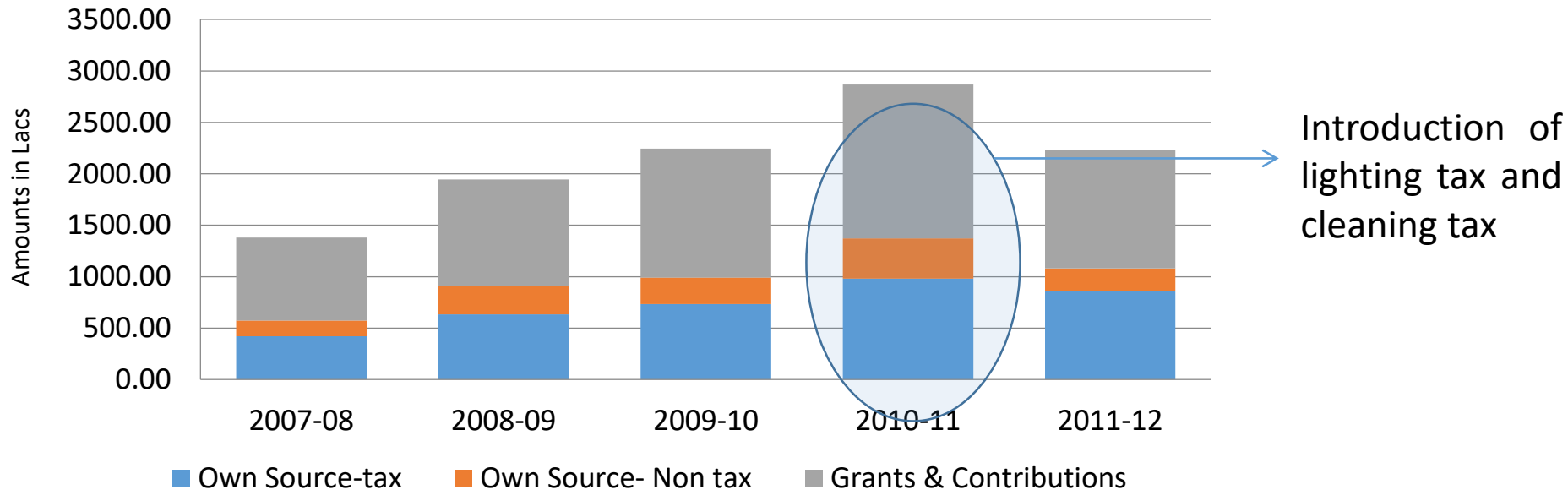
collection efficiency



Revenue Expenditure



# REVENUE INCOME BREAKUP



## Own Source- Tax:

50% of taxes comes from consolidated tax, 40% from special water tax and rest from drainage tax. Consolidated tax doubled in 2008-09, showing an increase in the property tax rate.

## Own Source- Non Tax:

Major sources: Rent, T.P betterment charges, connection fee.

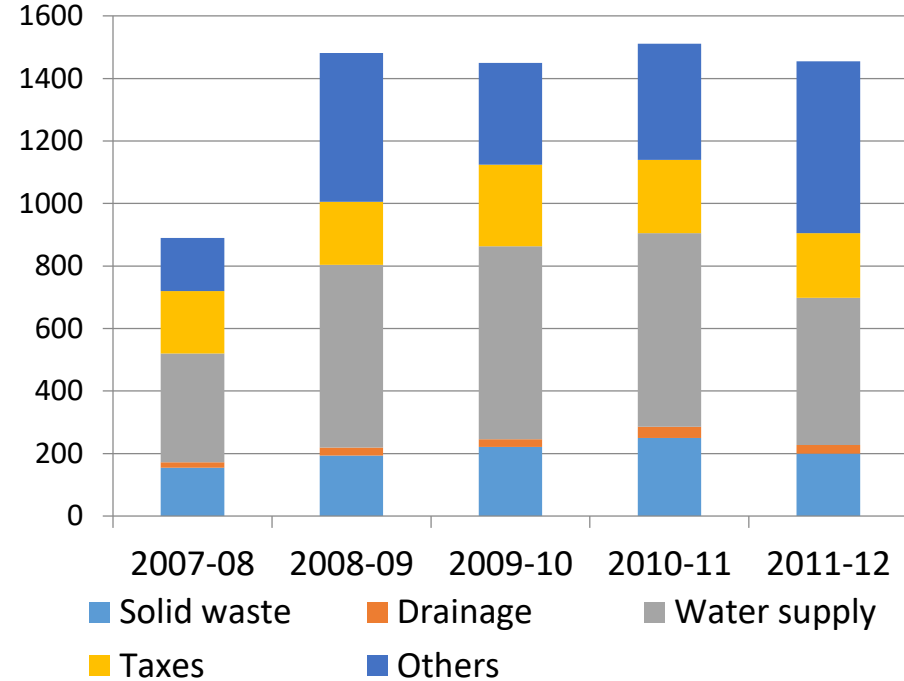
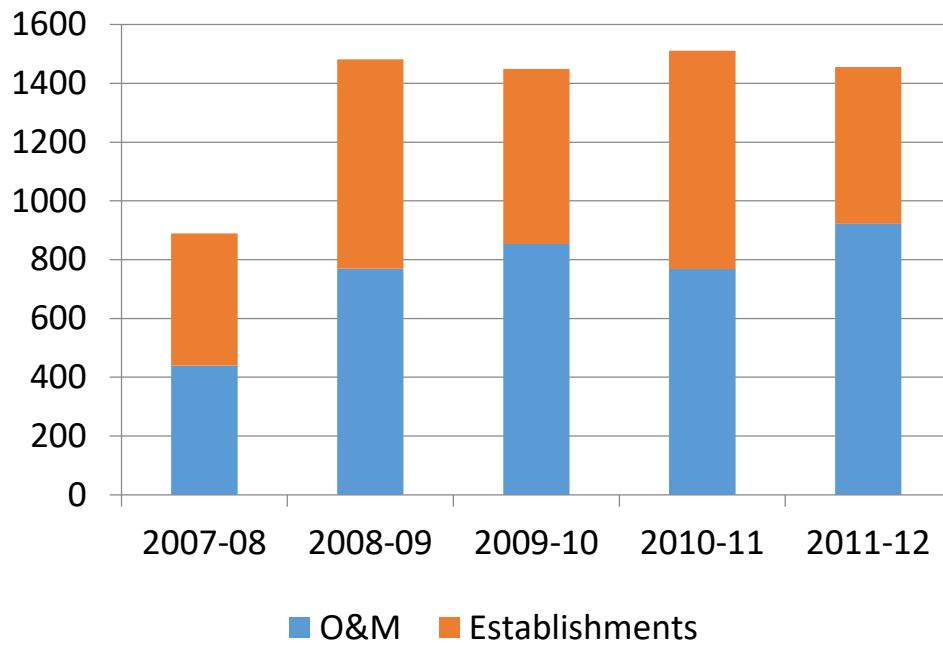
## Grants & Contributions:

Major contribution from octroi grant and service tax.

Octroi grant decreased over the years and service tax started in 2008-09.

SJMMSVY grant introduced in 2010-11 for augmentation of water supply and sewerage of the city.

# REVENUE EXPENDITURE CATEGORISATION

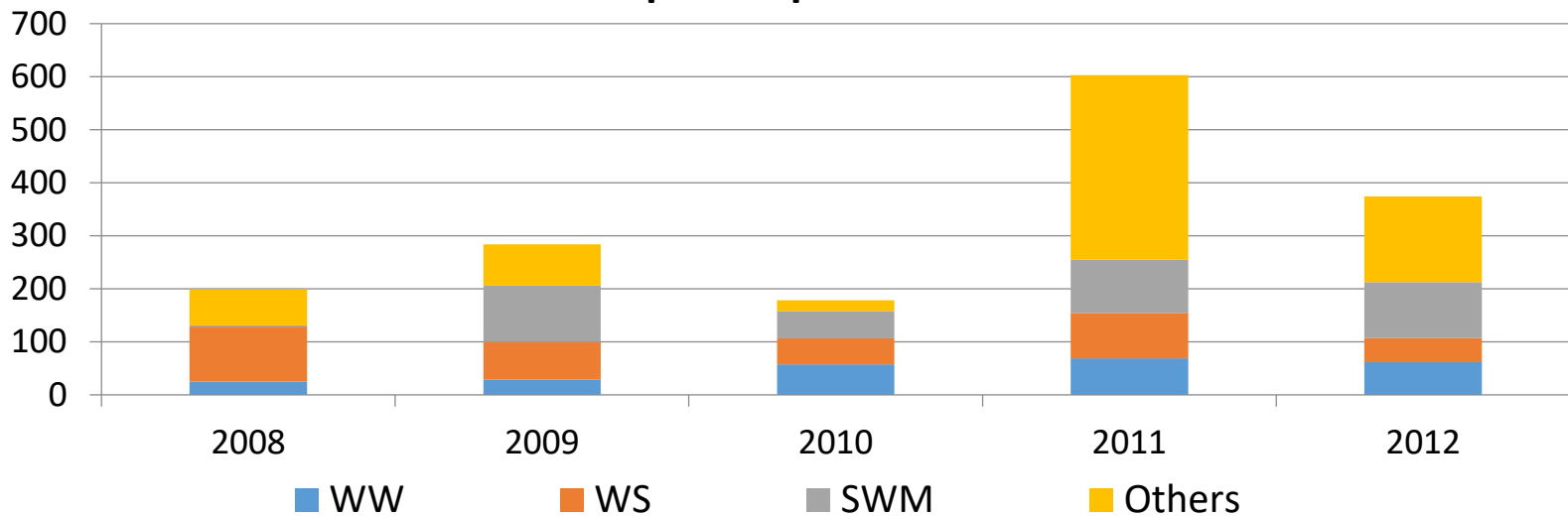
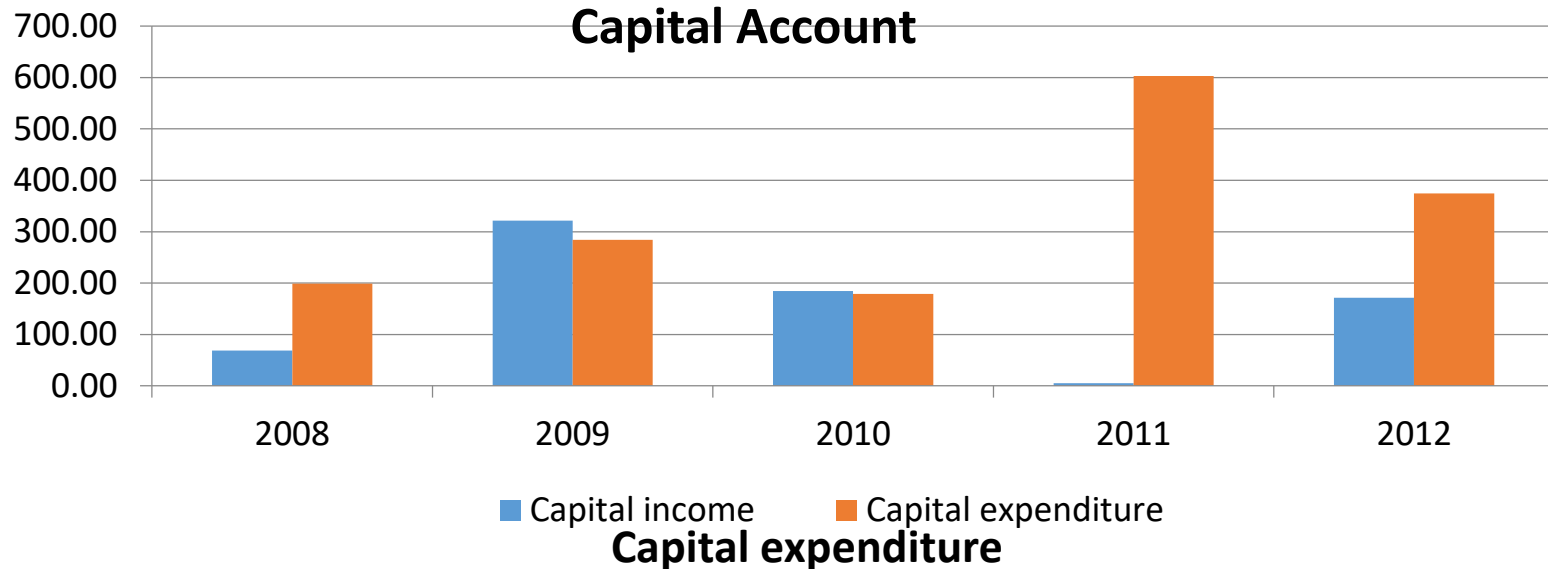


- The ratio of O&M expenditures and establishment expenditure remains constant.

## ***Sectoral Share:***

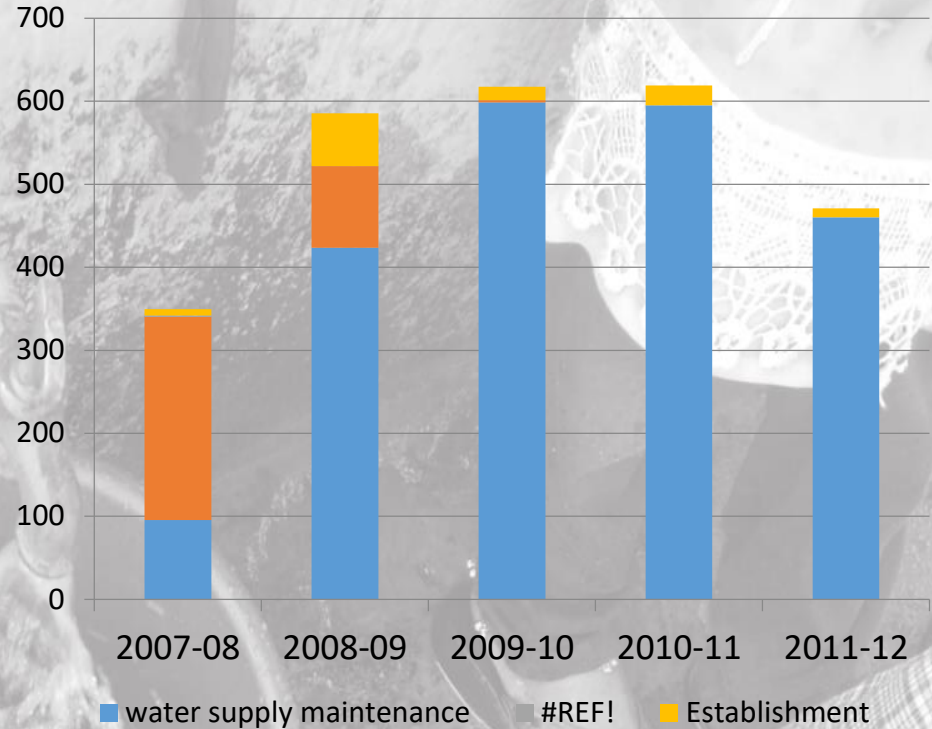
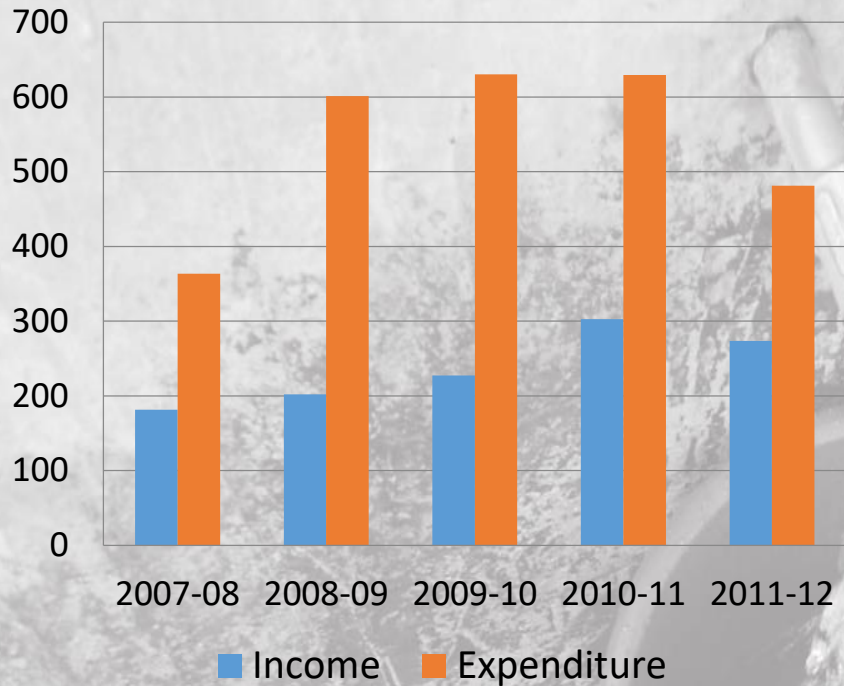
- Water supply: 45%
- Sewerage: 3%
- Solid Waster: 17%
- Water supply O&M expenses-95%
- Establishment costs in Solid waste management-77%

# CAPITAL ACCOUNT CATEGORISATION



The capital expenditure is higher than the income, the deficit is covered by the excess revenue income.

# SECTORAL ANALYSIS – WATER SUPPLY

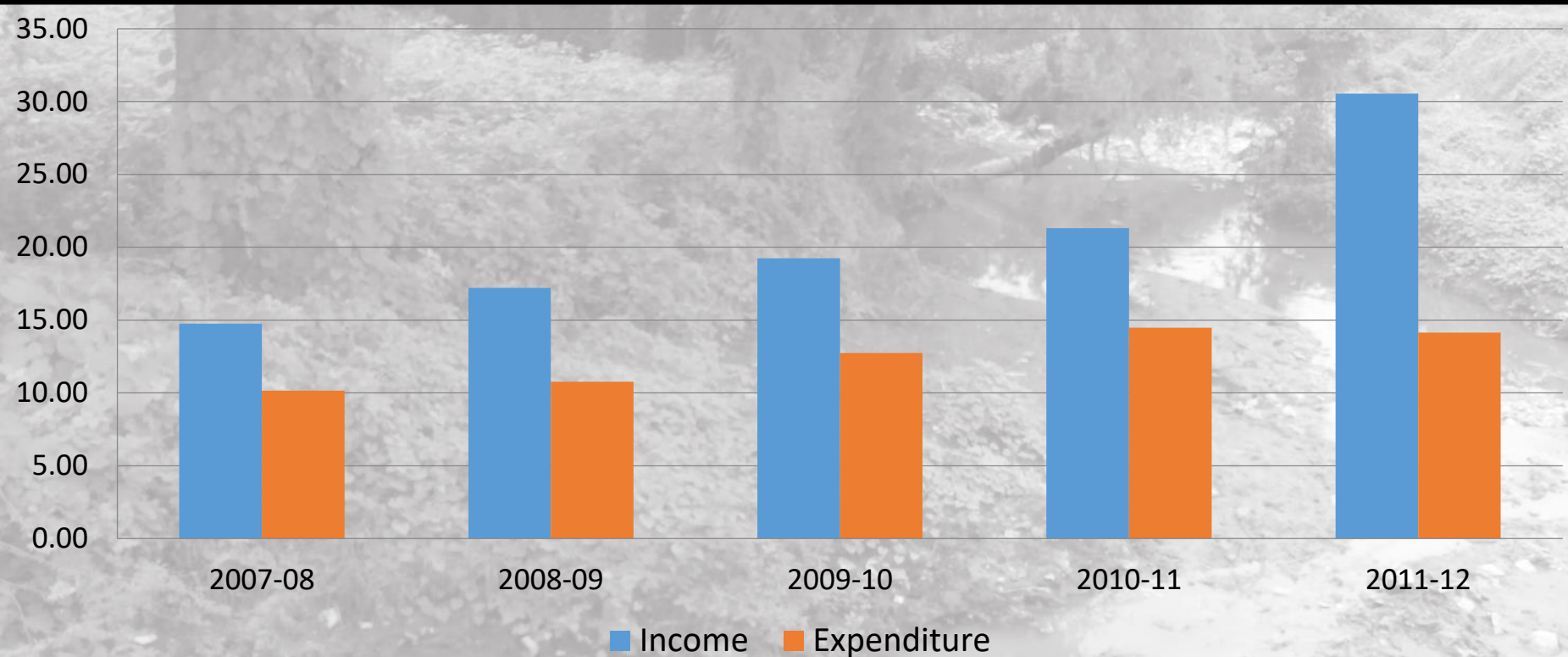


- Income for water comes from special water tax, water fee and connection fee.
- 95% of the revenue comes from special water tax.
- Major expenditures goes in O&M, which are unavoidable.
- Very less amount seen for administrative purpose.
- Energy bills are not paid every year.

## TARRIFS:

- |                       |                         |
|-----------------------|-------------------------|
| • Water tax:          | Special water tax:      |
| • Residential: Rs 100 | Deposit: Rs 1800        |
| • Commercial: Rs 150  | Water tax: Rs 750/month |
|                       | Flat fee: Rs 100/year   |

# SECTORAL ANALYSIS – WASTE WATER



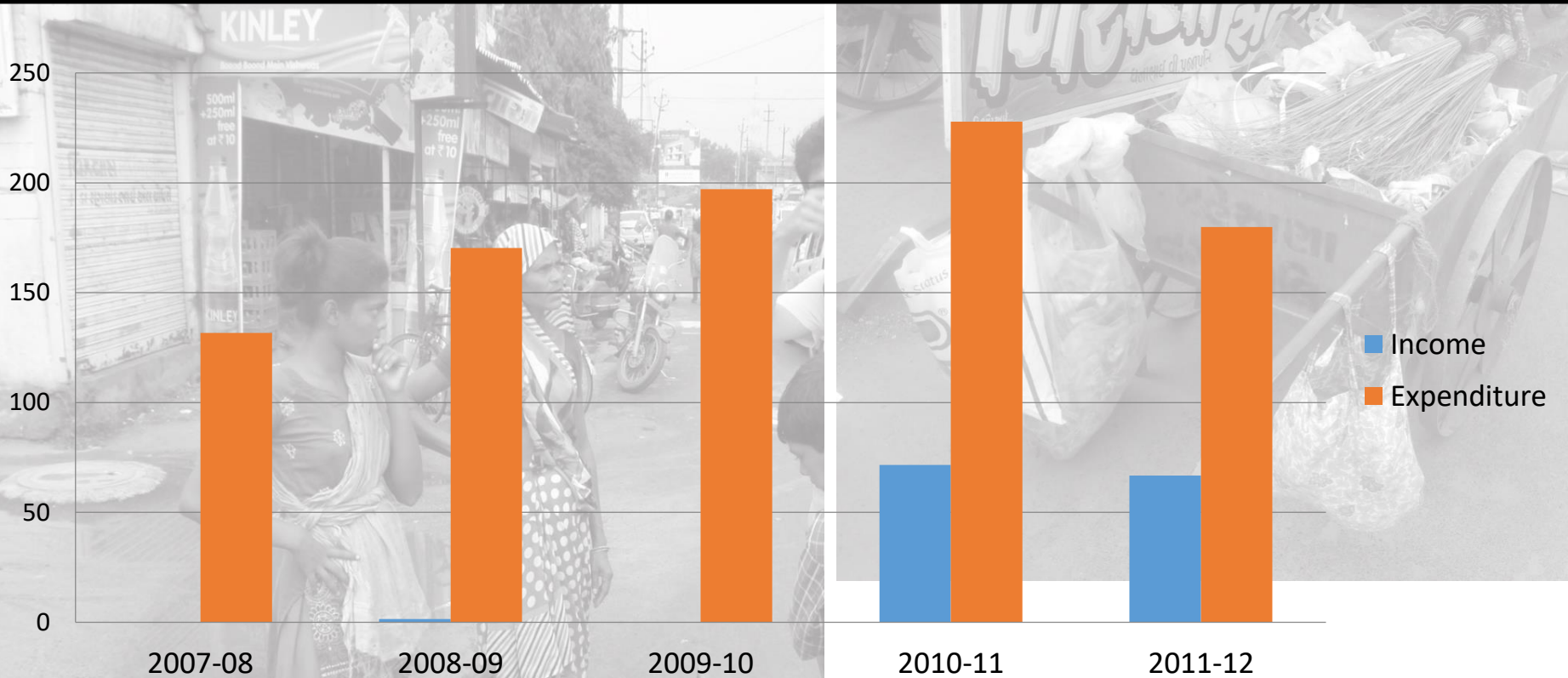
- Equal expenditure for both establishment and O&M is seen.
- Major O&M expenses-cleaning of latrines and petrol, diesel costs.
- Revenue from connection fee and drainage tax.
- Trend suggesting an increase in revenue income-own source tax every year.
- Very small portion of total expenditure

## **TARRIFS:**

Connection fee: Rs 500/month

Flat fee: Rs 500/month

# SECTORAL ANALYSIS – SOLID WASTE MANAGEMENT



- **16% of the Total expenditure towards MSWM**
- 80% of the expenditure as establishment costs. Rest O&M includes vehicle related costs.
- Income from cleaning tax. Low levels of cost recovery.
- Cleaning tax was started after 2007, and other grants are received occasionally.

## TARRIFS:



# CAPITAL EXPENDITURE PHASING

## Capital expenditure

Projects  
Reform based projects  
Policy revision

## Revenue expenditure

O & M,  
establishment.

It may not be necessary that the municipality will be able to fund all the projects, in such cases the municipality will have to prioritize the project according to the need of the city and its financial viability. The parameters on which the prioritization can be done are:

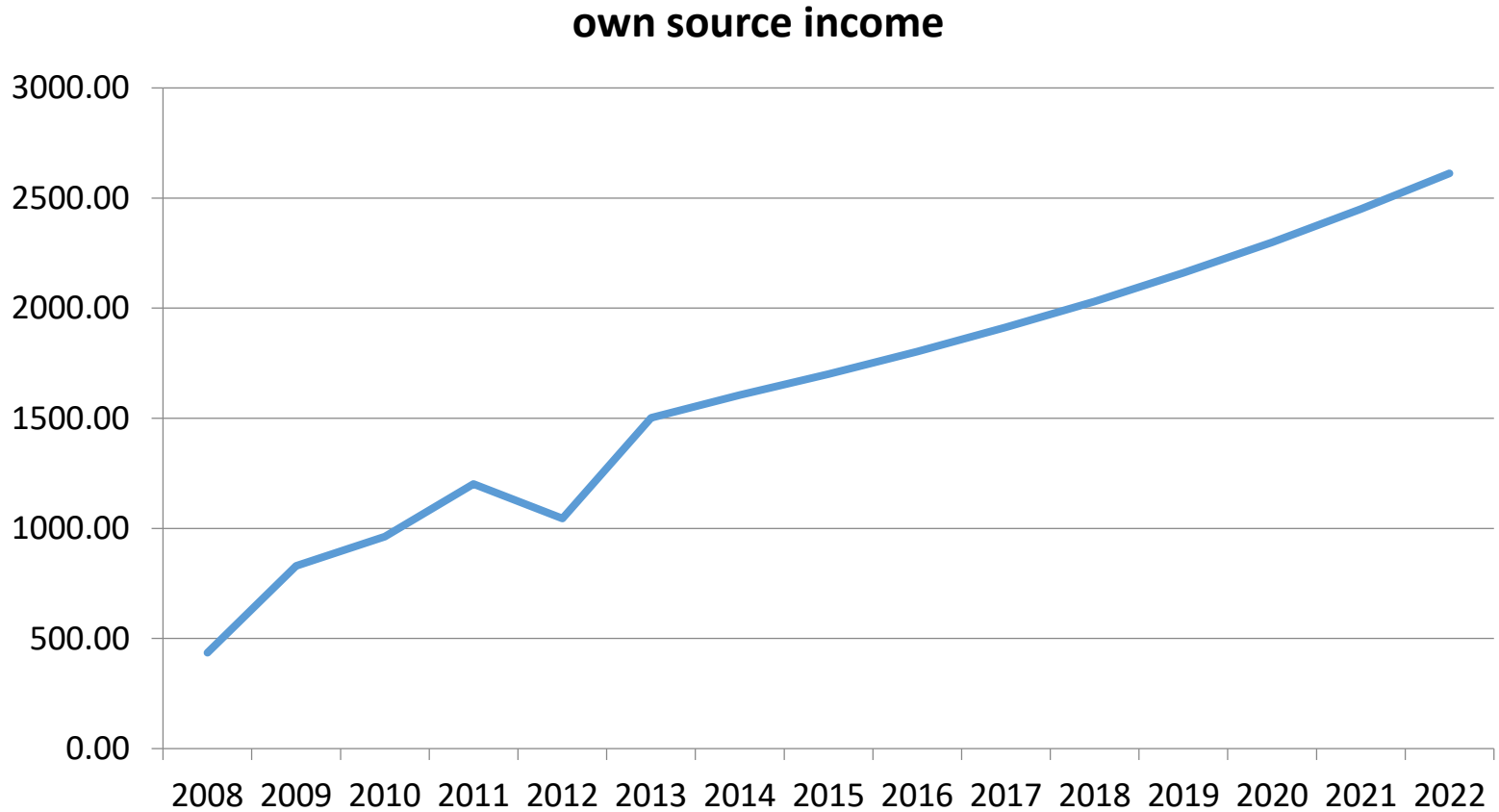
- Current service requirements of the city
- Socio-economic benefits of the projects

Sectoral prioritization

- Feasibility of the projects by new way of financing
- Revenue stream generation of the project
- Possible alternative way of delivering the service.

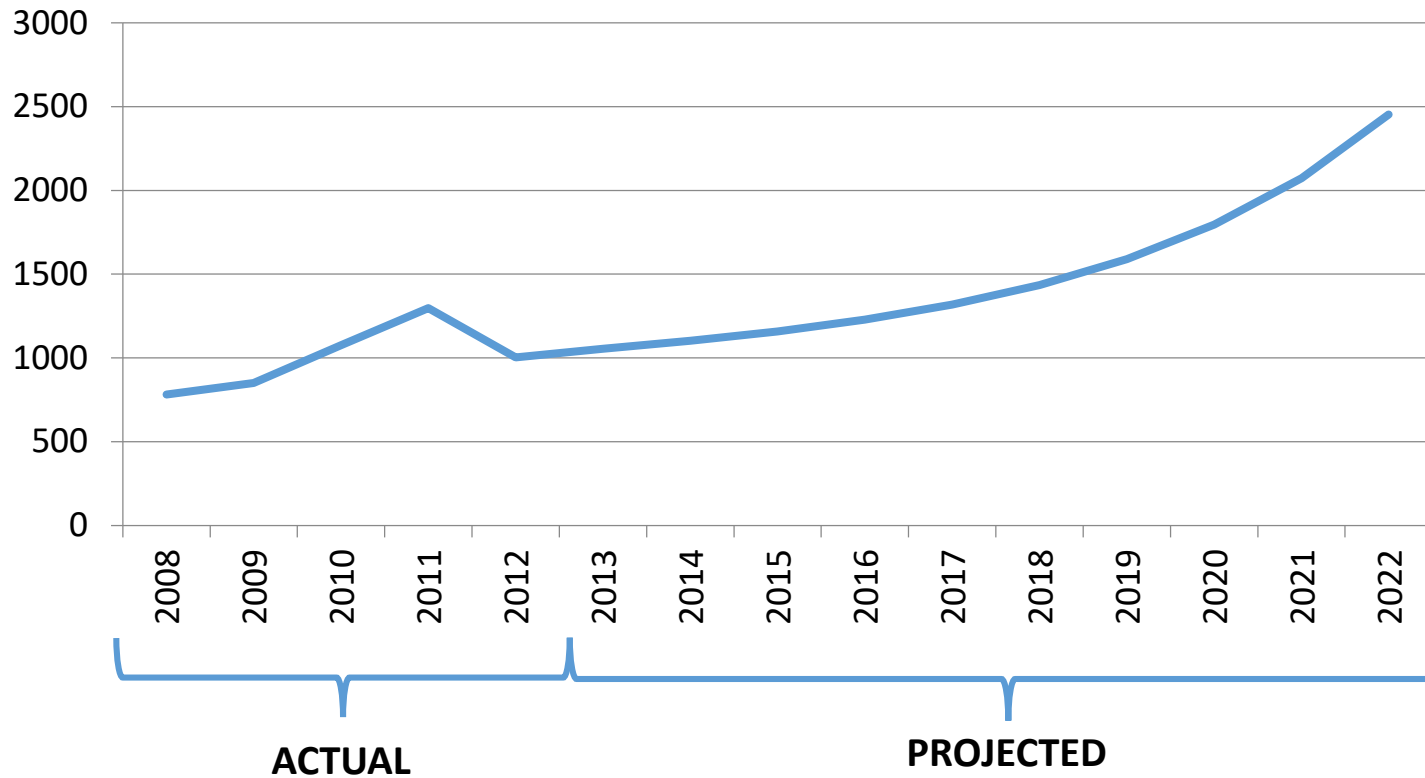
financial prioritization

# BUSINESS AS USUAL SCENARIO-REVENUE INCOME-OWN SOURCE



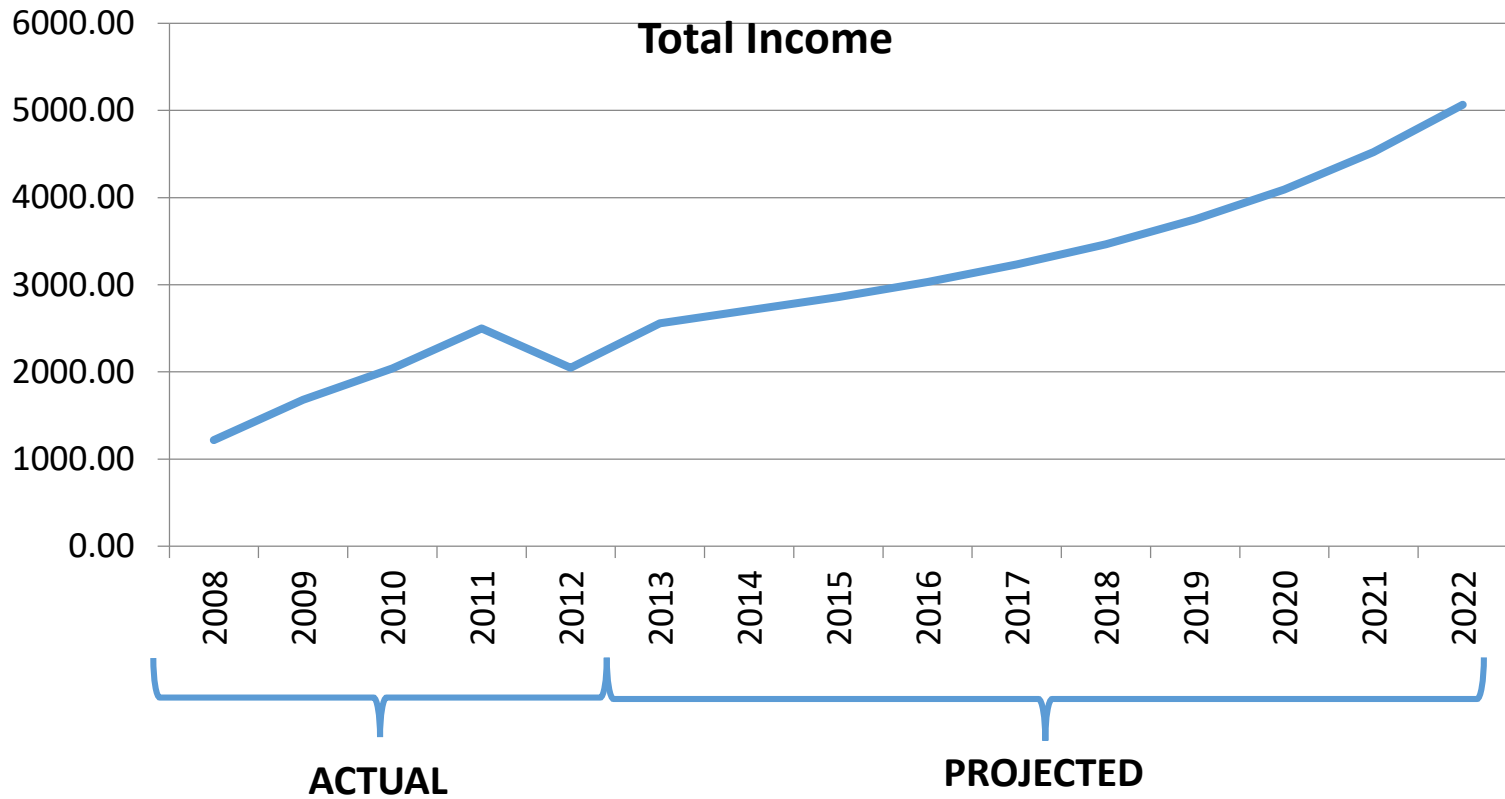
- Projected as per previous 5 years (avg: 6%)
- Revenue income from property tax, drainage tax, cleaning tax, water tax is projected according to the Collection efficiency achieved currently and adding the inflation rate.

# BUSINESS AS USUAL SCENARIO-REVENUE INCOME-GRANTS



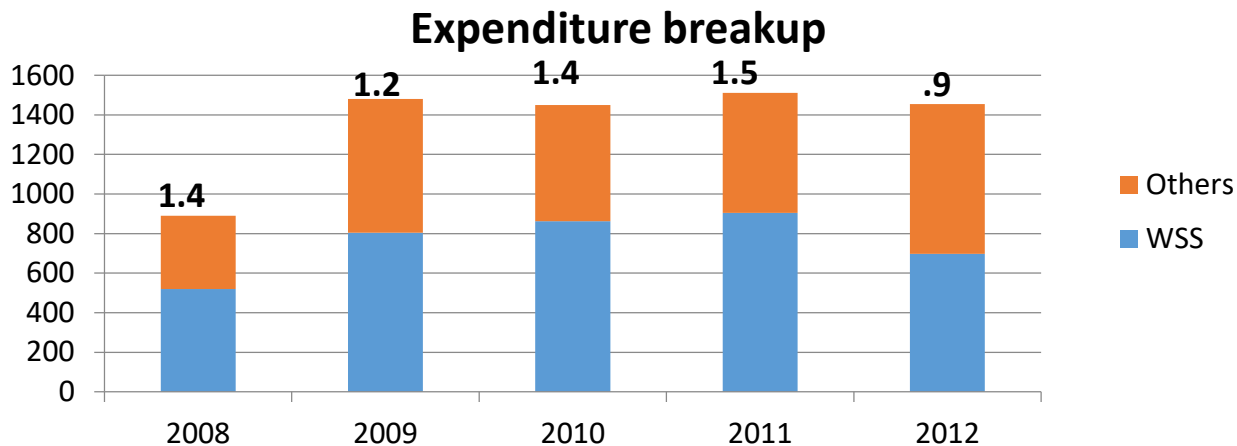
- The grants are: Entertainment grant, dearness allowances, octroi grant, Professional taxes, education cess, M.P M.L.A. grant, Finance commision grant, TP scheme betterment charges and Cable TV grant.
- Average growth rate:5%

# BUSINESS AS USUAL SCENARIO-REVENUE INCOME-GRANTS

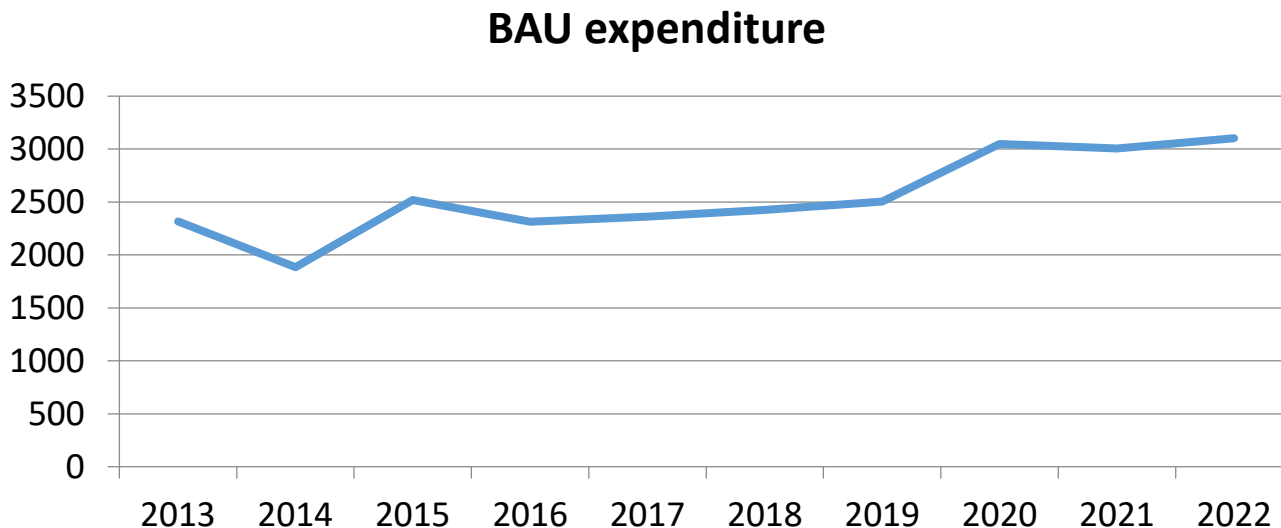


- The grants are: Entertainment grant, dearness allowances, octroi grant, Professional taxes, education cess, M.P M.L.A. grant, Finance commision grant, TP scheme betterment charges and Cable TV grant.
- Average growth rate:5%

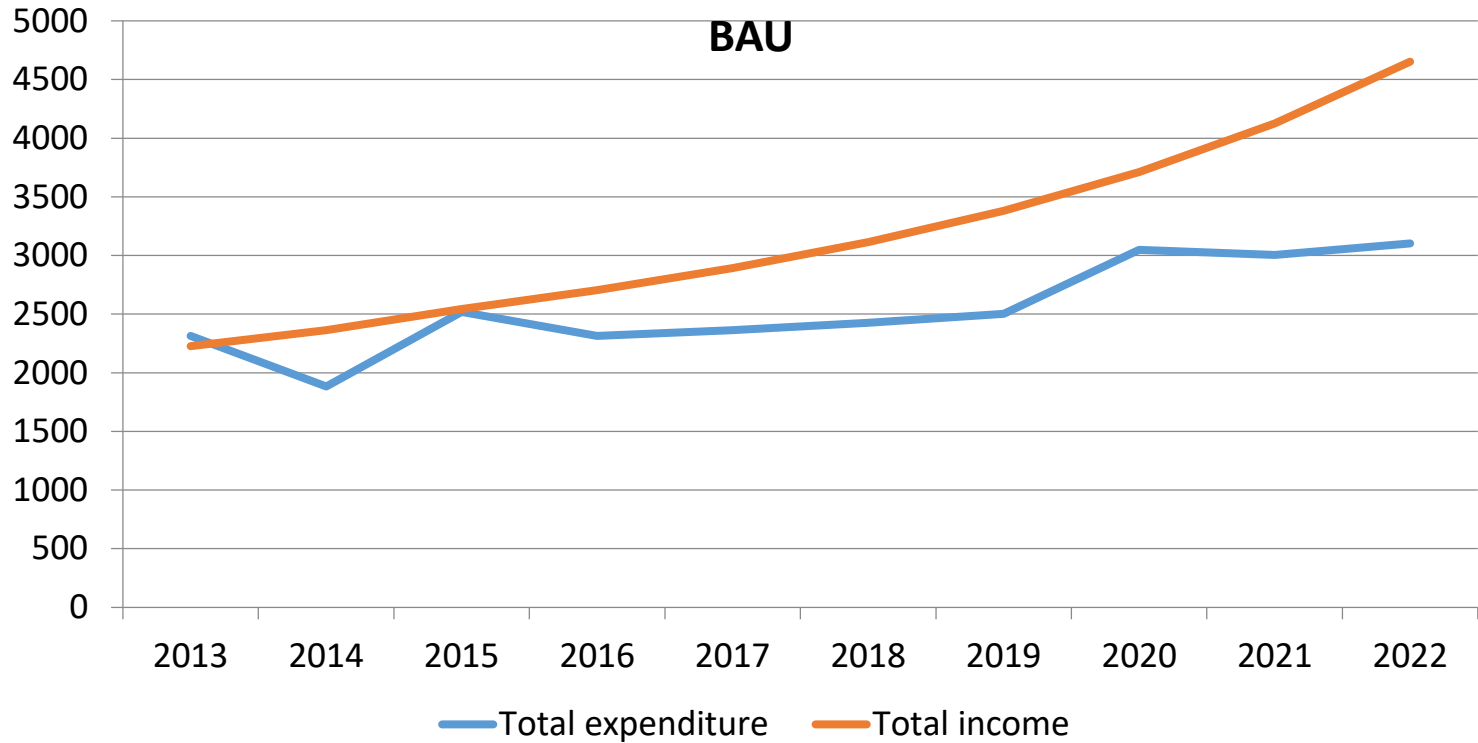
# PROJECTING FUTURE SPLIT OF WSS AND OTHER EXPENDITURE



Based on the previous years split expenditure, future years total expenditure for the BAU scenario projected.



# PROJECTING REVENUE SURPLUS



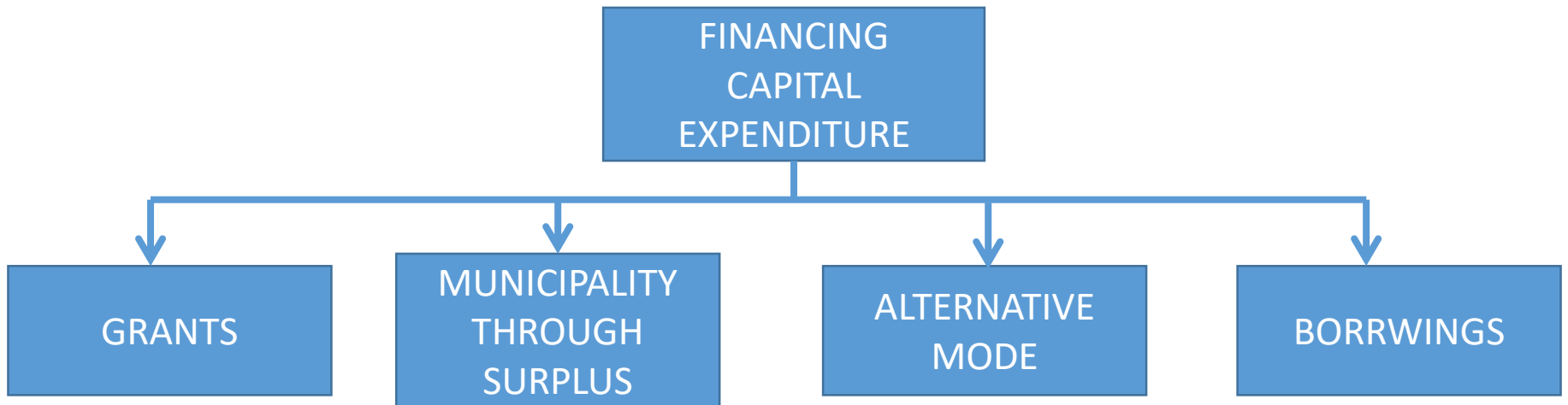
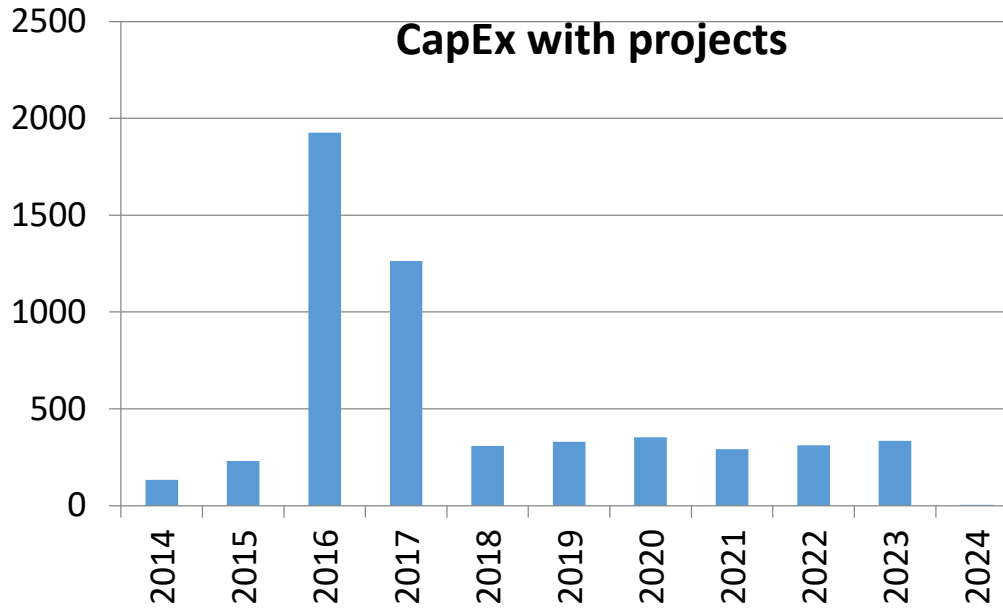
<b>Total expenditure</b>	2315	1884	2520	2313	2363	2426	2503	3047	3005	3103
<b>Total income</b>	2226	2364	2504	2665	2852	3073	3342	3672	4085	4612
<b>Surplus</b>	-89	480	-16	352	489	646	839	625	1080	1509

In next 10 years revenue surplus is generated, which can be used for the revenue costs for the proposed projects.

# CAPITAL EXPENDITURE PHASING

Projects	Implementation	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Providing Public toilets ©	Grant for Pay and Use Toilet	85										
Procurement of machinery for septic tank	Grant for vehicles			72				8			8	
Septage disposal and treatment with FSM ©	SJMMRY Grant			23.4								4
STP (30 crore)					1000	1000	1000					
Storm water drainage network ©		18	18	18								
compost plant©	Grant for infrastructure development			30								
Sale of green and black waste collection bins at lower rates.		21	21									
Tata ace for waste collection				40								
Rain water harvesting system to government buildings and institutional buildings.		20	20	5	5							
To develop ground water recharging structures to augment ground water table.			20	20	20	20	20	20				
Build water transfer and water storage structures (Water Spreading system & Percolation shaft)			4	30	22.5							
Proposed ESR 2.5 lakh capacity ©												
Construction of ESR ©	Grant for infrastructure development				56							
Network Restructuring ©						200	200	200				
Consumer metering ©									170	170	170	
IEC campaign for all sectors		5	5	5								
<b>Total</b>		<b>144</b>	<b>83</b>	<b>238</b>	<b>1104</b>	<b>1220</b>	<b>1220</b>	<b>228</b>	<b>170</b>	<b>170</b>	<b>178</b>	<b>4</b>

# CAPITAL EXPENDITURE FINANCING





# FINANCING THROUGH GRANTS



For any capital expenditure, grants is one of the options, but if the required grant is not received on time then the required funding comes from revenue surplus.

As the income from grants(above graph) is not predictable, we also need to tap in for alternative capital funding.

GRANTS  
+  
DEBT FINANCING

GRANTS  
+  
PUBLIC PRIVATE  
PARTNERSHIP

# SCENARIO 1

Projects For Debt Financing:

Stp

2016-17

Network Restructuring

2017-19

Consumer Metering

2019-21

STP

80% Grant+ 20% Debt Financing

24 Crore + 6 Crore



6 crore surplus of 2012  
can be used, but balance  
becomes 0.

## INTRODUCTION OF ALTERNATIVE CAPITAL FUNDING

Network Restructuring

50% Grant+20% Debt Financing

3crore+1.2 Crore

Consumer Metering

50%grant+20% Debt Financing

3 Crore+1.2 Crore



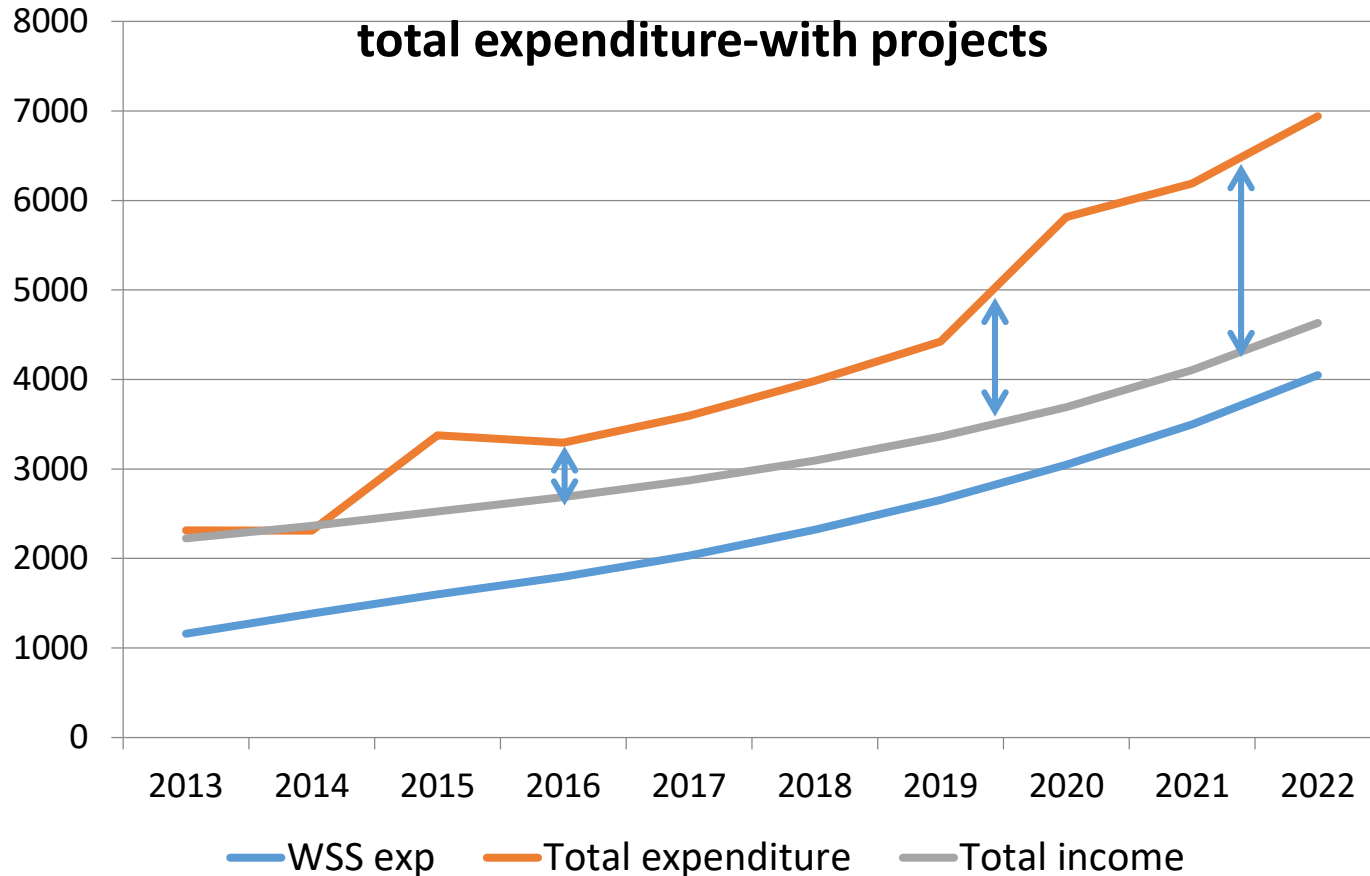
Both these projects can  
then be lumped and  
financed through PPP  
model.

# SUMMARY FOR CAPEX

*ANALYSING THE PRESENT SITUATION OF MEHSANA FOR CAPEX, IT IS EVIDENT THAT IT CAN NOT RELY ON DEBT FINANCING AS IT WILL CREATE LONG TERM BURDEN ON THE MUNICIPALITY, HENCE IT IS IMPORTANT TO GO FOR PRIVATE PARTNERSHIP IN ADDITION TO AVAILABLE GRANTS.*

WSS REVENUE EXPENDITURE PHASING												
Projects	Implementation	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Cleaning and maintainance of septic tank/soak pits (O)	Contractors(payment taken from users)	6	6	7	7	8	8	9	10	10	11	12
Regular O&M of open drains(O)	Contractor for all ye	10	11	11	12	13	14	15	16	17	18	20
Admin staff for FSM			30	32	34	37	39	42	45	48	52	55
Incorporating Formal & Informal Sector For Recycling Of Solid Waste.	Monitored by NGO	21	22.5	24	25.73	27.53	29.5	31.52	33.72	36.1	38.61	41.31
Waste auditing for solid waste management in Mehsana.			2	2	2							
Regular training and skill development programs of employees ©		12	13	14	15	16	17	18	19	21	22	24
Establishment for Compost plant		20	21	23	25	26	28	30	32	34	37	39
O&M for compost plant					1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
O&M for tata ace				3	3.21	3.435	3.68	3.932	4.208	4.5	4.817	5.155
Establishment for tata ace				36	38.52	41.22	44.1	47.19	50.49	54	57.81	61.85
Identify the location for water harvesting structure	Technical consultancy		3									
Repair valve and storage tank		5.5										
Develop water distribution network(O)	Technical team			6								
Maintain the system (Desilting Before Monsoon	contract to agency						0.5	0.5	0.5	0.5	0.5	0.5
Control of leakages (O)							11	11	11			
Engineering works												
<b>Total</b>		<b>74.5</b>	<b>109</b>	<b>158</b>	<b>164</b>	<b>173</b>	<b>197</b>	<b>210</b>	<b>224</b>	<b>227</b>	<b>243</b>	<b>260</b>

# TOTAL EXPENDITURE-WITH PROJECTS



To cover the deficits, following scenarios are explained below:

**Scenario 1:** improved collection efficiency

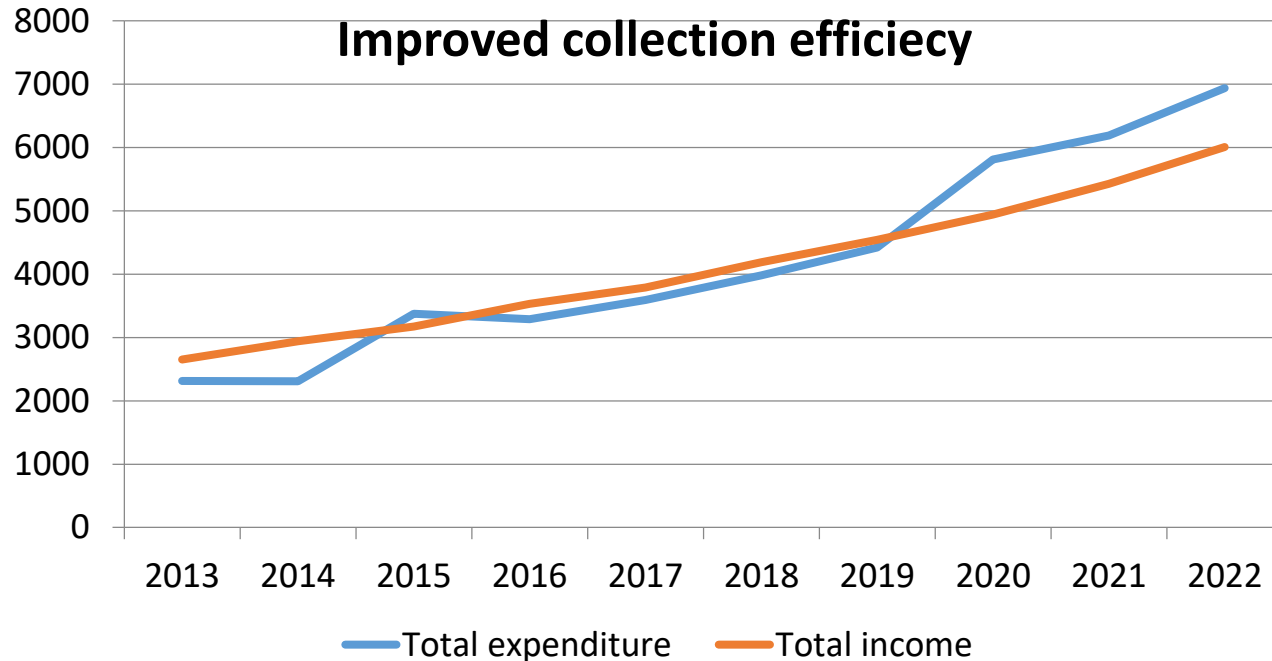
**Scenario 2:** revised tariffs

With all the scenarios, the revenue generation stream is added.

# SCENARIO-1

Increasing the collection efficiency by:

- Property tax increases from 70% to 100% in 5 yrs.
- Drainage tax from 40% to 70% in 7 yrs
- Wwater tax from 75% to 100% in 5 yrs.
- Cleaning tax from 67% to 100% in 6 yrs.



In this case deficit of **12 crore** is seen in 10 years

# TARIFF REVISION

Per capita expenditure		
	Total (in lacs)	per capita/per day
Solid waste	199.52	0.28
Drainage	27.94	0.04
Water supply	470.87	0.66
Total	698.33	1.62

Per capita income		
	Total( in lacs)	per capita/per day
Solid waste	66.71	0.09
Drainage	30.55	0.04
Water supply	273.44	0.39
Total	370.69	1.16

To equalize the expenditures and income, the total amount to be payed per household will be as shown. The table also shows the tariffs at various places in India.

	Tarrifs/person	Tarrif/hh	Min tariff	Max tariff
Solid waste	102.58	512.91	300.00	600
Drainage	14.36	71.82	72.00	180
Water supply	242.09	1210.47	600.00	600
Total	359.04	1795.20	972.00	1380

Taking the maximum tariff, it comes as 2% of the per capita income of Mehsana. Currently Mehsana is paying Rs 959/hh/yr.

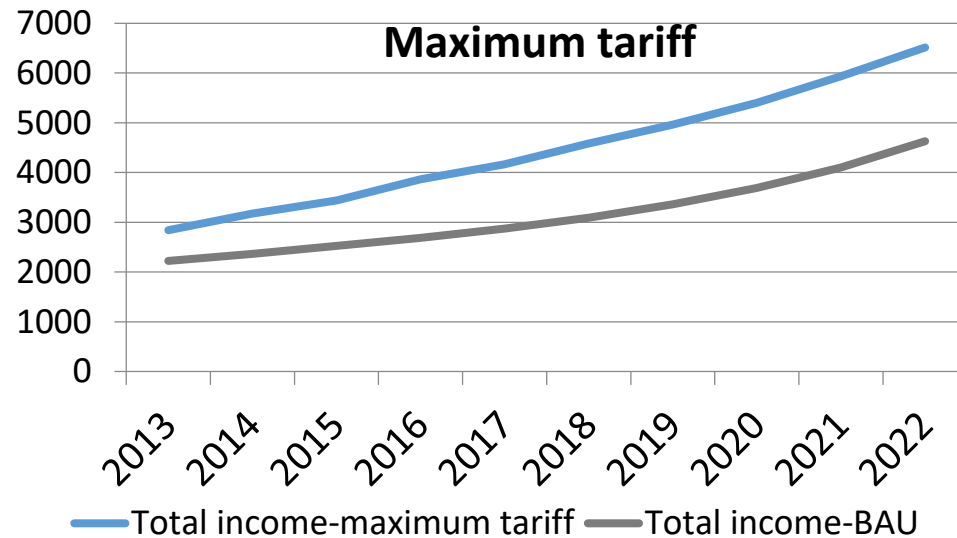
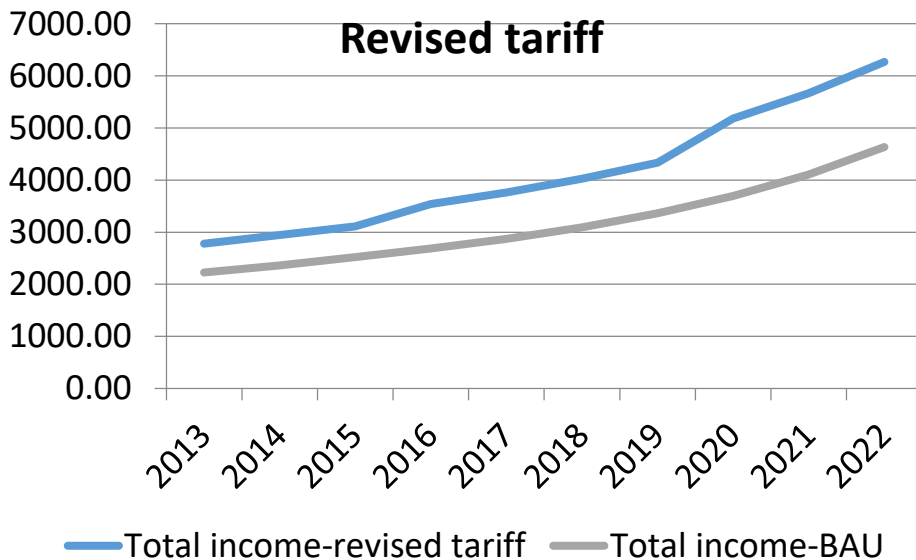
# TARIFF REVISION

Based on the study from various cities, the maximum tariff collected comes to 1380 for all 3 sectors.

We propose to add electricity surcharge on water supply tax and increase it to Rs 1000/hh

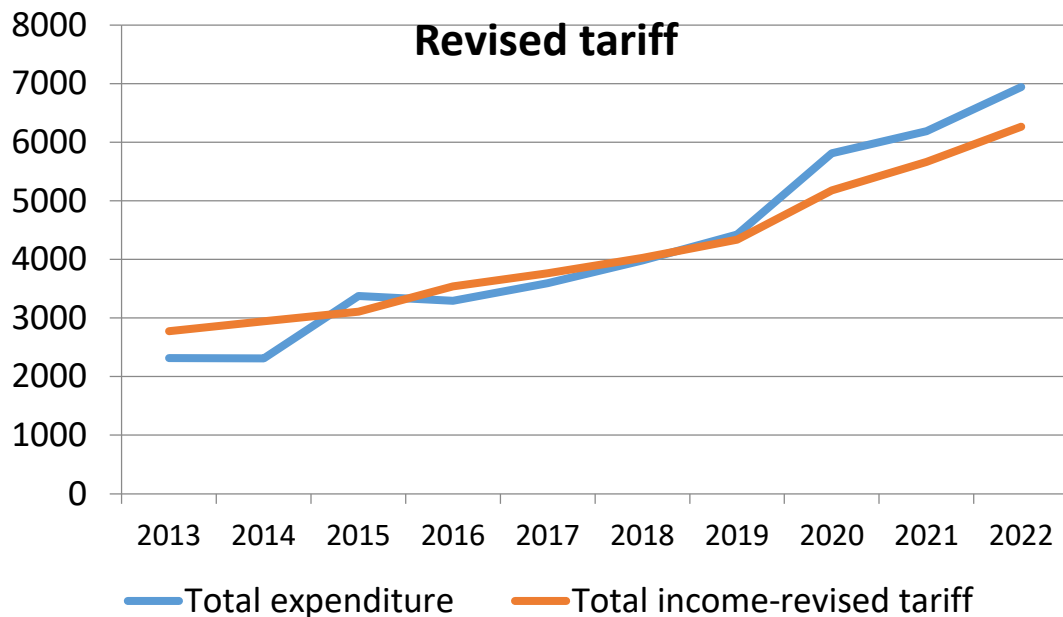
Per capita income			
	Per hh charged	Revised tariff/hh	Maximum tariff
Solid waste	175	250	500
Drainage	75	125	70
Water supply	700	1000	1200
Total	950	1375	1770

Property tax	1165	1500
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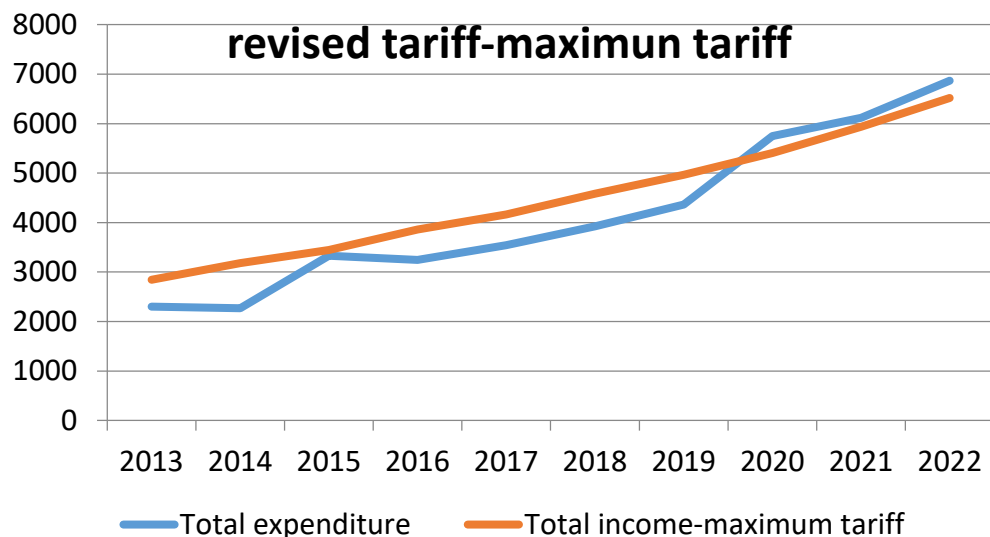




# SCENARIO-2



In this case deficit of **6 crore** is seen in 10 years



In this case surplus of **31 crore** is seen in 10 years.

Here we get a surplus, but the question is:  
**IS MEHSANA READY TO PAY SUCH TARIFFS.**

# SUMMARY

We need to consider various modes of financing the capital projects, and to finance the related revenue costs the income needs to be addressed. We propose to increase the own source income through increasing the tariff and a combination of PPP mode and grants will be required to finance capital expenditure.