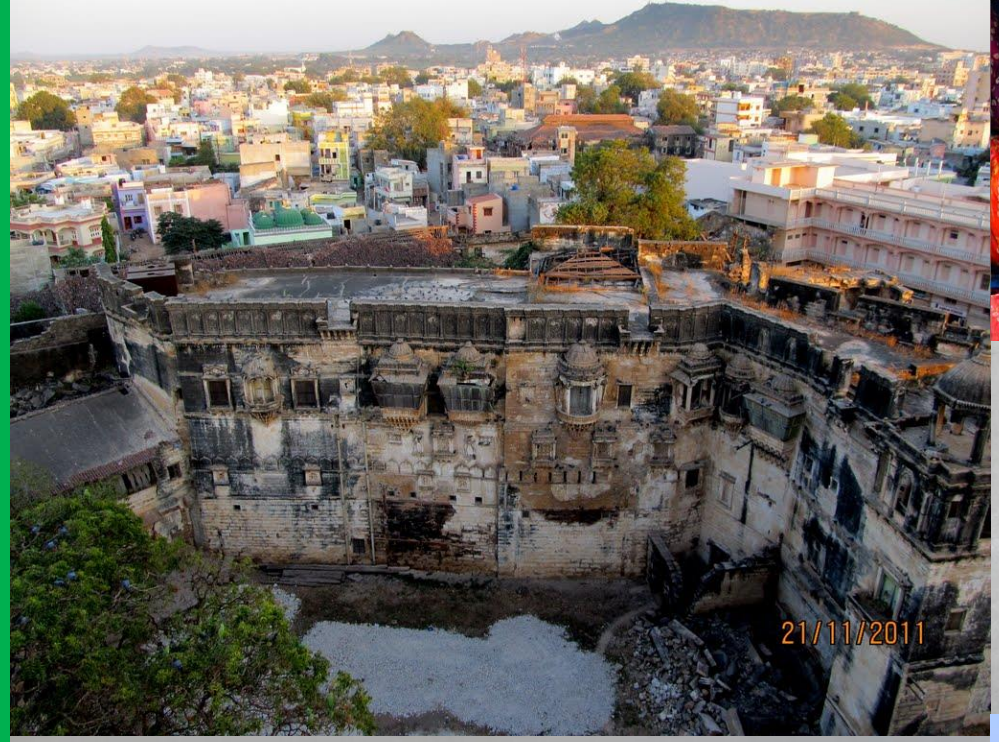
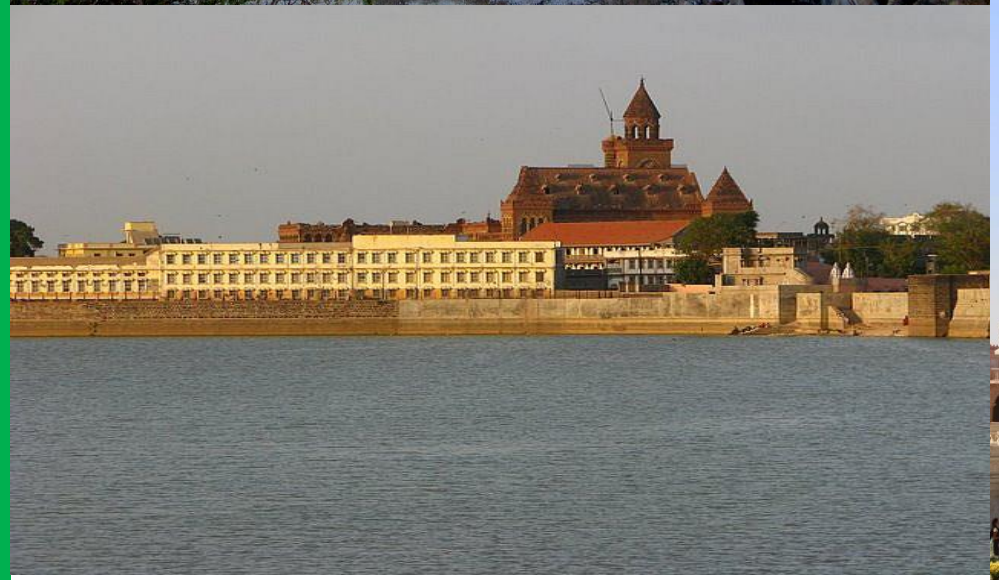
UNITED COLORS OF BHUJ

BHUJ

INFRASTRUCTURE PROJECT STUDIO **2016**





UNITED COLORS OF BHUJ

A GROUP OF **19**
STUDENTS EMBARKED ON
JOURNEY TO STUDY BHUJ

4 SITE VISITS
4 MONTHS

PHASE I

SECONDARY DATA &
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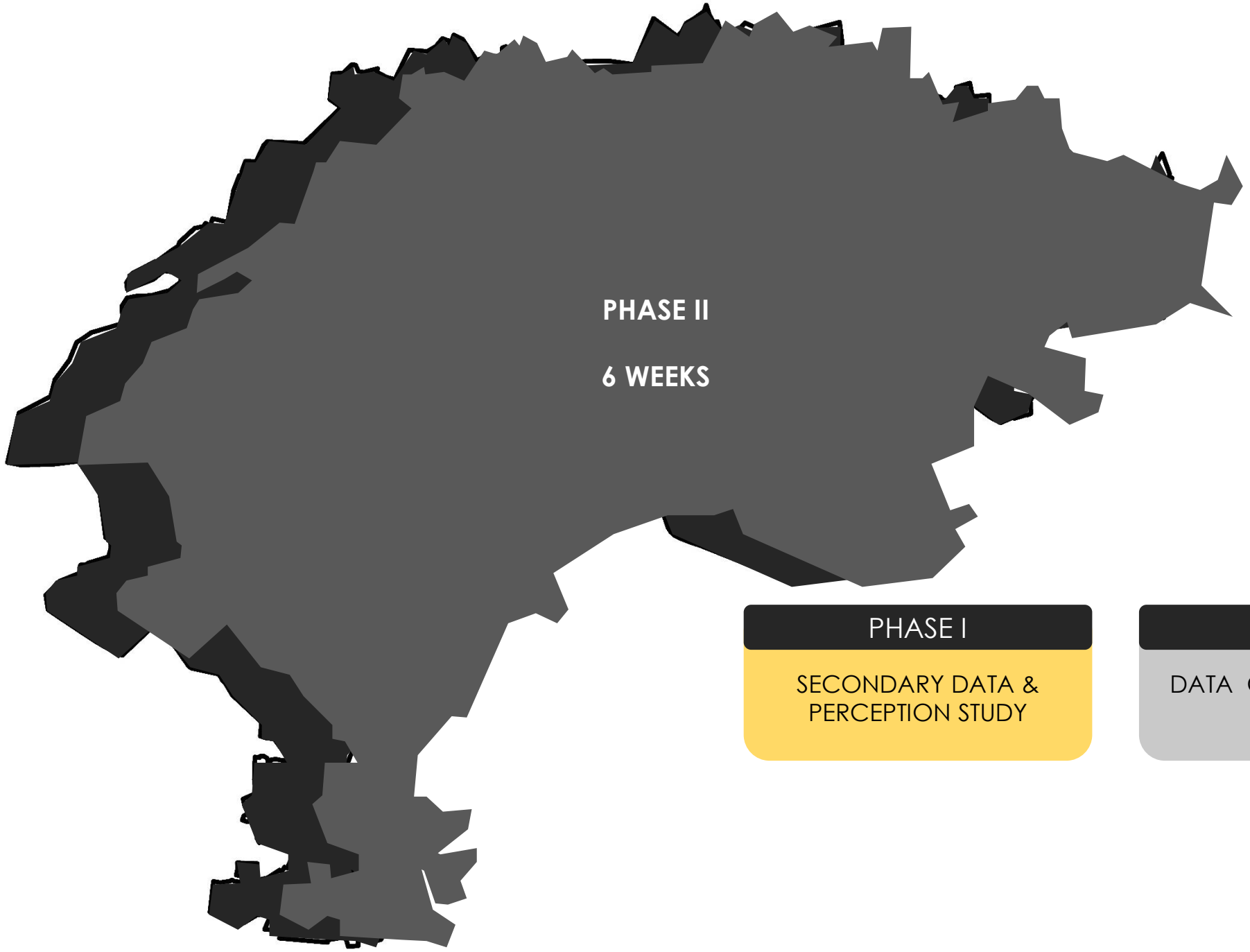

PHASE I	PHASE II
SECONDARY DATA & PERCEPTION STUDY	DATA COLLECTION AND ANALYSIS

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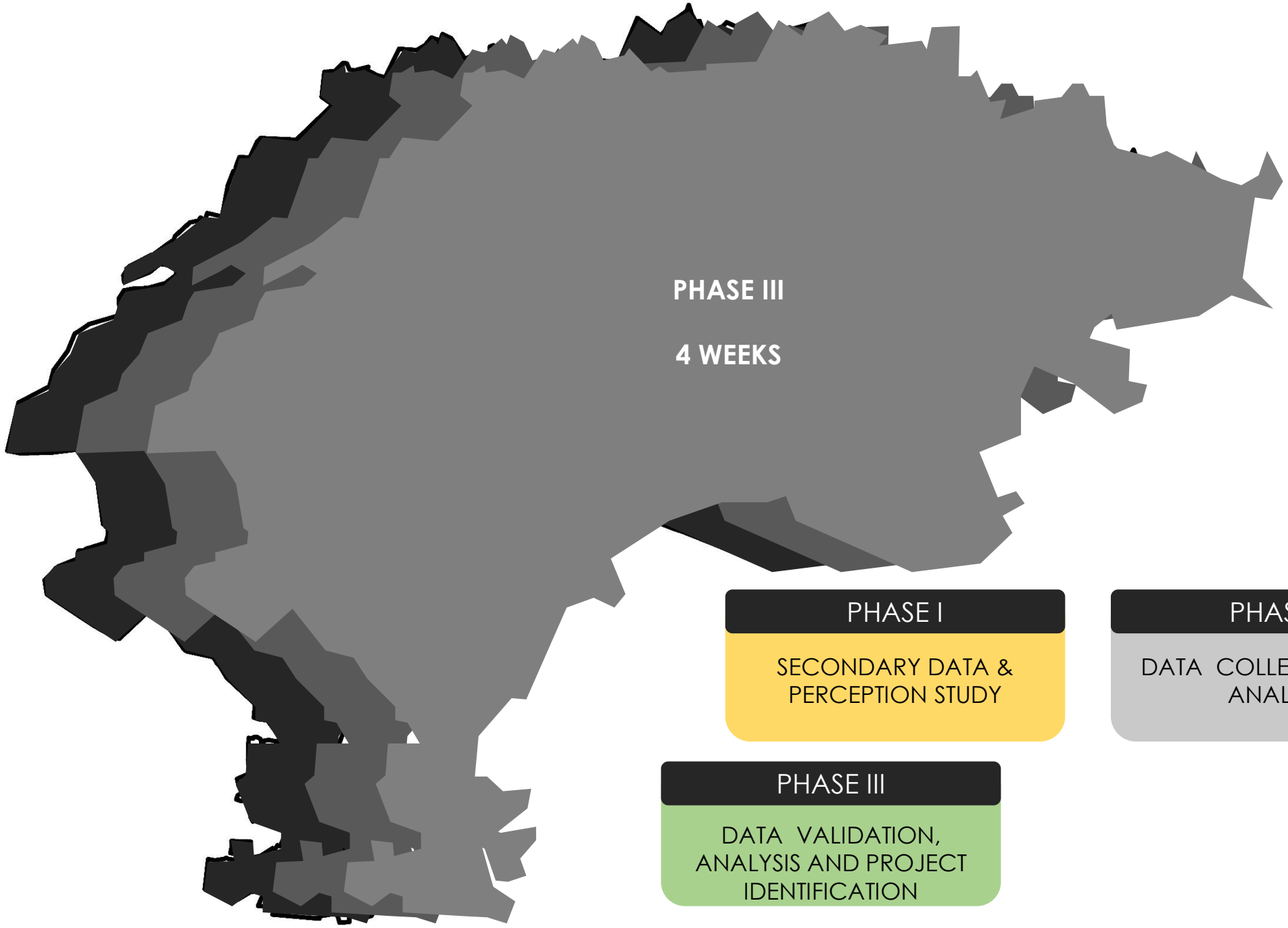

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SECONDARY DATA & PERCEPTION STUDY

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PHASE III

DATA VALIDATION, ANALYSIS AND PROJECT IDENTIFICATION

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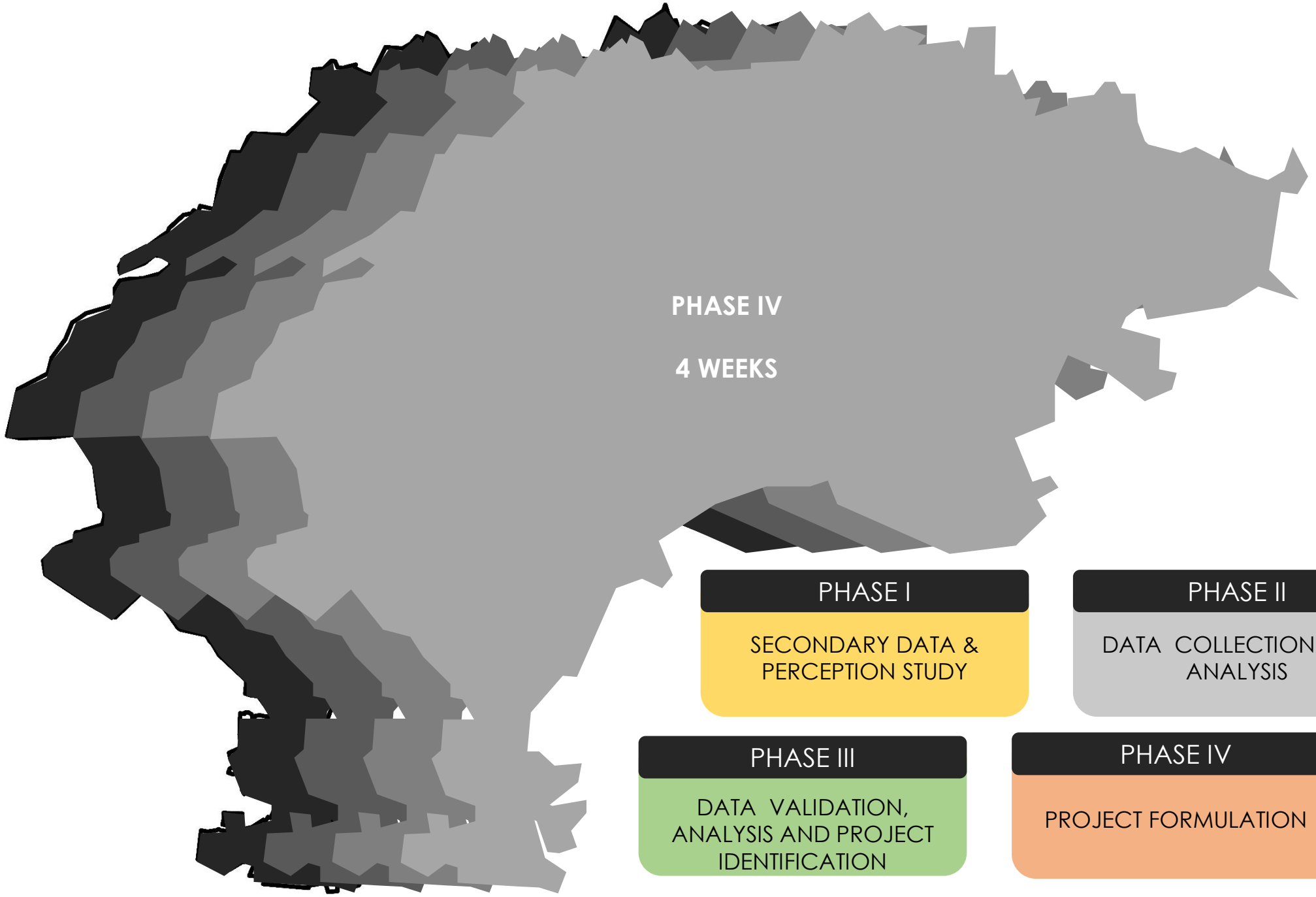

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SECONDARY DATA & PERCEPTION STUDY

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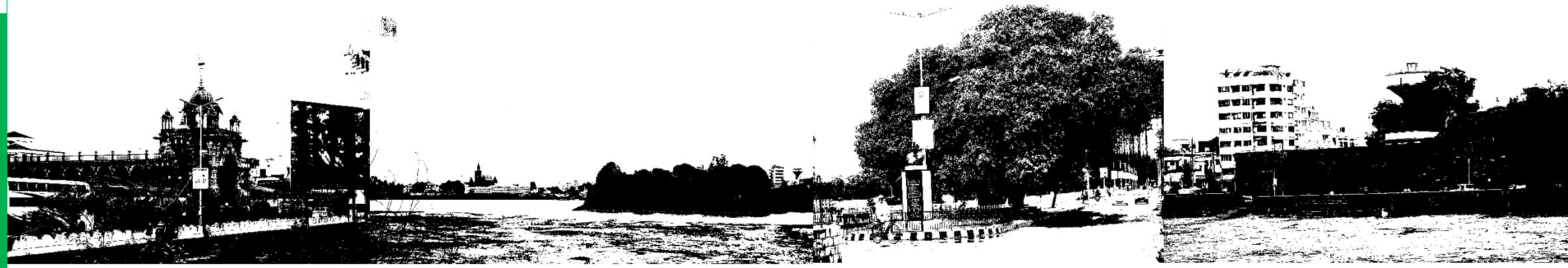
PHASE IV

PROJECT FORMULATION

PHASE I



THE CITY OF **BHUJ**

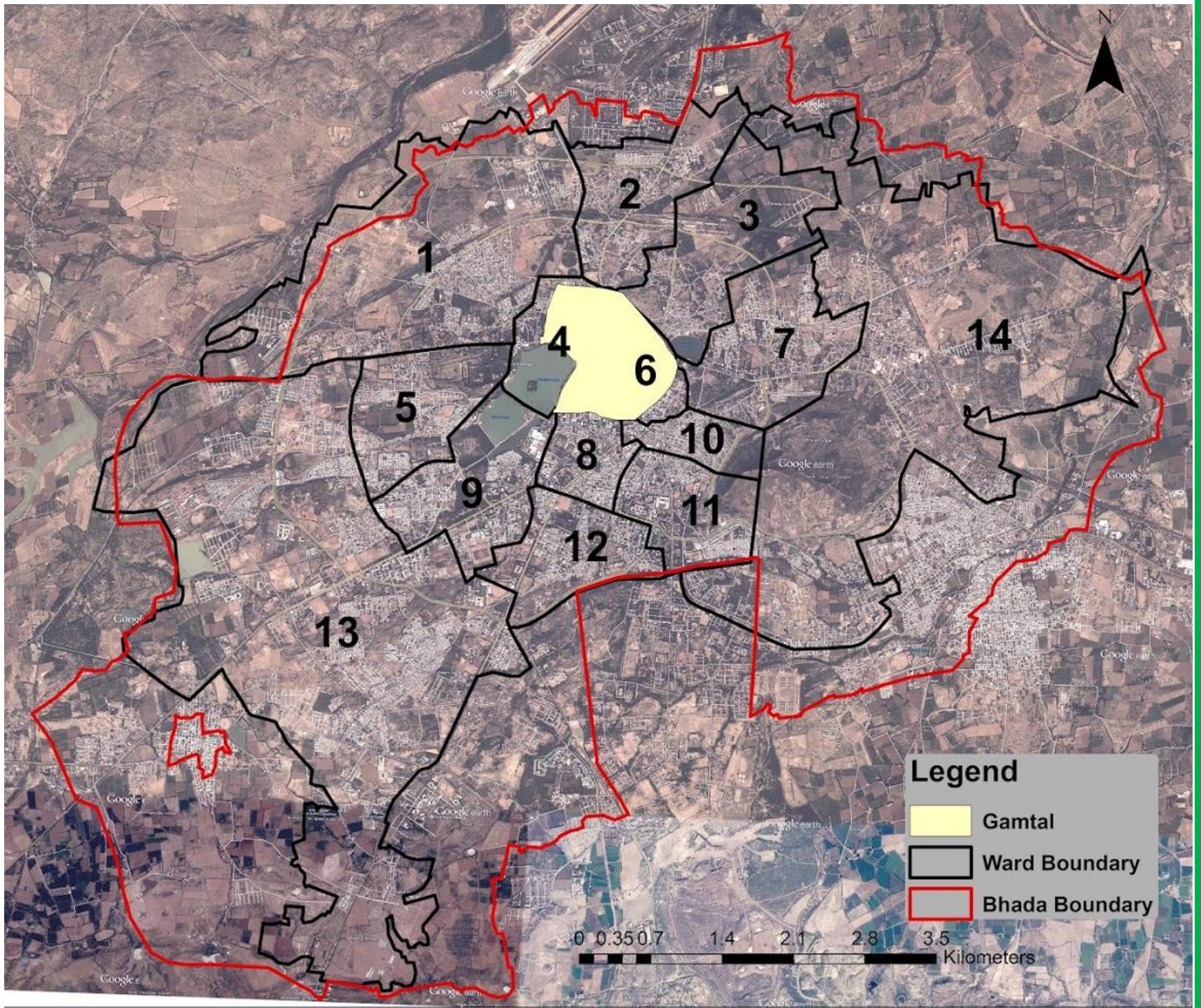
STUDIO OBJECTIVE

TO ARRIVE AT SUSTAINABLE SOLUTIONS FOR WATER AND SANITATION SERVICES IN BHUJ

STUDY OF SECONDARY DATA

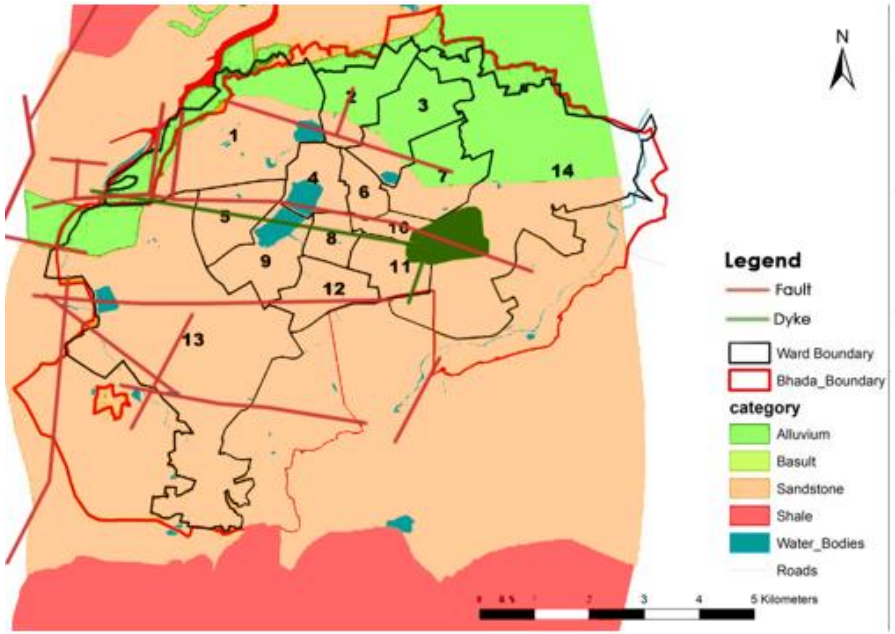
- INSTITUTIONS
- WATER
- WASTE WATER
- SOLID WASTE
- FINANCE

- DISTRICT HEADQUARTERS
- TRADITIONAL WATER SYSTEMS
- PRE/POST EQ SCENARIO
- BEST PRACTICES
- FUND ALLOCATION



BHUJ

	1,60,385
BNP BHADA	56 Sq.km 67 Sq.km
	39,123
	2864 per sq.km
	13% (2001 – 11)
	14 WARDS



- Water table in northern part of city- 12m- 15 m
- Water table in southern part of city- 33-37 m
- However **lower water table** has **negative effect: Saline and iron** content increases at greater depth

Resides on Large porous **sandstone aquifer**

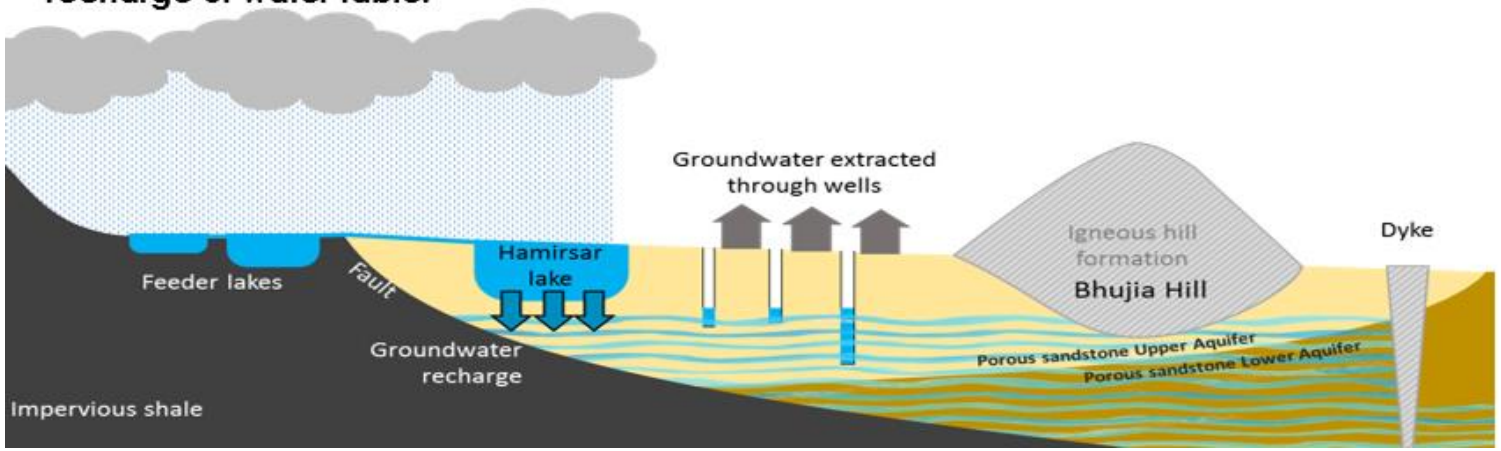
Enormous capacity to hold water

With fault lines on South, East and West, it f**orms a Confined Aquifer**

Receiver lakes are located on sandstone belt increases **recharge of water table.**

Moving Average of Rainfall

530 mm



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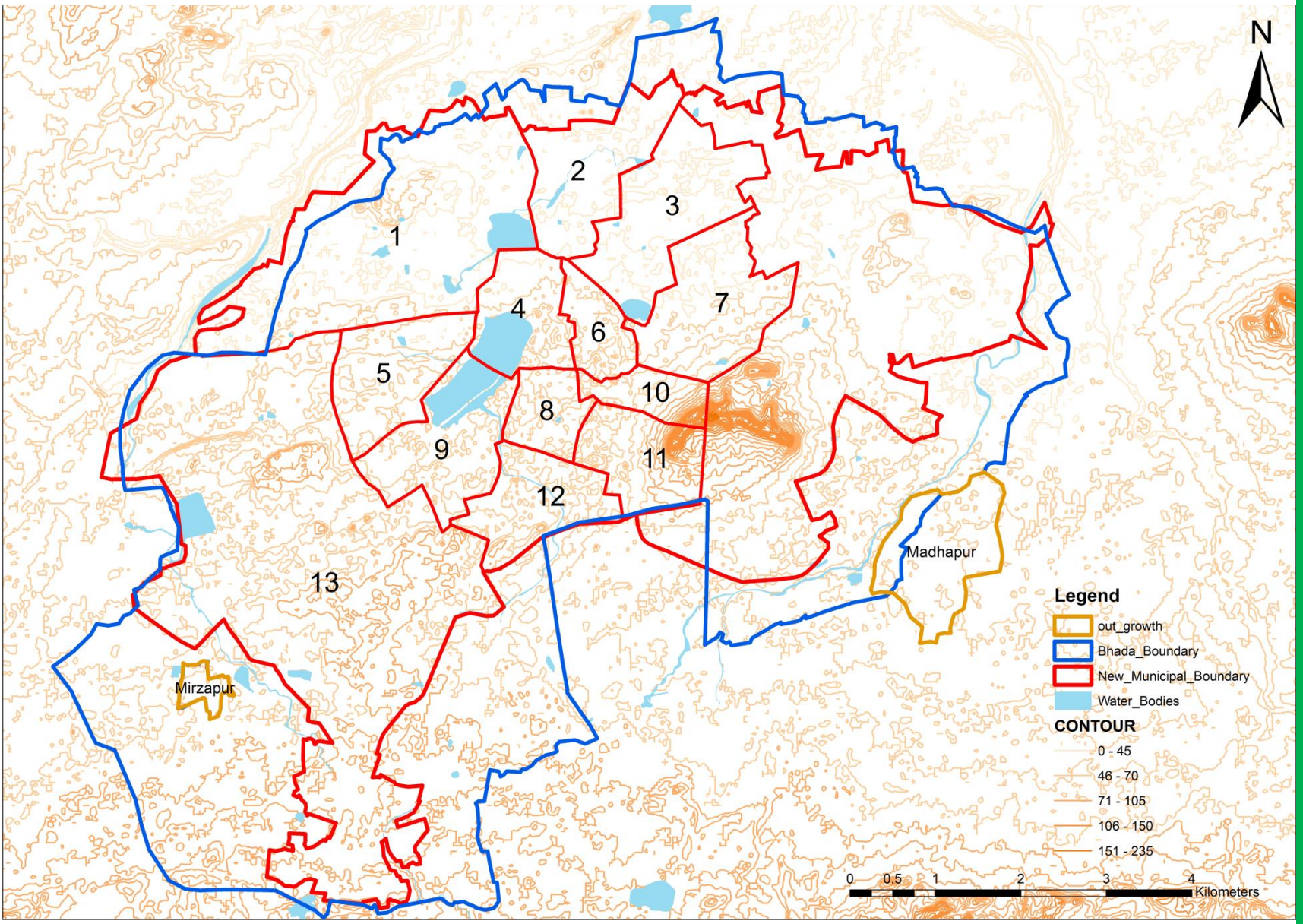

BHUJ

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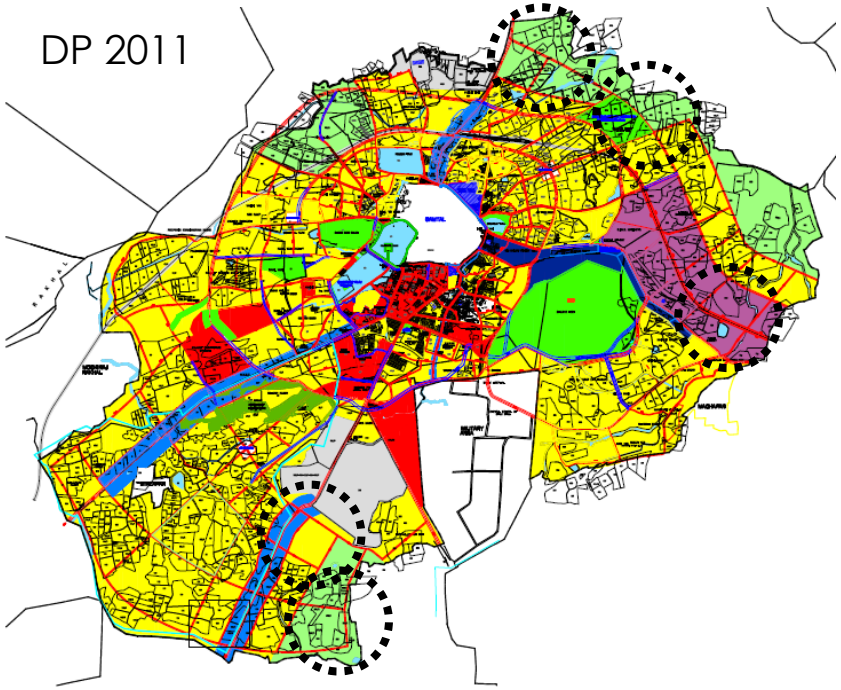
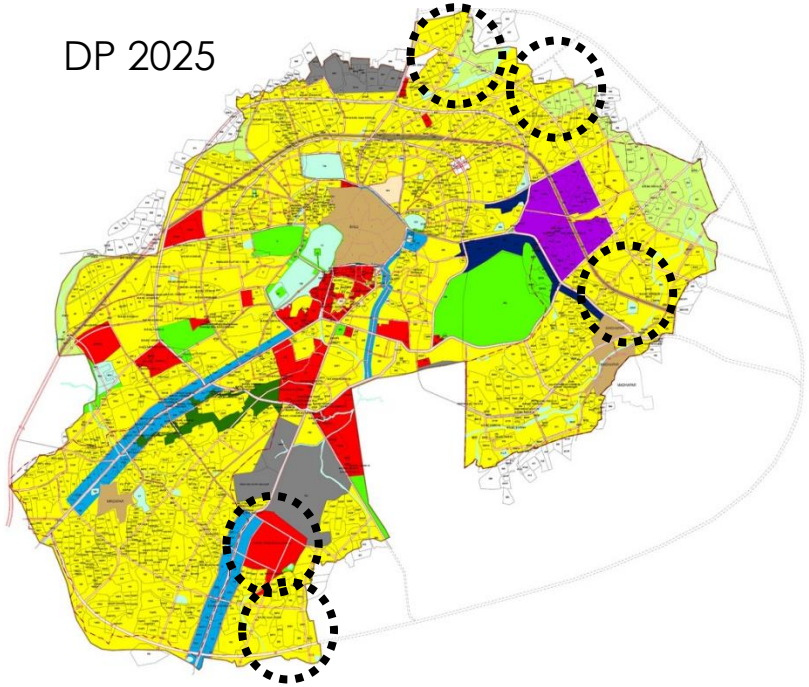
DP 2011



DP 2025



- Conversion of Agriculture area into Residential areas in the northern part of the city
- Decrease in the Industrial area
- Conversion of Agricultural area into Residential area in the southern part of the city
- Conversion of Residential area into Institutional area in the northern part of the city

BHUJ

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13%
(2001 – 11)

14
WARDS

PERCEPTION STUDY: TO GET A FEEL OF BHUJ

URBAN SETU AND SLUMS

- Details of slums
- Mediator
- Infrastructure services in slums

SAHJEEVAN

- Past initiatives and drives
- Collaboration with BNP

ACT

- Present pilot projects
- Monitoring details of wells

BHADA

- TP schemes
- Rehabilitation of relocation of slums
- Single point development permits

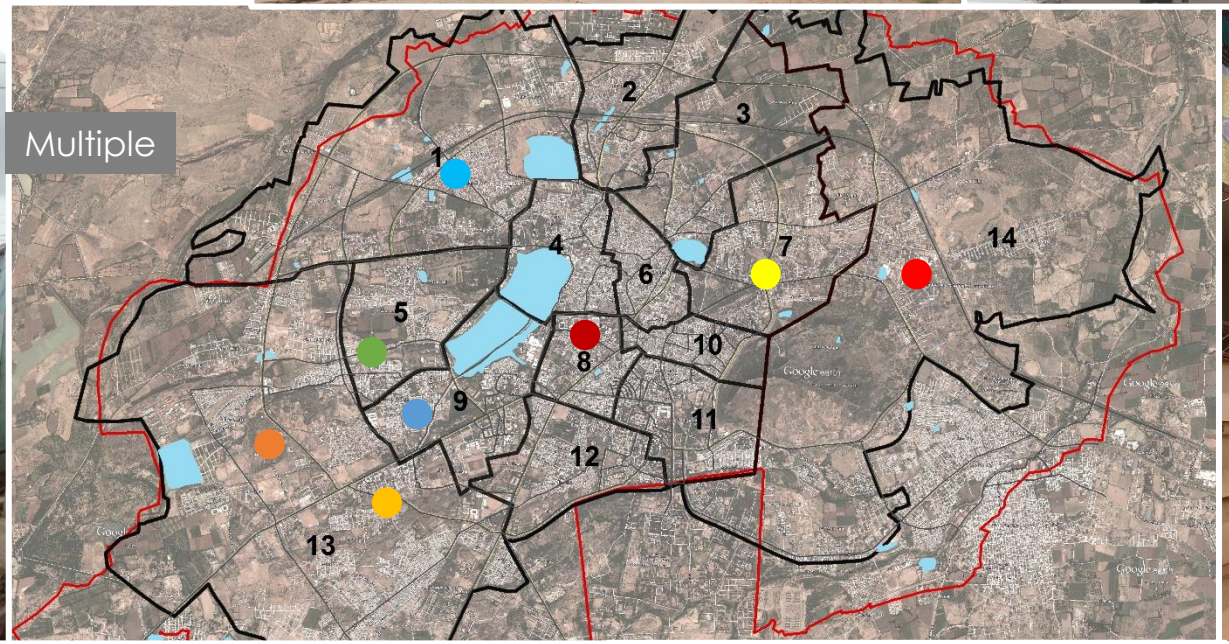
BHUJ NAGAR PALIKA

- First point of contact
- Understanding Organization structure
- Balance sheets
- Working of department
- Key persons

BUILT FABRIC

OUTCOME

A BASIC UNDERSTANDING OF ADMINISTRATION OF BHUJ



OUTCOME

A BASIC UNDERSTANDING OF ADMINISTRATION OF BHUJ

Multiple sources of Supply
High Dependency on R.O. bottled water

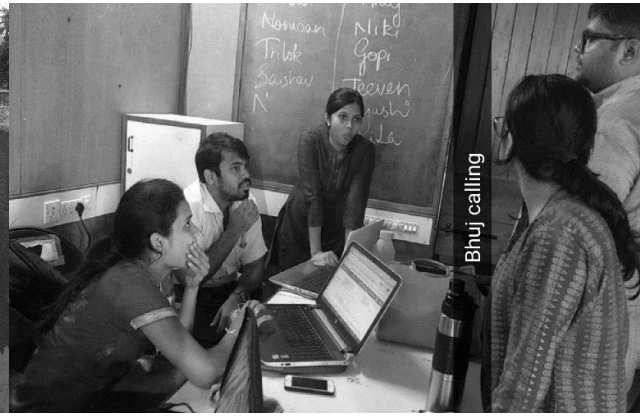
Partially Dry with Solid Waste dumped

Lack of Public toilets
No treatment of waste water
Frequent overflow complaints

Willingness to Pay for better services
Open Dumping & Burning of Waste

PHASE II

DATA COLLECTION AND ANALYSIS



PREPARATION OF BASE MAPS

- Based on administrative and ward boundaries

QUESTIONNAIRE FORMS FOR SURVEYS

HOUSEHOLD SURVEYS

- 6 Groups
- Purposive ad-hoc r sampling
- Focus on 3 sectors
- Bucket surveys

FOCUS GROUP DISCUSSIONS IN SLUMS

- Based on inputs from Urban Setu and BNP

OTHER VISITS

- Lakes
- Oxidation pond
- Dumpsite
- Water treatment plant
- Distribution tanks
- Schools & Hospitals

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DATA COLLECTION AND ANALYSIS

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OUTCOME

ANALYSIS OF THE COLLATED DATA AND INDENTIFICATION OF VULNERABLE AREAS

PHASE II

DATA COLLECTION AND ANALYSIS

PREPARATION OF BASE MAPS

- Based on administrative and ward boundaries

QUESTIONNAIRE FORMS FOR SURVEYS

Pressure issue & Frequency of Water Supply
Non-Functional WTP

Water Logging at Main roads
Clogged Storm water drains

Network is relatively new
Single Pit system is prevalent in HH's

Waste collection Services are poor
Recycling Potential

HOUSEHOLD SURVEYS

- 6 Groups
- Purposive ad-hoc r sampling
- Focus on 3 sectors
- Bucket surveys

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OUTCOME

ANALYSIS OF THE COLLATED DATA AND INDENTIFICATION OF VULNERABLE AREAS

PHASE III

PROJECT IDENTIFICATION

LEARNINGS FROM PREVIOUS VISIT

- Density based sampling
- Time management
- Resource allocation

REVISION OF QUESTIONNAIRE

HOUSEHOLD SURVEY

ACTIVITY MAPPING AROUND LAKES

STREAMLINE STUDY

OTHER VISITS

- Monitoring wells
- Pumping stations
- Parks
- GIDC
- APMC and other markets
- Scrap dealers

PHASE IV

OUTCOME

ESTABLISHING THE MISSING LINKS TO IDENTIFY THE PROJECTS

PROJECT SPECIFIC SURVEY

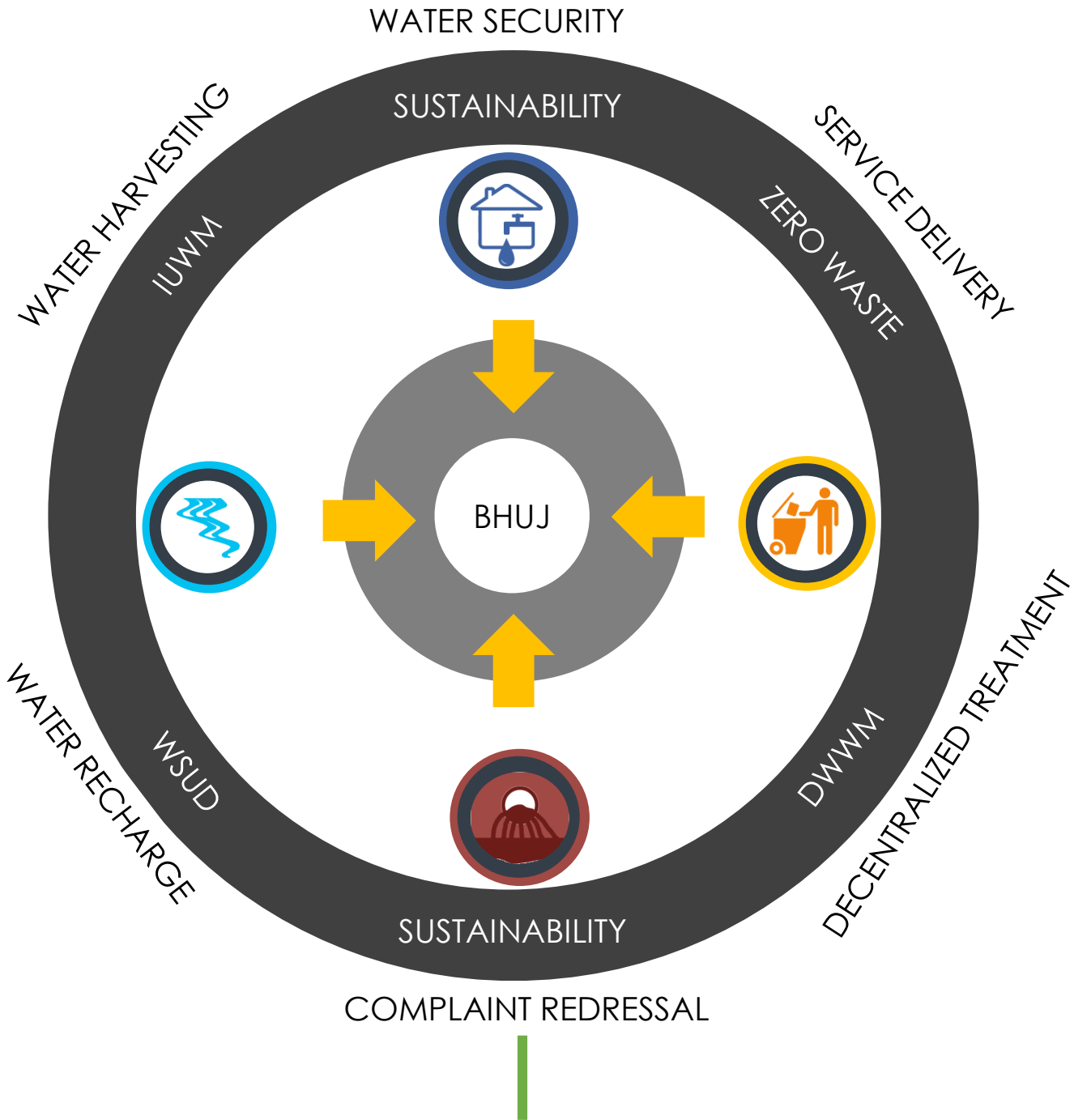
Low revenue against Expenditure on water
Strong Presence of Pvt. water market

Blocked Stream lines due to dumping
Encroachment of drains/lakes

Pumping Stations not running at designed capacity
Opportunity for Waste water reuse

Dumpsite still within the limits & can be transformed to Sanitary Landfill

EVOLVING IDEAS



Studio Vision

Water
Water Secure Bhuj with Improved service delivery

Lakes
To make Bhuj the City of Lakes

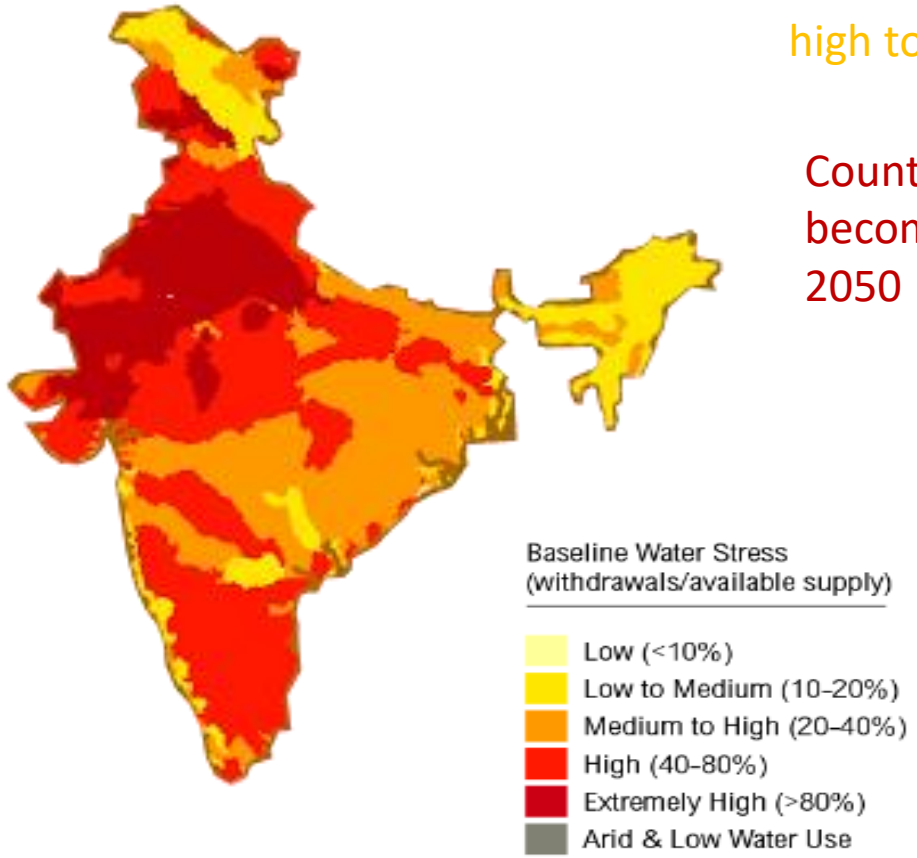
Waste water and Sanitation
To achieve sustainable sanitation

Solid Waste Management
Towards zero waste management

WATER

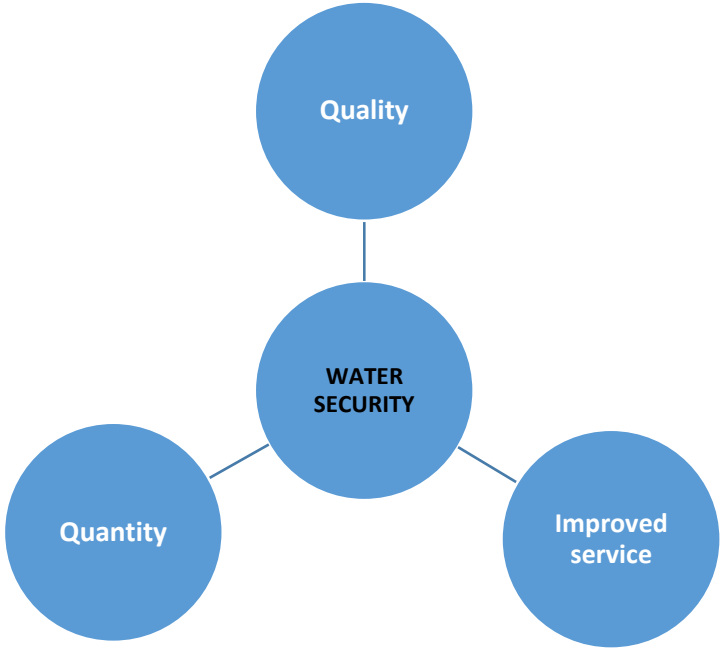
Water

Water Stress is the ratio of withdrawal to available supply with respect to either surface or sub surface resources…



54% of the country faces high to very high stress levels

Country is expected to become water scarce by 2050



Water Security

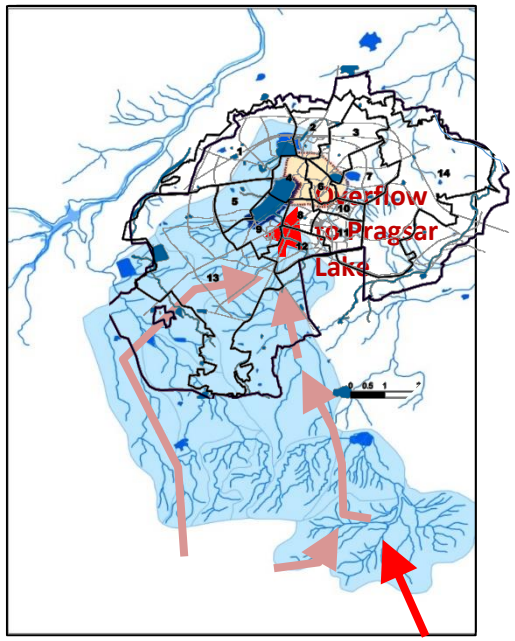
Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN-Water, 2013)

Source: http://www.wri.org/applications/maps/aqueduct

Water Evolution

1500-1800

- Hamirsar lake catchment and Bhuj
- 24 well system
- Adding Dhunaraja dam



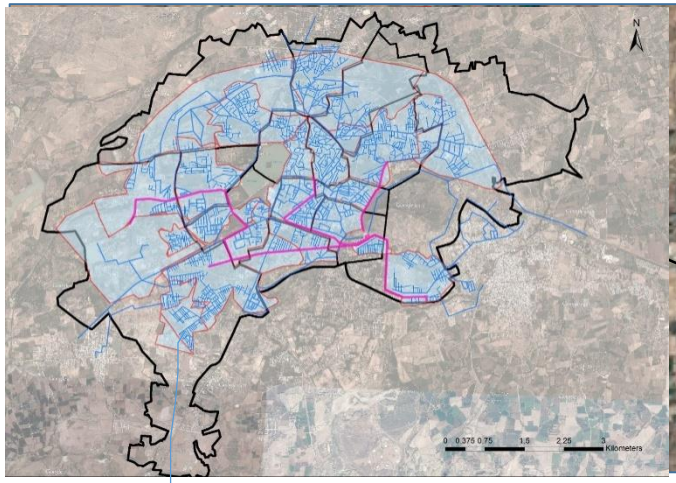
Lake system helped to recharge the aquifers and supply drinking water through wells

1800-1960

- **Community managed wells**
- **British era- Centralized system of Management**
- **Traditional system neglected**

1960-2000

- **Spatial growth of city Piped supply system in 1968- increasing demand**
- **Water bought from outside Bhuj, Kukma (11 kms from Bhuj)**
- **Pricing was as flat charge**
- **Tariff was very low at only Rs 10 per month**
- **Water was not valued as a scarce resource**

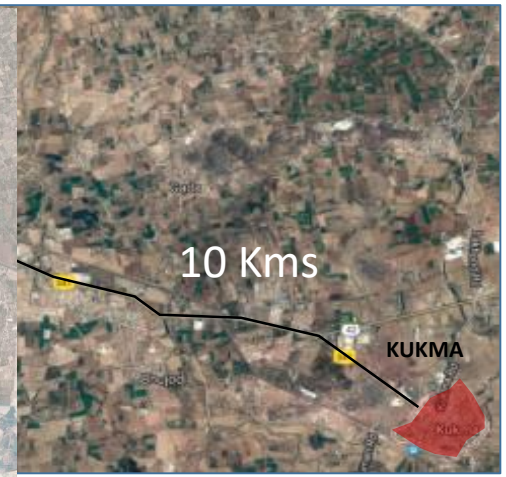


9 Kms

Bharapar

2000-2010

- 2001 Earthquake
- Bringing water from Narmada(2008) , 700 kms from Bhuj
- Bharapar water scheme post 2011

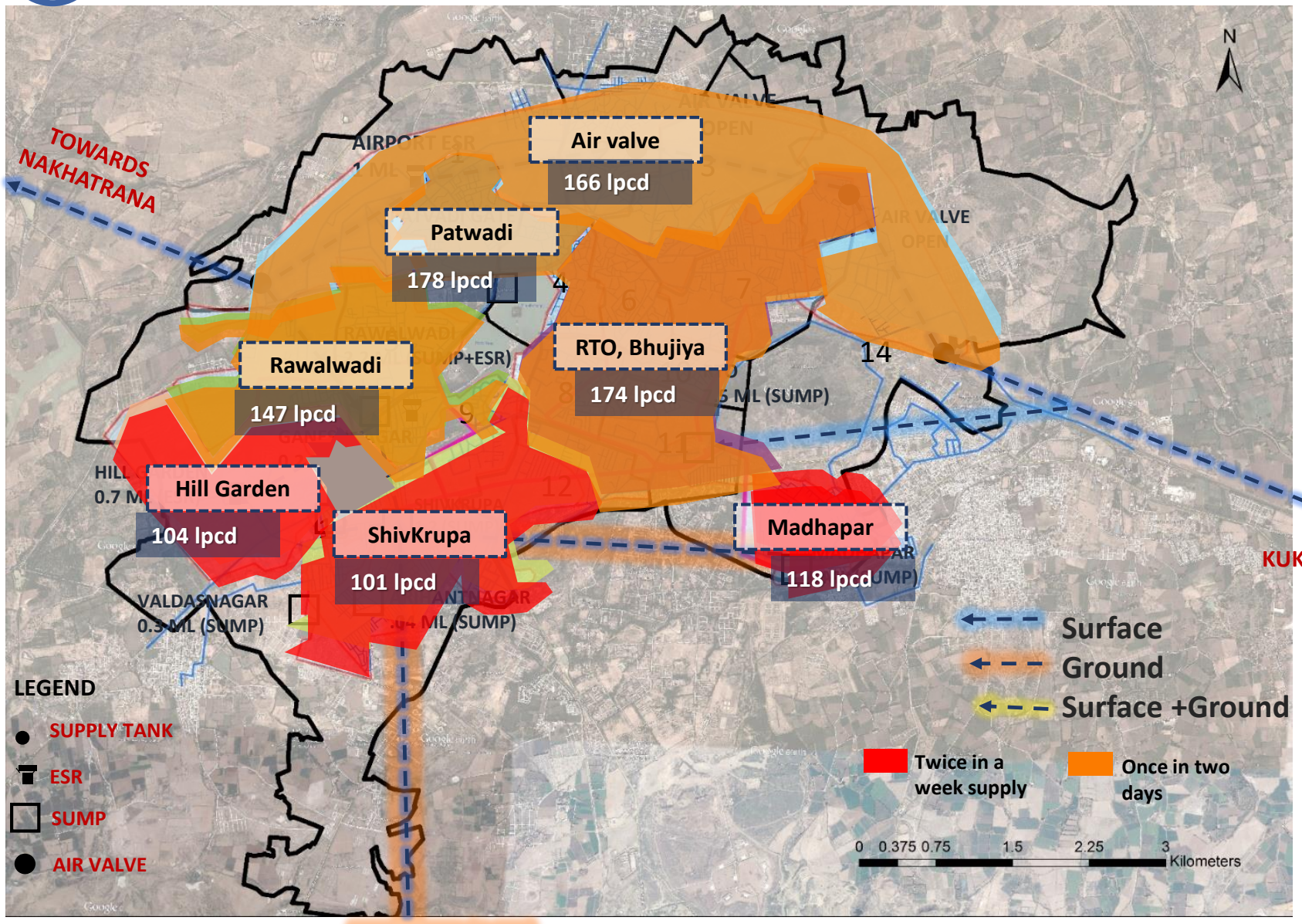


Narmada: GWIL

Advent of the piped network and the resultant rise in quantity of water demand increased the dependence on distant sources

Source: ACT, water economics report,2016

Present Situation

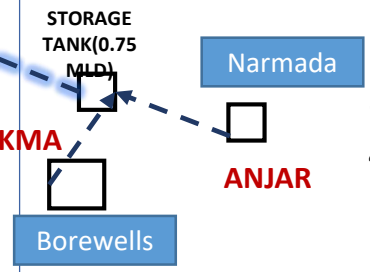


TOTAL WATER SUPPLY: = **31 MLD (Surface:58%, Ground: 42%)**

Water

Water Distribution

Kukma	14MLD
Air valve	4MLD
Bharapar	2MLD
Madhapar	8MLD
Patwadi	1.5MLD
Valdasnagar	1.5MLD
Total Water Distributed	**31MLD**



58% SURFACE WATER
42% GROUND WATER

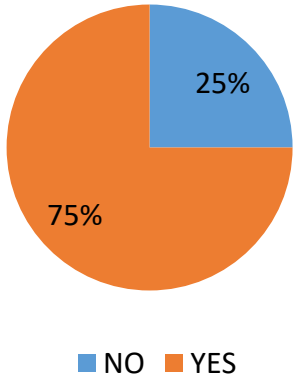
- Irregular water supply
- Frequency of water supply varies from alternate supply to twice a week supply in some areas

- Total road network: **226 km**
- Water network coverage: **90%**

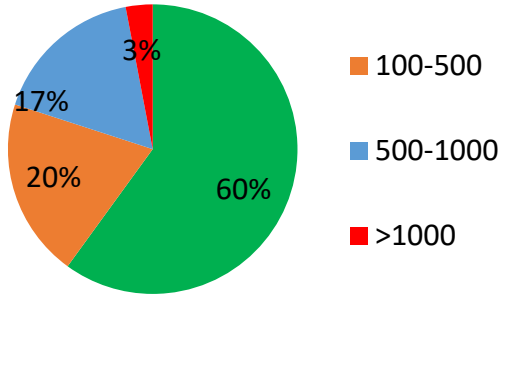
Source: Primary survey

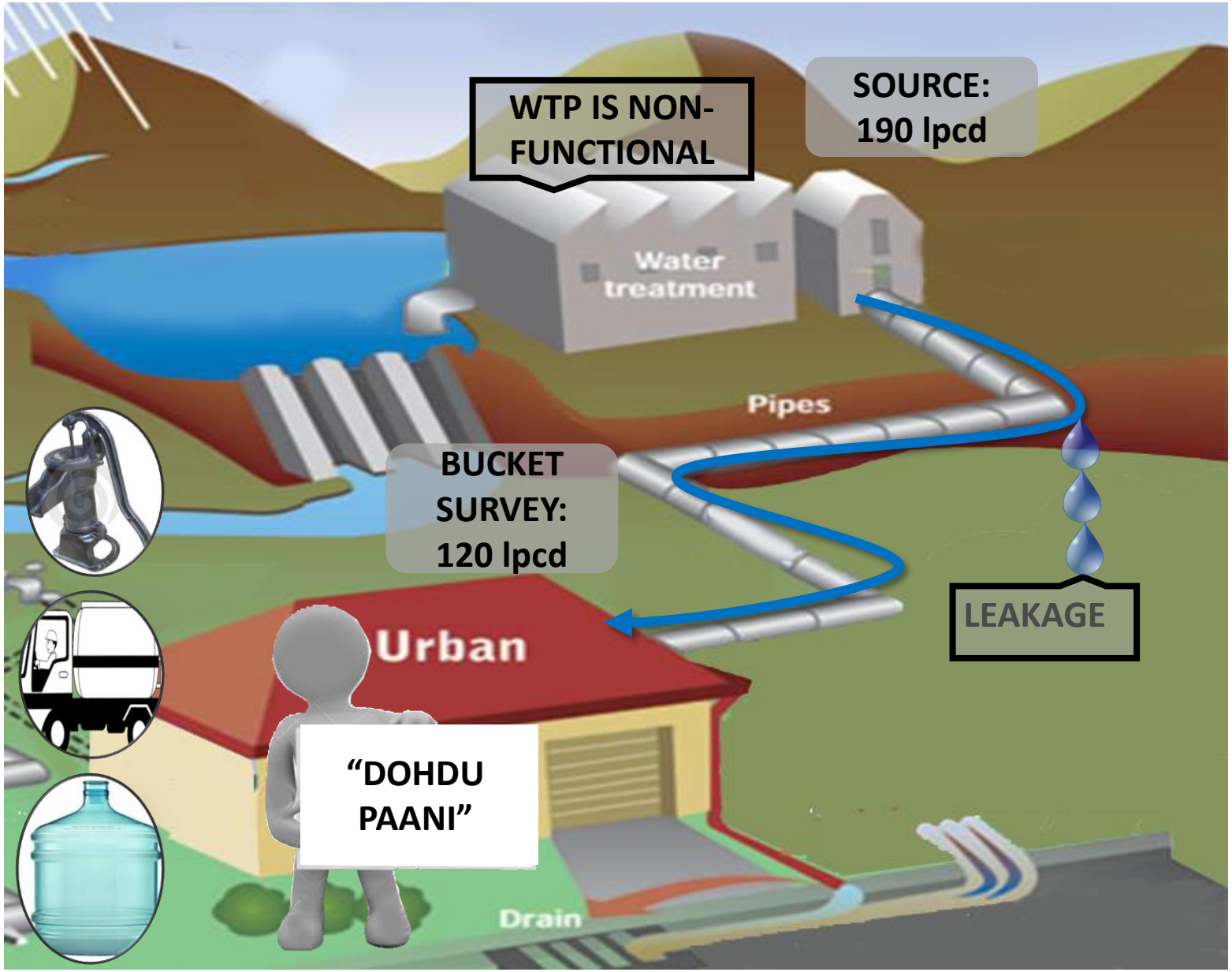
City Wide Issues: People's Perspective

Quality Issue



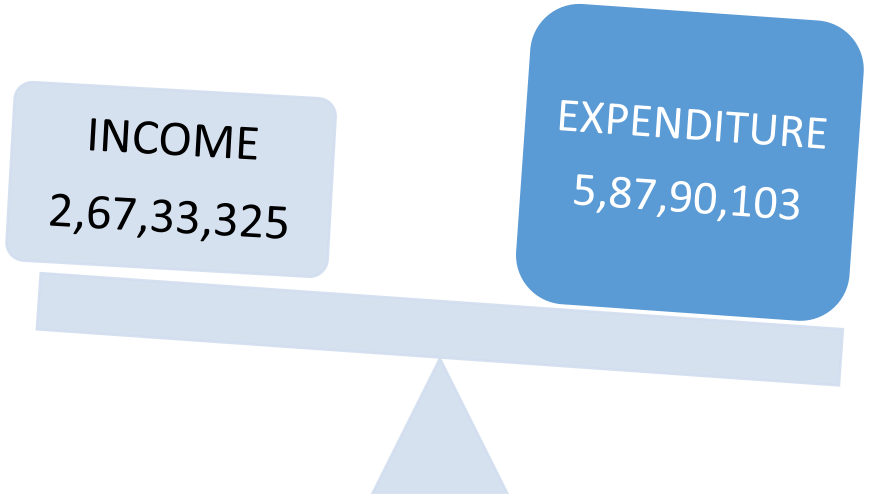
Total monthly expense on Water





Source: primary survey

2015-16



OPERATING RATIO 2.20

Source: **Bhuj budget,2014-15**

Project: 24 hours water supply-DMA

Water distribution data records maintenance

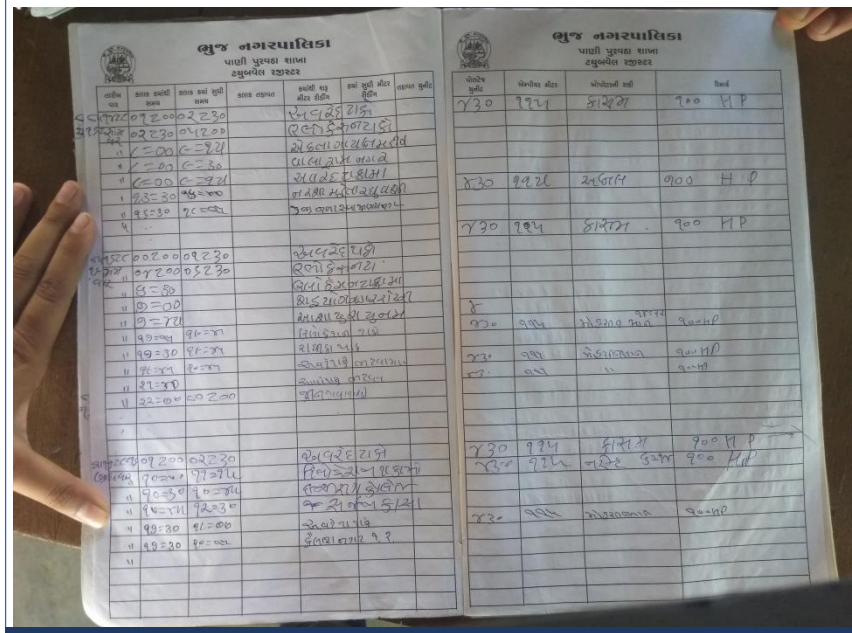
Valve men/ Sump in charge keeps manual register record of water supply hours, area covered and electricity consumption

→ Occasional inspection in case of water distribution related complaints

→ Register submitted for inspection in BNP, new registered is issued

Records and Checklist to be carried out (as per CPHEEO)

Daily Reporting	Monthly Reporting	Annual Reporting
• Distribution pressure at source • How much water distributed • How much water supplied • Any leakages or losses etc.	• Quality of infrastructure and maintenance works • Painting, cleaning, corrosion repairs. • Check for water quality and pollution sources/ causes etc.	• Review of method of giving new connections in the field • Number of connections • Status of distribution system etc.



Register entry with no common format followed for data collection

- **Register is used to find water supply coverage, quantity of water supplied in water zones.**
- **No digital record are maintained, variation in water distribution time.**
- **Data can not be used to estimate water losses during distribution.**

Source: CPHEEO, Primary Survey, BNP

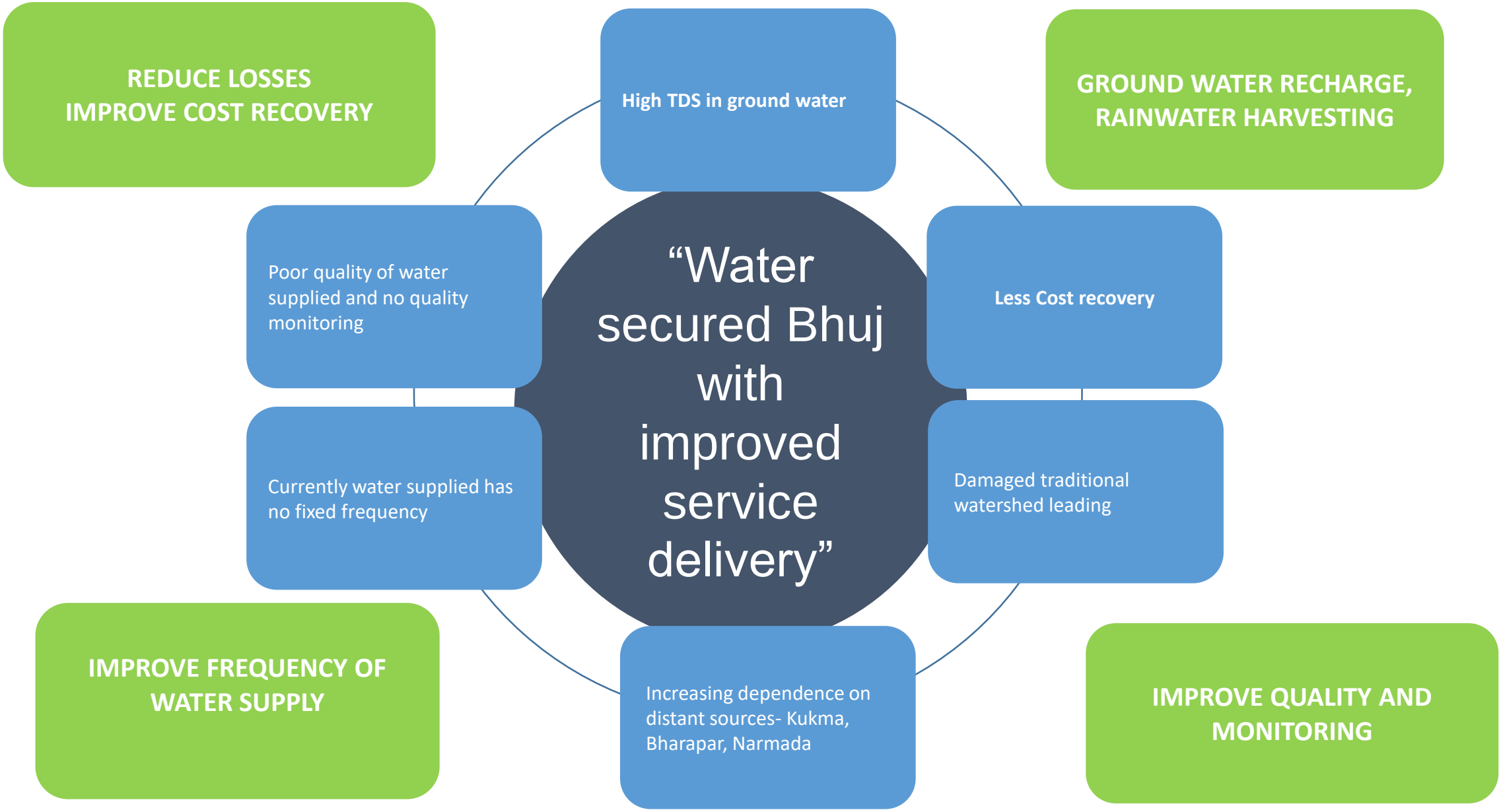
Who collects and maintain the Records?

Employees in water department

System components	Staff for Water Supply- BNP	CPHEEO suggested requirement
Assistant manager (AE)	1	1
Operators	7	7
Helper/fitters	7(Regular)+37(Rojander)+ 95(contractors)	86
Electrician/ Mechanic		2
Watchmen		6
Total	**147**	**102**

Manual collection of data and analysis **may not be helpful in large undertakings** if water utilities have to aim at enhanced customer service by **improving water quality and service level with reduced costs**. -CPHEEO O&M water Supply

Source: CPHEEO, BNP


REDUCE LOSSES
IMPROVE COST RECOVERY
High TDS in ground water
GROUND WATER RECHARGE, RAINWATER HARVESTING
Poor quality of water supplied and no quality monitoring
"Water secured Bhuj with improved service delivery"
Less Cost recovery
Currently water supplied has no fixed frequency
Damaged traditional watershed leading
IMPROVE FREQUENCY OF WATER SUPPLY
Increasing dependence on distant sources- Kukma, Bharapar, Narmada
IMPROVE QUALITY AND MONITORING

Daily Water Supply & 24X7 Water Supply in Bhuj

Objective of water distribution system by CPHEEO

'To deliver wholesome water to the consumer at adequate residential pressure in sufficient quantity at convenient points and achieve continuity and maximum coverage at affordable cost.'

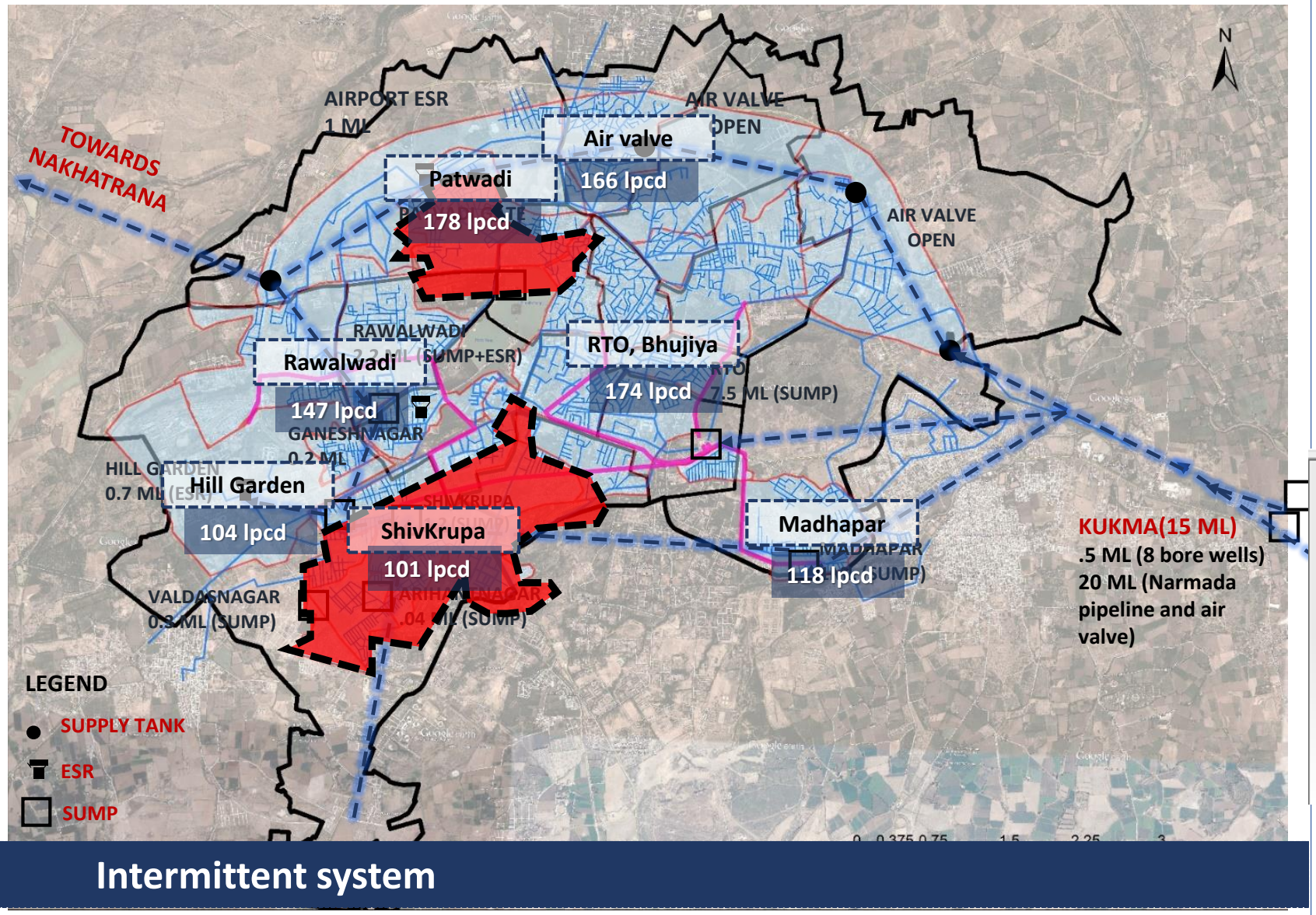
Issues in Water Distribution System

Mentioned in CPHEEO

- **Intermittent System**
- **Low Pressure at supply Points**
- **Non Availability of required quantity of water**
- **Lack of records**
- **Leakage of water**
- **Unauthorized connections**

Source: CPHEEO

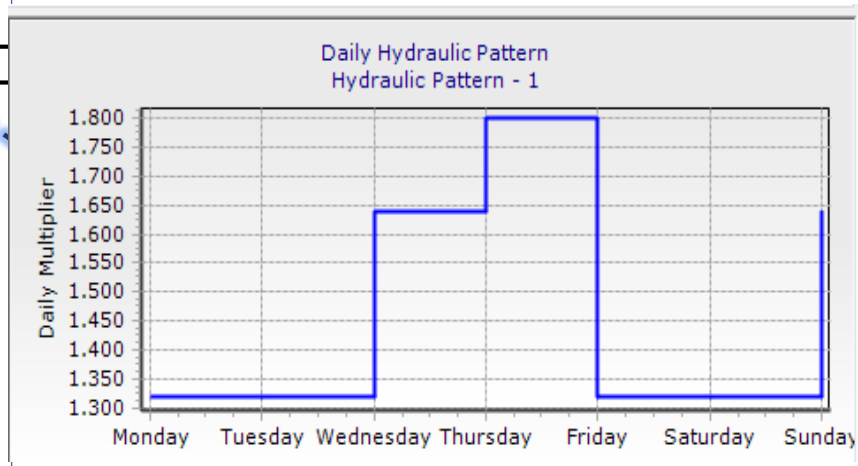
Issues



Intermittent system

Water

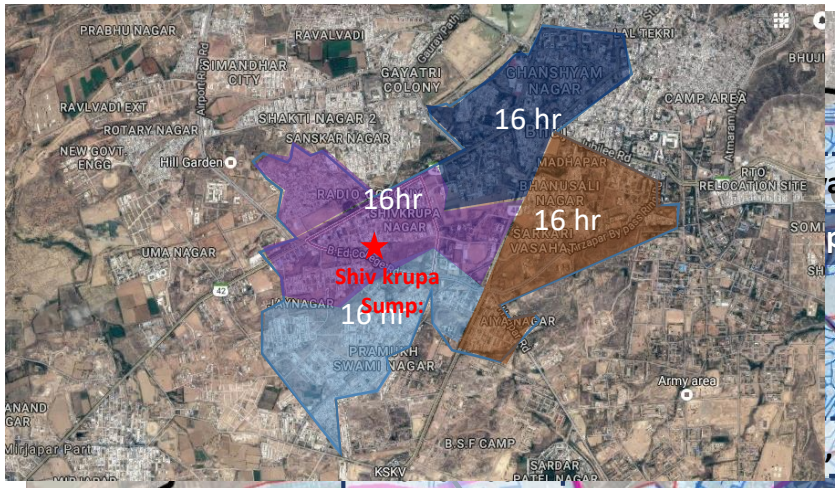
- **Irregular time of water pumping to HH in different water zones**
- **Irregular hours of distribution**
- **No reliability of water supply**
- **Prompts the consumers to always keep open the taps of both public stand posts and house connections leading to wastage of water whenever the supply is resumed.**

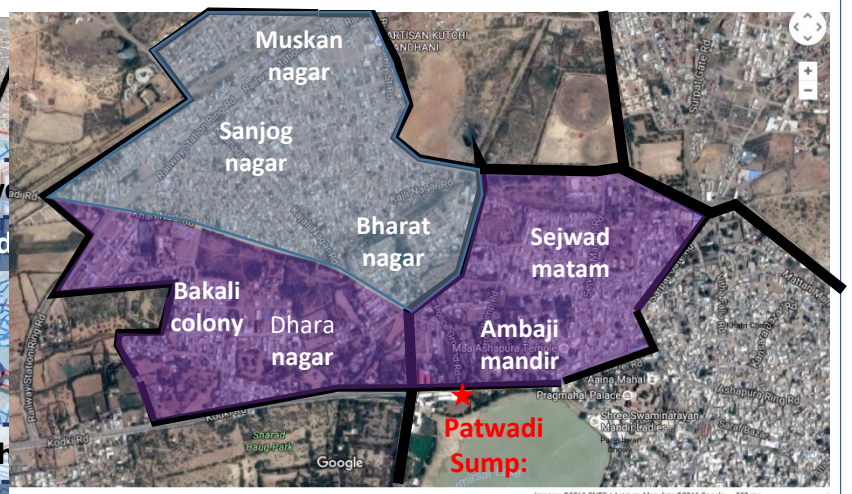


Daily Water distribution pattern from storage sump **Shivkrupa**

Source: Interviews with Valve men, BNP

Issues





Shiv Krupa Sump(101lpcd):

Tank size: 1.2ML

population served: **14267** HH-**~2853**

- Supply: 1.59 MLD
- Demand: 1.92MLD
- Supply pump: 100HP+60HP+60HP
- 2.5-3.5hrs hours of water supply

Patwadi Sump (178lpcd):

Tank size: 0.7ML

Population served: **4737** HH-**~950**

- Supply: 9.3 Lakh litre per day
- Demand: 6.4 Lakh litre per day
- Supply motor:- 35hp+ 35hp
- 1.5 to 2.5hrs of water supply

intermittent system

Water

- **Irregular time of water pumping to HH in different water zones**
- **Irregular hours of distribution**
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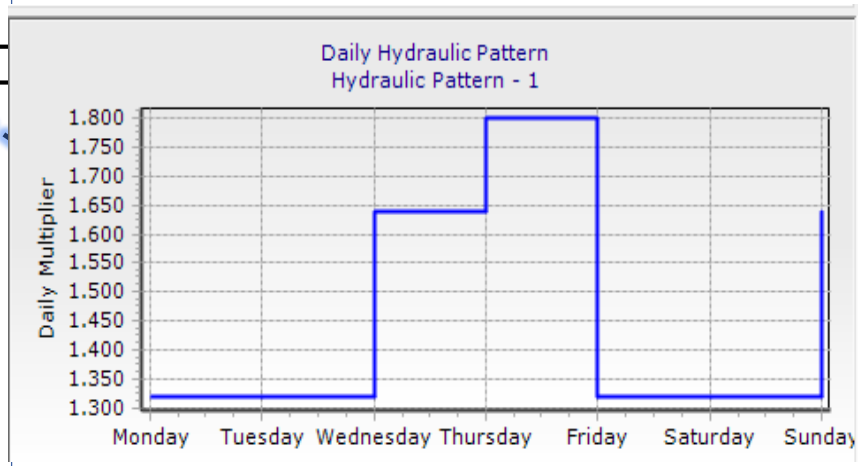
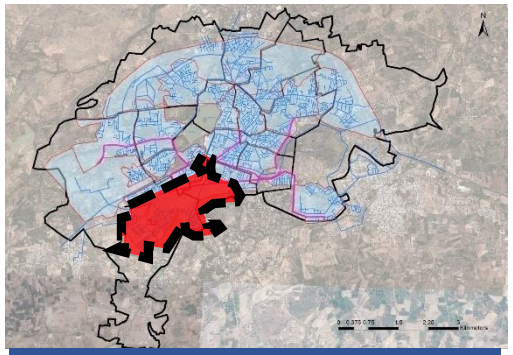


Daily Water distribution pattern from storage sump **Shivkrupa**

Source: Interviews with Valve men, BNP

Project: Regular water supply

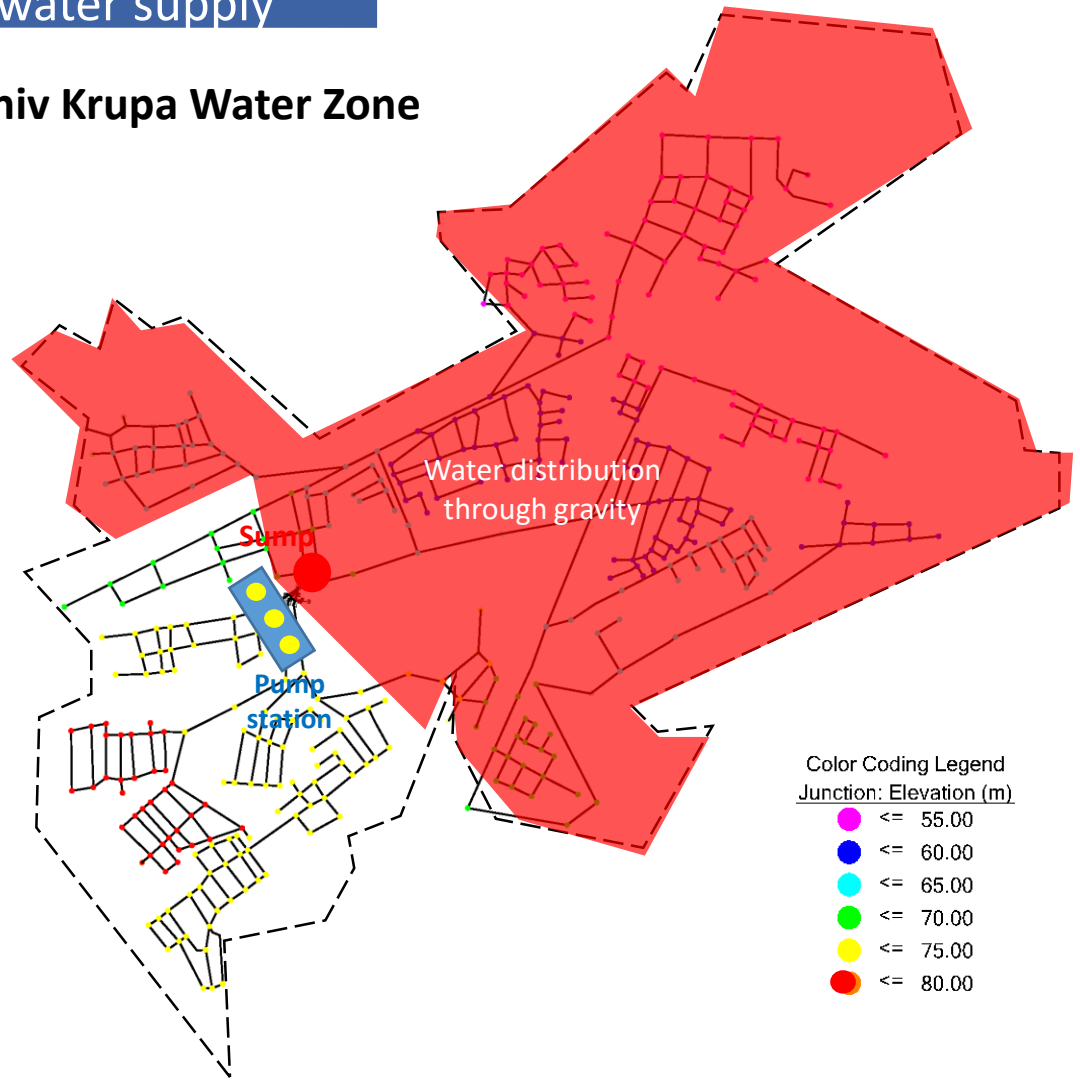


Location on Bhuj Map

ShivKrupa Sump

Pumps at pump Station near Shivkrupa sump

Shiv Krupa Water Zone



How to have daily water supply in ShivKrupa area?

- Storage Capacity
- Water Pressure
- Water Network

Interview with Ravender Bhai at ShivKrupa Sump

Shiv Krupa Sump(101lpcd):

Tank size: 1.2ML

population served: **14267** HH-**~2853**

- Supply: 1.59 MLD
- Demand: 1.92MLD
- Supply pump: 100HP+60HP+60HP
- 2.5-3.5hrs hours of water supply

- **Total work hours per day: 16hrs**
- **Existing water flow rate in Bhuj is 678 l/hour**

Source: Interviews with Valve men, BNP

Project: Storage Capacity

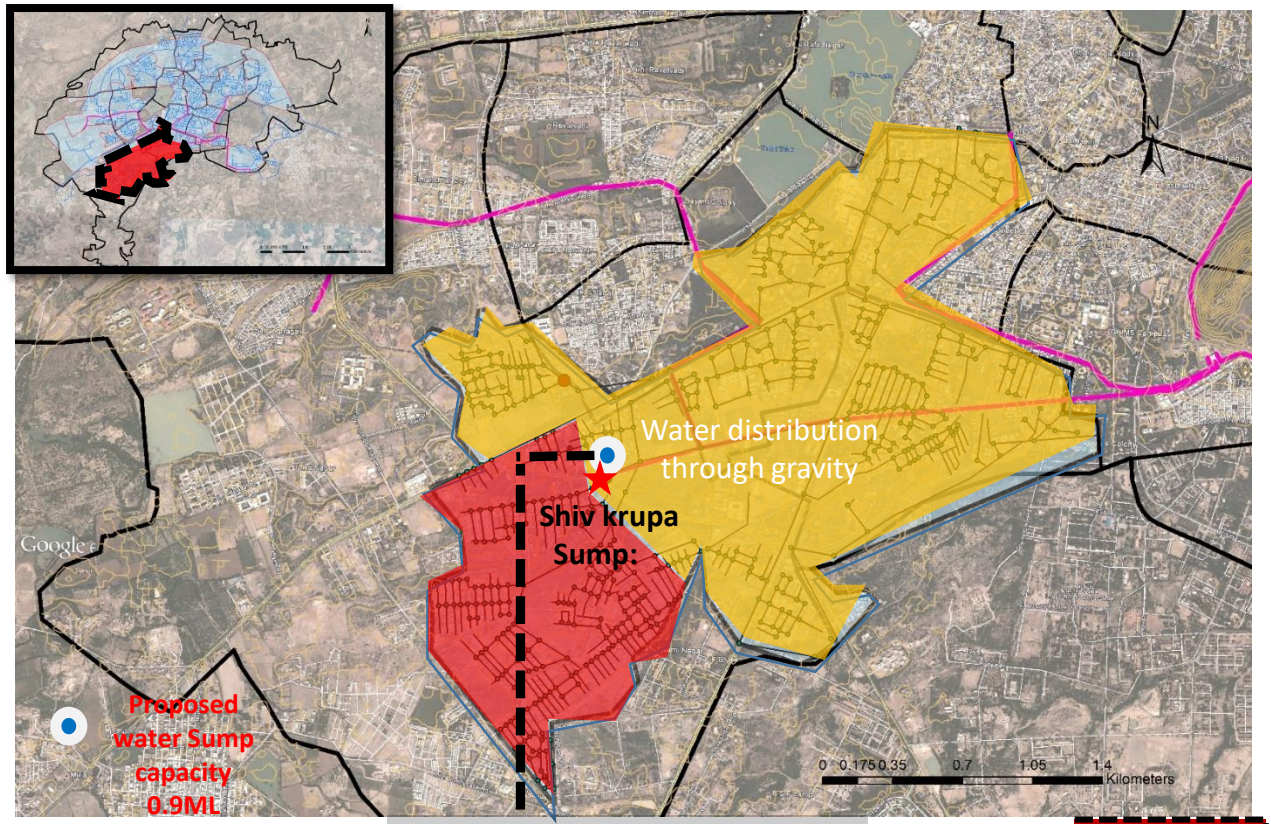
Water

101 LPCD
Once in 2 days/ daily supply

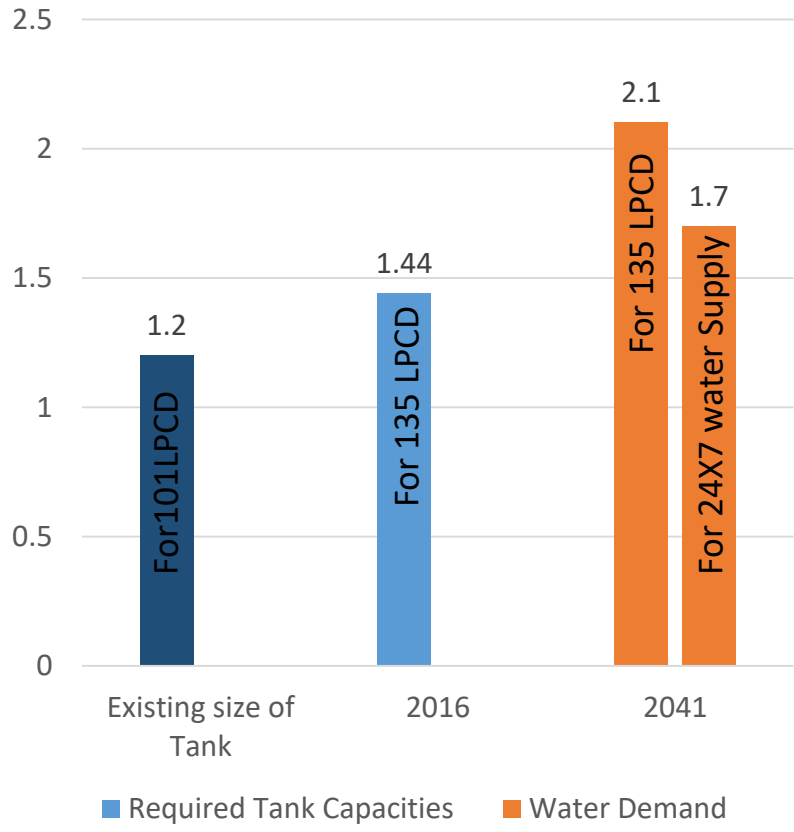
1.2ML Tank

135 LPCD
Once in 2 days/ daily supply

1.44ML Storage Capacity



Demand of storage Capacity



1.6 ML water can be stored and distributed if filled at 6ft/8ft level

Proposed Tank

2041

1.2ML Tank

Existing Tank

0.9ML Tank
For 135 LPCD

OR

0.5 ML Tank
For 101 LPCD

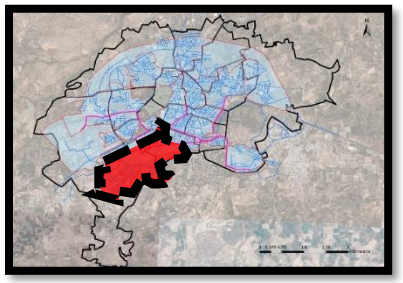
24X7 water supply

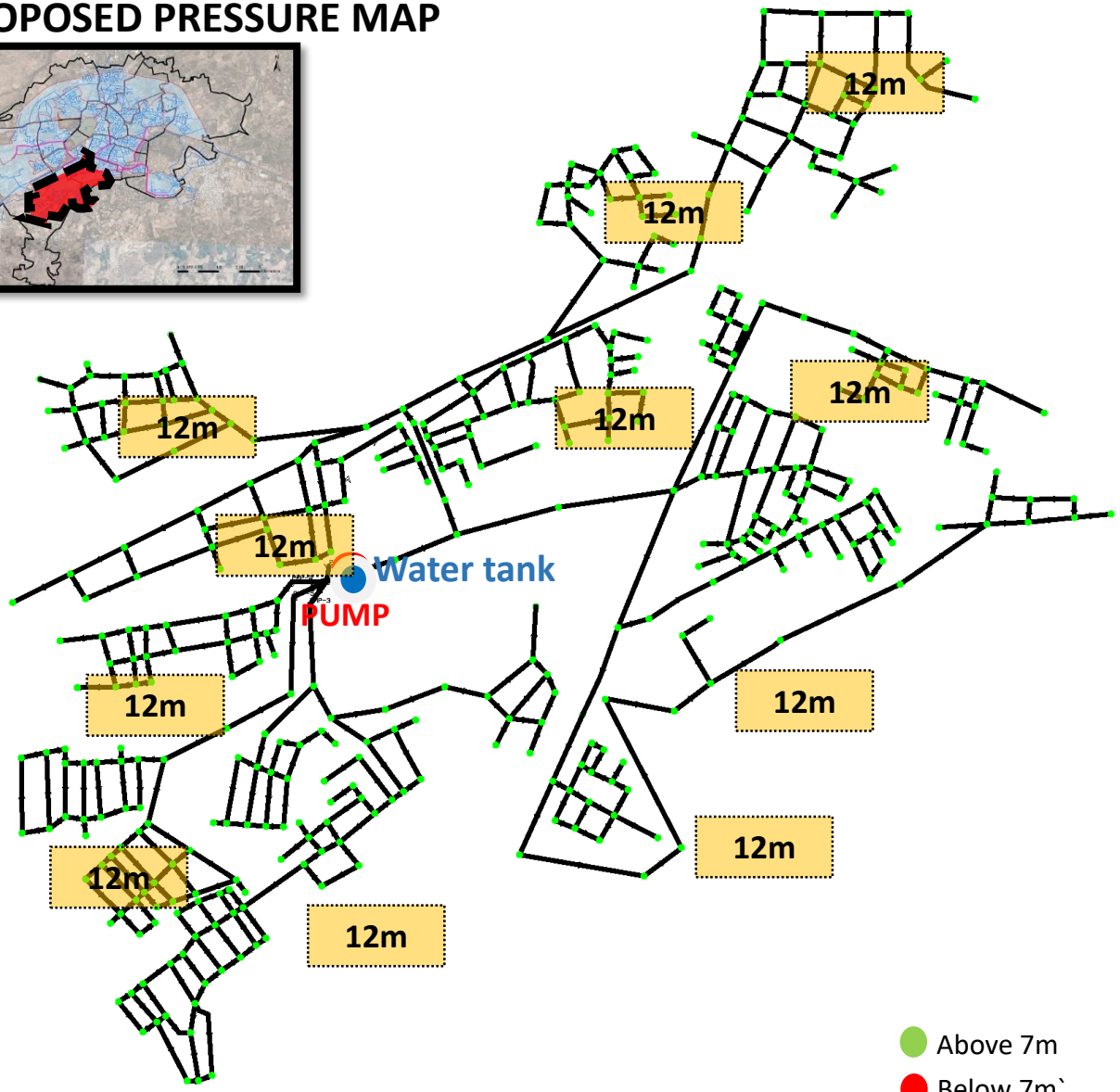
Base Elevation of proposed water tank: 20m

Source: BNP

Projects: Water Pressure

PROPOSED PRESSURE MAP





Less reliability on water pressure at consumers.

Very minimal water pressure related complaints

Underground Water Tank storage varies from 1,500 l to 10,000l.

In Shivkrupa areas have less pressure as 1m- 2m in few Societies

3 functional ESR in Bhuj

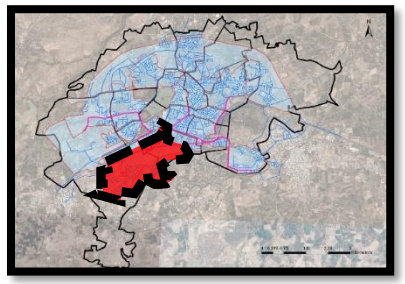
BNP water collected in UGT during supply

Demand flow at major junctions: **715 l/s**

- Proposed Pressure 12m in all location in Shiv Krupa water Zone
- Installation of water meter at Sump outlet and inlet of distribution. (10 in number)

Source: Bucket Survey, Watergems analysis

Project: Network Augmentation



Modification of water network:

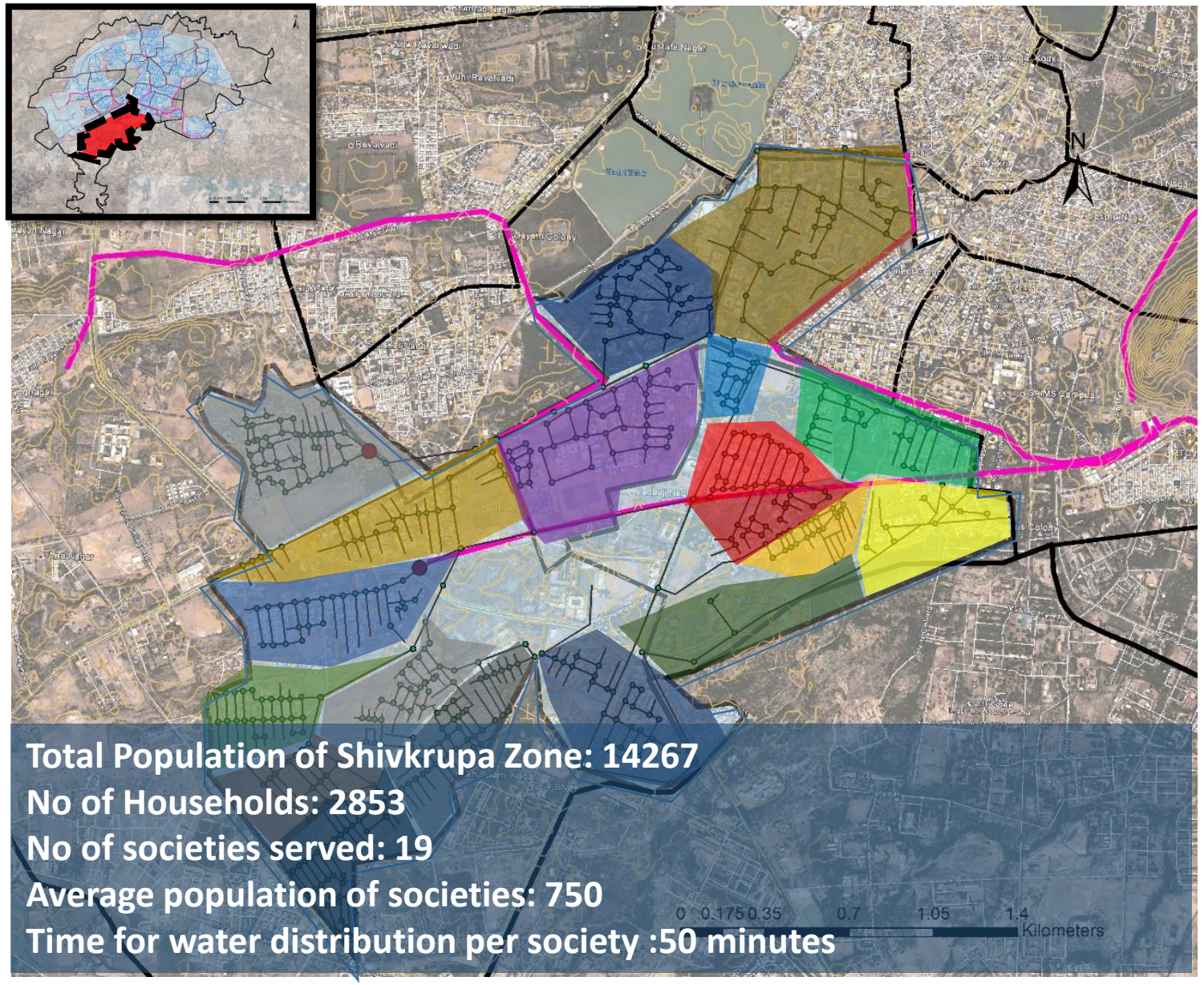
- 'Designing whole network in such a way that pipe diameter gradually decrease from main trunk lines to branch lines'

- Pipe diameter varies from 500mm to 110 mm

Identifying Water leakage points in the network to reduce losses & modifying network accordingly.

Source: BNP, Watergems analyses

Project: Regular water supply



- **Total work hours per day: 16hrs**
- **Demanded water flow: 900 l/hr (for 135lpcd water supply)**
- **Fixed minute of supply per household: 50 min**
- **Distribution schedule to be mentioned in water bills &SMS alerts**

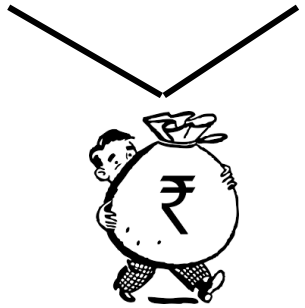
Source: Primary Survey, BNP

2A. SCHEDULING OF WATER SUPPLY

CASE STUDY: Bangalore

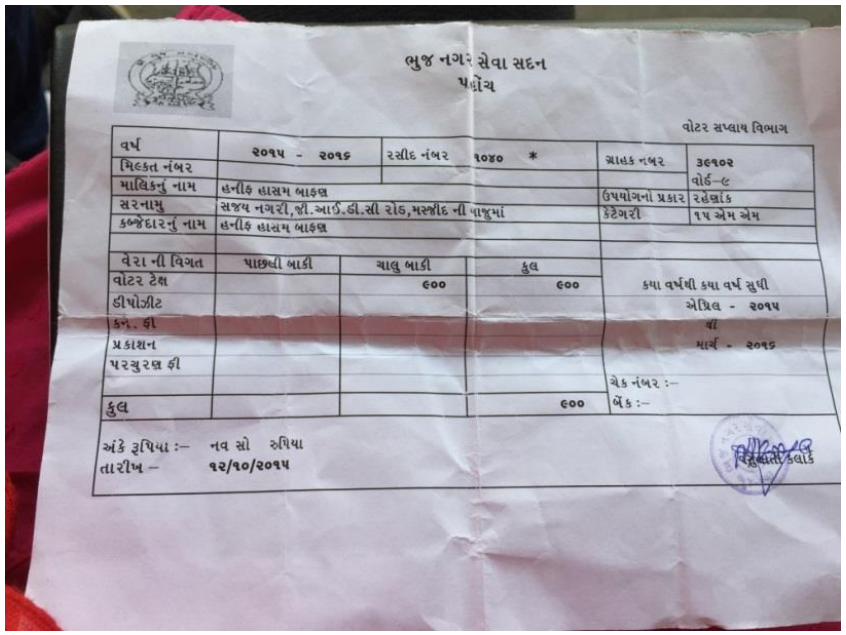
SLUM AREAS

NON-SLUM AREAS



NextDrop INITIATIVE → **25,000 REGISTERED USERS** → **USERS GET REGISTERED:** Official website of NextDrop **OR** Calling to a toll-free number → **SMS 1 HOUR BEFORE:** Valvemen will sent sms to the NextDrop team and one to BWSB for record

NextDrop TEAM WILL SEND TO THE USERS



ભુજ નગર સેવા સદન
પહોંચ

વોટર સપ્લાય વિભાગ

વર્ષ	૨૦૧૫ - ૨૦૧૬	રસીદ નંબર	૨૦૪૦ *	ગ્રાહક નંબર	૩૬૧૦૨
મિલ્કત નંબર					વોર્ડ-૯
માલિકનું નામ	હનીફ હાસમ બાફણ			ઉપયોગનો પ્રકાર	રહેણાંક
સરનામું	સજય નગરી,જી.આઈ.ડી.સી રોડ,મસ્જીદ ની બાજુમાં			કેટેગરી	૧૫ એમ એમ
કબ્જેદારનું નામ	હનીફ હાસમ બાફણ				

વેરા ની વિગત	પાછલી બાકી	ચાલુ બાકી	કુલ	
વોટર ટેક્ષ		૬૦૦	૬૦૦	કયા વર્ષથી કયા વર્ષ સુધી
ડીપોઝીટ				એપ્રિલ - ૨૦૧૫
કને. ફી				થી
પ્રકાશન				માર્ચ - ૨૦૧૬
પરચુરણ ફી				
				ચેક નંબર :-
કુલ			૬૦૦	બેંક :-

અંકે રૂપિયા :- નવ સો રુપિયા
તારીખ - ૧૨/૧૦/૨૦૧૫

Printing of supply schedules on the back

Sms To The Users By NextDrop

IN BHUJ

BNP Water Department

↓

Valve man SMS to BNP & Water Official of Ward Committee

↓

SMS Sent 1 hour Before

↓

Users receive an SMS

Source: http://m.firstpost.com/business/startups-business/nextdrop-a-startup-that-informs-you-what-time-water-will-be-supplied-in-your-area-2-2010283.html

COMPLAINT REDRESSAL SYSTEM

TELEPHONIC COMPLAINTS

+

WRITTEN COMPLAINTS

THREE TYPES OF COMPLAINTS:

- **Frequency of Water Supply**
- Breaking of Water Lines
- Mixing of Sewage water

- Household Surveys- Complaints redressed within a week
- **Slum Areas- Complaints do not reach the BNP**
- Making the existing system efficient and stronger
- Lack of Communication, therefore focus on slums

WARD COMMITTEES SET UP BY URBAN SETU

Ward 2, ward 3

REPRESENTATIVE OF THE WATER OFFICIAL

WATER OFFICIAL (WARD COMMITTEE)

WATER DEPARTMENT (BNP)

RECORD OF COMPLAINTS MAINTAINED

Source: Household Survey, Urban SETU

‘24-7 supply is achieved when water is delivered continuously to every customer of the service **24 hours a day**, **every day of the year**, through a transmission and distribution system that is continuously full and under positive pressure throughout all of its pipelines and networks.’

Guidance Notes for Continuous Water System, MoUD, 2009

COMPONENTS OF 24x7 WATER SUPPLY

- Network Designed in Watergems software
- HDPE and MDPE joints for reduction of water losses, Ferrule before every meter at HH level
- AMR meters on distribution network **DMA**
- Telephonic tariff
- Bulk metering at ESR and HH, with pressure sensors
- water distribution management system WDMS

Outcomes of implementation:

- Improvement in delivery time and services.
- Quality of water
- Decrease in wastage of water
- Control of the distribution system shifted from valve men to consumers
- Meter reading and billing made easy

Source: CPHEEO

Project: 24 hours water supply

Why 24X7 water supply?

Smart City
MISSION TRANSFORM-NATION

Service Level Benchmark

Atal Mission for Rejuvenation and Urban Transformation

CPHEEO

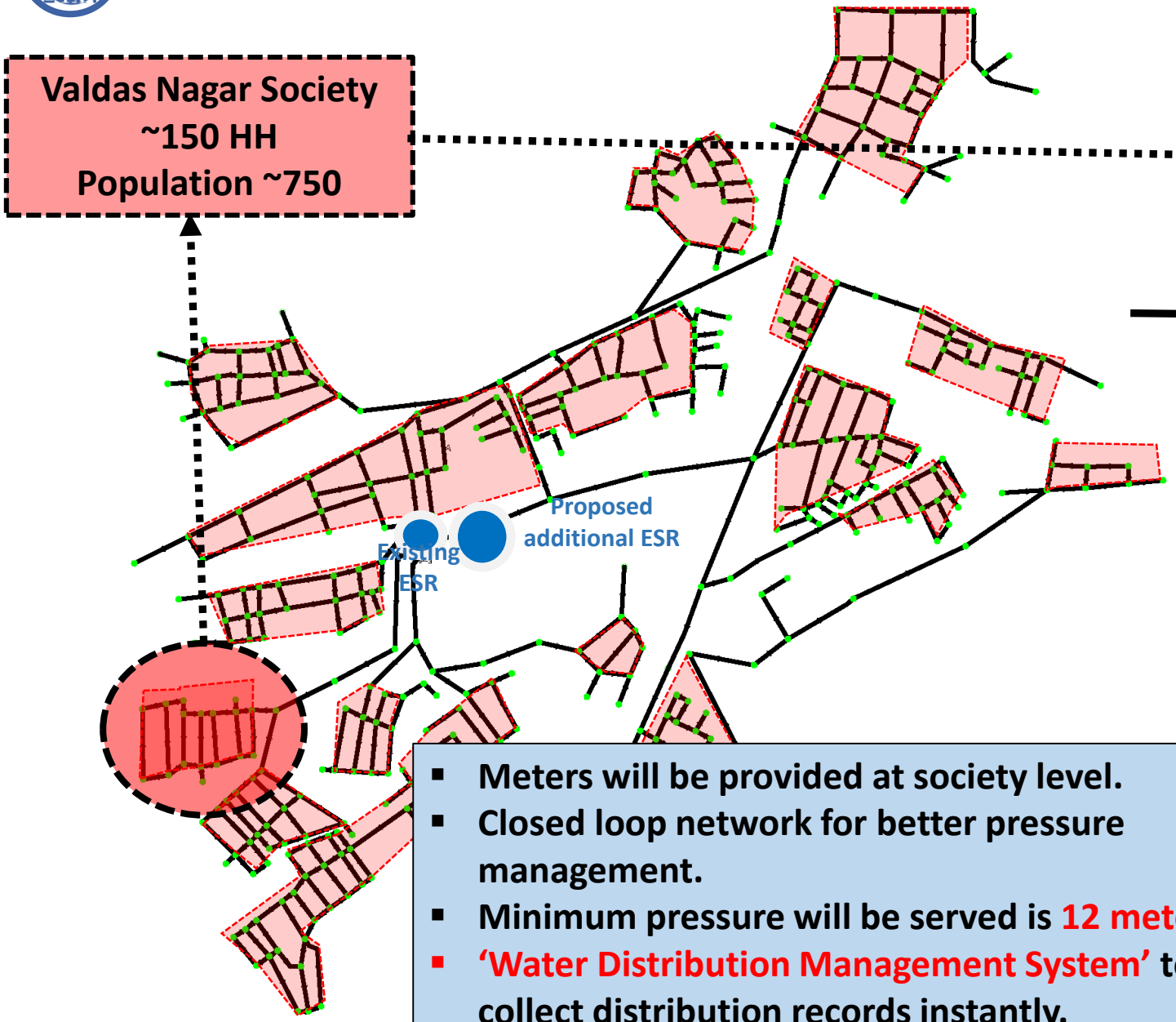
JnNURM

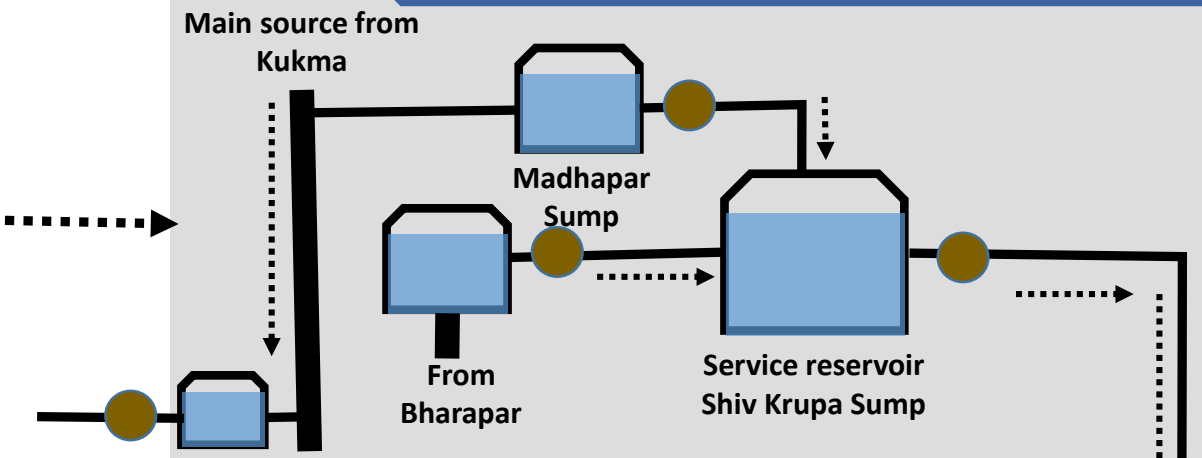
Parameters	Belgaum		Hubli		Dharwad		Gulbarga	
	Before	After	Before	After	Before	After	Before	After
Population served in demo zones		72,124		46,270		35,140		29,134
Number of connections in demo zones	4,918	8,509	5,346	7,577	4,139	5,779	1,996	3,307
Supply frequency (hours/weeks)	12/168	'24/7'	9/168	'24/7'	9/168	'24/7'	10/168	'24/7'
Volume of water supplied (average), cum/month	203,400	229,814	178,800	176,552	203,400	108,461	203,400	73,778
Total length of distribution lines rehabilitated		94		69.8		34.6		48.3
Actual losses in distribution system (l/connection/day/m head)		7.93	**35**	**5.43**		3.15		0.50
Average water pressure		**15**	0-5	**25-40**		**22**		**12-15**
Complaints recorded and resolved		45		53		89		61
Revenue collected		60%		**98.44%**		**99%**		**97.7%**

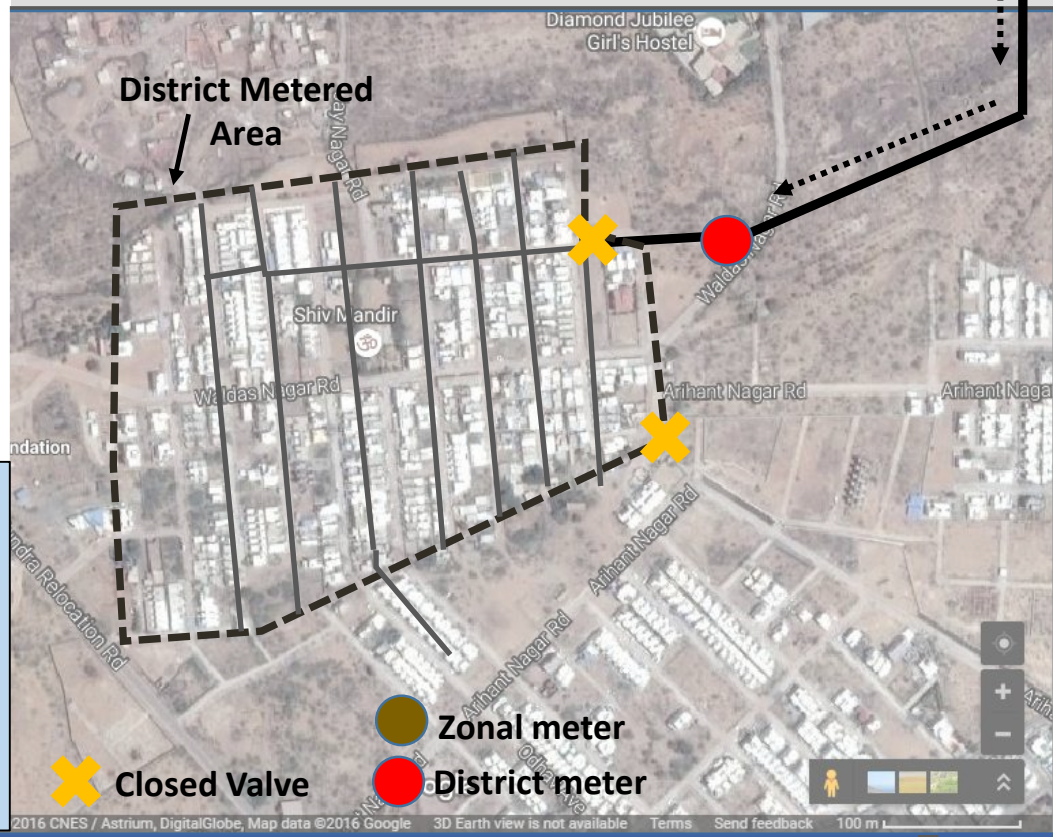
Source: https://www.wsp.org/sites/wsp.org/files/publications/WSP_Karnataka-water-supply.pdf

Project: 24 hours water supply-DMA

Valdas Nagar Society
~150 HH
Population ~750



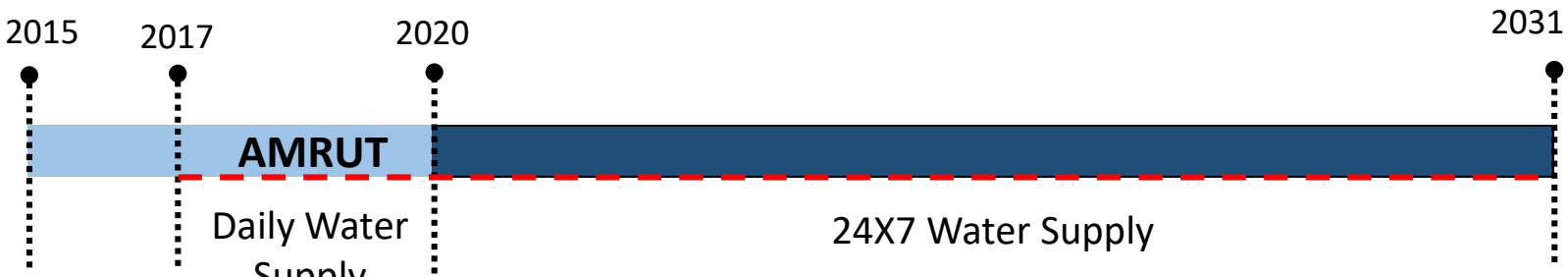




- Meters will be provided at society level.
- Closed loop network for better pressure management.
- Minimum pressure will be served is 12 meter
- 'Water Distribution Management System' to collect distribution records instantly.

Source: opportunities and challenges for implementation of 24X7 water supply, Dhavir Patel, AMRUT guidelines

Project: 24 hours water supply-DMA



- ESR to increase storage Capacity
- New DI pipes
- Installation of pressure metres at sumps

- Metering at DMA
- HDPE and MDPE pipe installation
- Isolation Valves installation
- Automated pumps
- Pressure meters
- Water Distribution Management System

		Daily Water Supply	24X7 water Supply	Total cost
Capital Cost	Pilot	1.9 Crore	4.5 Crore	6.4 Crore
	Bhuj	8.42 Crore	53.1 Crore	61.6 Crore
O&M cost	Pilot	0.71 Crore	0.22 Crore	24X7 water supply saves nearly 50% of O&M cost
	Bhuj	**6 Crore**	**3.3 Crore**	

Daily Water Supply for preparing basic infrastructure to cater 24X7 water Supply

24X7 water Supply for less water consumption, better collection efficiency, less O&M cost and service delivery

Atal Mission for Rejuvenation and Urban Transformation

50: 40: 10

30.8Cr : 24.64 Cr : 6.16 Cr

ULB: INR 6.16 Cr

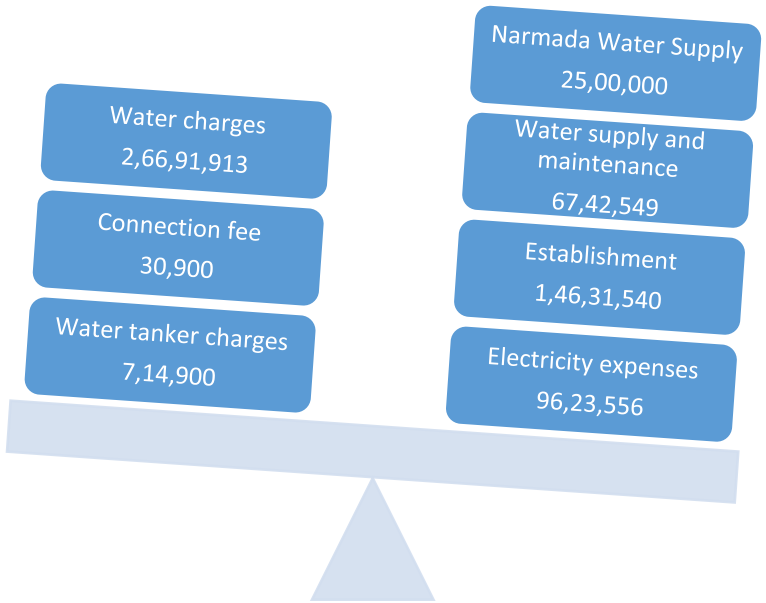
Source: opportunities and challenges for implementation of 24X7 water supply, Dhavir Patel, AMRUT guidelines

Leak Detection & Cost Recovery

Income and expenditure of water supply services 2015-16

2013-14

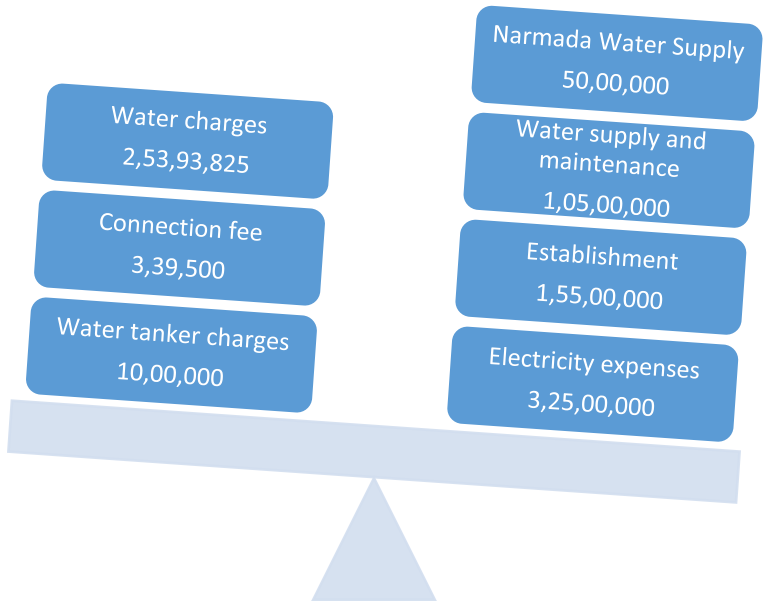
INCOME	EXPENDITURE
2,74,37,713	3,34,97,645



OPERATING RATIO 1.22

2014-15

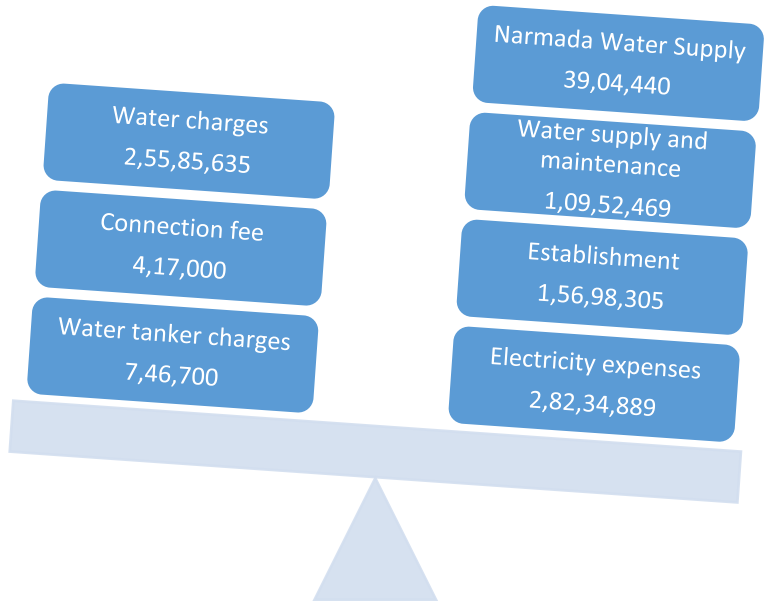
INCOME	EXPENDITURE
26733325	6,35,00,000



OPERATING RATIO 2.38

2015-16

INCOME	EXPENDITURE
2,67,33,325	5,87,90,103



OPERATING RATIO 2.20

Source: Bhuj Budget 2015-16

Financial analysis: BNP water supply 2015-16

INCOME (in lakhs) TOTAL	267
WATER CHARGES	225 (96%)
CONNECTION FEE	121 (2%)
CHARGED TANKER SUPPLIES	7 (3%)
% OF TOTAL INCOME OF BNP	3%

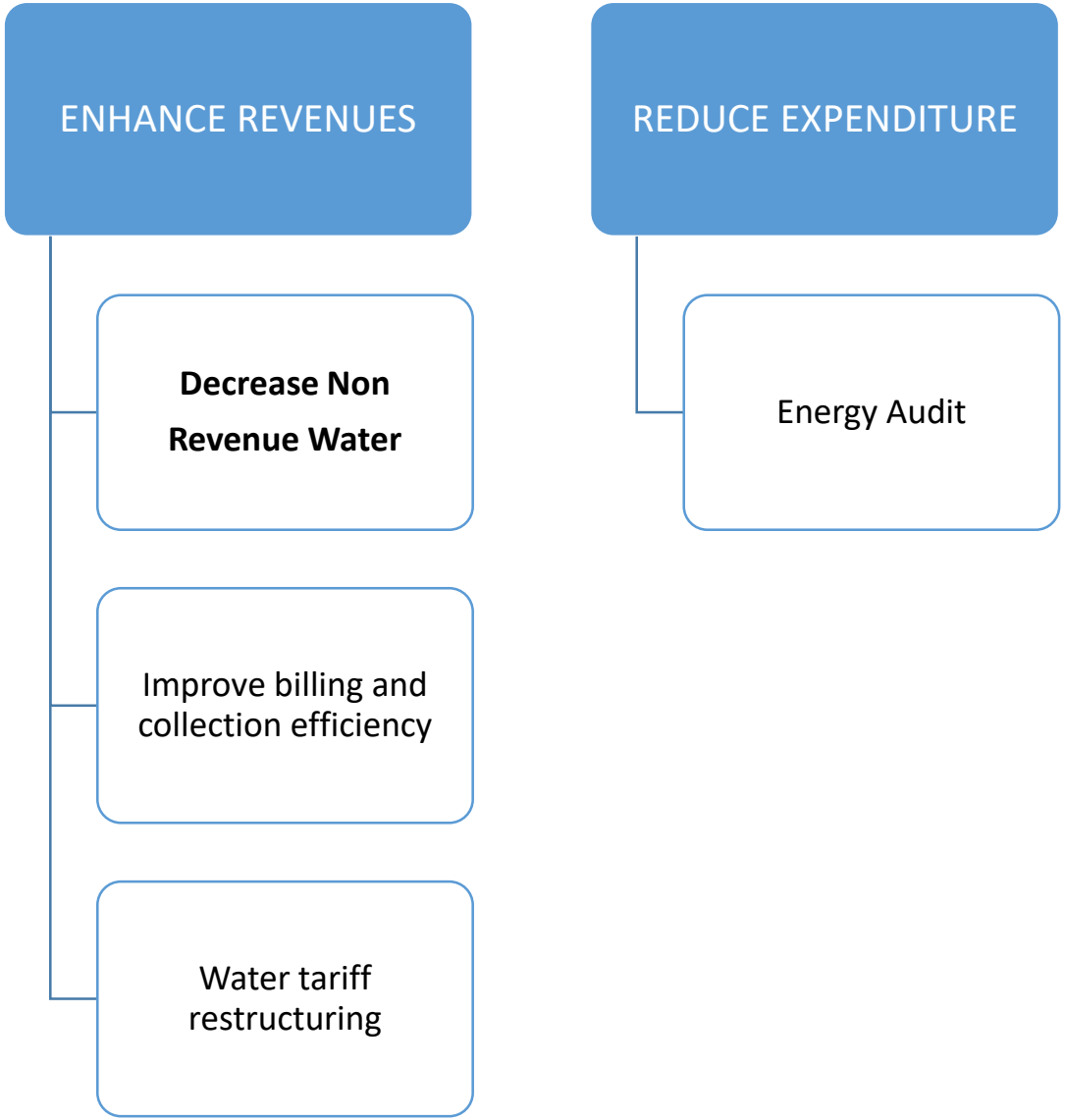
EXPENDITURE (in lakhs) TOTAL	588
ELECTRICITY CHARGES	282 (48%)
NARMADA WATER SUPPLY	39 (7%)
REPAIR AND MAINTENANCE	109 (19%)
ESTABLISHMENT COST	106 (18%)
SALARY	50 (9%)
% OF TOTAL EXPENDITURE OF BNP	19%

High cost of water production and low cost recovery may be attributed to high electricity consumption, losses, inefficient billing and collection, no metering and lower tariffs

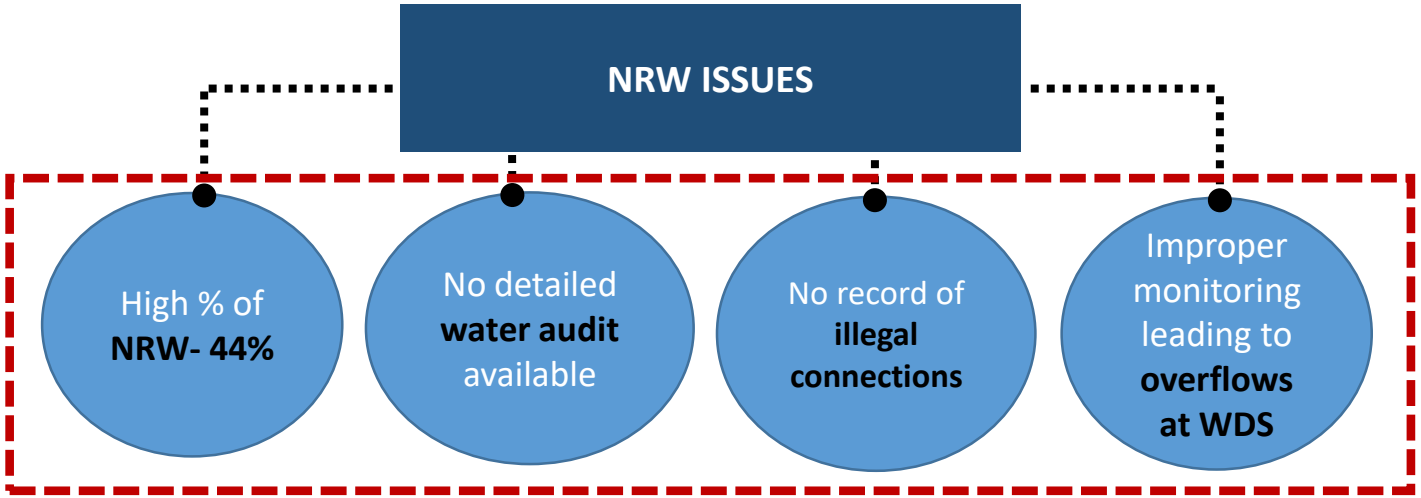
- O and M cost per KL : Rs. 5.2
- Revenue per KL : Rs. 2.36
- Tariff (ferrule based)–
  - Rs 900 per year for half inch connection (domestic)
  - Rs 3600 per year for half inch connection (commercial)
- Operating ratio : 2.20
- NRW : 14280 KL (44%)
- Cost of NRW per year: 2.7 cr

Source: Bhuj Budget 2015-16

To improve operational efficiency of water operations



Issues related to NRW




LEAKAGE AT RAVALWADI SUMP


THEFT AT AIR VALVE

Source: Primary Survey

IWA chart at a glance..

System Input Volume **31 MLD**	Authorized consumption **17.22 MLD**	Billed authorized consumption	**Billed metered consumption (NA)**	Revenue water **17.22 MLD**
			Billed unmetered consumption **17.22MLD**	
		Unbilled authorized consumption	**Unbilled metered consumption (NA)**	
			Unbilled unmetered consumption 4.2 MLD	
	Water losses	**Apparent losses**	**Unauthorized consumption 0.48 MLD**	**Non revenue water (NRW) 14.28MLD 44%**
			Metering inaccuracy (D6)= NA	
		Real losses 9.1 MLD	Leakages on transmission and / or distribution mains	
			Leakages and overflows at Utility's storage tanks **0.00015MLD**	
			Leakage on services connections up to point of customer metering	

- More than 50% NRW lies in the **unbilled authorized and apparent losses**
- Distribution lines are relatively new except for part of it in the old city area
- For long term sustainability, **current leakages need to be reduced** and a system for **active leak reduction** needs to be put in place

Source: Primary survey

Reduce authorized unbilled

Authorized Unbilled -4.2 MLD (**29%** of losses)

PUBLIC INSTITUTIONS	WATER USE (in KLD)	Number
Govt. offices	90	20
Govt. schools	4220	31
Public Toilets	3	10
Gardens	6	3
Public Tankers (charged)	400	74670
Public Urinals	4	13
TOTAL	4723 KLD	

INTERVENTION

- **Meters** to be put in place at govt. offices, schools and gardens to measure water consumption (covering 90% water use)
- **Charge from employees if water use exceeds 45 LPCD** (according to institutional demand as per CPHEEO)

Regulatory approach for water demand management

Source: Developing effective billing and collection practices, WSP

Reduce unauthorized consumption..

ISSUES

Theft observed at air valve

No record of **illegal connections** as on date

INTERVENTION

Monitoring of **air valves**

Regularizing illegal connections

Unauthorized consumption- 0.5 MLD

(**3%** of losses)

AMNESTY SCHEME FOR 1 YEAR

- No **connection fee** charged
- **Identifiers** would be rewarded
- **Defaulters-** Penalty of Rs. 2500

PENALTY

- Legalization fee of Rs. 2500
- One time tariff payment in advance

Source: Cost Recovery in Urban Water Services: Select Experiences in Indian Cities, WSP report 2011

Real losses??

REAL LOSSES

- **No detailed water audit** to quantify real losses

- **Leakages** possible in old city area

ACTIVITIES NEEDED TO BE UNDERTAKEN

Prepare detailed **water audit**

Active **leak detection** and **repair of leaks** in pilot DMA

Capacity building of BNP

City wide **Metering** (long term goal)

Reducing real losses

Real losses-approx. 9.1 MLD (67% of losses)

WHAT CAN BNP DO?


LEAKAGE AT RAVALWADI

Use of ball valve technology at WDS to **prevent overflows**

Repair leakages at WDS (ex- observation at Ravalwadi)

CONTRACTS

1. Leak detection and repair- Performance based contract

2. Metering

Performance based contract for water audit and leak detection

Performance Based Contract for Leak Detection in pilot DMA

Scope

- Water Audit
- Identification of **leaks** in DMA

Payment structure

- **Performance fee** (based on revenue generated by saving meter cube/day
- Repair and replacement of pipes (reimbursable)
- Fixed fee (cost of labor)

Performance Indicator

- Number of **complaints** redressed in a month
- Amount of **revenue generated by saving** meter cube per month

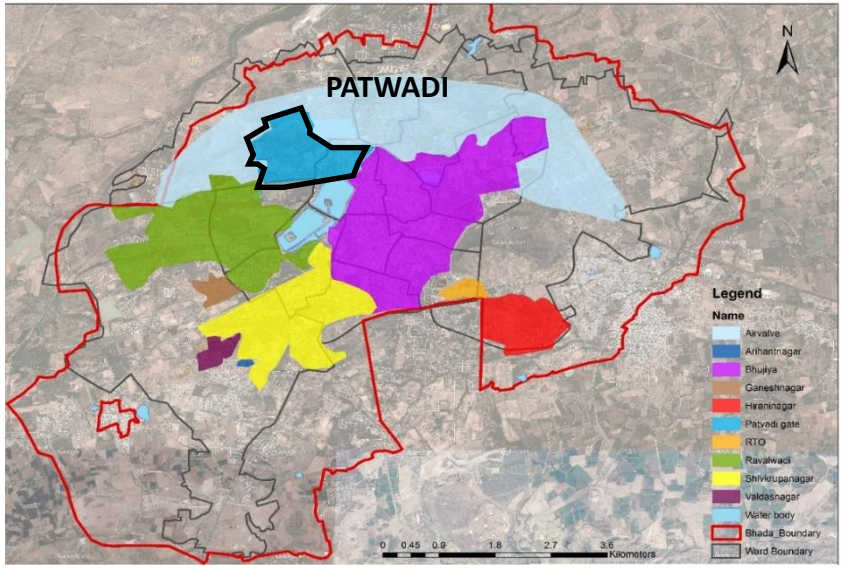
Incentive

- **Bonus** if loss reduction surpasses a particular amount
- **Penalty** or termination clause if losses increase after a certain level

Role of BNP

- **Monitoring** of water loss reduction as per information from contractor

PATWADI AS THE PILOT DMA



Leakage high due to old water distribution network

Easier to isolate as source- BNP bore well

Area	Population	Capacity of Sump
13.26 HA	4700	0.7 ML

Source: **Challenges of reducing non revenue water in Developing Countries, Bill Kingdom, Roland Liemberger, Philip Marin**

Metering for domestic sector

Contract for Metering- in pilot DMA (Patwadi)

Scope

Bulk meters at WDS to measure loss at WDS

Domestic **meters** for households

Monthly **meter reading**

Computerized **records**

Monitor and therefore timely replacement of meters

Awareness generation at community level for importance of metering

Phase 2-

Long term- **metering at city scale**

Source: **Developing effective billing and collection practices, WSP**

Need for capacity building

Does BNP have the capacity ?

To prepare
water audit?

Leak detection in DMA's

GIS database
Updating customer base information and water distribution network information

Capacity building and awareness generation contract

Scope

- **Training needs assessment** (TNA)
- Provide **technical training** in
  - Link and update **customer database** with GIS
  - Attach **distribution system details** in GIS
- Provide training for **active leak detection**
- Training to **prepare water audits**

Awareness for Community

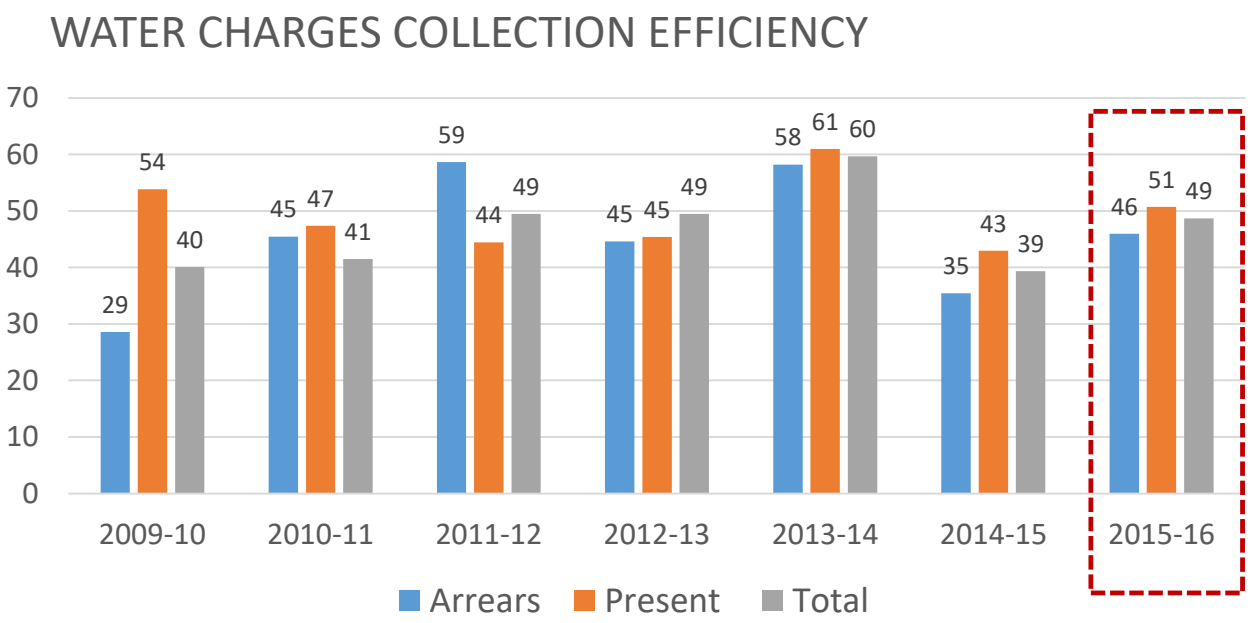
Sensitize communities to reduce water losses/wastage at HH level

Source: JNNURM NRW TOOLKIT, Training Needs Assessment for Surat Municipal Corporation , UMC

How to improve operational efficiency of water operations?

- ENHANCE REVENUES
  - Decrease Non Revenue Water
  - **Improve billing and collection efficiency**
  - Water tariff restructuring
- REDUCE EXPENDITURE
  - Energy Audit

What about billing and collection efficiency??



For 2015-16	Revenue Potential (in lakhs)
If collection efficiency of current demand is increased from 50 % to 90%	270
If collection efficiency of arrears (2015-16) is increased by 40% (up to 90%)	99

Source: DCB Table, BNP

Improving Billing and Collection efficiency

Currently, citizens pay bill only at the BNP office

Current Tariff (based of ferrule size)	Amt.
Residential (half inch pipe dia)	Rs 900/month
Commercial (half inch pipe dia)	Rs 3600/month

Improving current demand collection

- **Tally electricity bill and property tax bill** every 6 months to ensure property tax bill is received at all HH that pay electricity bill
- **Spot billing** based on meter reading (long term)
- Introduction of **online payment option and collection counters**
- **Penalty mechanism and a disconnection clause**, based on a one-time surcharge (additional payment) of 10 percent on current demand and no surcharge levied on arrears

Improving arrear collection

- **Online payment** of arrear
- **One-Time Settlement scheme** (6 months)
  - Discount of 10 percent to those who would pay their arrears upfront
  - 10 installments was made for those who could not make upfront payments of arrears all at one time

Revenue Generation

- 30% increase in collection of current demand
- (9o lakhs/year)

- 30% increase in collection of arrears
- (68 lakhs/year)

Source: Developing Effective Billing and Collection Practices, WSP report 2008, Rajkot case study of innovative tax collection

How to improve operational efficiency of water operations?

- ENHANCE REVENUES
  - Decrease Non Revenue Water
  - Improve billing and collection efficiency
  - **Water tariff restructuring**
- REDUCE EXPENDITURE
  - Energy Audit

Tariff Restructuring

Existing tariff (ferrule based)	
Domestic (half inch)	Rs.900/year
Commercial (half inch)	Rs. 3600/year

Existing tariff (ferrule based)	
Domestic (half inch)	Rs. 2600/year
Commercial (half inch)	Rs. 5400/year

Total Cost: 316 Lakhs

Atal Mission for Rejuvenation and Urban Transformation

↓

50: 40: 10

ULB: INR 31.6 lakhs

INCLUDES

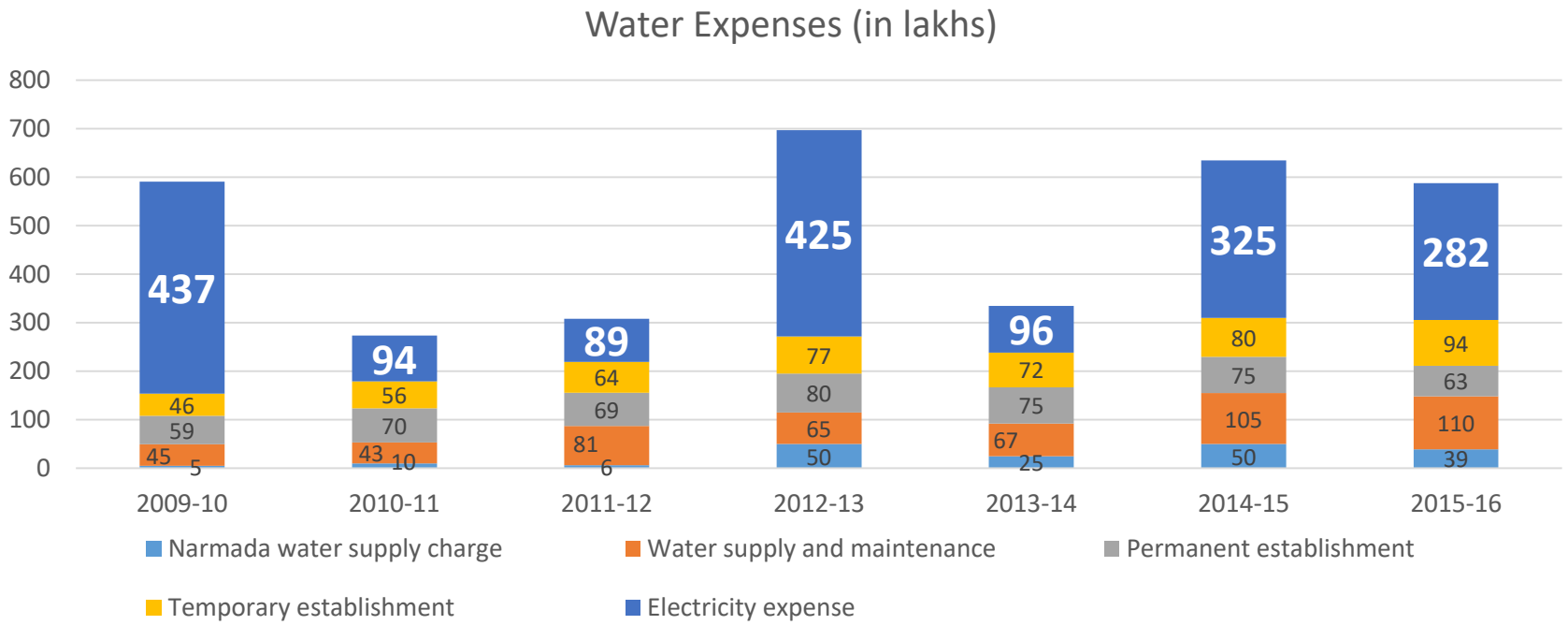
- Improved cost recovery @ 20% per year (of current demand and arrears)
- O and M cost of WTP (@ Rs. 268 per connection per year)
- O and M of daily water supply (@ Rs 967 per connection per year)

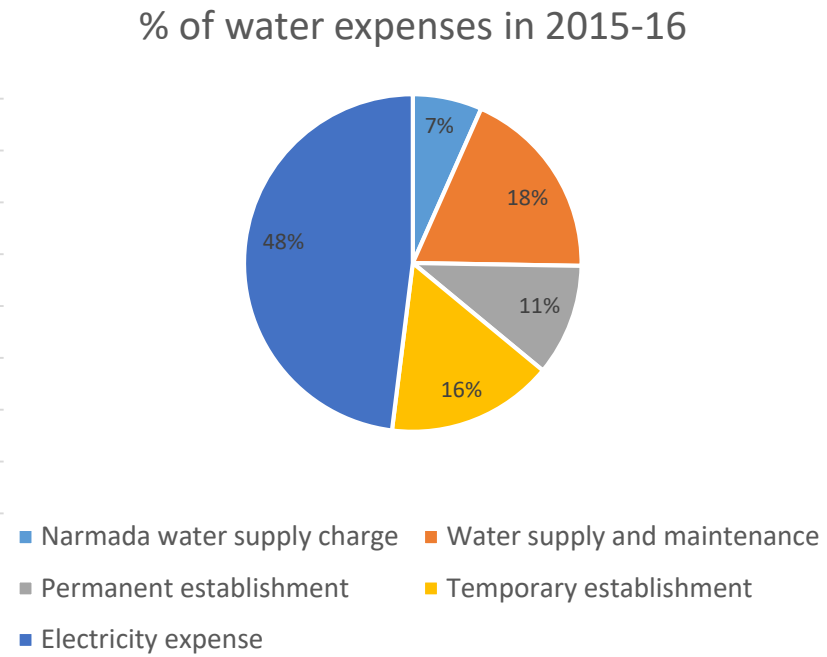
Source: **Developing Effective Billing and Collection Practices, WSP report 2008,**

How to improve operational efficiency of water operations?

- ENHANCE REVENUES
  - Decrease Non Revenue Water
  - Improve billing and collection efficiency
  - Water tariff restructuring
- REDUCE EXPENDITURE
  - **Energy Audit**

BNP expenses on water





(in lakhs)	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Narmada water supply charge	5	10	6	50	25	50	39
Water supply and maintenance	45	43	81	65	67	105	110
Permanent establishment	59	70	69	80	75	75	63
Temporary establishment	46	56	64	77	72	80	94
Electricity expense	437	94	89	425	96	325	282
Total	591	273	308	697	335	635	588

Source: Bhuj Budget (2015-16)

Performance Based Contract for Energy Audit

Scope of Contract

- **Preliminary survey** of pumping stations
- Analysis of **energy consumption components**
- **Detailed Energy audit** to identify cost effective components

Performance Evaluation

- **Operating efficiencies** of components of at pumping stations
- **Bonus** if energy savings surpass an agreed limit
- **Termination clause/ penalty** if energy savings go down below an agreed limit

Role of BNP

- **Monitoring** energy savings reported by contractor

Payment Structure

- **Performance based fee** based on energy savings
- **Fixed fee** (cost of labor)
- **Replacement** of energy intensive components

Total Cost: 200 Lakhs

Atal Mission for Rejuvenation and Urban Transformation → 50: 40: 10

ULB: INR 20 lakhs

Source: Nagpur, Booster Pumping Stations Energy Audit and its Energy Conservation measures, International Journal of Scientific Engineering and Applied Sciences

Enhancing Water Quality

Present Situation

- Non functional since last 10 Years
- GUDC : Constructed WTP of capacity: 27 MLD


KUKMA: STORAGE TANK


KUKMA: FILTRATION UNIT


KUKMA: CHLORINATION TANK

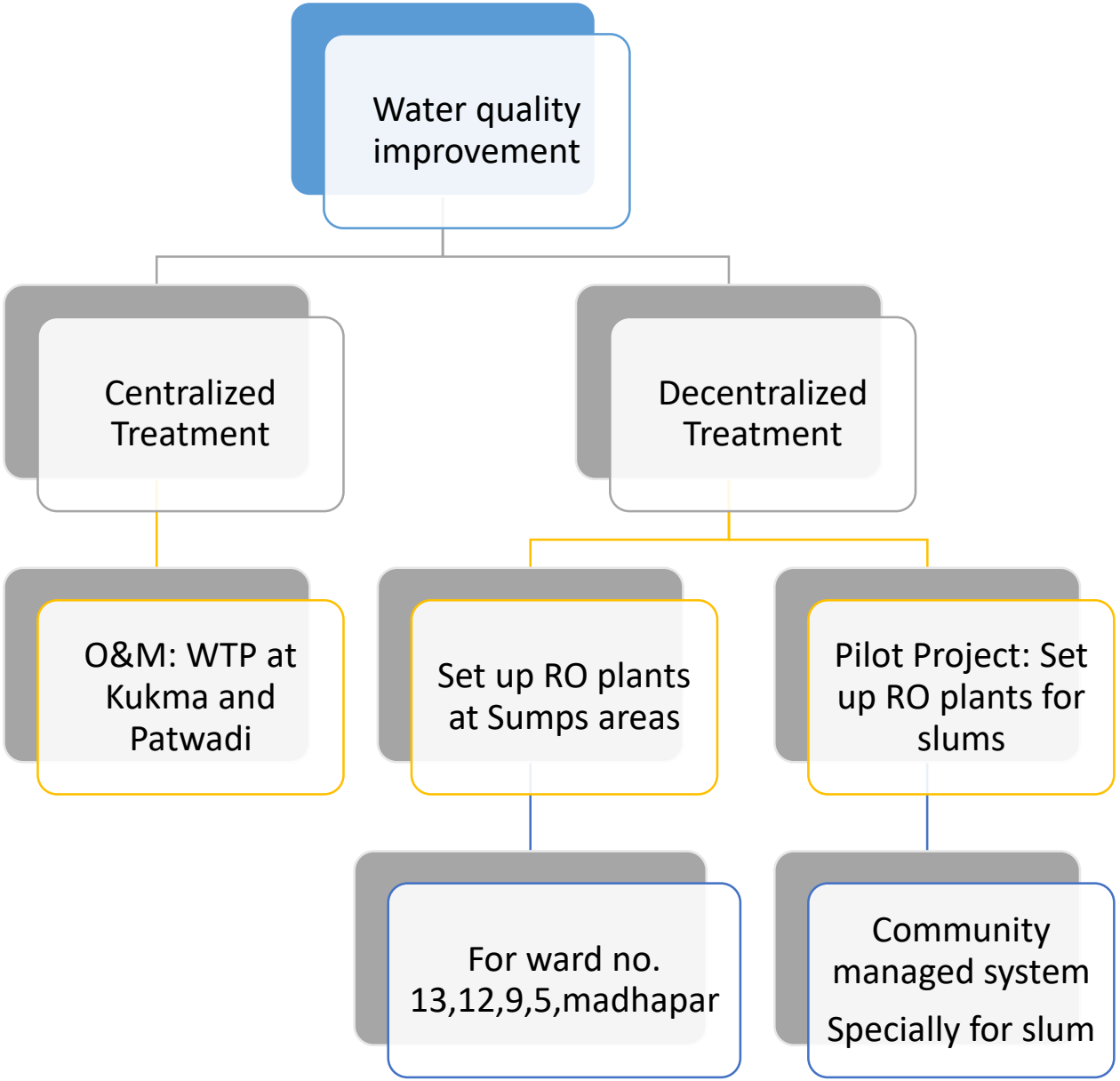
UV Technology : Not suitable for high TDS

High TDS content in ground water of Bhuj

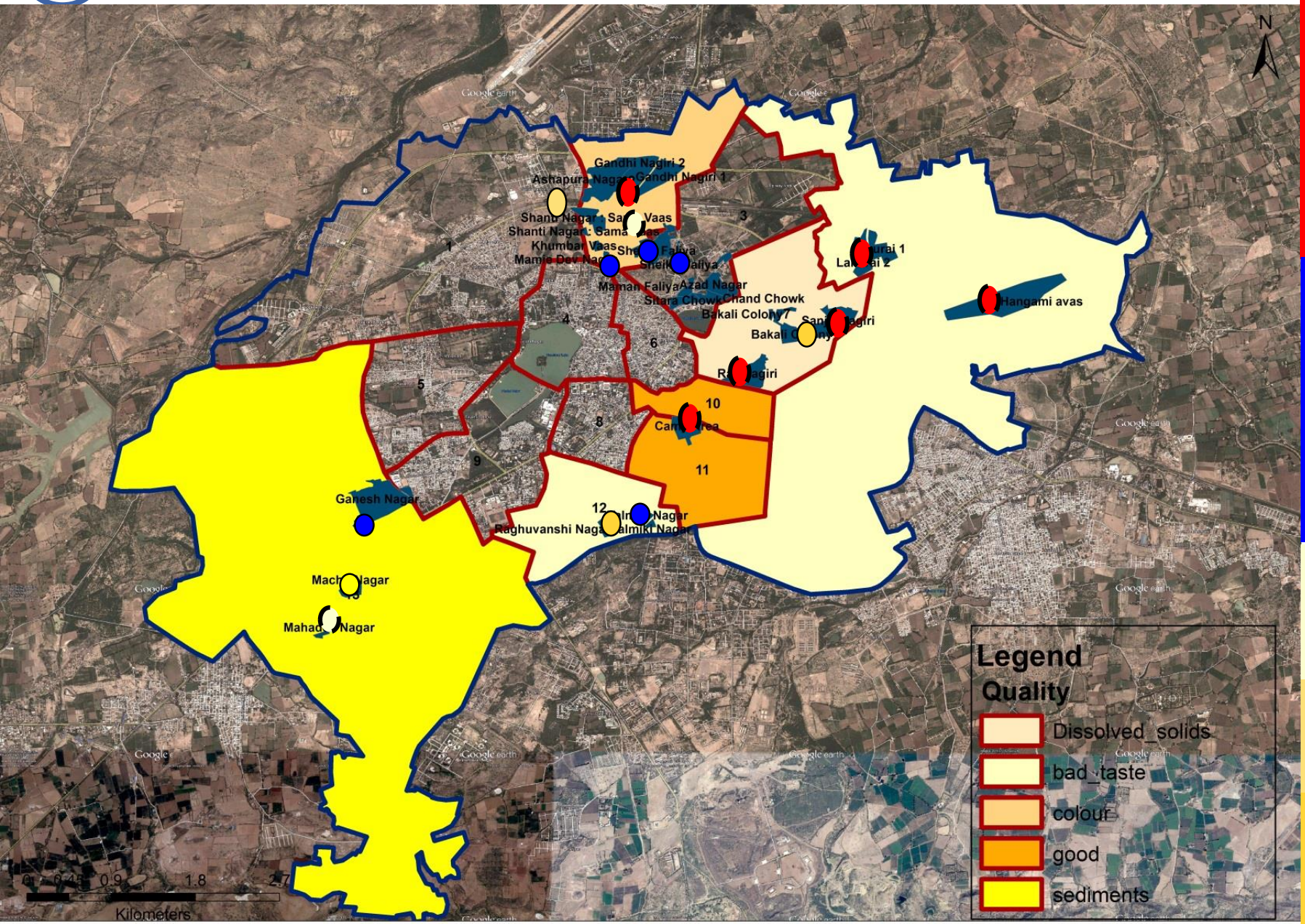
Only Spot Chlorination at Sumps

Failure of two treatment plants because of wrong treatment Technology

Source: Primary survey


Water quality improvement
Centralized Treatment
Decentralized Treatment
O&M: WTP at Kukma and Patwadi
Set up RO plants at Sumps areas
Pilot Project: Set up RO plants for slums
For ward no. 13,12,9,5,madhapar
Community managed system
Specially for slum

WATER QUALITY



Water

Coloured Water, Bad Taste

1. Sanjaynagari
2. Ramnagar
3. Hangami Awas
4. Lakhurai 1
5. Sheikh Faliya
6. Camp Area

TDS, Odour

1. Valmiki Vas
2. Ganeshnagari
3. Sonapuri
4. Azadnagar
5. Sitara Chowk
6. Chand Chowk

Bad Taste

1. Mahadev Nagar
2. Maman Faliya

Color

1. Momai Nagar
2. Kumbhar Chowk

Good

Raghuvanshinagar
Bakali Colony

Source: Primary Survey

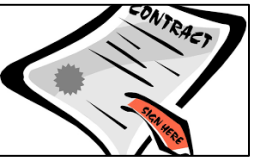
O& M contract for centralized WTP

- **Capital expense including replacement or rehabilitation of existing system will be borne by BNP**

- O & M and bear any escalation in electric charges
- chemical required for operating WTP
- Staff Salary
- In case of any failure of machine he should bare the expenses

Ownership: BNP

5-10 years, depending upon the financial feasibility of the project and political will



Parameters	Quality Max. Permissible as per IS 10500
pH	6.50-8.50
Turbidity, NTU	5.00
Alkalinity, mg/L	600
Total Hardness ($CaCo_3$), mg/L	600
Calcium as (Ca^{++}), mg/L	200
Magnesium (Mg^{++}),mg/L	100
Chloride Cl, mg/L	1000
Sulphates (SO_4), mg/L	400
TDS, mg/L	2000

Source: CPHEEO(IS-10500)

Monitoring and quality check: technical engineer appointed by BNP

BNP will fix the tariff and determine its escalation

Payment to private contractor: Consumer → BNP → Private contractor (fixed amount= O&M cost+ approx. 5% of total O& M cost)

Source: Ahmedabad case study, https://books.google.co.in/books?id=6g0_CQAAQBAJ&pg=PT247&lpg=PT247&dq=performance+based+contract

Performance Standards:

1. WTP to function at minimum capacity of **100%**
2. Water treatment loss should be in the range of **0% to 3%** [1-(quantity of water discharged from WTP)/quantity of water received at WTP*100]
3. Water quality to be maintained as per **CPHEEO(IS-10500)**
4. If the quality is not as per standard than penalty will be charged.

Atal Mission for Rejuvenation and Urban Transformation

50: 40: 10

ULB: INR 200 Lakhs

Replacement or rehabilitation of existing system cost**: INR 20 Cr.**

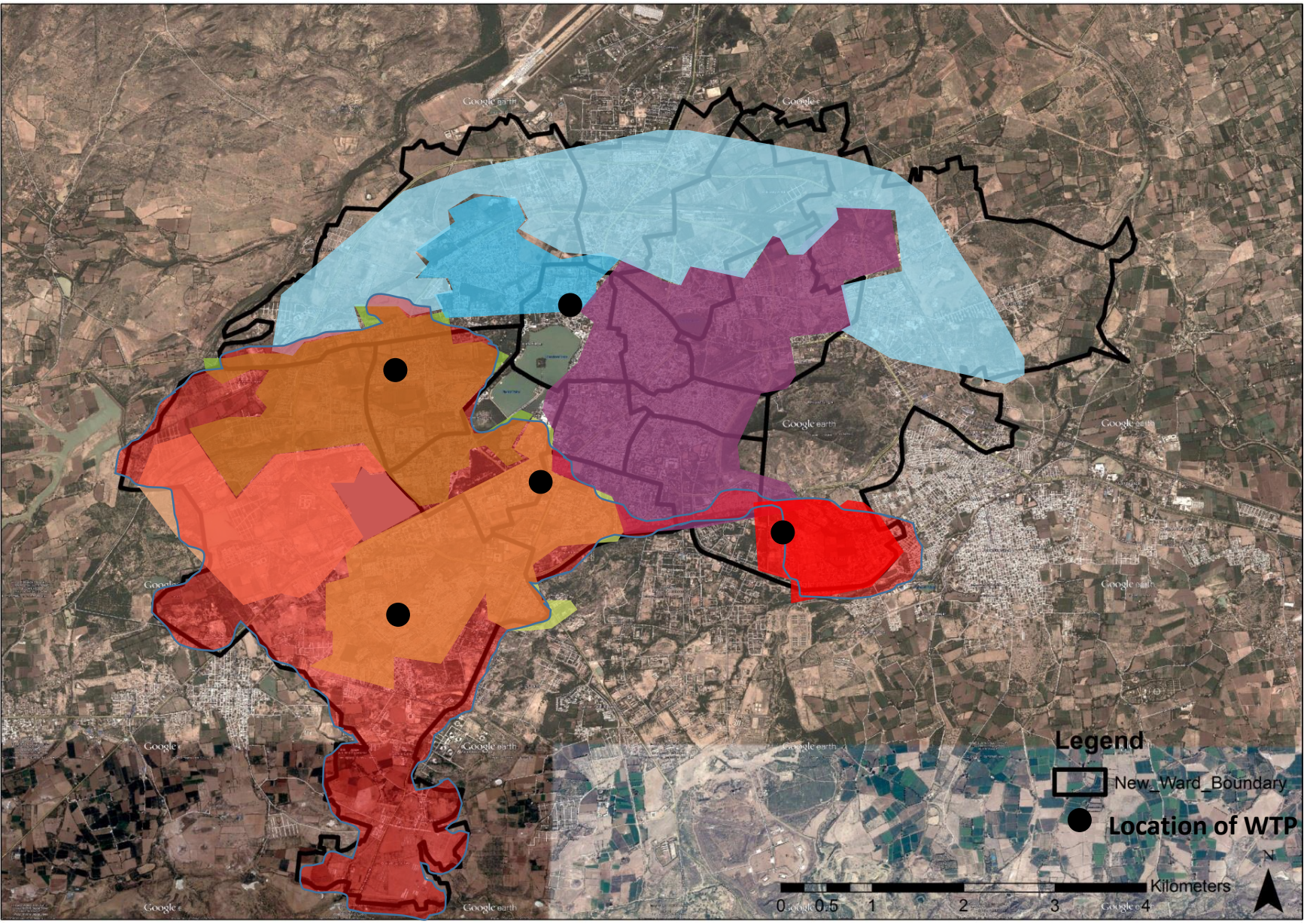
Finance can come from consumers:

Total water Production Cost O&M(including electricity cost, staff salaries, Material cost and payment to contractor) : **INR 96 lakhs/Annum**

Tariff: INR 280/Connection/annum (residential non residential)

Source: CPHEEO

Decentralized WTP For ward no. 13,12,9,5,Madhapar



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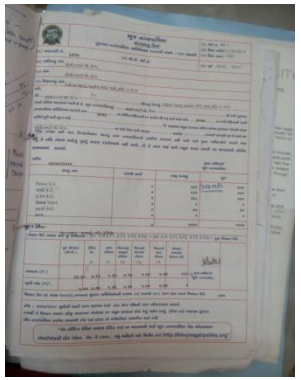
Only for those who have BNP water connection

Consumer Charges: INR 10/Bottled water



People have to show their property bill to buy bottled water

83% Cost Recovery from consumer charges
17% can be collected under CSR ,NGOs

Source: Primary Survey

PROJECT : Decentralized Water Treatment Plants

Total INR: 500 Lakhs. For 5 treatment plants *

Atal Mission for Rejuvenation and Urban Transformation

INR 6.43 lakhs

50: 40: 10

ULB: INR 50 lakhs

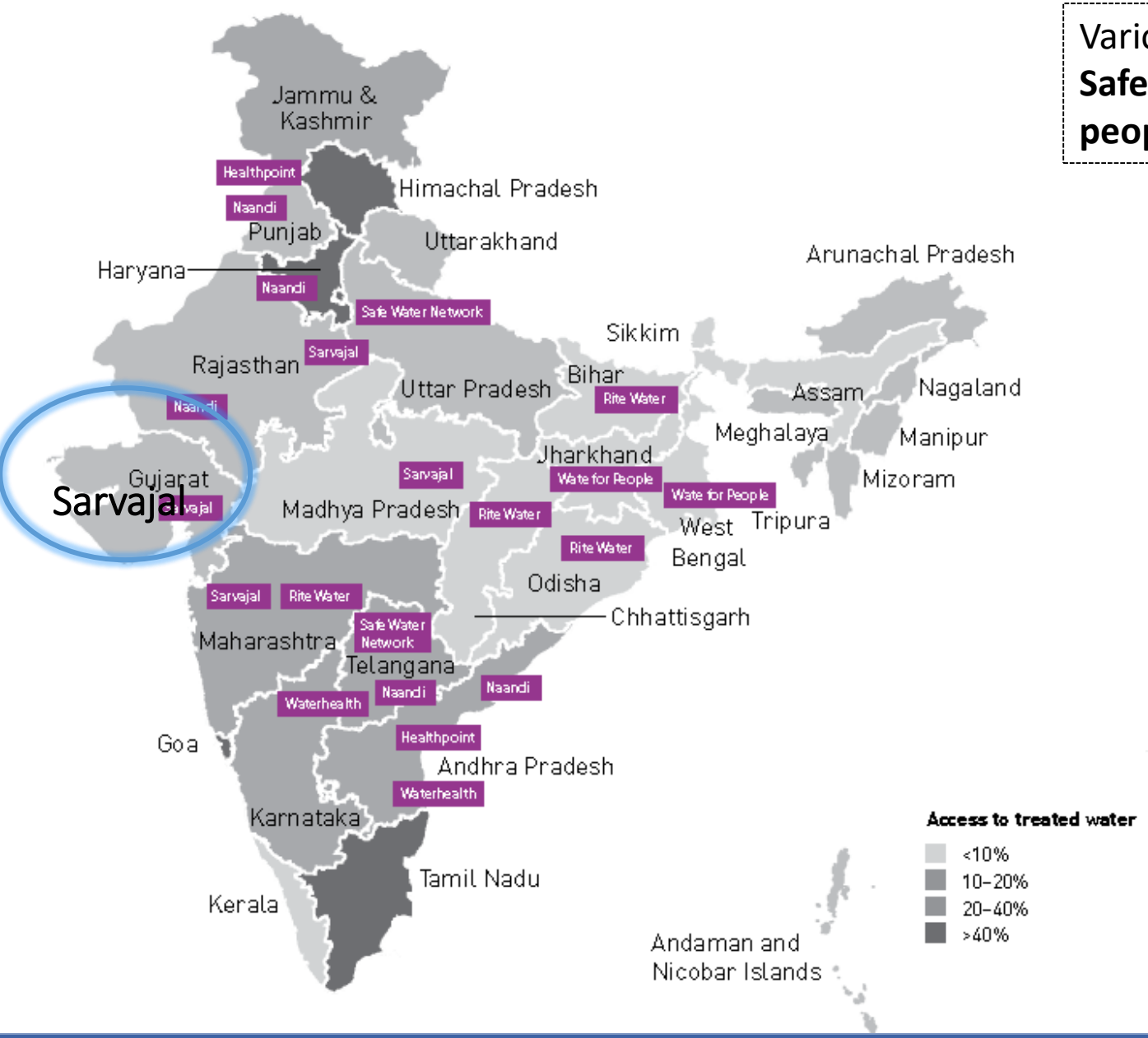
Consumer Charges: INR 10/bottle

Benefits:

Economic, Social and Environmental Benefits

***Approx: assuming required plant capacity may vary**

Project : Decentralized: Community Safe Water Solutions (CSWSs)



Various organizations have developed CSWSs(**Community Safe Water Solutions) in India for providing safe water to people of rural areas and urban slums.**

Naandi Foundation

Rite Water Solutions

Water For People

Safe Water Network

Water Health International

Spring Health

Sarvajal

Water life

Bala Vikasa

Health point Services India

Economic model: Community managed system **or** PPP with government → Pilot: Mainly for Urban Slums

Decentralized WTP: Pilot Slums

CMS

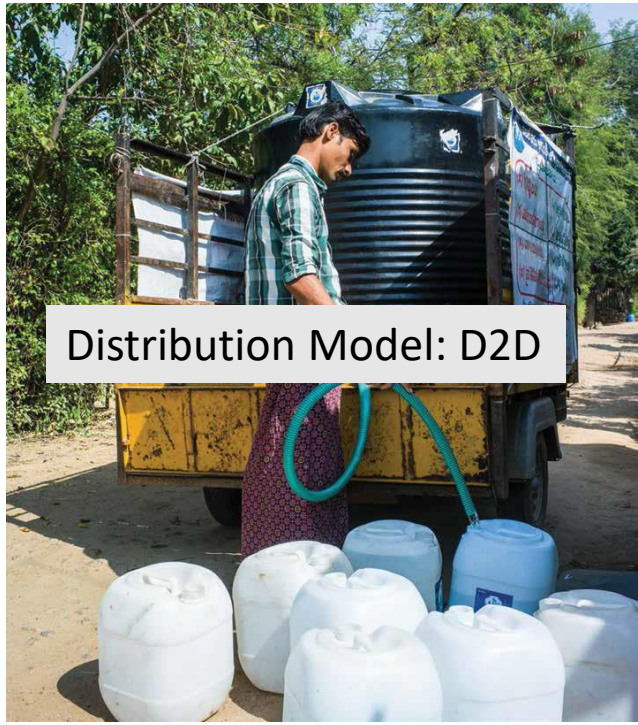
Ownership: Community

PPP

Ownership: BNP

Awareness and training → Set up plant on community or BNP land → Operate and maintained by community

- **CAPEX:** INR 30,000-15,00,000/ treatment plant (2000 LPH)
  (Based on selected technology for treatment)
- **OPEX:**INR 1,500-20,000/month
- **Water Pricing: INR 0.2-0.5 / liter.**
  i.e. INR 2-10 /20 liters



- Finance can come from:

Capital Cost

1. **Government:** AMRUT, MDWS, ADB, WB
2. **Commercial Banks or Investors**
3. **CSR** : 2% of profit : From Swaminarayan Trust and NGO s like ACT ,JSSS, Parab

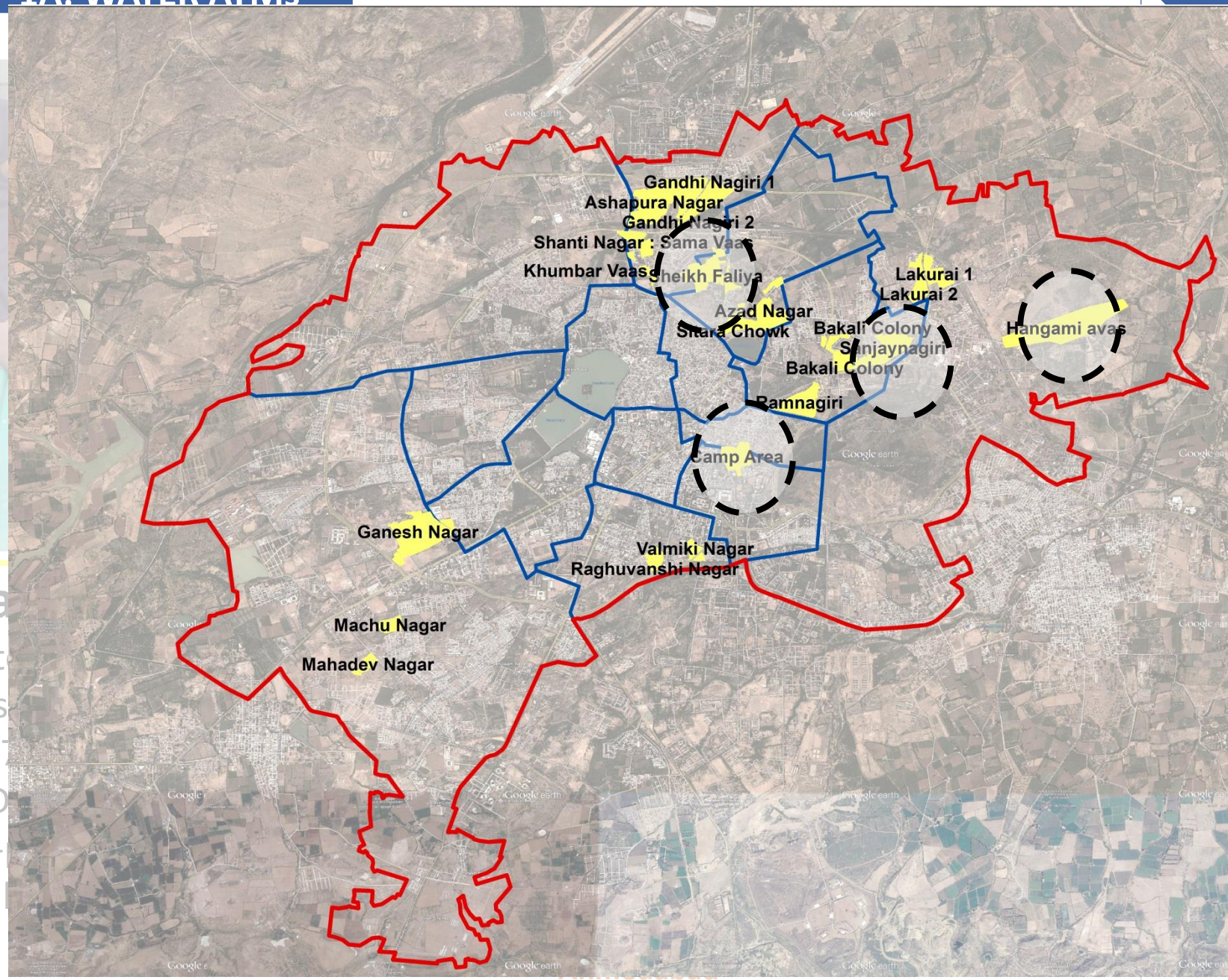
O&M Cost: From consumer charges

Self sustainable:

1. **Economic Sustainability**: Recover O& M cost from consumer charges
2. **Consumer sustainability:** Awareness Campaigns and Education & Distribution Model: D2D
3. **Operational Sustainability** :Ownership, Maintenance and Repair: Training program
4. **Technical Sustainability:** Monitoring and Evaluation
5. **Environmental Sustainability:** Security of Supply: Recharge well near borewell, Reducing Impact of Discharge, Water Safety Plans: water quality testing module(WHO, MWSD)

Source: Community Safe water solutions: INDIA sector review, safe water network report, 2014

1A. WATER ATMs



1. Sanjaynagari (905)
2. Hangami Awas (305)
3. Sheikh Faliya (1322)
4. Camp Area (3408)

Source: Piramal Sarvajal Website

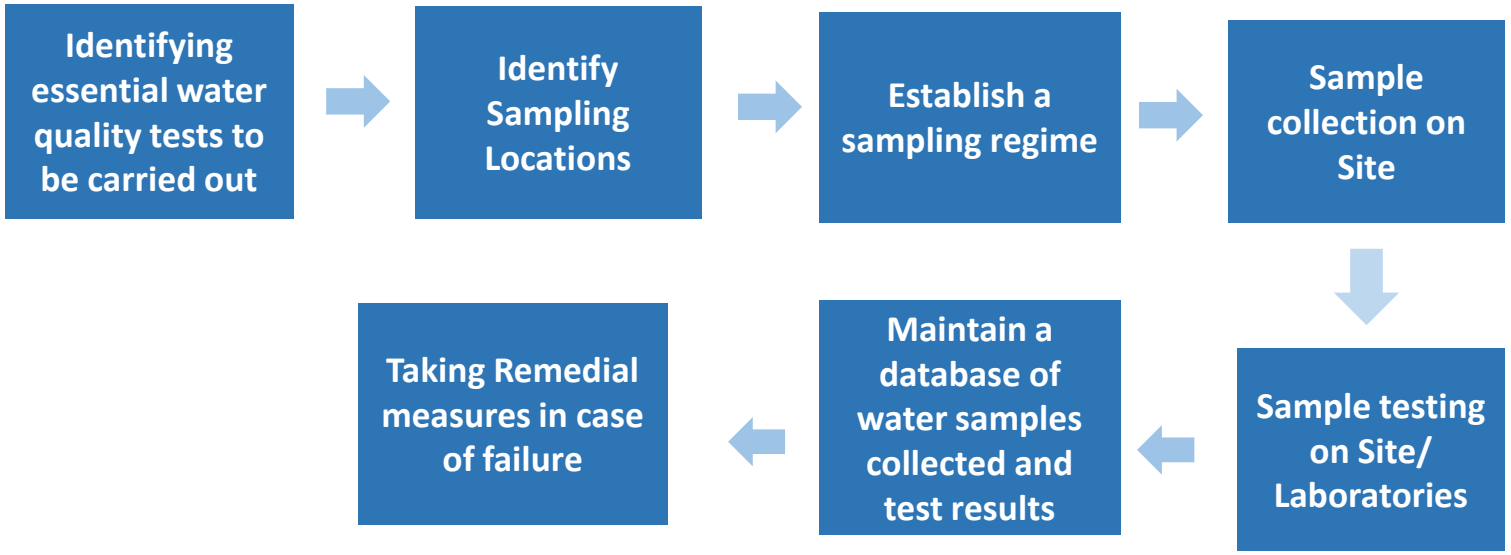
Decentralized: Community Safe Water Solutions (CSWSs) Specially for Slum

Financial model	CMS: Community+ Sarvajal	PPP : BNP + Sarvajal
CAPEX: Land cost	Community	BNP/CSR/Community
CAPEX: RO Water treatment plant equipped with a remote monitoring device : INR 15,00,000/plant=60 lakhs	Sarvajal	**AMRUT: 50:40:10= 30:30:24:6 Lakhs**
O&M charges= INR 40,000/month *	Consumer charges	Consumer charges + CSR
Water Consumer charges*	Approx: INR 4/20 liters	Approx: INR 2/20 liters
• Community mobilization, consumer activation, and institution building • Operator training • Technical support • Monitoring and evaluation	Sarvajal	BNP + NGOs
Recharge well	Sarvajal	BNP + NGOs
Quality monitoring	Sarvajal	BNP Laboratory
Revenue share	• 40 percent of revenue sharing with Sarvajal	• Revenue sharing not defined

* Water price : based on case study ; T&C: It can differ

Source: Community Safe water solutions: INDIA sector review, safe water network report, 2014

WATER QUALITY TESTING & MONITORING



PHASING AND IMPLEMENTATION

SIX MONTHS	1.5 YEARS	TWO YEARS
Identifying surface water locations as a part of consumer end for water samples and testing in the laboratories	Water ATMs will be set up in the 4 slum locations by CSWS having quality sensors for the same and will be reporting to BNP for quality check	Water Treatment Plant might become functional. Samples then will be collected from the distribution network

TOTAL COST PER TEST:

PHYSICAL TEST:

Rs **10** per kit

CHEMICAL TEST:

Rs **200**

MICROBIOLOGICAL TEST:

Rs **100** per sample & per kit

25Ml Testing water- Rs **100** per bottle

HUMAN LABOR COST:

Chemist- Rs 12,000

Lab Assistant- Rs 7000

Helper- Rs 5000

Total Monthly Cost

=Rs **24277**

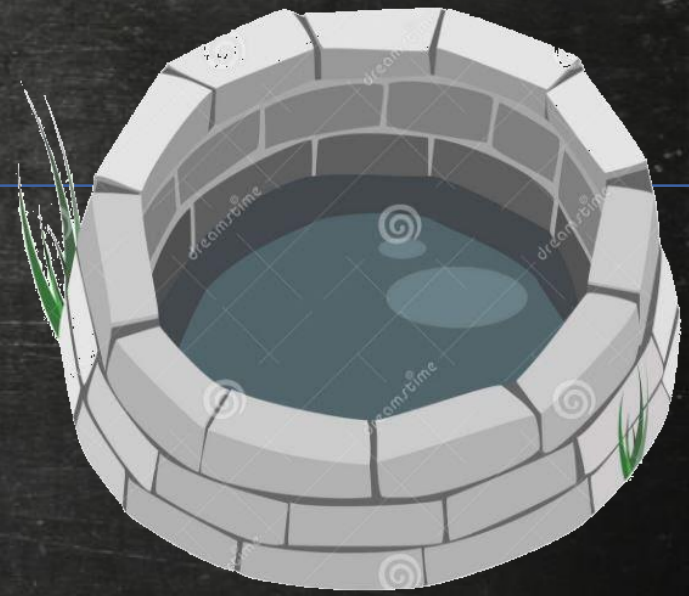
Source: **SOP for Routine Water Quality Surveillance in ULBs in Gujarat, UMC & PAS; CPHEEO Guidelines**

WATER QUALITY TESTING & MONITORING

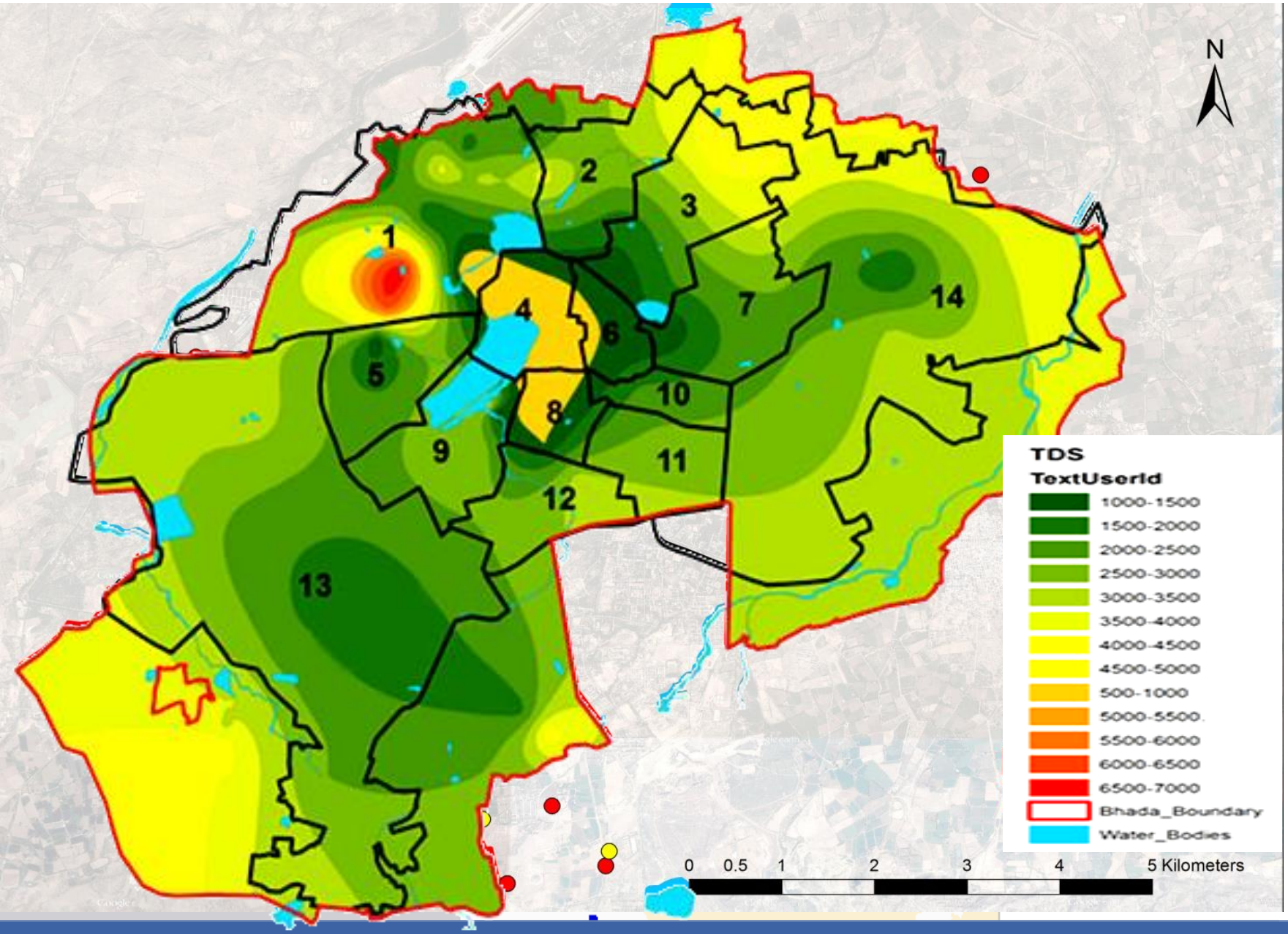
MOBILE VANS	TESTING BY NGO/BNP	NABL ACCREDITED LAB
Private Contract basis Mobile Van- Rs **45,00,000** per van Initial Cost- 3 X 45,00,000 =Rs **135 Lakhs**	PHYSICAL TEST: Rs **10** per kit CHEMICAL TEST: Rs **200** MICROBIOLOGICAL TEST: Rs **100** per sample & per kit 25Ml Testing water- Rs **100** per bottle HUMAN LABOR COST: Chemist- Rs **12,000** Lab Assistant- Rs **7000** Helper- Rs **5000** Total Monthly Cost- =Rs **24277**	No water Testing Lab Nearest is Rajkot Distance between Bhuj & Rajkot- **236 Kms** According to CPHEEO, Maximum **24 Hrs**, samples should be send to the Lab Time taken- 4 Hours (Approx.) Transportation Cost- Rs **1655** (per journey) Total Monthly Cost- =Rs **49650**

Source: CPHEEO Guidelines, ELICO Website, CPCB Water Quality Monitoring Guidelines

Ground Water Monitoring and Recharge

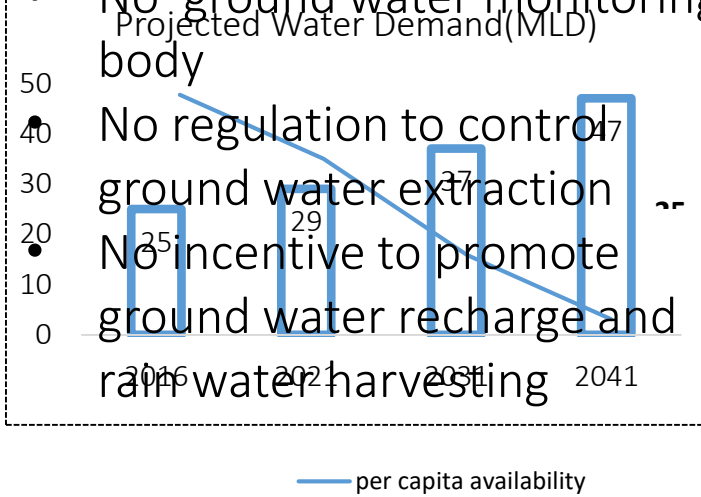


Issue and need for ground water extraction and monitoring



- High Ground water dependency
- High TDS content in Ground Water
- **Water scarce(GW Quality)**

- No ground water monitoring body
- No regulation to control ground water extraction
- No incentive to promote ground water recharge and rain water harvesting



Need…

- To control extraction of ground water
- To recharge ground water through Rainwater harvesting

Source: ACT borewell monitoring data

- Case studies emphasis on participatory information gathering, use of non-formal means of education(Awareness), capacity building and social mobilization.
- Ground water Monitoring Body is a must

Policy intervention

"Ground water extraction and rain water harvesting monitoring CELL"

1. Stakeholder from BNP Water resource management body and building department(Monitoring)
2. Stakeholder from NGOs Like ACT, JSSS, Parab (Monitoring and technical guide, Awareness generation)
3. Community (Involvement, Awareness generation)

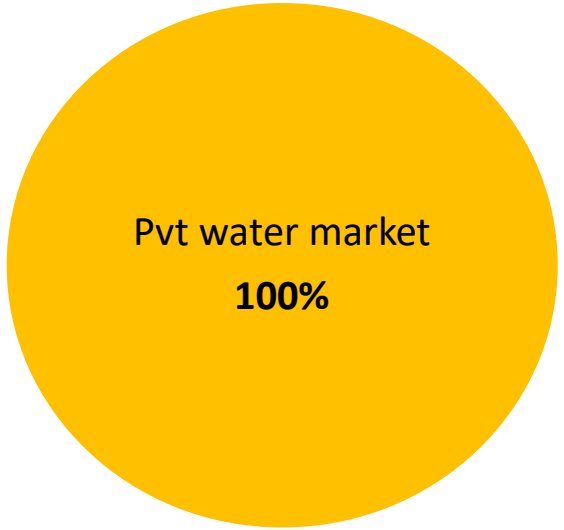
Regulation

- GW Extraction should be less than recharge
- Regulation on Building permission,RWH and GW Recharge

	Administrative measures	Technical support	Awareness generation	Incentives
To promote RWH by **"Ground water extraction and rain water harvesting monitoring CELL"**	Make RWH compulsory for all buildings having area>250 sq ft New Building permission only if it has Rain water Harvesting structure.	A separate Technical committee to guide the "Cell"	Firstly all government building should have RWH Structure as a pilot project Awareness generation : distribute pamphlets and coordinate with NGO: ACT,JSSS,Parab	Rebate of 6% in property tax for implementation
Stakeholder from CELL	BHADA, Building department of BNP	ACT,JSSS,Parab	ACT,JSSS,Parab	Building department of BNP

Source: learning from case studies explained in Thesis :Upasna Yadav,Ground water governance Gujarat ,2012 and Manan Shah, Rain water Harvesting structures: Case study Ahmedabad ,2012,Guided by Mona Iyer, CEPT University

ISSUES: Private water market



Need to control water extraction

BNP: **"Ground water extraction and rain water harvesting monitoring CELL"**

Permission under Gumasta Dhara

GWMC

No record keeping and monitoring cell and BNP Level

No permission from CPCB and GPCB

Proposal:

Ground water monitoring body:

- Central Ground Water Board (CGWB).
- License from Gujarat Pollution Control Board (GPCB) for safe disposal of rejects

Rules for limiting ground water extraction :

1. Restriction on depth of borewell.
2. They should construct and monitor Ground Water Recharge Structure or RWH structure.
3. Monitoring by ground water monitoring body created by BNP under guidance of ACT, JSSS, Parab.

Penalties:

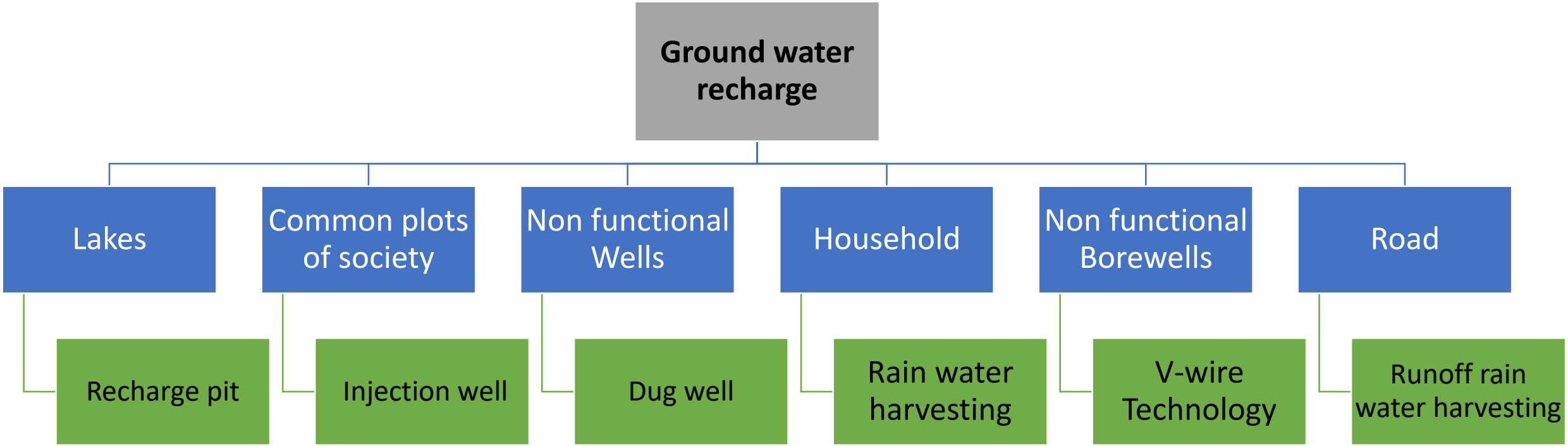
- In case of failure they have to pay penalty worth INR 1,00,000/-
- Shutting down their business for a week.
- Construct recharge well immediately.

Benefits:

Environmental

Source: Primary Survey

Project: Technical intervention : Ground Water Recharge



Source: CPHEEO

Common plot level ground water recharge

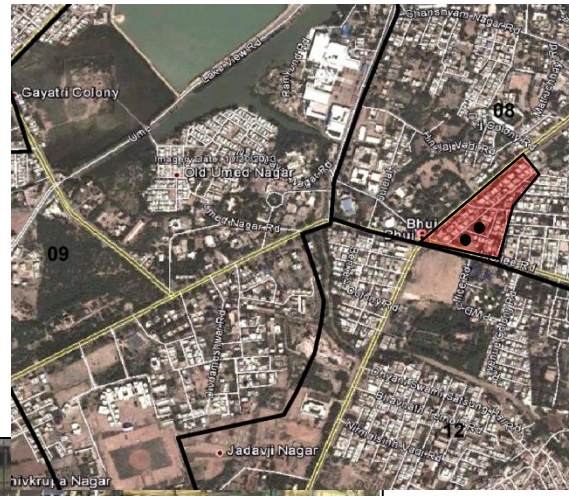
At Common plot of society: Vertical injection well:
ACT ground water recharge model: Jubilee Colony

CAPEX: INR 4 Lakhs

Financial model: PPP:
80 % : grant : NGO - Arghyam

- 20 % : ACT + Residential
- BNP Contribution: Machinery provision

- This type of successful model should be replicated city wide.

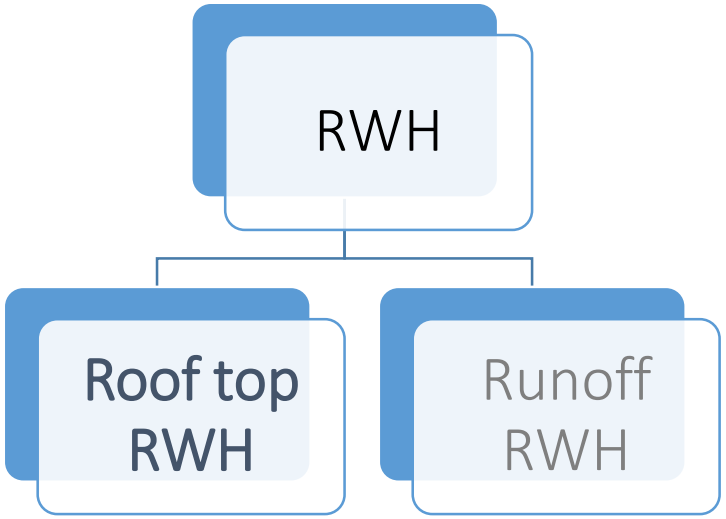


Benefits:

Economic, Social and Environmental Benefits

Source: Bhuj report, 2016, Primary Survey

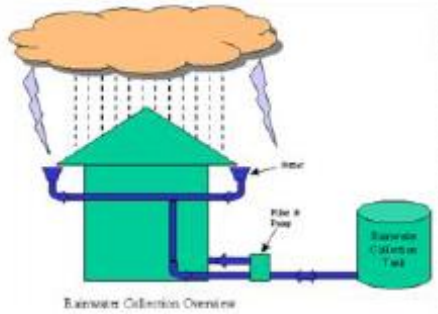
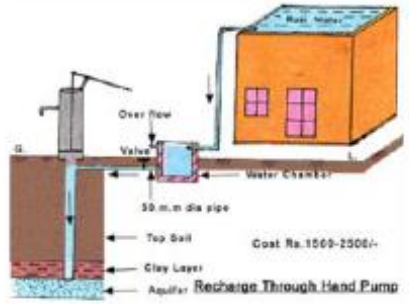
Proposal: RWH Model: Replicate ACT models



Source: **Bhuj report, 2016, Primary Survey**

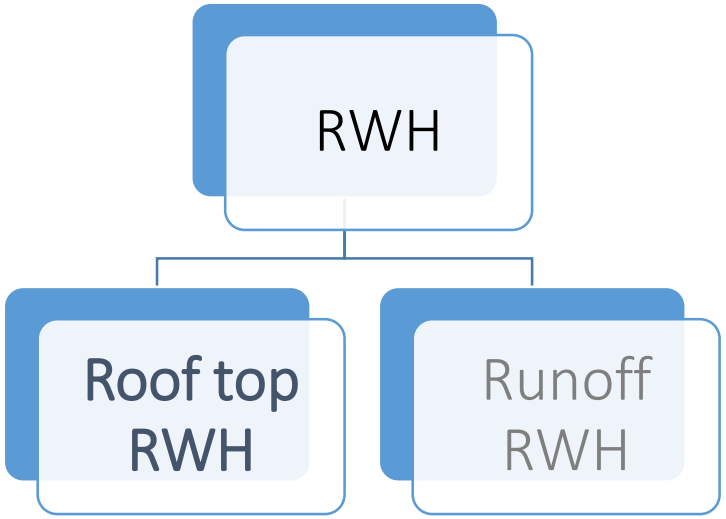
Proposal: RWH Model: Replicate ACT models

Rainwater Harvesting Systems

Types of Catchments	Types of collection system: Storage	Storage with Groundwater Recharge	Groundwater Recharge only
	for direct Consumption	*surplus water is recharge into ground and withdrawal with handpump / borewell for usage later*	
Roof Top Rainwater harvesting			
Surface run-off Rainwater Harvesting (open spaces, storm water, roads)			

Source: **Bhuj report, 2016, Primary Survey**

Proposal: RWH Model: Replicate ACT models



Rain Water Harvesting models by ACT

Shiv Nagar school: Roof Rain Water Harvesting Model:

- It consisted of 2 water tanks of 25000 liters and 10000 liter capacity each as well as a hand pump.
- O & M: by a committee of students
- They also take care that water is not wasted in the school.
- The people in the neighborhood look after the model while the school is closed.

Benefit: Environmental, Economic

- For Bhuj, estimated rain water harvesting potential is about 2000 million liters per annum, or 5.70 MLD (ACT, 2015).
- This is nearly one-fifth of the total water supply for Bhuj.
- Reduces stress on urban water supply by 25%.

CAPEX: INR 1.01 Lakhs

Financial Model:

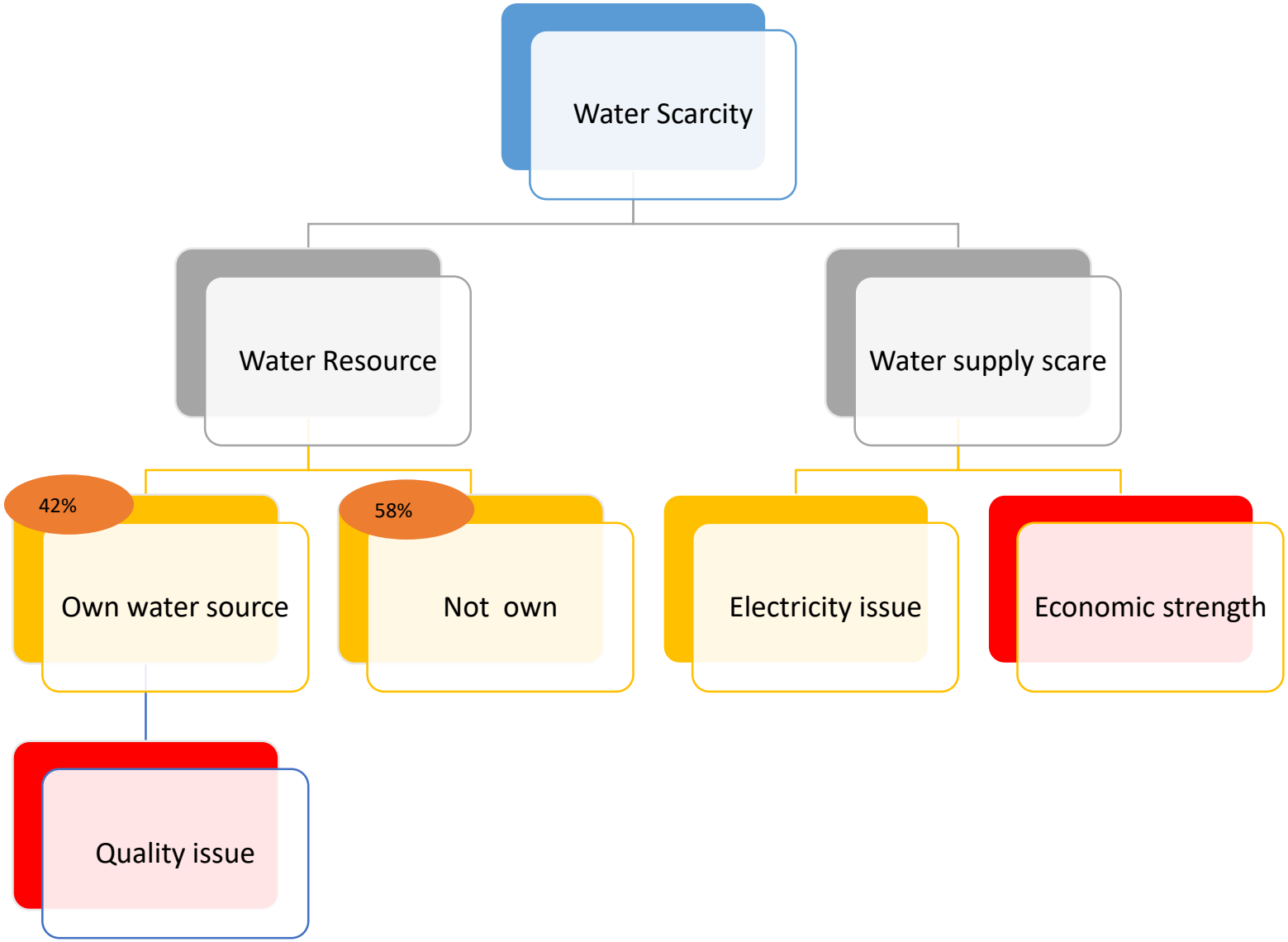
- Public participation: INR 33,350/-
  (1 rupee/ head is given by students and teachers)
- Donation by : Sushil Trust: INR/-33,251
- For recharge Borewells : INR 35,000/-
  Funded by ACT+ JSSS

Source: **Bhuj report, 2016, Primary Survey**

Conclusion

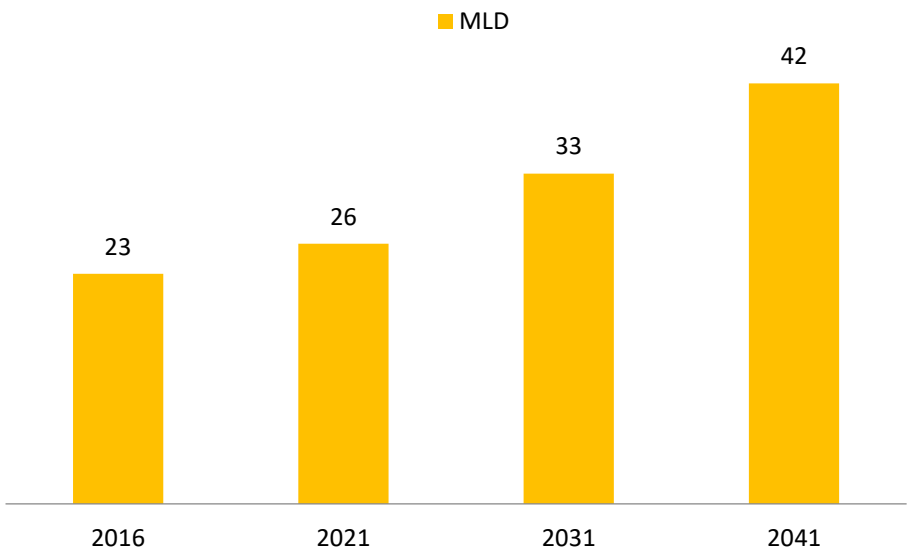
Issues	Projects	Interventions	Stakeholder	Benefits
• Intermittent water supply • Pressure • Storage capacity	Daily water supply 24*7: Pilot	• Scheduling	BNP Consumer ease	Social
• High water losses • Authorized unbilled •Low Billing and collection efficiency	Cost Recovery	• Reduction of NRW • Increase collection efficiency • Reduce Expense	BNP Consumer ease	Economic, social
• Water Quality	WTP: Centralized and decentralized	O&M Contract	BNP Community participation	Social, Environmental
• High ground water extraction	Ground water and rainwater harvesting Cell	• Regulate ground water extraction and Rainwater harvesting	Participatory Ground water management, NGO,BNP	Social, Environmental
• No Water Quality sampling	Water Quality Monitoring	Lab	BNP, NGO ,ACT	Social, Environmental, Economic

Conclusion

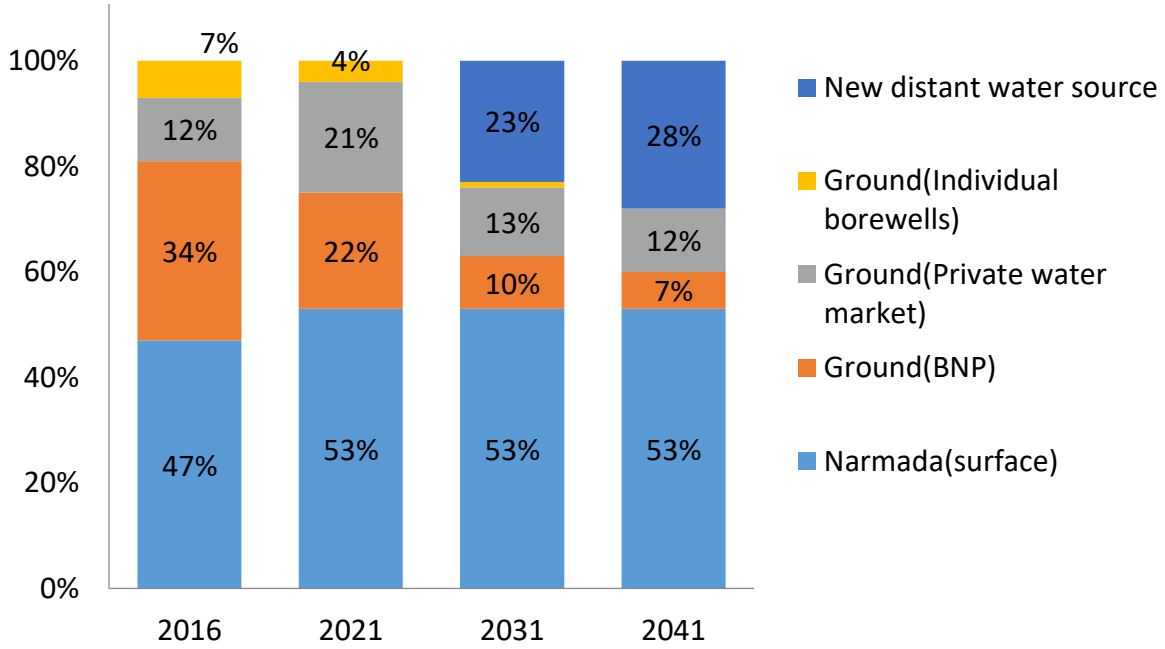

Water Scarcity
Water Resource
Water supply scare
42%
58%
Own water source
Not own
Electricity issue
Economic strength
Quality issue

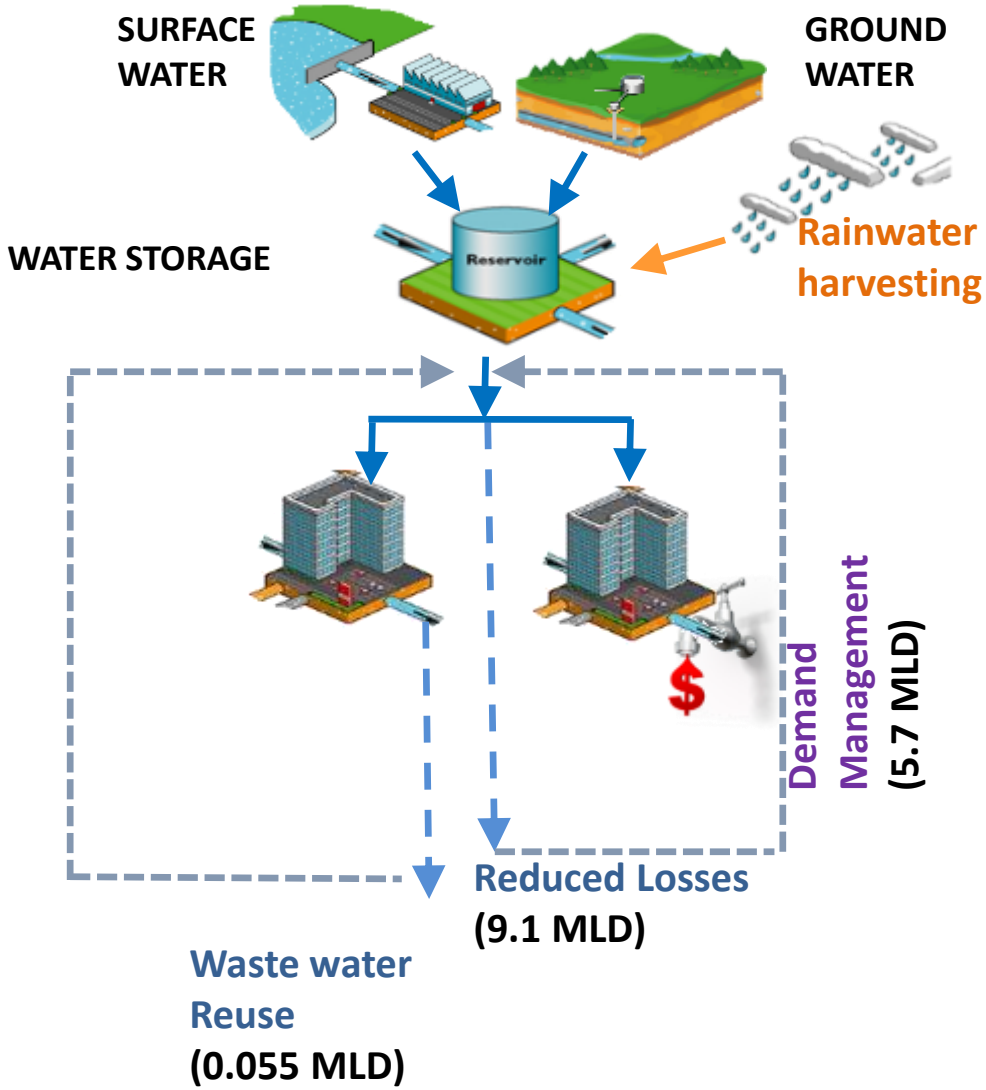
Business as usual scenario

Demand projection



Source of water





SOURCES OF WATER:

31MLD (Existing Supply)

9.1MLD (Leakage Management)

\+ 5.7 MLD (Demand Management)

\+ 0.055MLD (Waste Water Re-use)

= 14.86 MLD

48% of Total existing water supply

Summary

PROJECTS	IMPLEMENTING AGENCIES	CAPEX (in lakhs)		OPEX (in lakhs)		REVENUE (in lakhs)		ULB SHARE
		PUBLIC	PRIVATE	PUBLIC	PRIVATE	PUBLIC	PRIVATE	
Daily water supply & 24X7 Water Supply	BNP Pvt. Contractor	5544 (60.5%)	616 (7%)	330 (100%)	-	-	-	616
Improving Cost Recovery	BNP NGO	320 (3%)	-	196	-	156 (47%)	-	86
Water Quality	BNP	2560 (28%)	-	138	-	138 (53%)	-	256
Water Quality Testing	BNP NGO	135 (1.5%)	-	3	-	-	-	13.5
Ground water monitoring and recharge by rain water harvesting	BNP Pvt. Contractor	-	5	0.1	-	-	-	

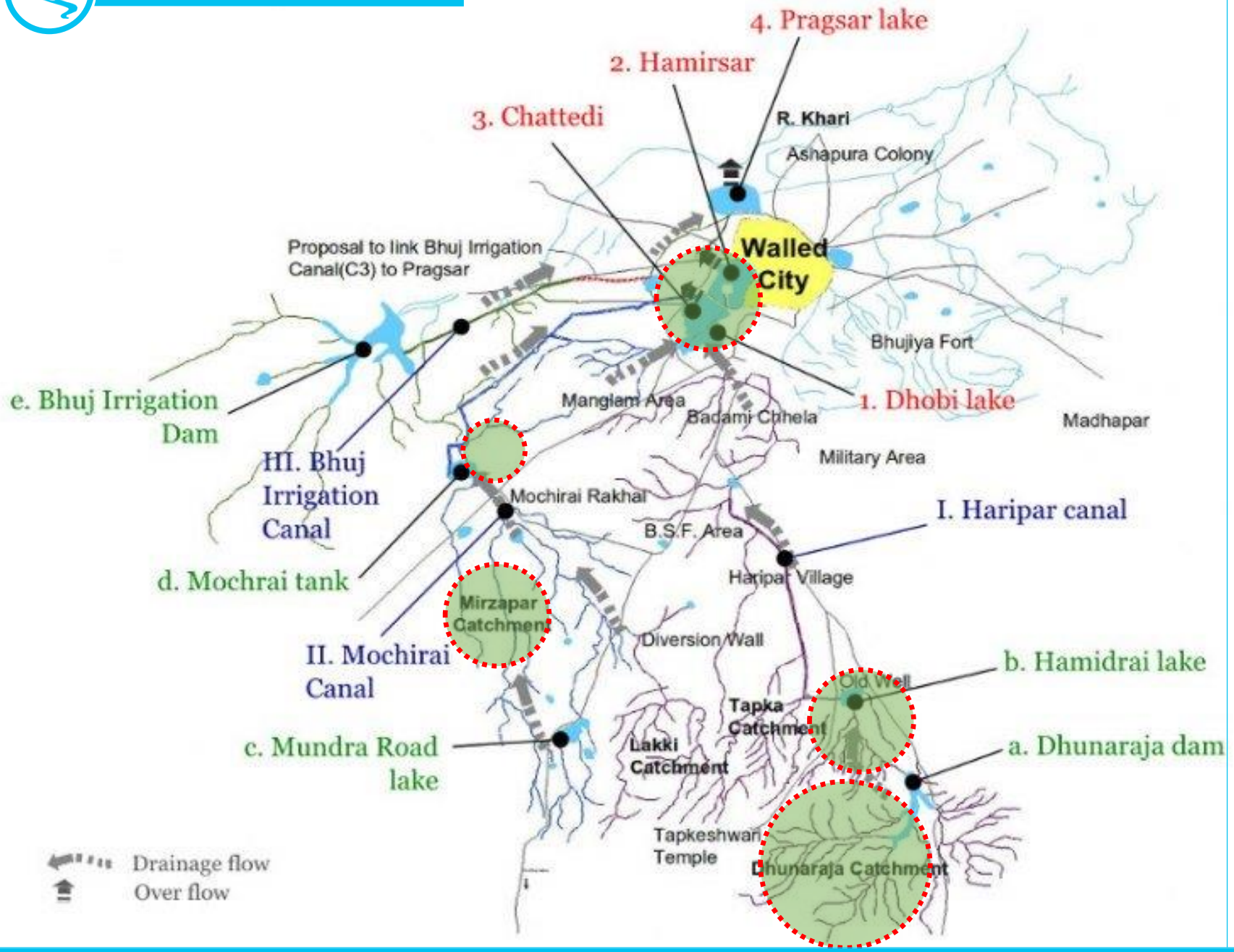
Total Project Cost 6,595 Lakhs

Phasing

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Daily water supply																				
Improve cost recovery																				
Improve Quality of water																				
Water quality Testing																				
Ground water Monitoring and Recharge																				

LAKES AND FLOOD CONTROL

Lake and Flood Control



1510-1549, system for water management was designed and built to harness water from catchments (Hamirsar)

1549 Hamirsar Lake was converted into a big lake. harness water from Hamadrai and Mirzapur catchment

1880's water courses from Dhunaraja Catchment

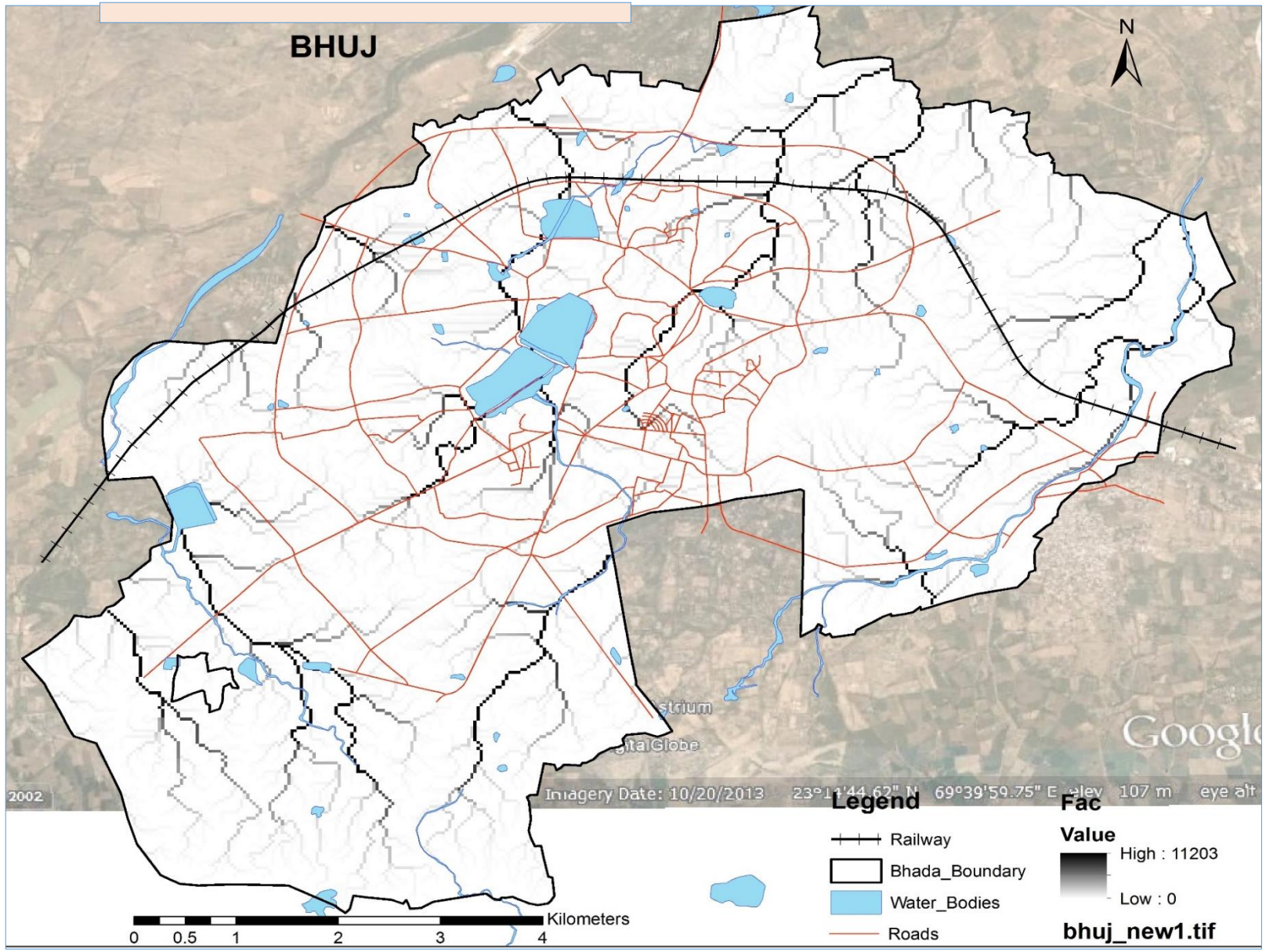
Late 1880's construction of present day very well known chaubees kuaan(twenty four wells)

Mid 1990's Dependency of water shifts from lakes to bore wells

Late 1990's-2000's Construction , encroachment, debris dumping, etc. been responsible for slow destruction of the ancestral water system

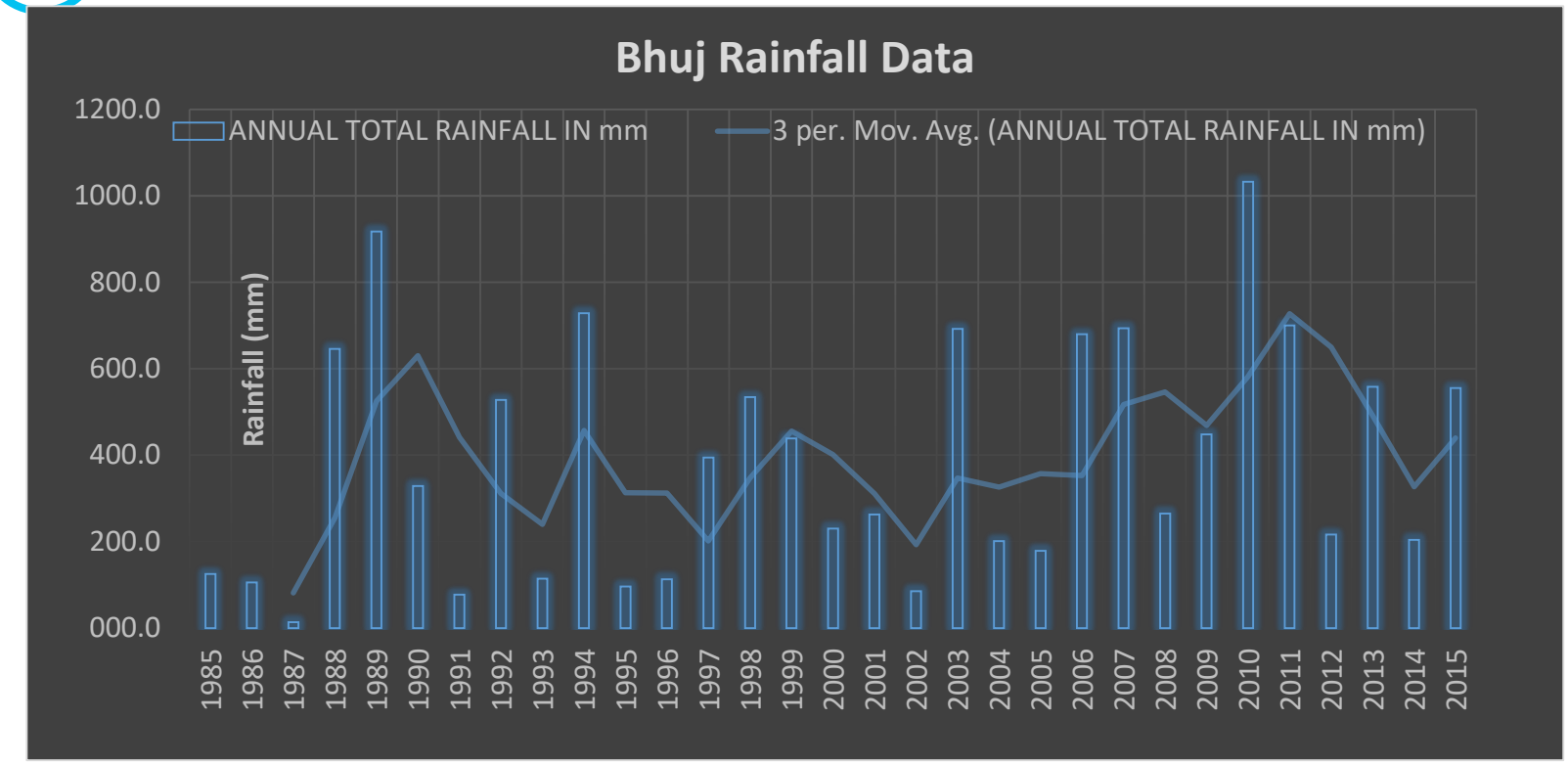
Source: Bhuj bole che

Lake and Flood Control



- Total Road network in Bhuj is **250Km.**
- There's **1Km** length of existing storm water length-Bus stand to Bheed naka.
- AMRUT-**20%**
- Total funding-**8Cr**
- Target-**20% to 40%**
- Natural storm water drains - **47Km**
- Identified and traced- **14km**

Source:

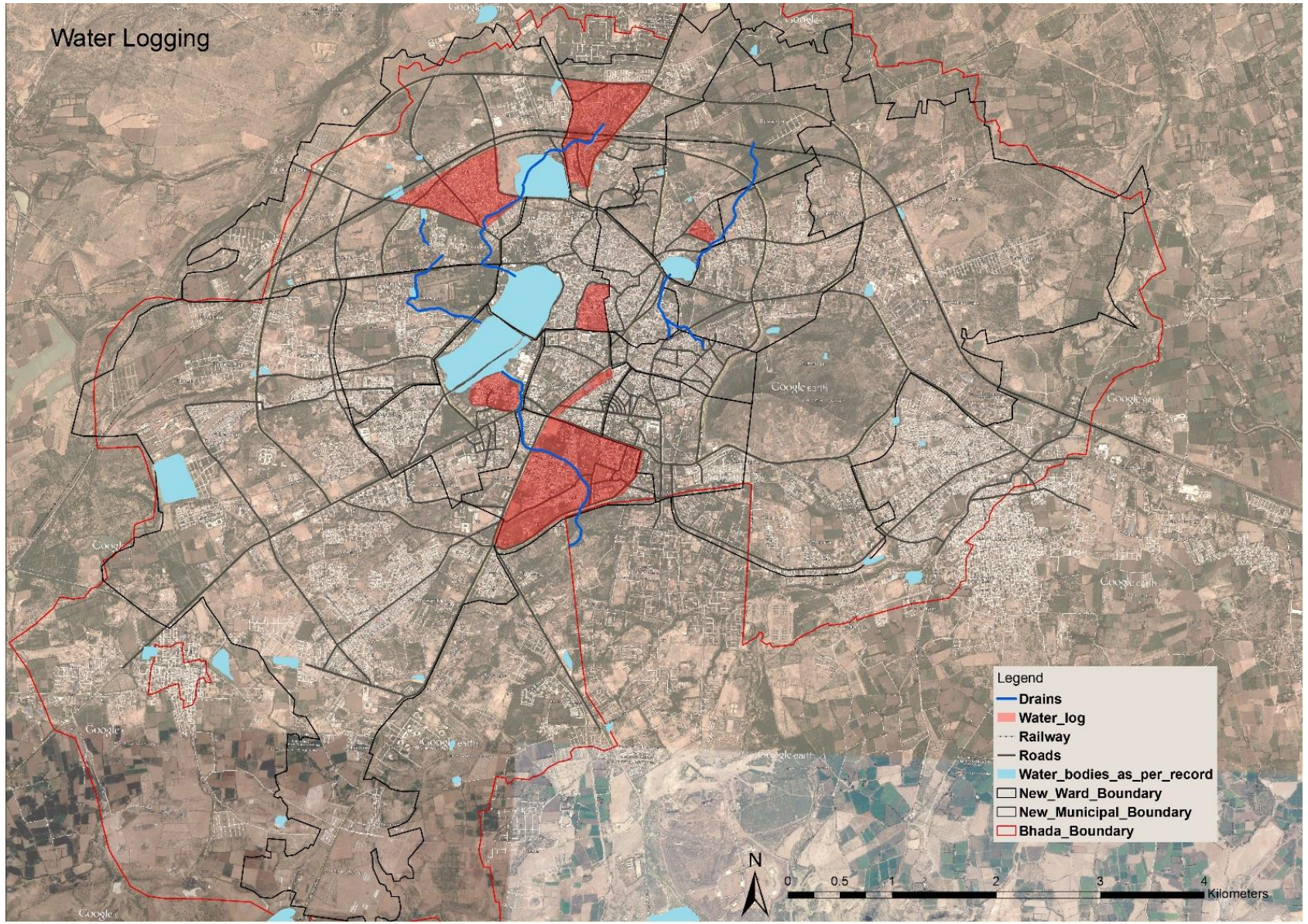


Year	Rainfall(mm)	Return period Probability(years)
2010	1032mm	62
1989	917	21
1994	728.1	12
2011	700	9
2007	639.4	7
2003	691	6
2013	558.4	4

Average rainfall	mm
last 31 years	400mm
last 25 years	407mm
last 20 years	435mm
last 15years	472mm
last 10 years	529mm

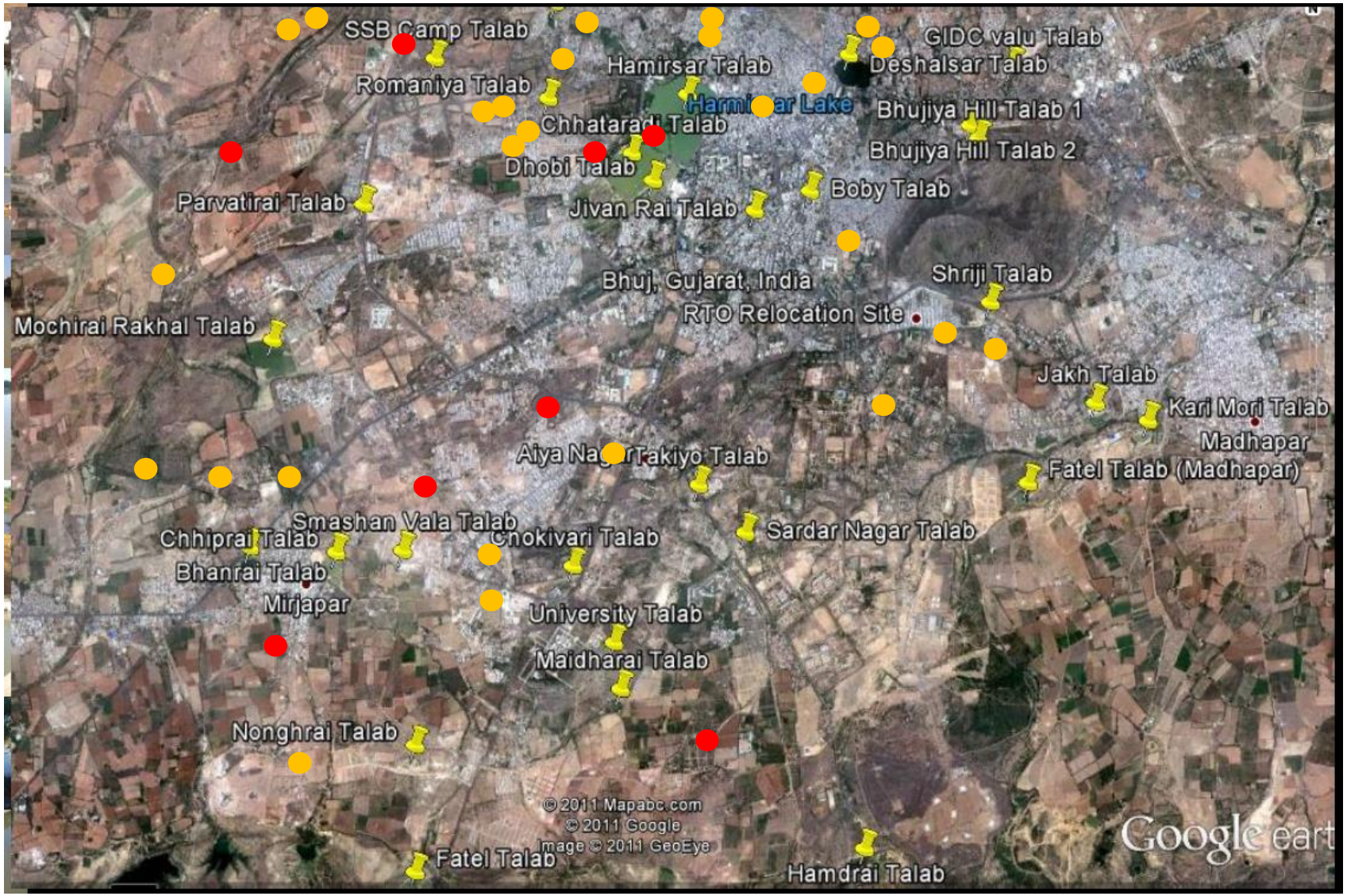
Average rainfall intensity	mm/hr
last 31 years	3.23
last 25 years	3.28
last 20 years	2.84
last 15years	2.86
last 10 years	3.11

Source: ACT



Flooding in the year 2011 September, Center of the city is majorly affected

Source: ACT



EXISTING LAKES

DEAD LAKES

CONDITION OF THE LAKES	NUMBER
Existing and visible lakes in "good condition"	29
Silted lakes	13
Disappeared Lakes	6
Polluted	11
Partially encroached lakes	7
Lakes used for drinking and domestic water	6

Source: Primary Survey , PAS.org , ACT, Bhuj bole che

BANGALORE

Issues:

- Blockage of Drains.
- Contamination of lake water.
- Water logs
- Decreases the carrying efficiency of the drain.

Major reason:

- Encroachment.
- Sewage discharge in to drains.
- MSW

Proposed action:

- Integrated catchment based management and planning
- Develop overall flood mitigation strategy for the city.
- Minimise sewage inflow to storm water
- **Integrated Municipal Solid Waste Management**
- Community education programs to Improve understanding of the important of clean drainage and waterways

Source: Bangalore IISE

Lake and Flood Control

ISSUES

Catchment management Water logging and flooding

Encroached / Blocked /Extinct Natural Drains

Waste dumping/ sewage disposal/ C&D Waste dumping in Lake systems

Existing infrastructure and capacity of lakes

OBJECTIVES

Catchment (natural system) revival at local level and connect the missing links in natural drains to overcome flood/logging issues.

To Preserve Unique Character of lake.

To make lakes as identity and asset of Bhuj city

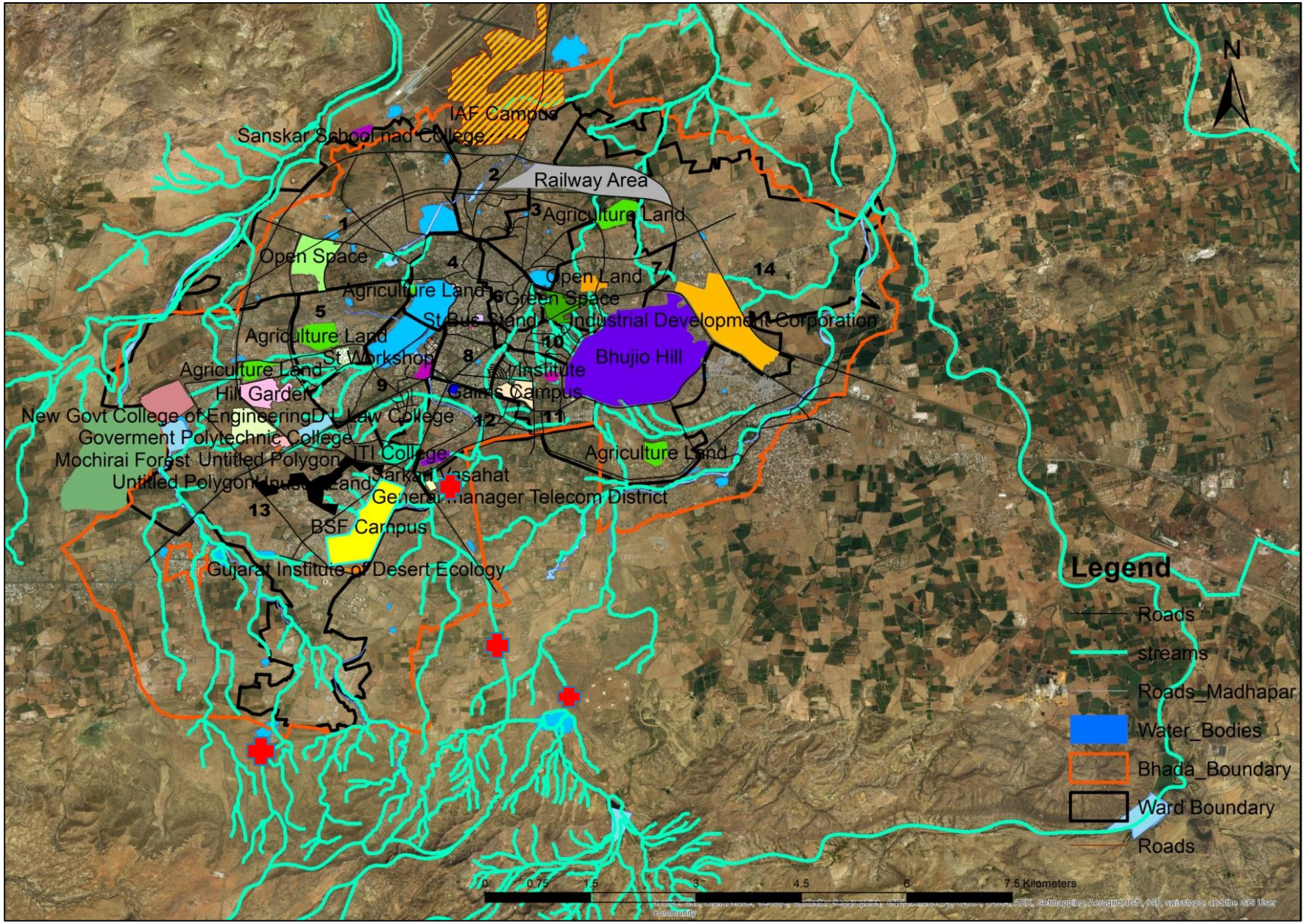
..To make Bhuj the‘City of Lakes’..

Linking and cleaning of natural drains through storm water drains

Storm Water Management through WSUD

Specific lake front development and capacity improvement

Participatory Catchment Management

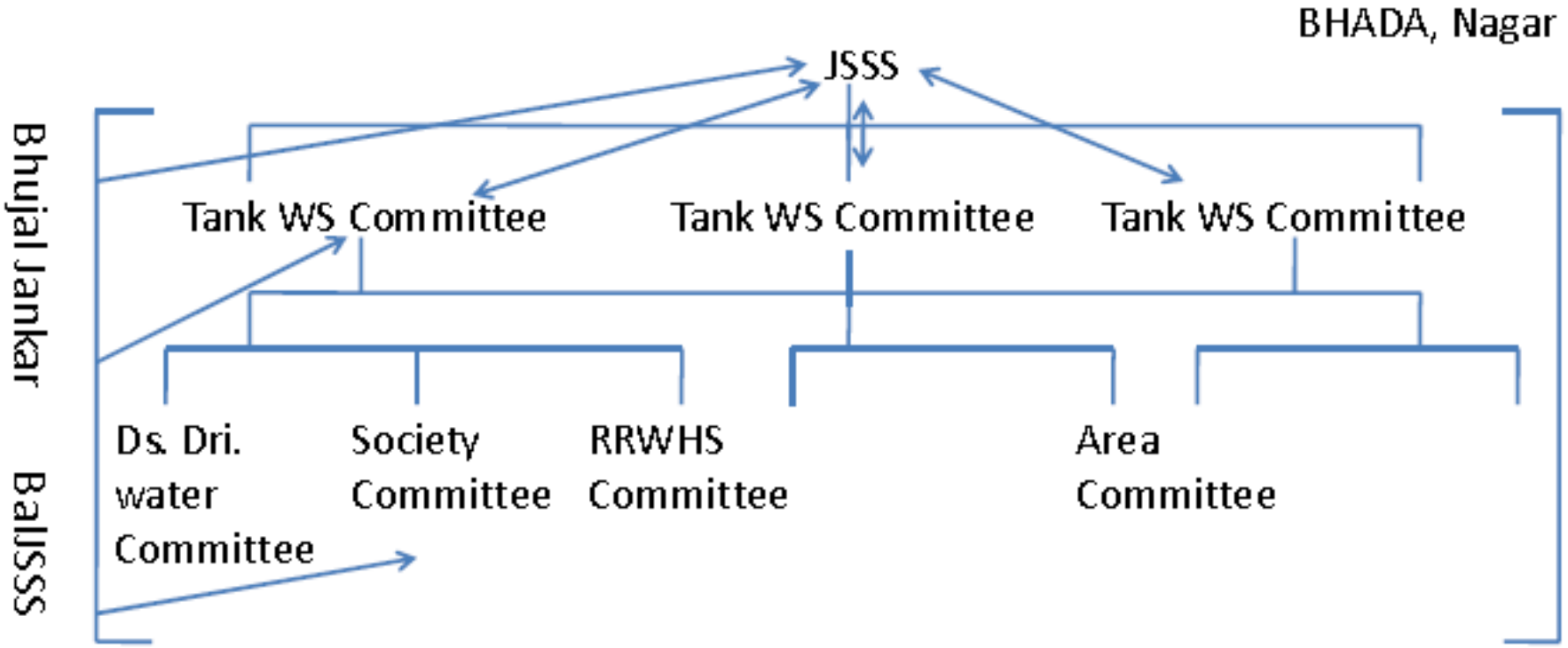


Siltation

Source :ACT, water economics

Participatory Catchment Management

Institution formation



Source :ACT, water economics

Participatory Catchment Management

MOWR, NWP:2012, NWM,2008

Resource conservation :

- For resource protection
- Land use integration
- Administrative Legislation
- Water Pricing
- Water distributions

RBO

Criticism:

- Failure to overcome traditional boundaries
- Impossible to operate
- Does not cover all water management dimensions
- Absence of adaptive management
- Failure to integrate knowledge

To conserve traditional water system:

- BNP Should form there own set of regulations and should form a **separate catchment management Body of different stakeholders to avoid overlaps issues**

Gujarat State water resource committee will give power to this catchment management committee under .

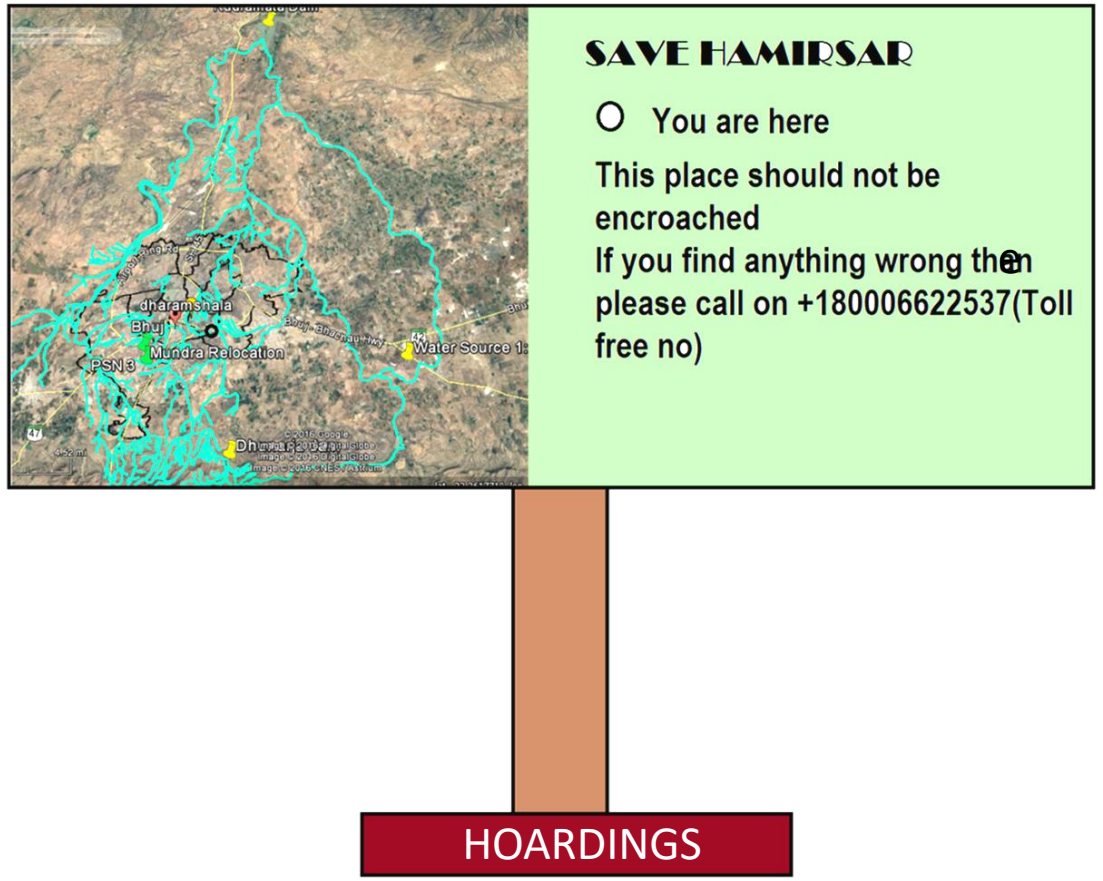
- Revival of catchments by removing siltation and diverting disturbed catchment lines
- Cost of desiltting: INR 590/Cub m
- Green buffer along the stream lines: No Go Zones
- Reuse of waste water to water the proposed green buffer.

Finance can come from NGOs, State resource committee and under CSR

Source: Susdrain, pinterest.com, IRC road drainage

Participatory Catchment Management

- Catchment Education and Information Exchange Program (CIEP) are:
  - A User Guide
  - An interactive community education program
  - A catchment information centre
  - Catchment phone link
  - Legal guidelines for information management
  - Institutional arrangements for information management and setting up a CIEP
- **Regional libraries for safe deposits of catchment material Or online information on Bhuj bole chhe!!.**
- A catchment Information System (CIS).

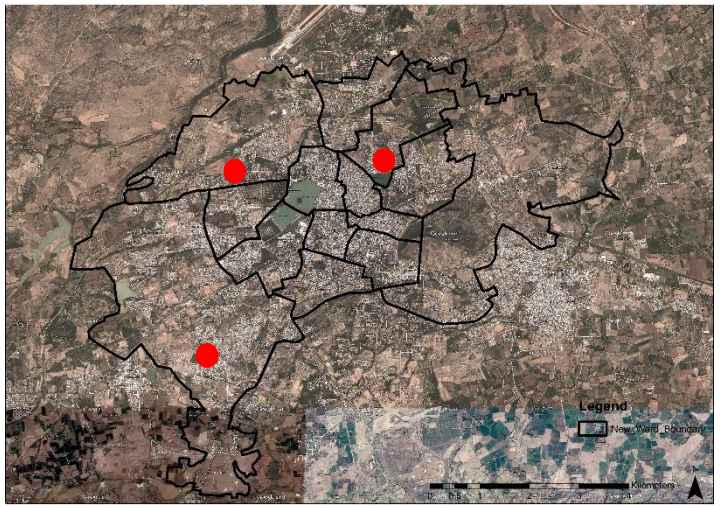


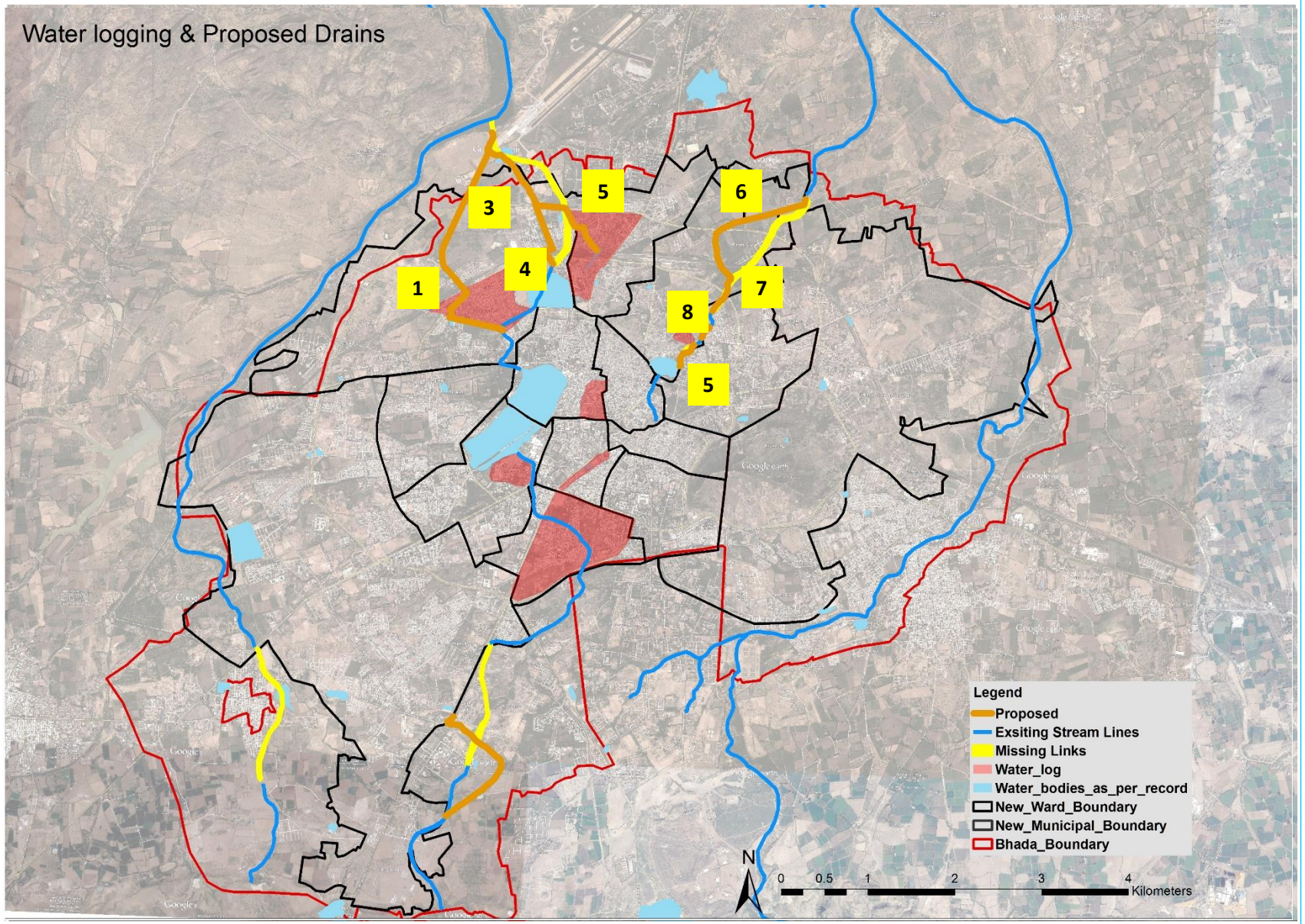
- Funding for CIEP can come from AMRUT under E-Governance head
- **Funding for** Capacity building for catchment management body can come from AMRUT: Capacity building head

Source: Susdrain, pinterest.com, IRC road drainage

Lake and Flood Control

Kutch university





SWD management

Construction of SWD

Costing

Code	Length(meters)	Cost
Proposed drain network 1	1950	195 Lakh
Proposed drain network 2	332	33.2 Lakh
Proposed drain network 3	49	4.9 Lakh
Proposed drain network 4	29.5	2.95 Lakh
Proposed drain network 5	2044	204.4 Lakh
Proposed drain network 6	77	7.7 Lakh
Proposed drain network 7	2199	219.9 Lakh
Proposed drain network 8	1010	101 Lakh
Total	**7690.5**	**769Lakh**

Capital Cost 7.69cr

Atal Mission for Rejuvenation and Urban Transformation

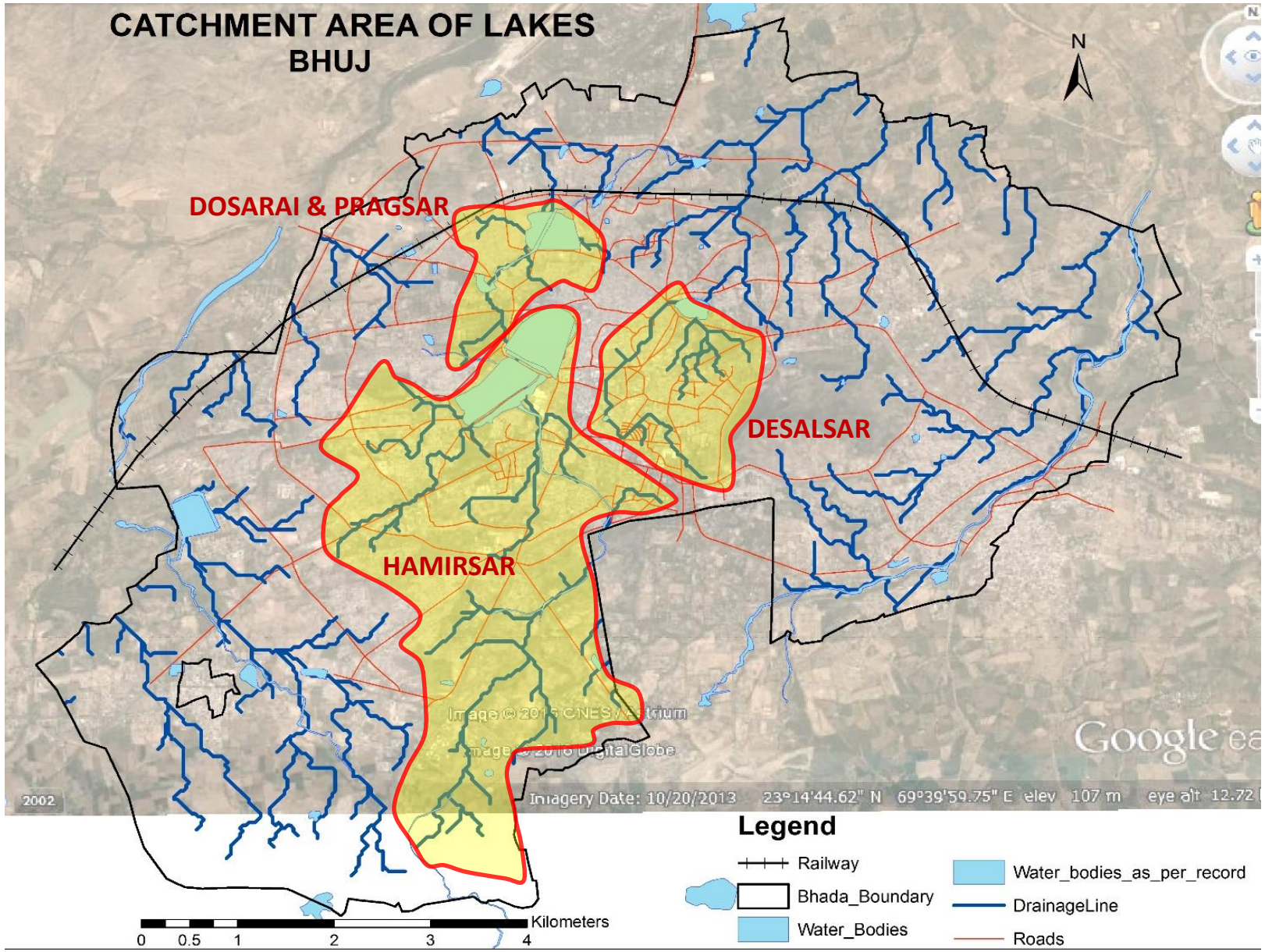
- **50%-Central**
- **40%-State**
- **10%-ULB**

SWD management

Construction of SWD

Atal Mission for Rejuvenation and Urban Transformation

Source:



Lake and Flood Control

HAMIRSAR LAKE

Catchment area: **6.17 Km.Sq.**
Maximum capacity: **275 ML**
Total Runoff: **700ML**

DESALSAR LAKE

Catchment area:**3.0 Km.Sq.**
Maximum capacity: **162 ML**
Total Runoff: **340ML**

DOSRAI Lake

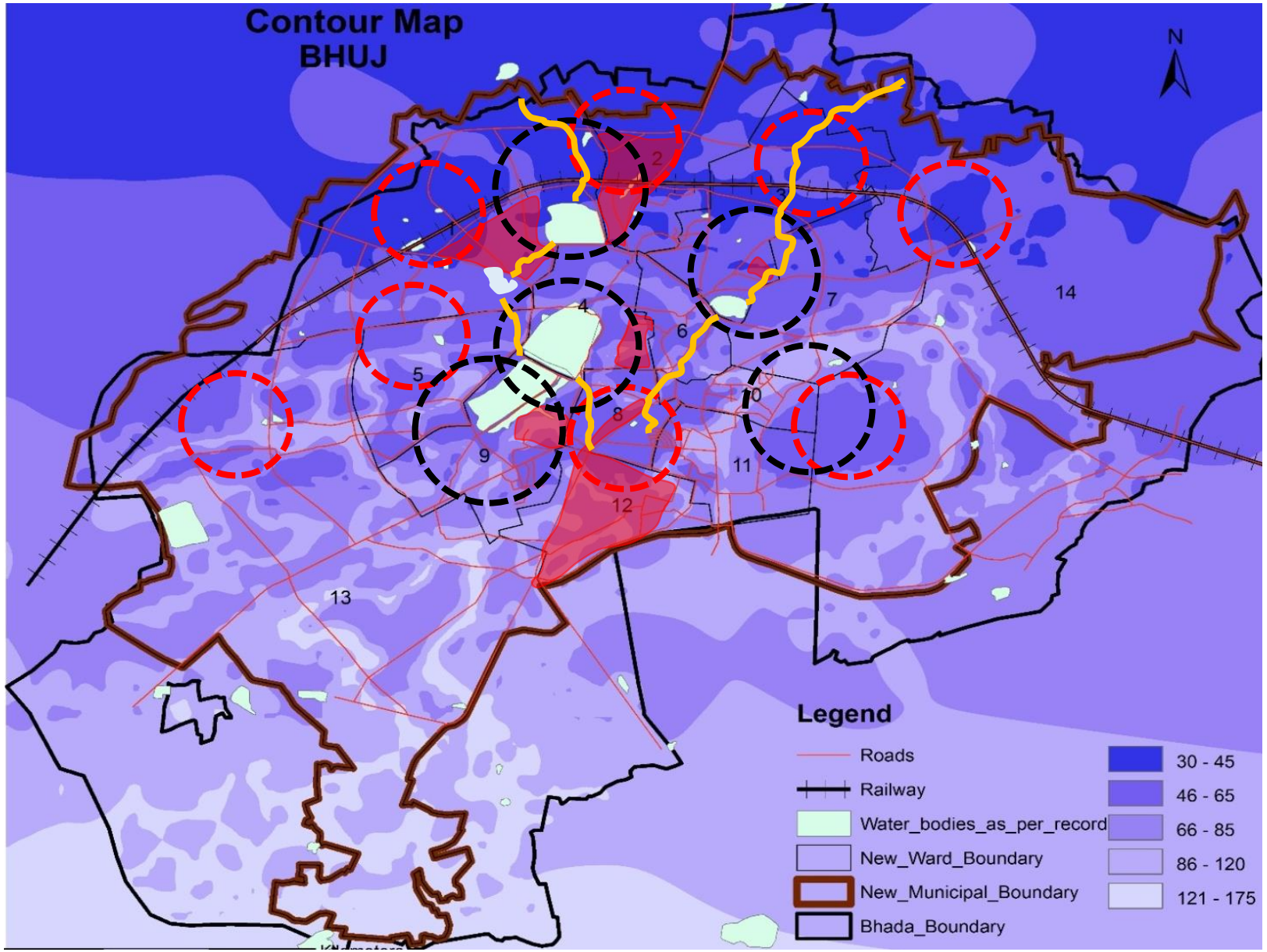
Catchment area: **0.6 Km.Sq.**
Maximum capacity : 23 **ML**
Total Runoff: 68 **ML**

PRAGSAR LAKE

Catchment area:**2.0 Km.Sq.**
Maximum capacity :**.57ML**
Total Runoff: **172ML**

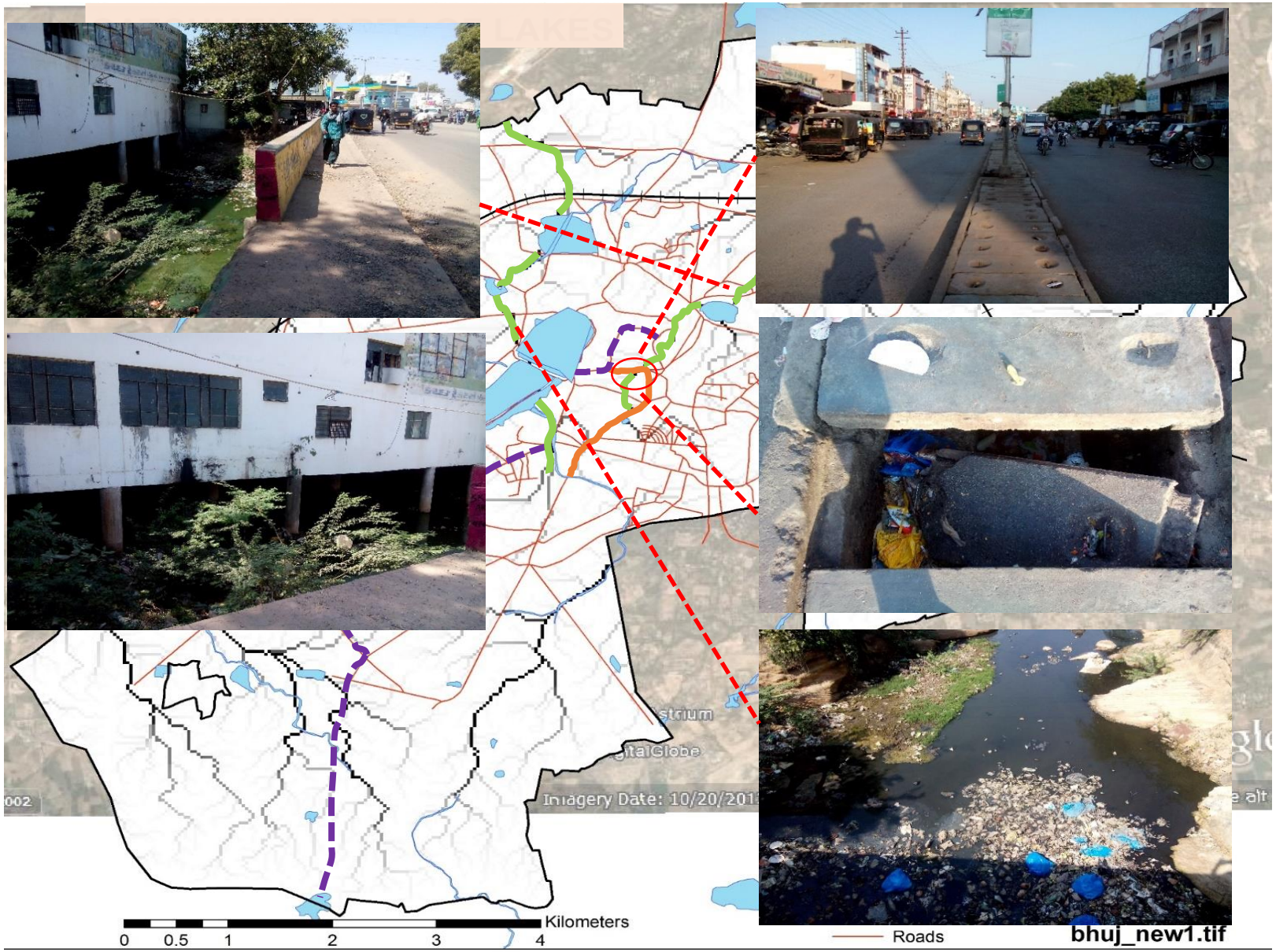
This harvested water can be supplied to city 51 days and serve as drinking water for 308 days

Issues



Lake and Flood Control

Source: ACT



Storm Water Network

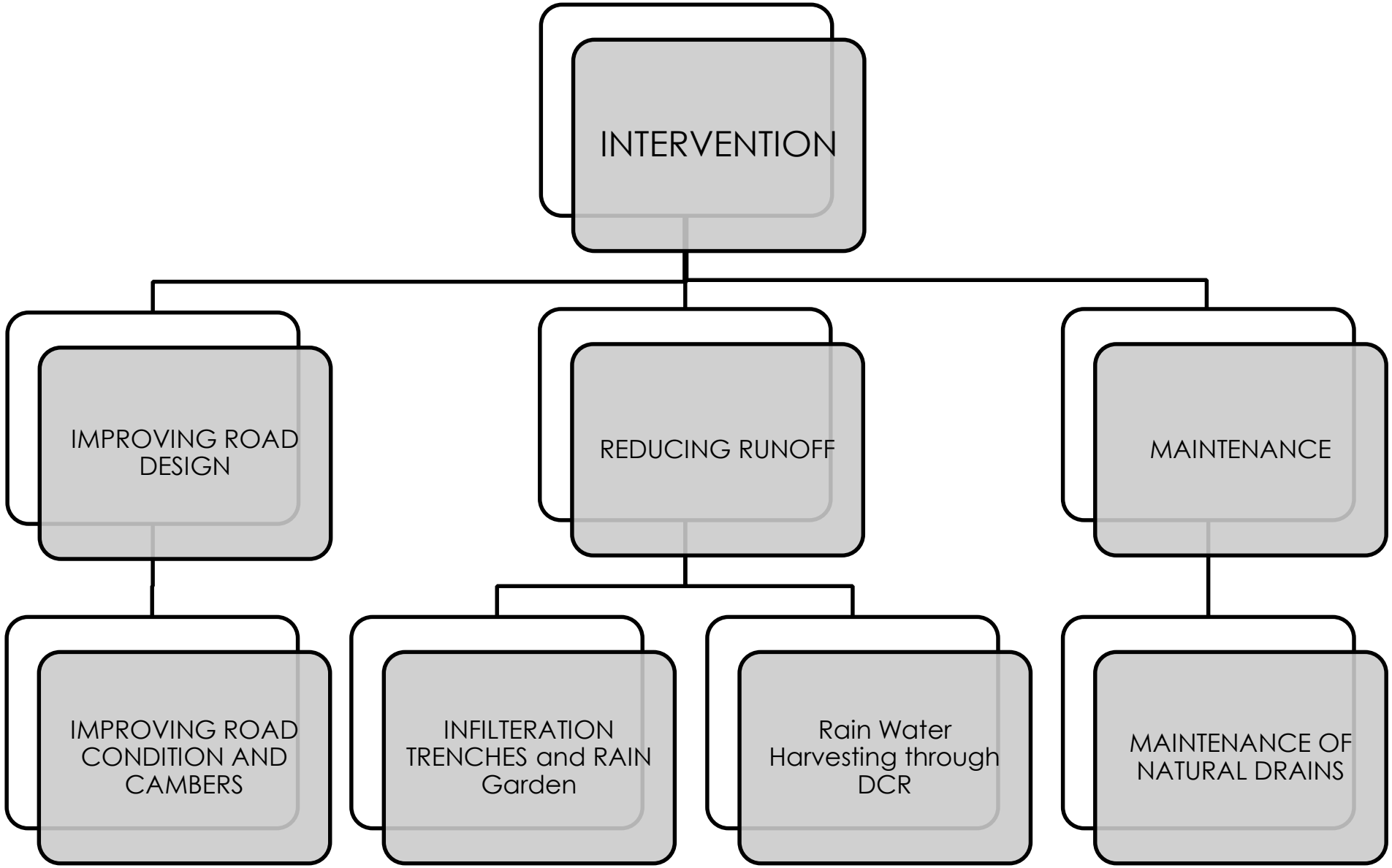
Existing –

- From Bhuj bus station to Bhidnaka which is 1 km

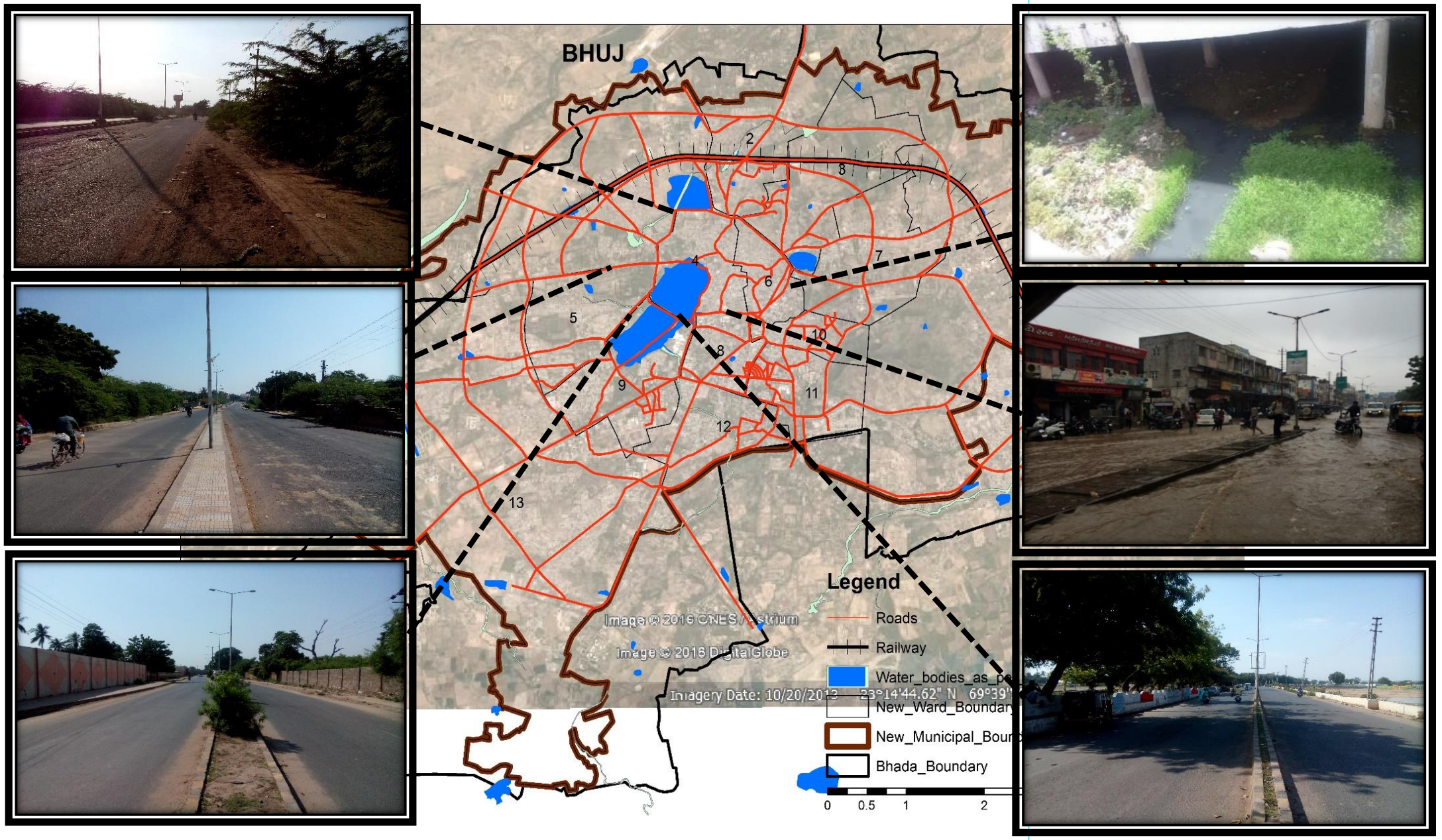
Proposed –

- From Hamirsar to Wokada Falaya.
- Form Umed Nagar to Fatal Talav

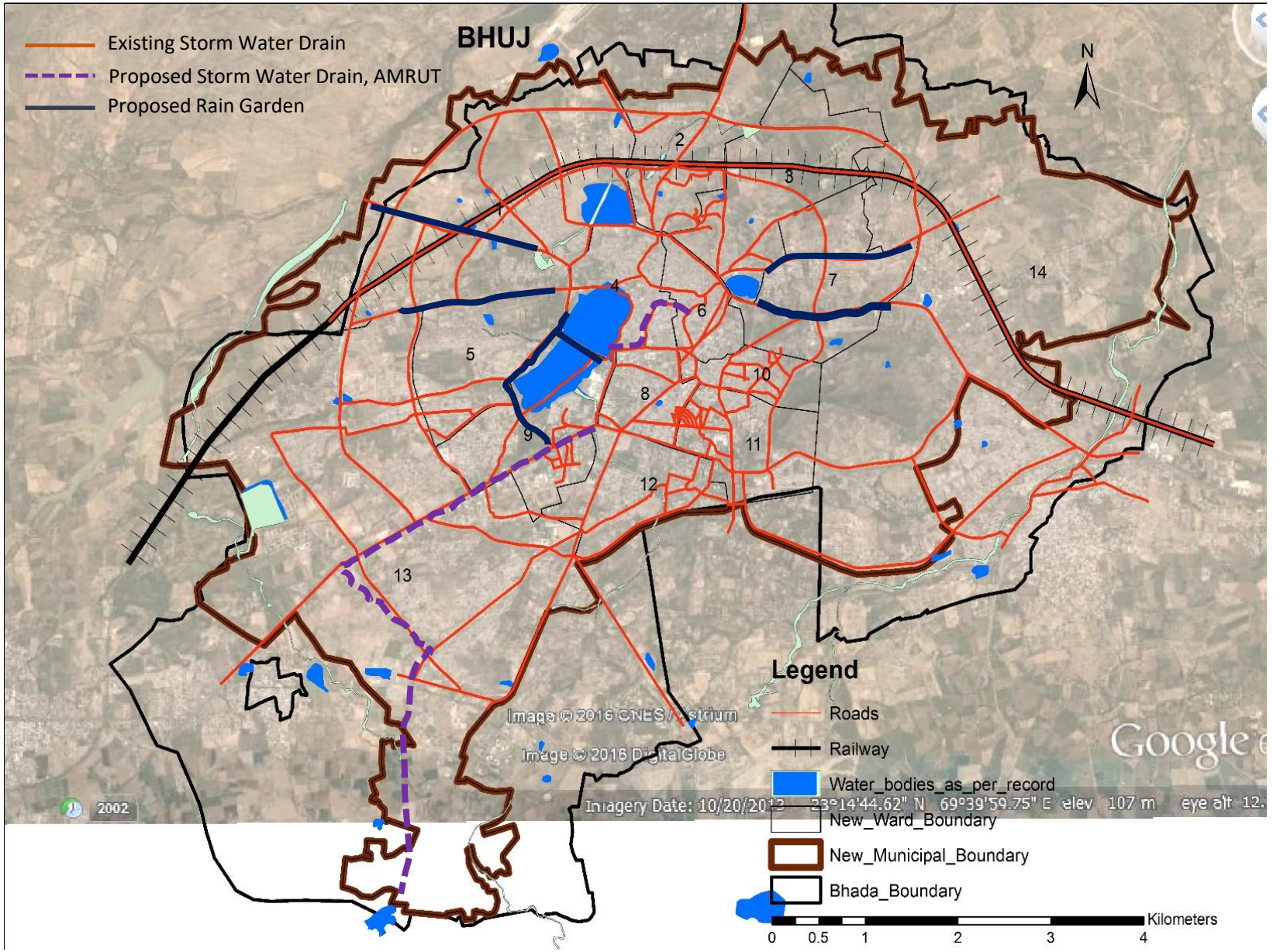
Natural Storm Water Drain – 16 km


INTERVENTION
IMPROVING ROAD DESIGN
REDUCING RUNOFF
MAINTENANCE
IMPROVING ROAD CONDITION AND CAMBERS
INFILTERATION TRENCHES and RAIN Garden
Rain Water Harvesting through DCR
MAINTENANCE OF NATURAL DRAINS

Lake and Flood Control



Lake and Flood Control



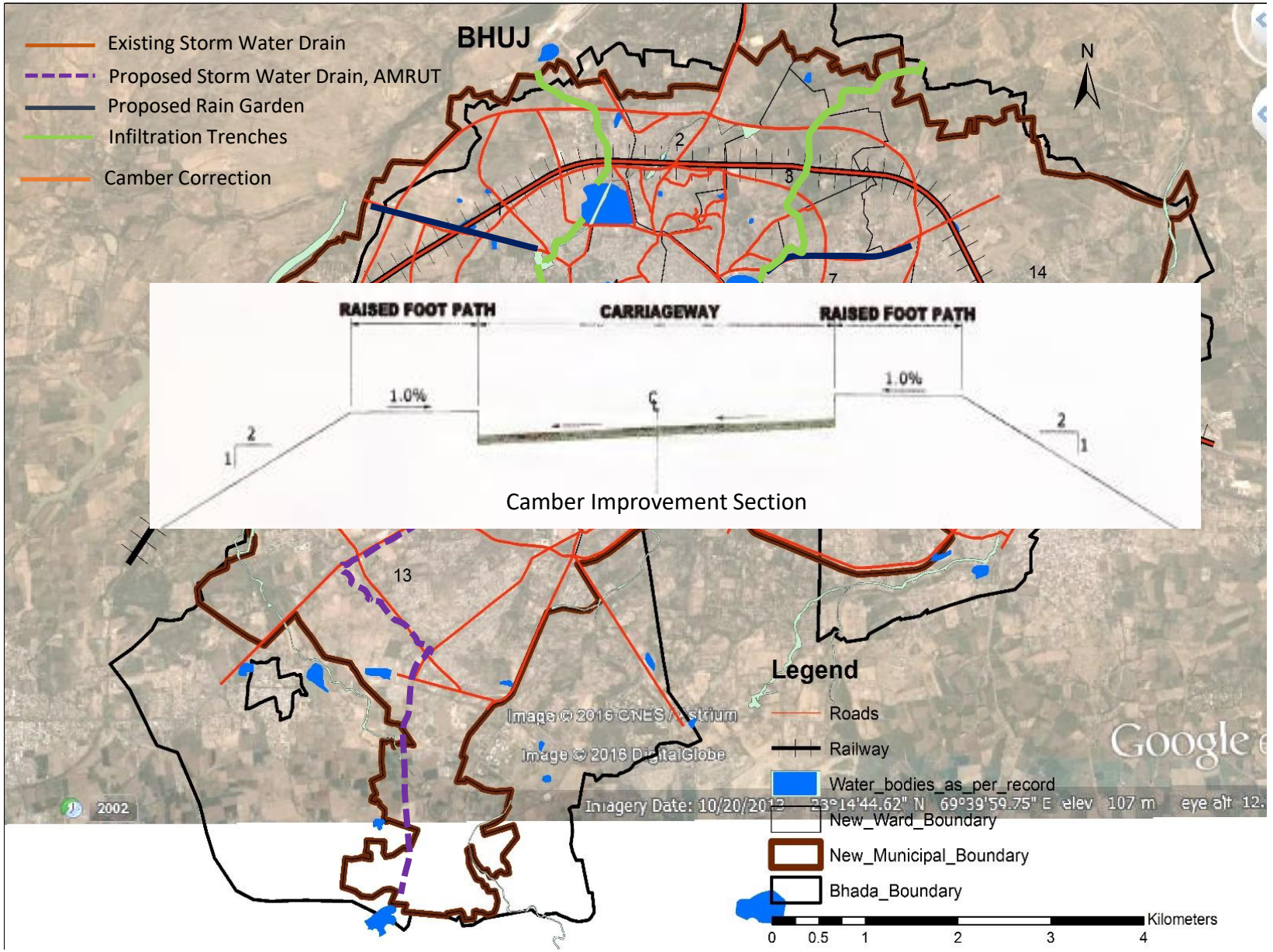
Project Cost

Intervention	Total
Rain Garden	108 lakhs

Maintenance Cost

Intervention	Total
Rain Garden	24 Lakh

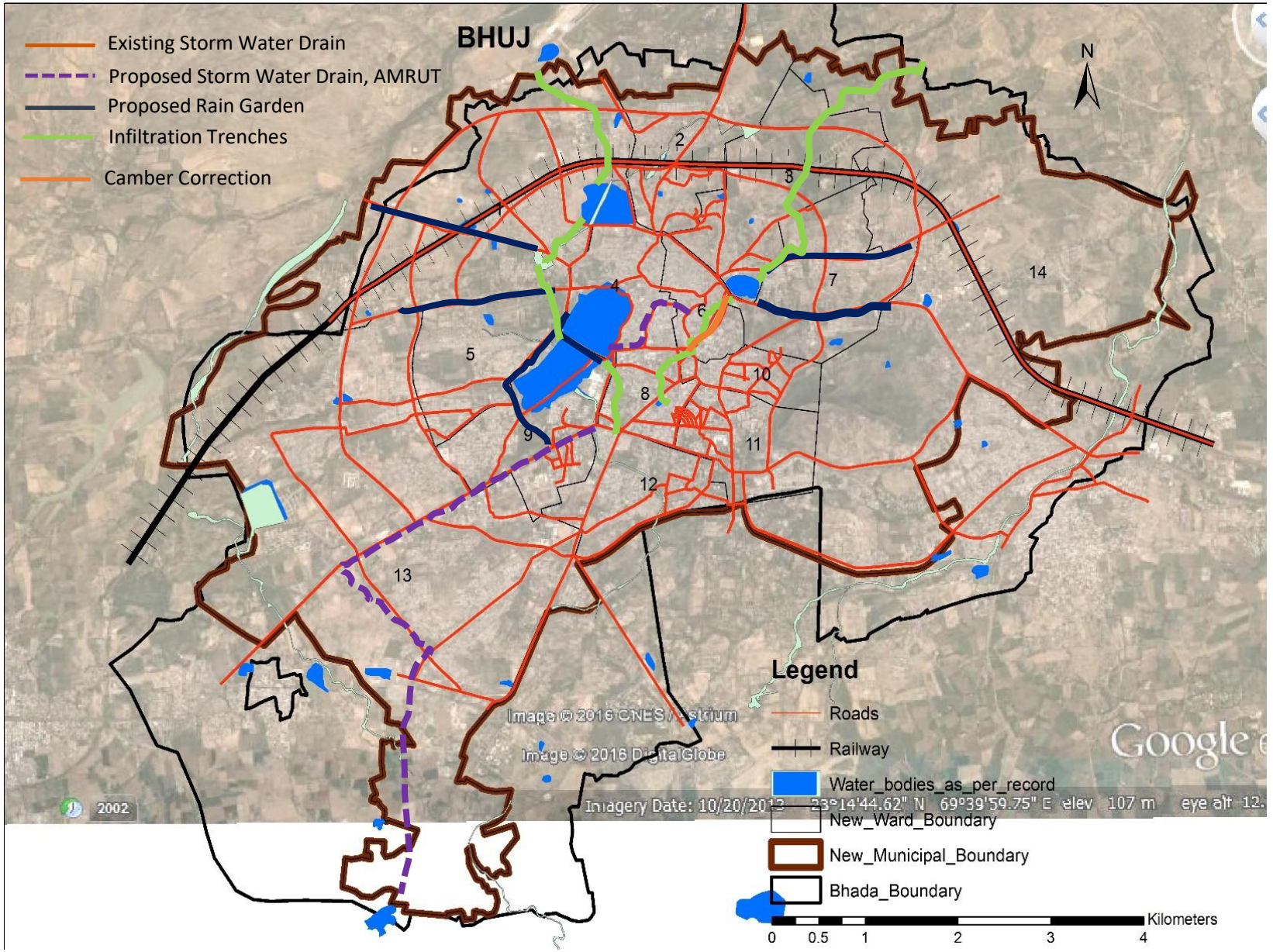
Source: Susdrain, pinterest.com, IRC road drainage



Project Cost

Source: Susdrain, pinterest.com, IRC road drainage

Lake and Flood Control

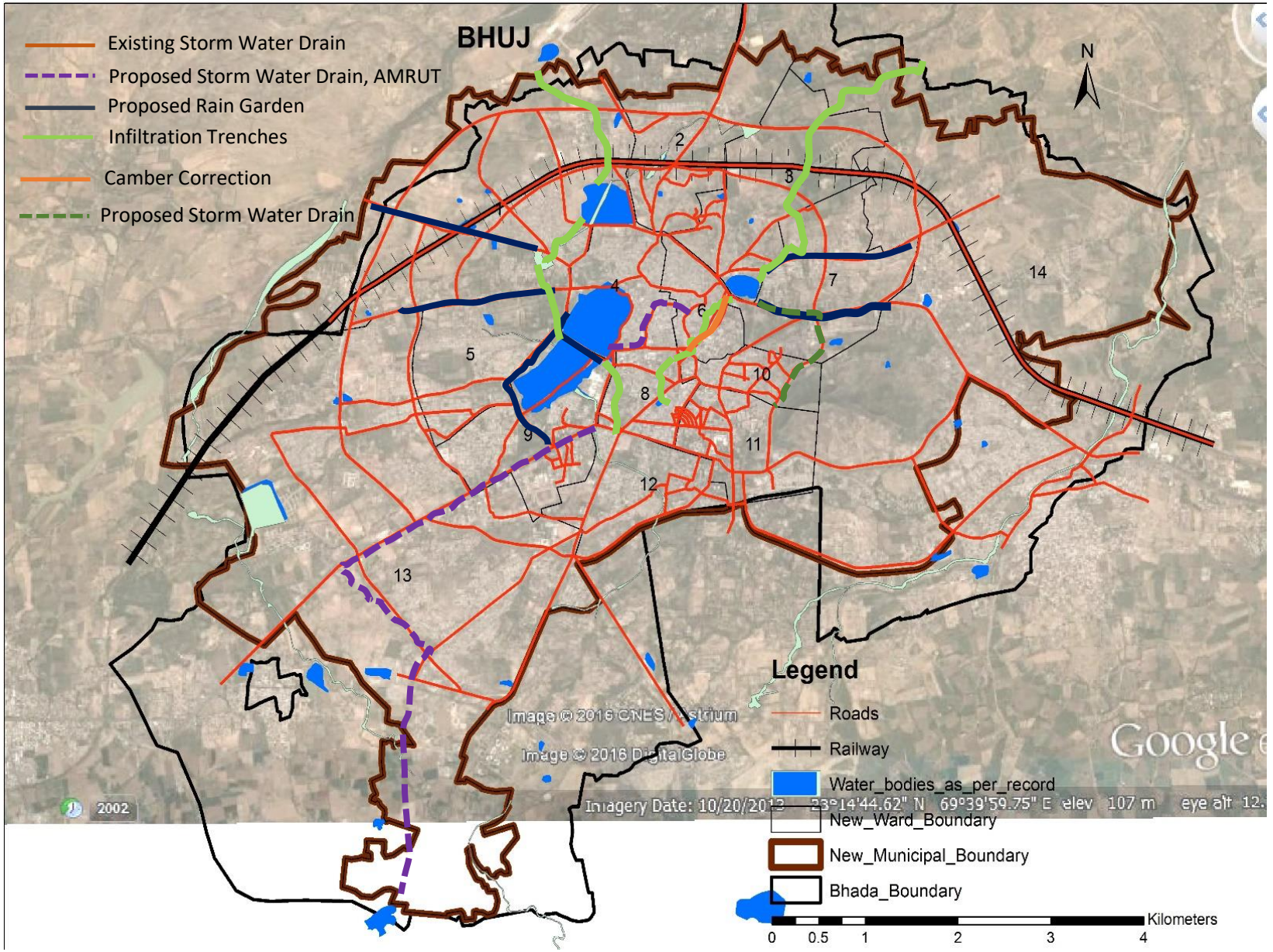


Project Cost

Intervention	Total
Camber	6 lakh

Source: Susdrain, pinterest.com, IRC road drainage

Lake and Flood Control

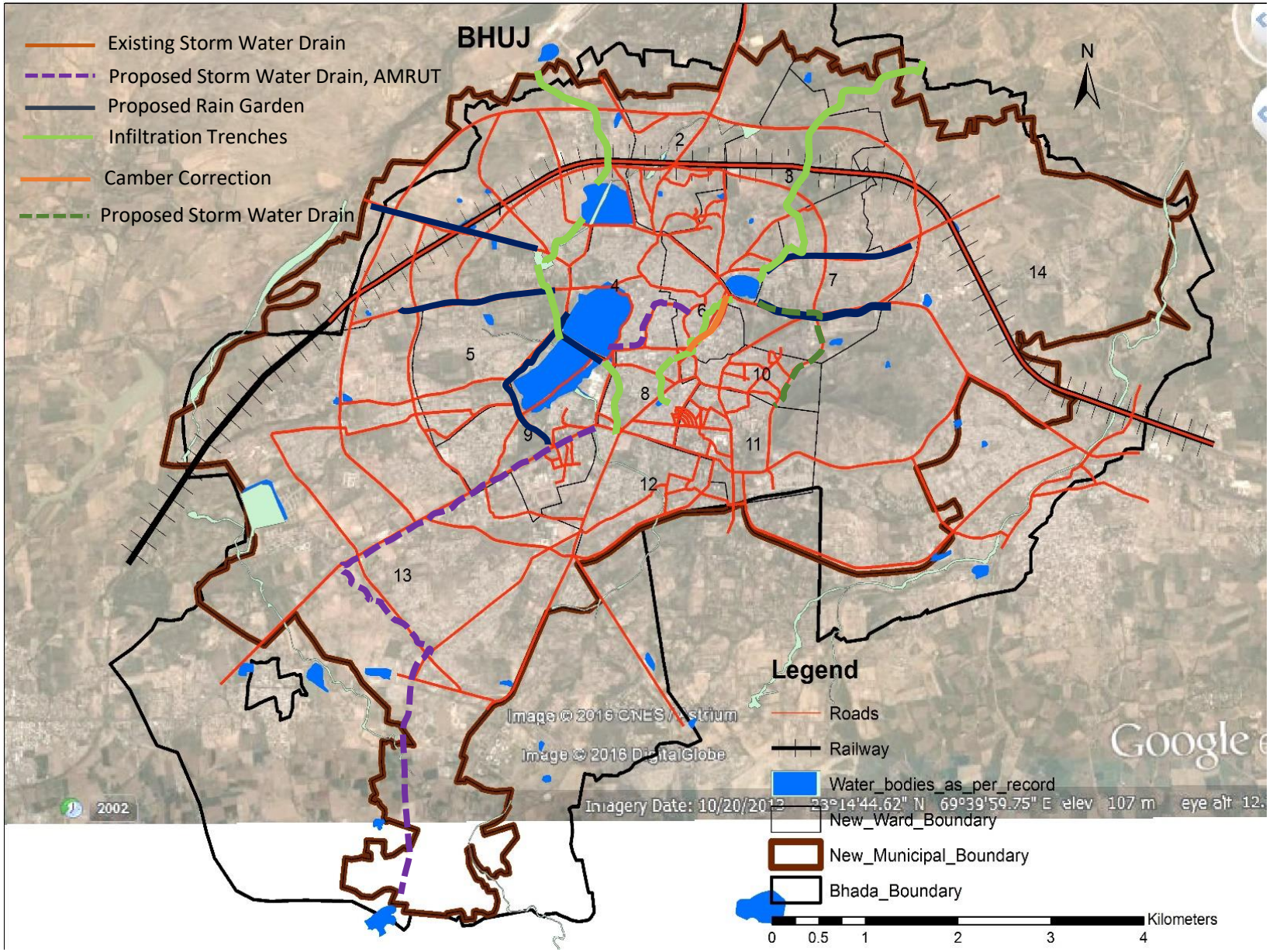


Project Cost

Intervention	Total
Storm Water Drain	170 Lakhs
Overall Cost	518 Lakhs

Source: Susdrain, pinterest.com, IRC road drainage

Lake and Flood Control



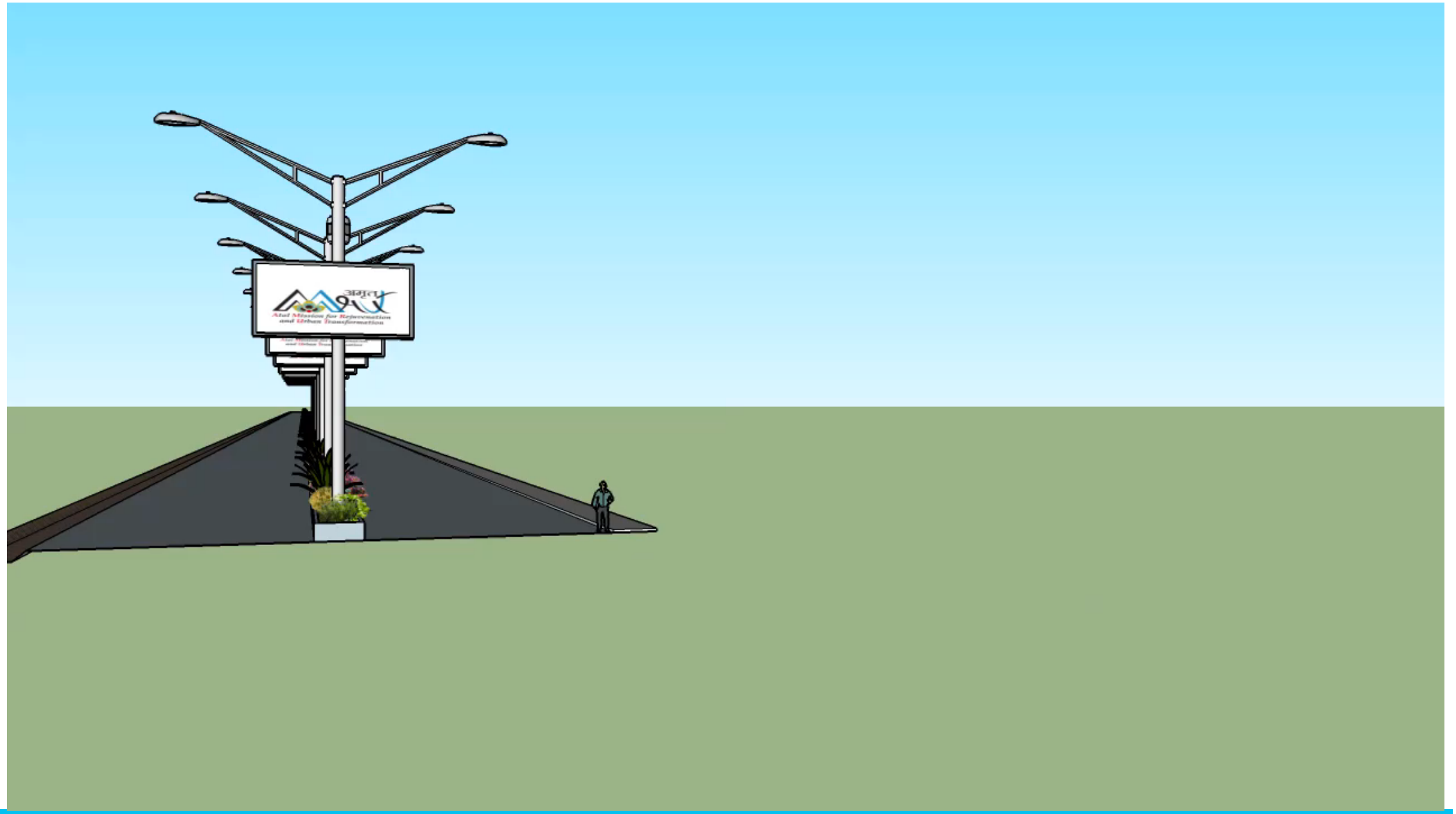
Revenue

Intervention	Total
Advertisement	200 Lakhs
CSR	20 Lakhs

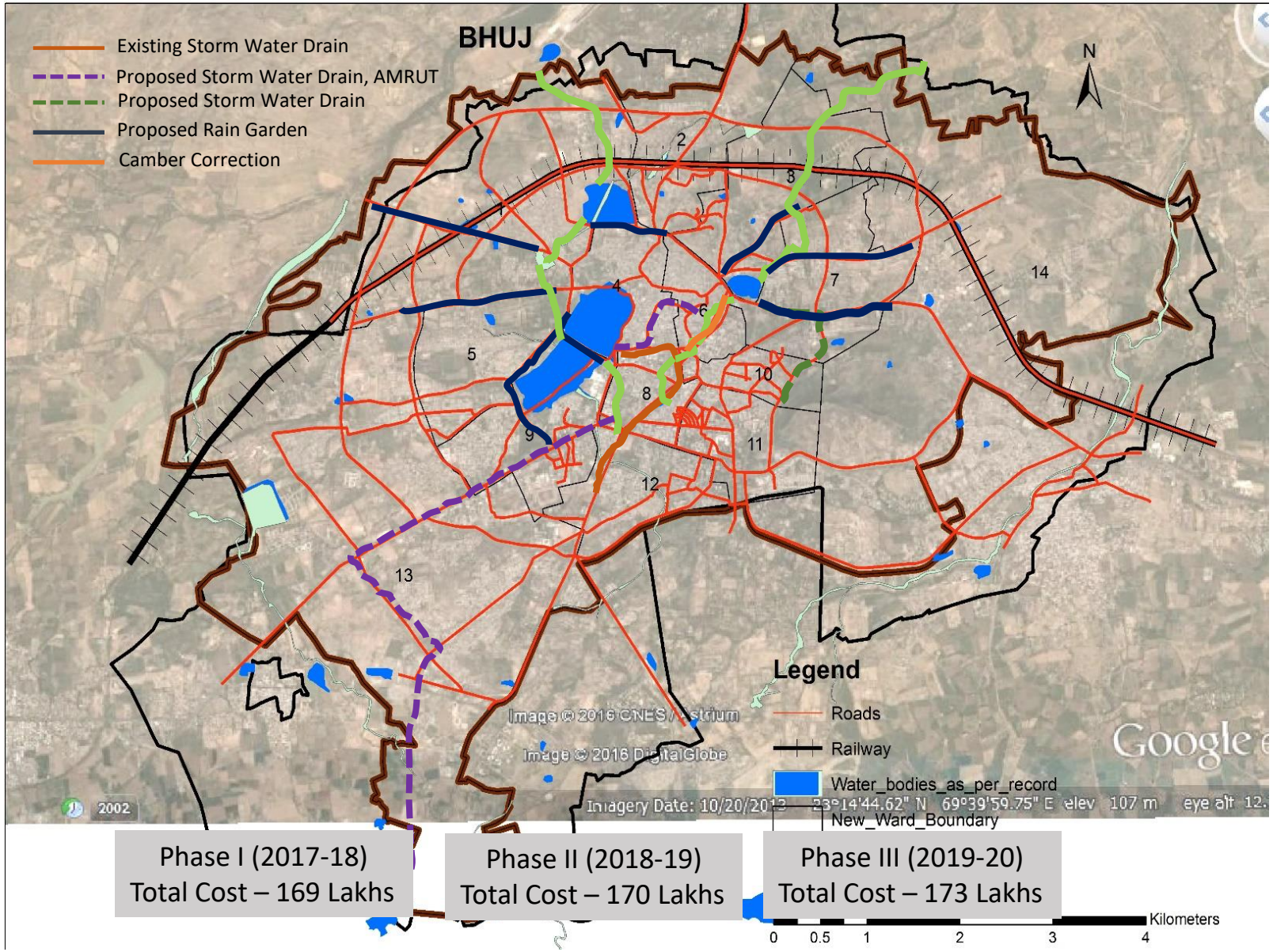
Source: Susdrain, pinterest.com, IRC road drainage

Lake and Flood Control

Source: images: - drystonegarden.com, pinterest.com, indiamart.com


Atal Mission for Rejuvenation
and Urban Transformation

Phasing



Phase I (2017-18)
Total Cost – 169 Lakhs

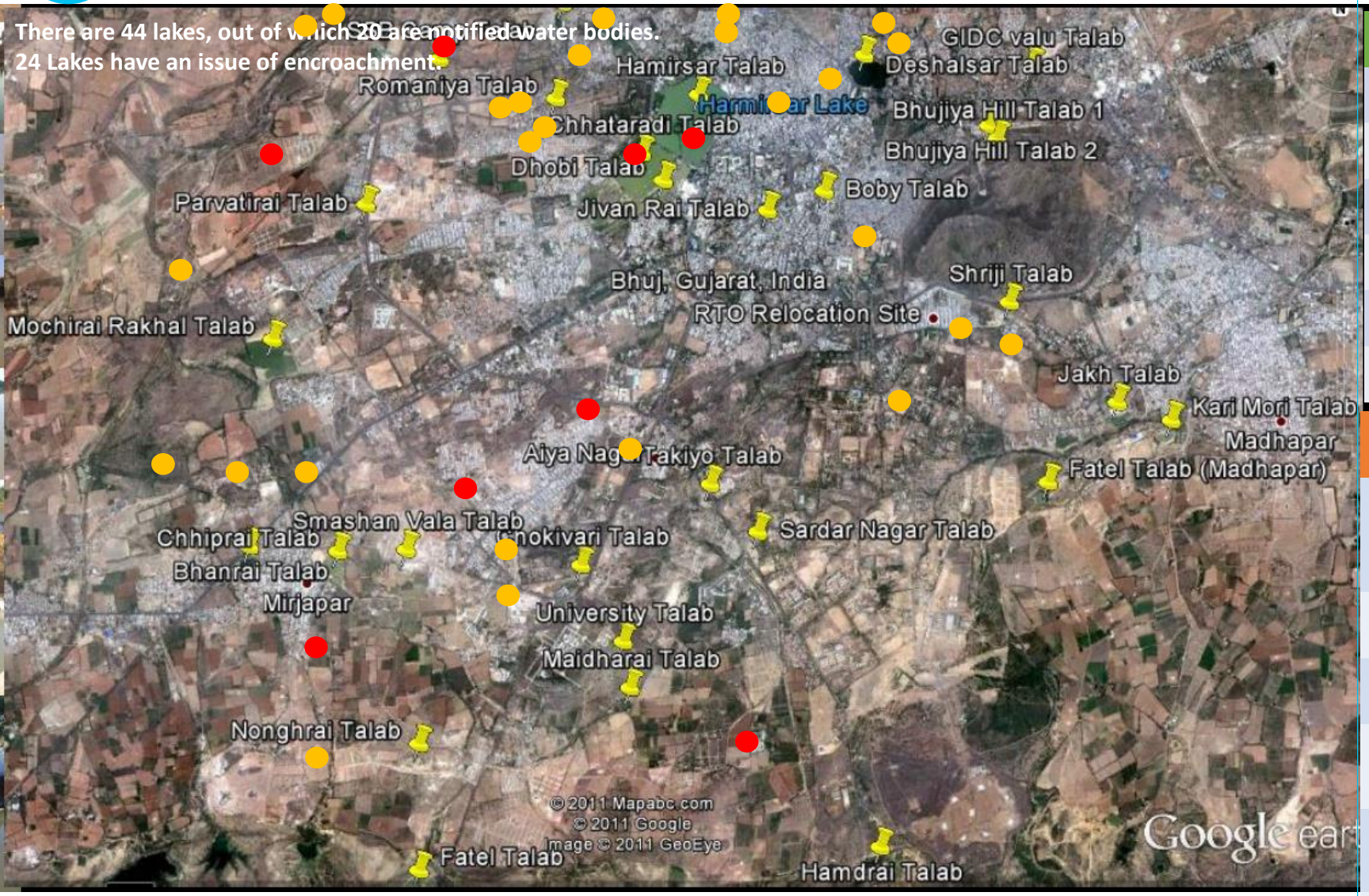
Phase II (2018-19)
Total Cost – 170 Lakhs

Phase III (2019-20)
Total Cost – 173 Lakhs

- Existing Storm Water – 1 km
- Proposed Storm Water, AMRUT – 8.28 km
- Proposed Storm water – 1.7 km
- Proposed Rain Garden – 10 km
- Camber Improvement – 0.6 km
- Infiltration Trenches – 16 km

Lakes- Introduction

Lake and Flood Control



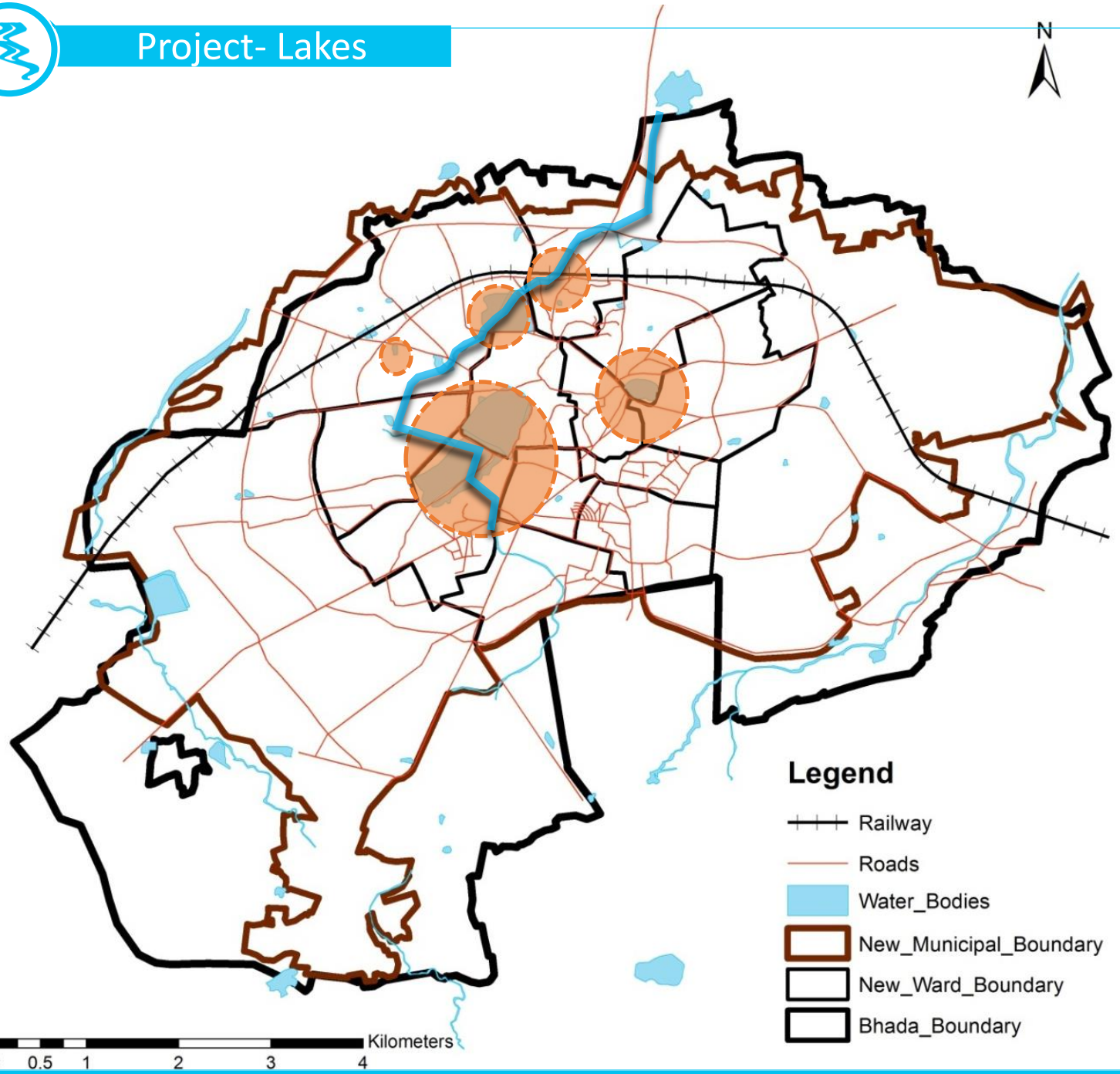
LOCATION OF THE LAKES	NUMBER
In the boundary of Bhuj city	30
In Haripur Village	4
In Mirzapur	3
In the boundary of BSF	2
In Madhapar	4
TOTAL	43

CONDITION OF THE LAKES	NUMBER
Existing and visible lakes in "good condition"	29
Silted lakes	13
Disappeared Lakes	6
Polluted	11
Partially encroached lakes	7
Lakes used for drinking and domestic water	6

EXISTING LAKES

DEAD LAKES

Source: Primary Survey , PAS.org , ACT, Bhuj bole che



Lakes for Intervention

- Hamirsar Lake
- Desalsar Lake
- Pragsar Lake
- Dosrai Lake
- Rati Lake

Macro/City level (DCR, Institution, Monitoring, Awareness)

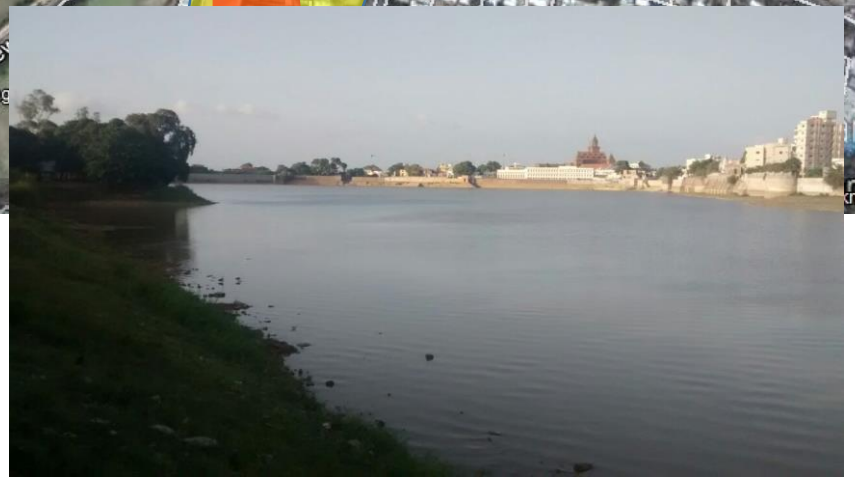
Micro/Area Specific (lake specific Local issues)

Source: Primary Survey

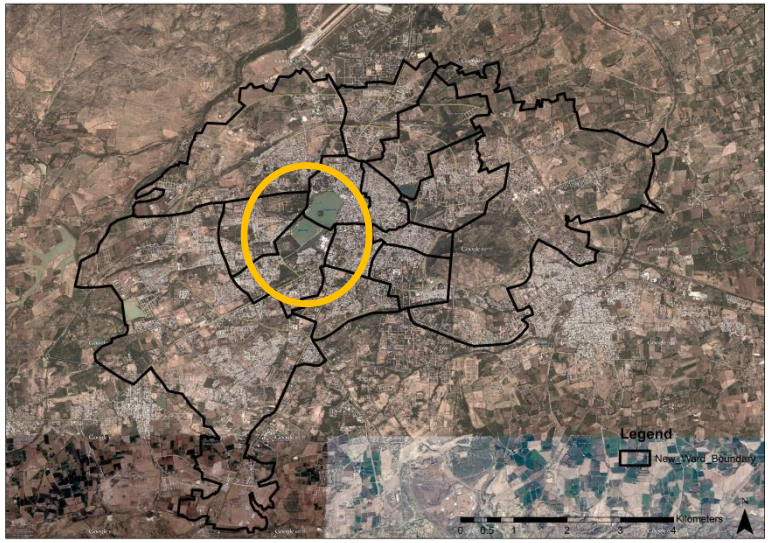
Project- Lakes

	HAMIRSAR	PRAGSAR	RATI TALAV	DESALSAR	DOSRAI
					
Area	491000 sq.m	112500 sq.m	9000 sq.m	65000 sq.m	36000 sq.m
Location	Near Aina Mahal	Shiv Nagar	Ashapura	New station road	Khari Nadi road
Owner	Bhuj Nagar Palika	Bhuj Nagar Palika	Bhuj Nagar Palika	Bhuj Nagar Palika	Bhuj Nagar Palika
Main Issues	*Lack of proper quality of water *lost heritage value *Water Logging/ flooding	*Dead lake *dumping of construction waste out of earthquake damage *flat land.	*Slum Encroachments *Dumping *Open Deification	*Solid Waste Dumping *Grey Water Disposal *Influence of Commercial peripheral Use	*Grey Water Disposal *flooding issue *Encroachment
Use	Historical and Religious Importance also used as recreational place	Dumping Spot	Utilitarian, mostly used by the slum dwellers , recharge structure	Utilitarian, mostly ground of disposal, washing	Utilitarian, mostly used by the slum dwellers , recharge structure

HAMIRSAR LAKE

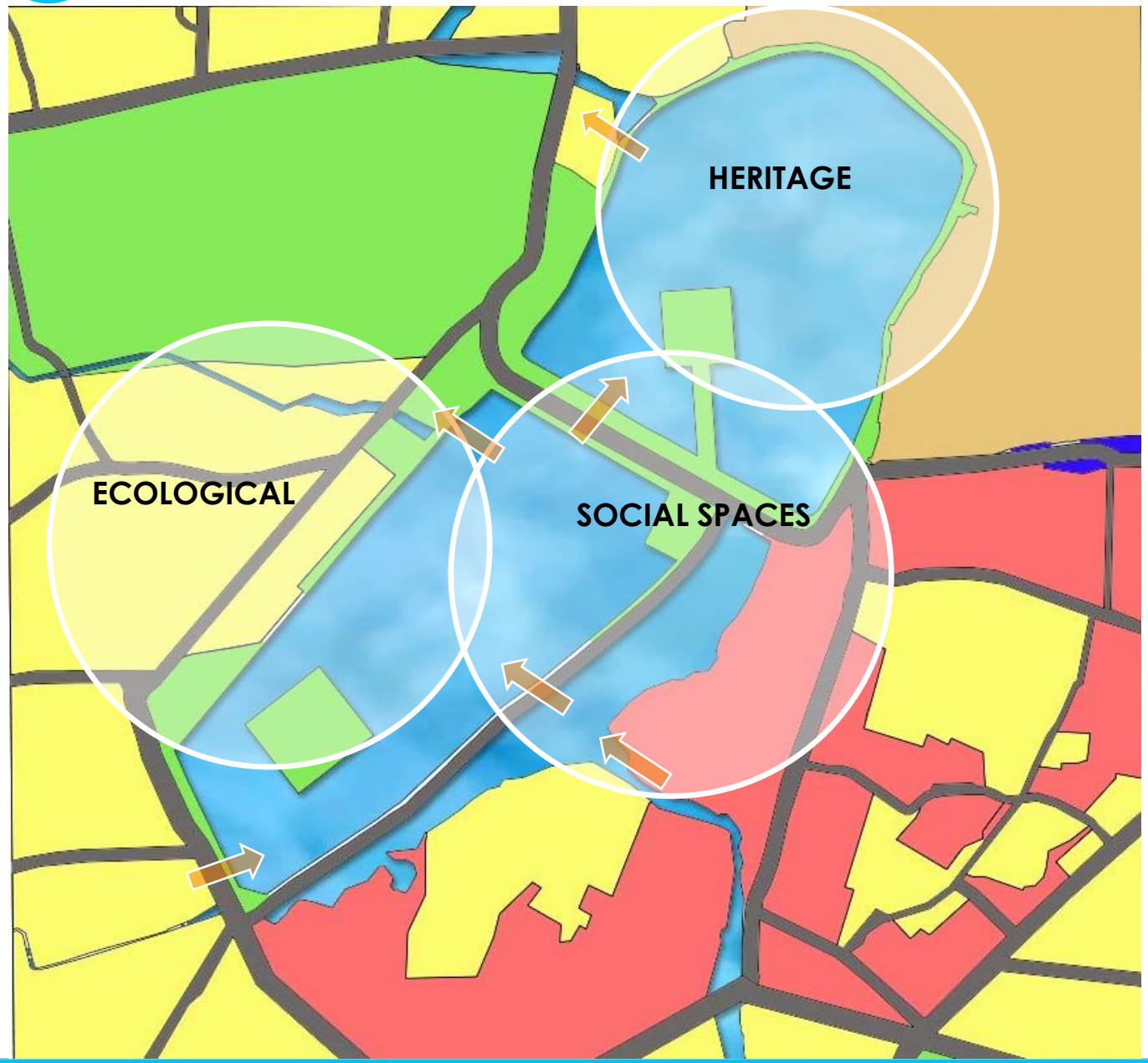


- **SOURCE:** Rainwater
- **LANDUSE :** Surrounded by residential areas and Fort and a bit of commercial presence
- **ACTIVITIES AROUND THE LAKE:** Temporary Vendors , mostly crowded at night
- **ECOSYSTEM:** Lake has rich ecosystem with Flamingo, fishes and turtles
- **PRESENT CONDITION:** Solid waste dumping and open



Source: Primary Survey

HAMIRSAR LAKE



HERITAGE

Integrate and restore the historic places and buildings to offer new avenues.

SOCIAL SPACES

Provide upgraded facilities and spaces to attract residents and other people daily lives weave with lakes

ECOLOGICAL

Providing natural ambience around the lake with rich ecology through integrated green spaces.

Source: Primary Survey, DP 2025

HAMIRSAR LAKE

CULTURAL AND HERITAGE LINKS

This would include Improvement of lake edge conditions, pedestrian connections,

ADJOINING GHATS

Restoring the links and providing the vistas along the ghats of Hamirsar to give people a cultural platform to interact and address and making it active.
This would include Pedestrian and steps Pathways and seatings for bird watching.

HAMIRSAR LAKE

ORGANISED LAKE FRONT

This would include Improvement of lake edge conditions, pedestrian connections, toilets, food outlets (organized vendors) and other public amenities.

Cleaning and de-silting of lakes and channels(inlet-outlet)

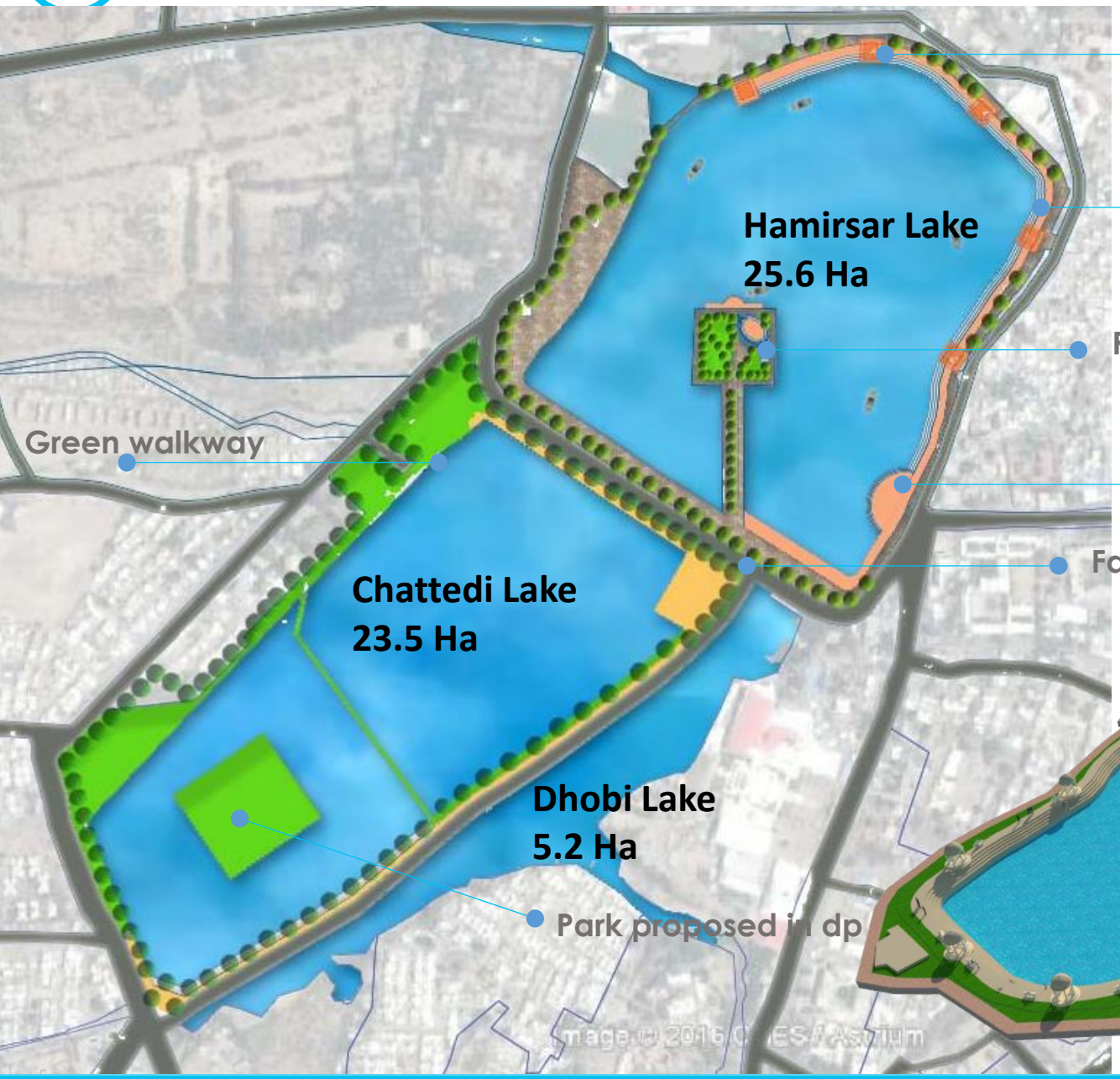
HAMIRSAR LAKE

LANDSCAPE AND VEGETATION (Green Circuit and Walkway through the parks)

Incorporating green spaces along the lakefront including green walkways and shaded pathways.

Forming a recreational system

HAMIRSAR LAKE



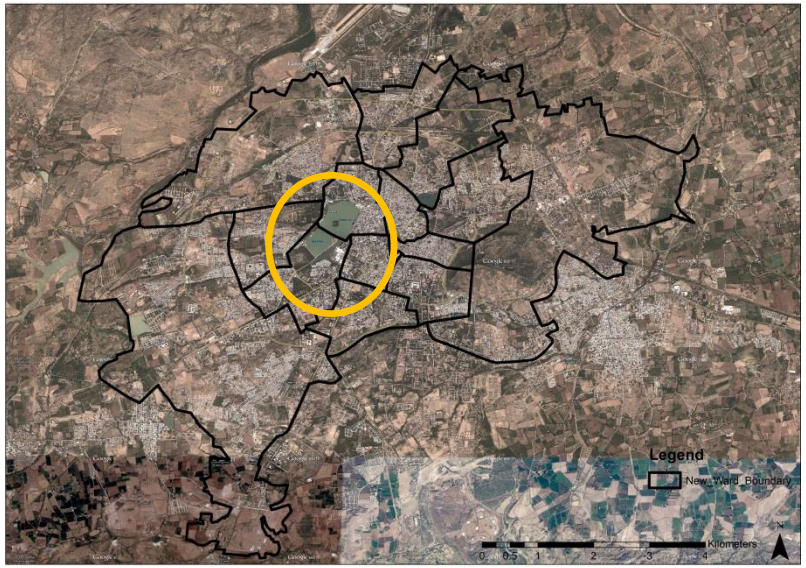
Ghats and step seating's

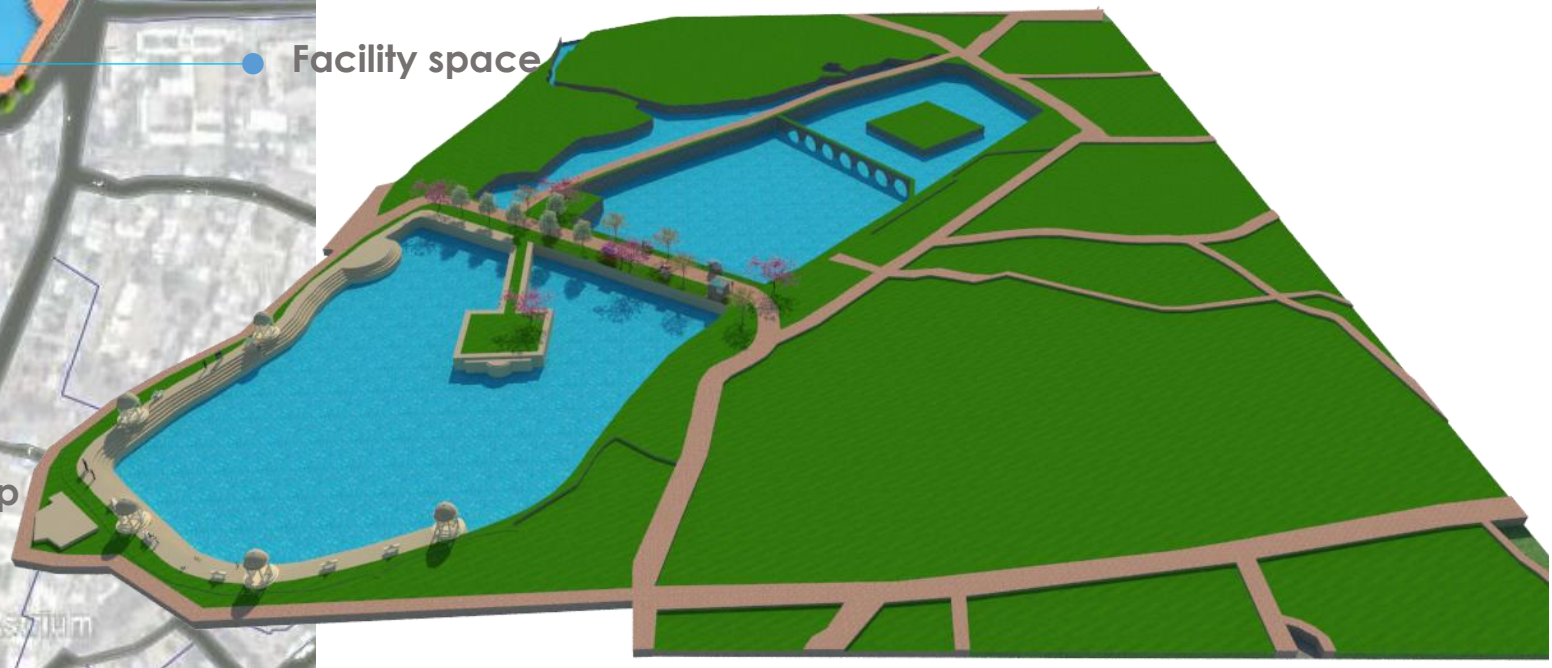
Chattri

Rajendraprasad bagh

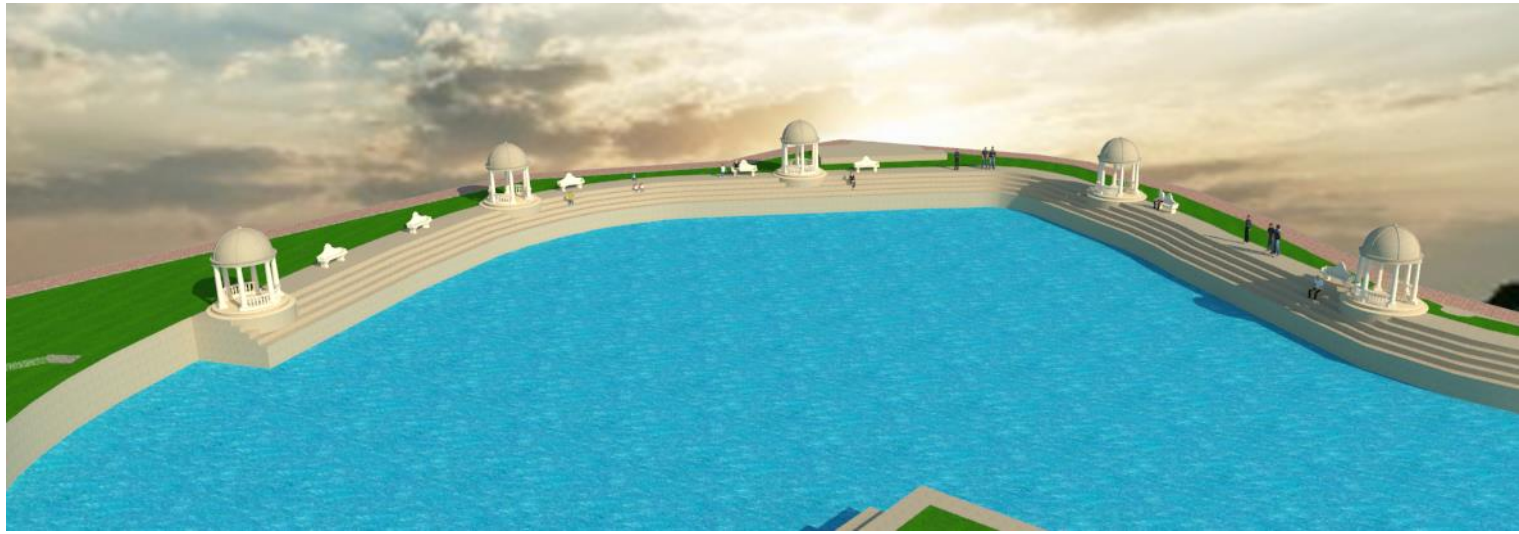
Vendor space

Facility space

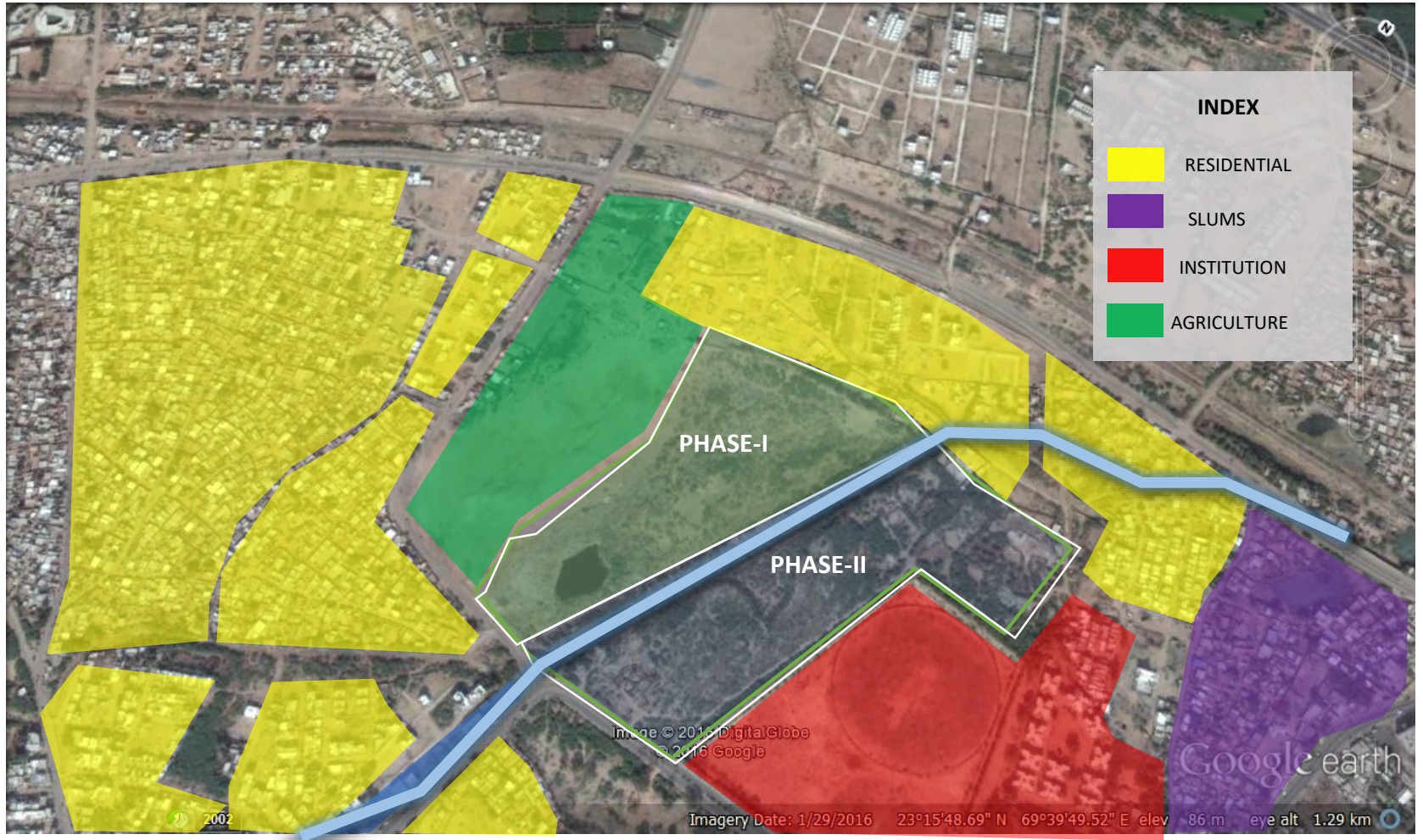




HAMIRSAR LAKE



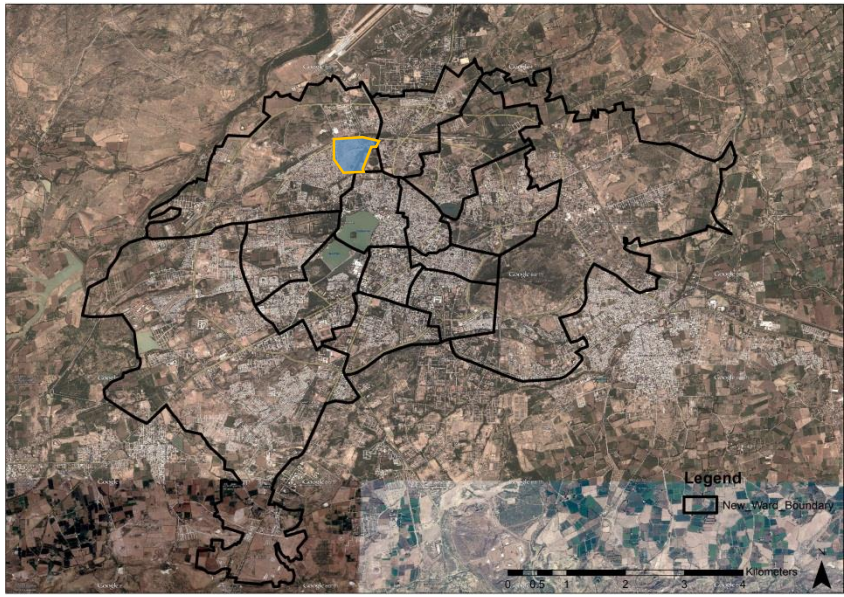
PRAGSAR LAKE



WHY PRAGSAR?

Dead lake and catchment due to dumping of construction waste out of earthquake damage and converted to flat land.

Plots have been assigned now. During monsoon the whole area gets water logged



Area of Pragsar= 54 Ha

PHASE-I
Area=65000 sqm
Volume= 325000 cu.m.

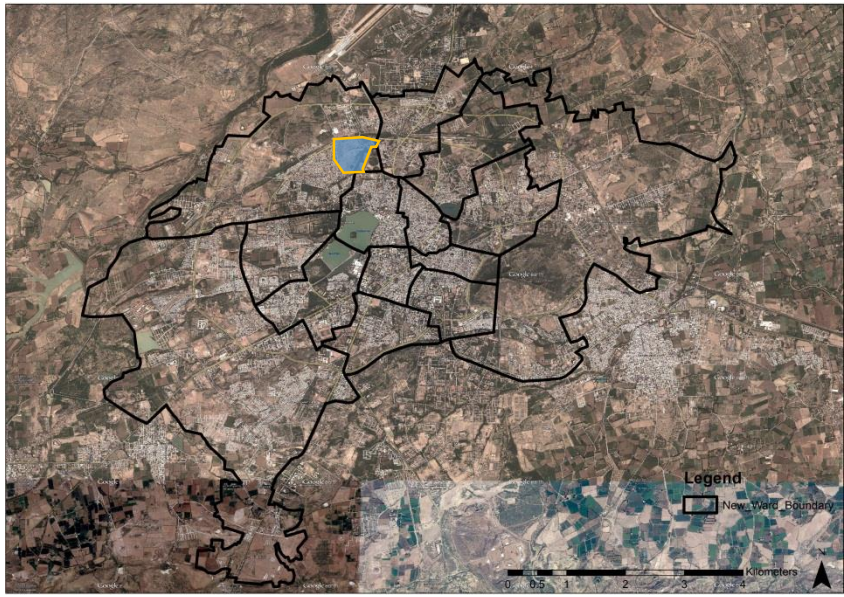
PHASE-II
Area=47500 sqm
Volume= 237500 cu.m.

Source: Primary Survey

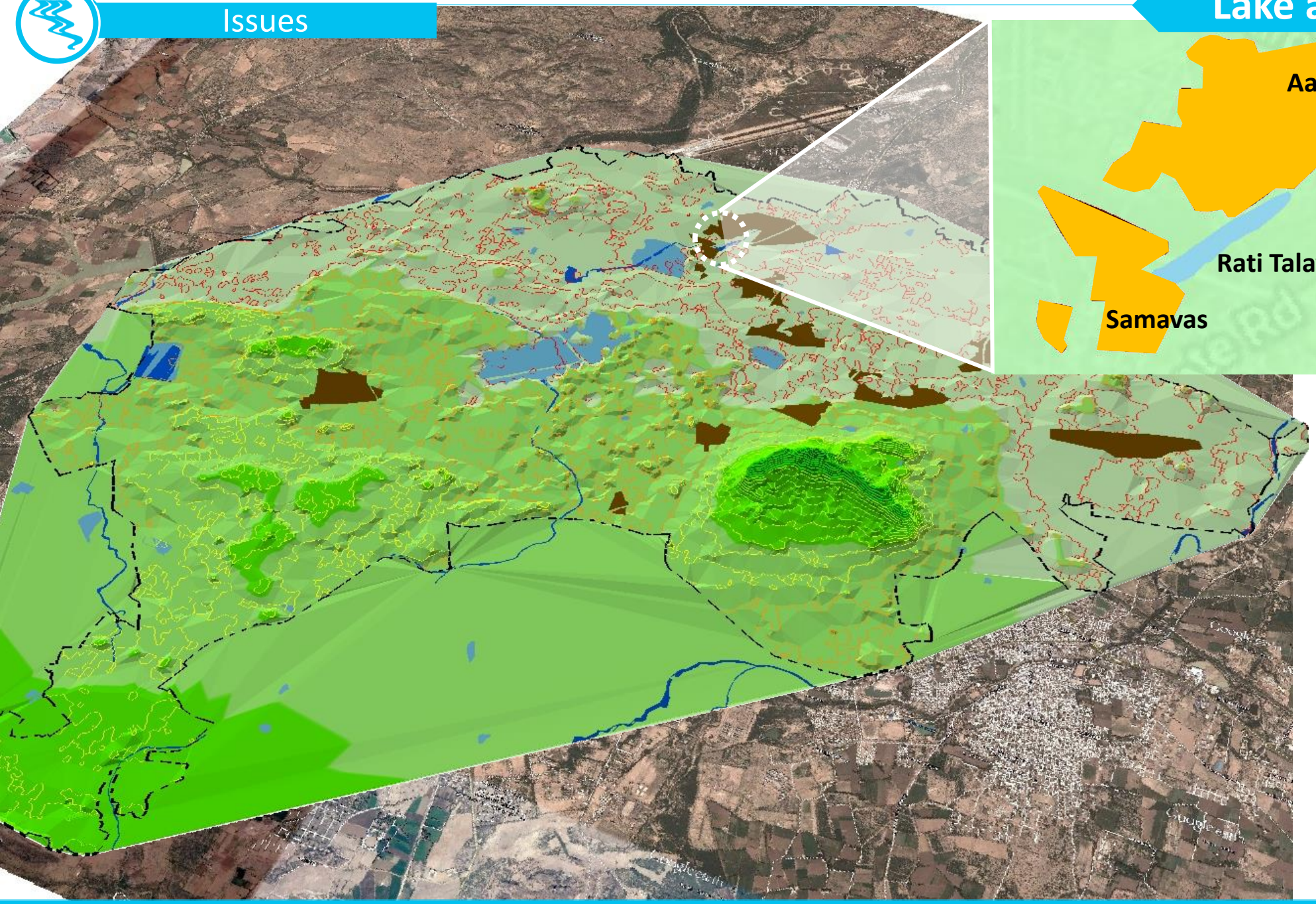
PRAGSAR LAKE

Interventions

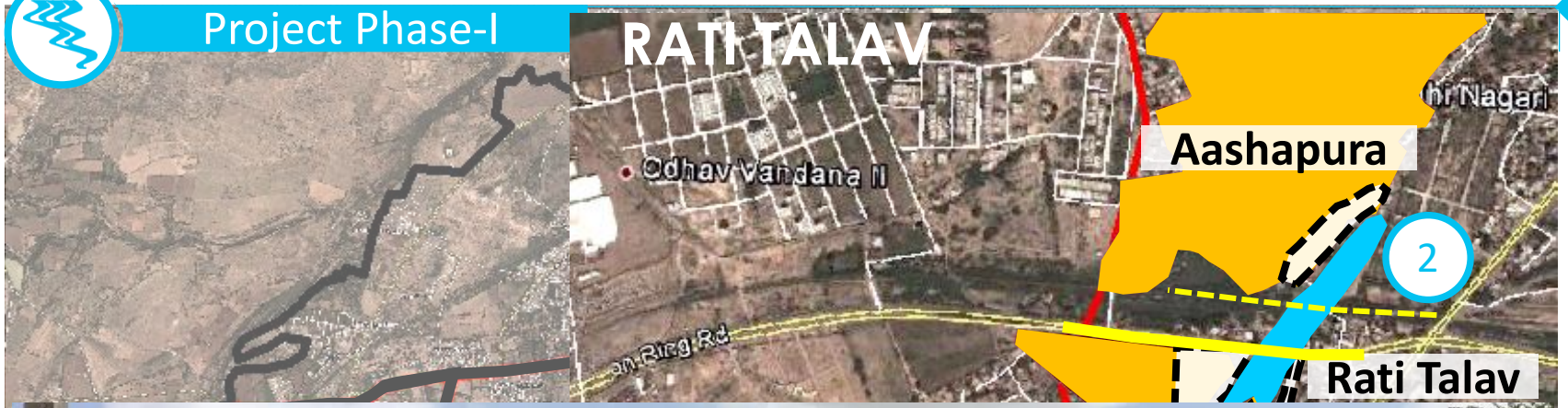
- Cleaning of inlet channels
- Digging of lake
- Clearing of encroachment from lake front
- Providing green buffer along lake side
- Lake front development
- Cleaning of dump spots in near lakes
- DCR Intervention
- Awareness programs.



Lake and Flood Control



Project Phase-I



Lake and Flood Control

WATER

Individual BNP Connection
Frequency Of Water Supply: Alternative Day/ 1.5 Hrs
Water Pressure: Satisfactory
Water Quality: Colour, Bad Taste, Poor quality
Purification: Usage of Alum

SANITATION

Open Defecation near the Rati *Talav*
Septic Tank usage is predominant
Septic Tank cleaned in every 10 years

SOLID WASTE MANAGEMENT

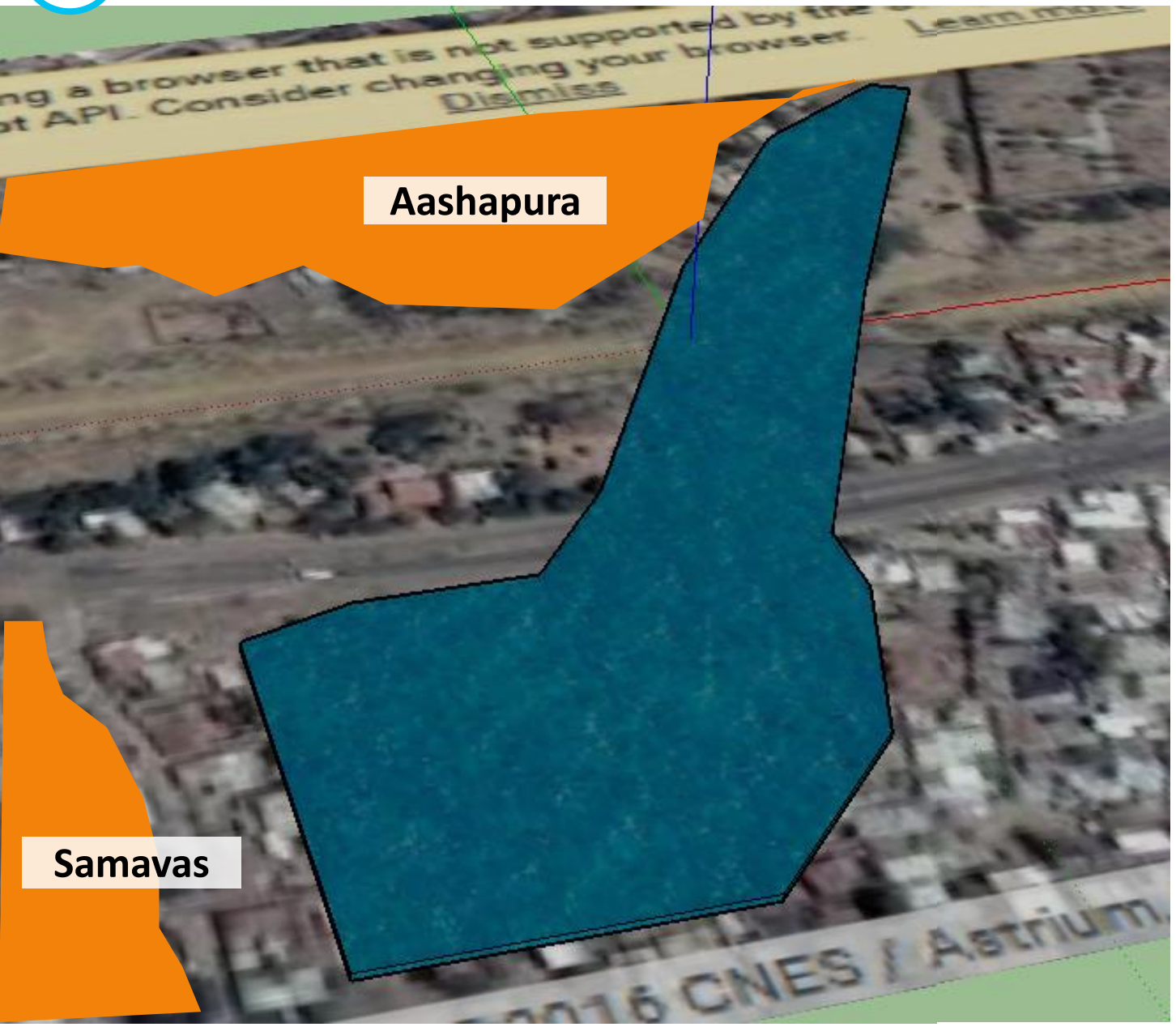
No waste collected
Waste is dumped into Rati *Talav*
Street sweeping is done along the main road

WATERLOGGING

Depth of water 2-3 Mts
Migration of the people for 2-3 Months during Waterlogging

Plot area: 1,000 Sqm **Cost:** Rs. 225 lakhs

Lake and Flood Control



Existing Depth is 1m

Proposal:

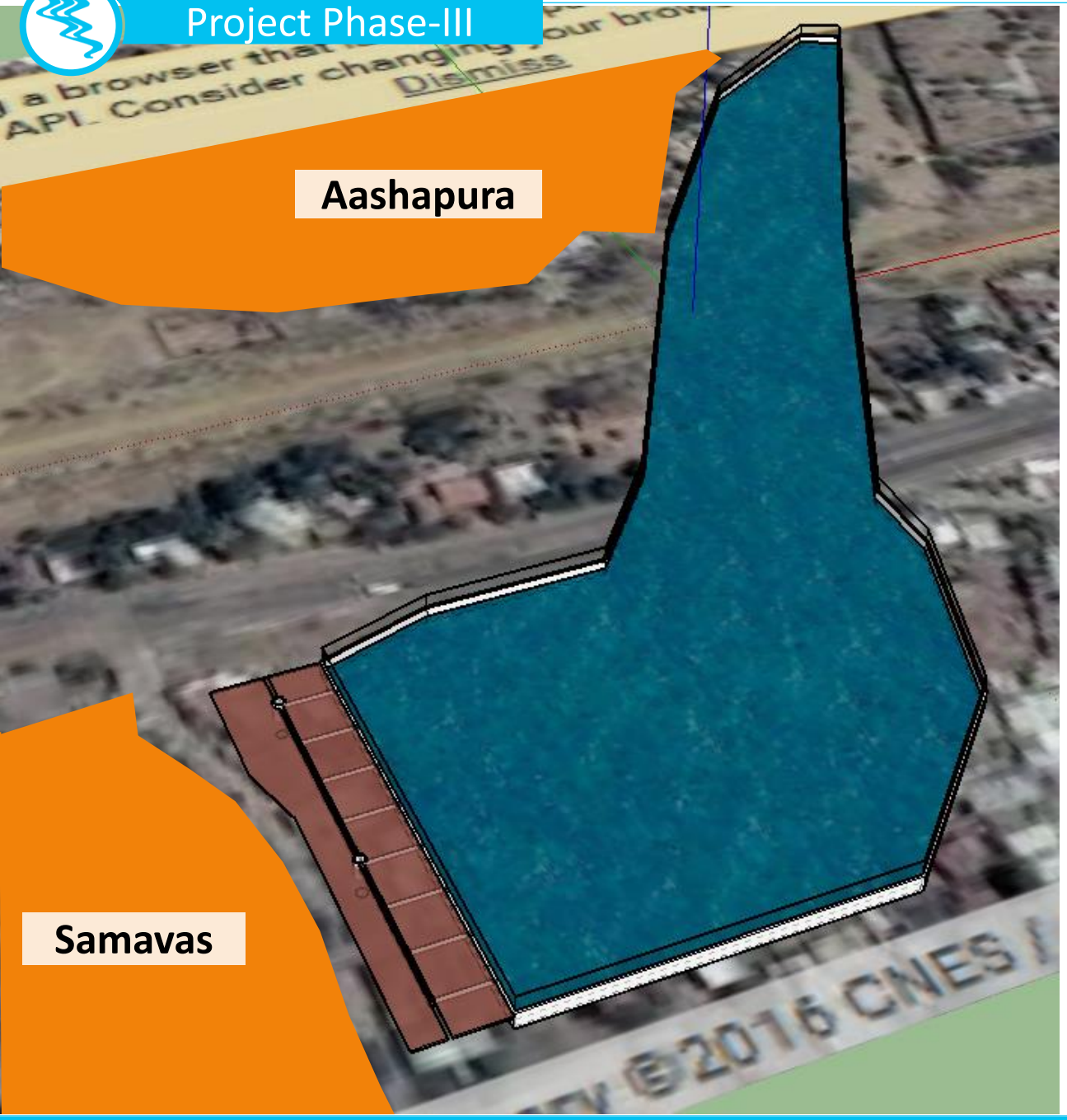
- ❖ Additional depth of 1m
- ❖ And Cleaning of catchment

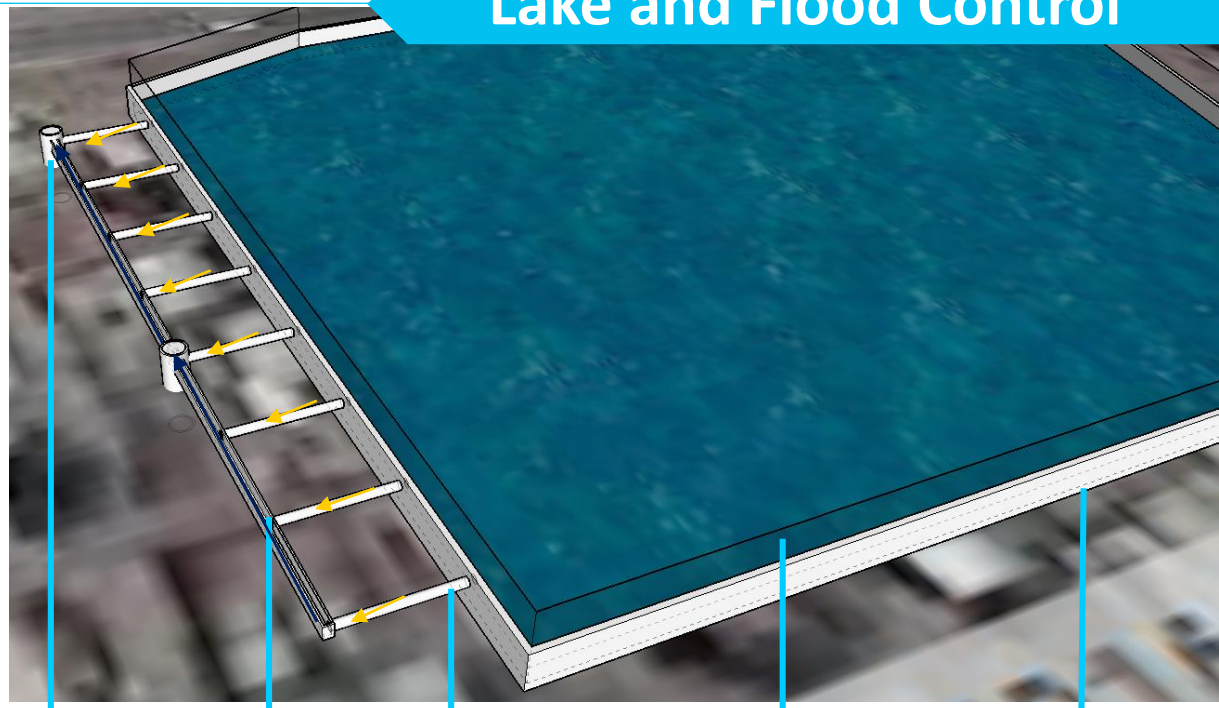
Cost: 36.34 Lakh

Lake and Flood Control

Aashapura

Samavas





Dug well

Water collector Pipe

Overflow Pipe

Wired mesh wall (Compound wall)

Retention Wall

Available Water-	**Max. Rainfall-**	**Additional Water-**
169 Lakhs L	456.77mm	77 Lakhs L

Cost: 24.83 Lakh

(Excluding cost of step 1 & 2)

PHASE-I

Rehabilitation (*residing slum in catchment area)*

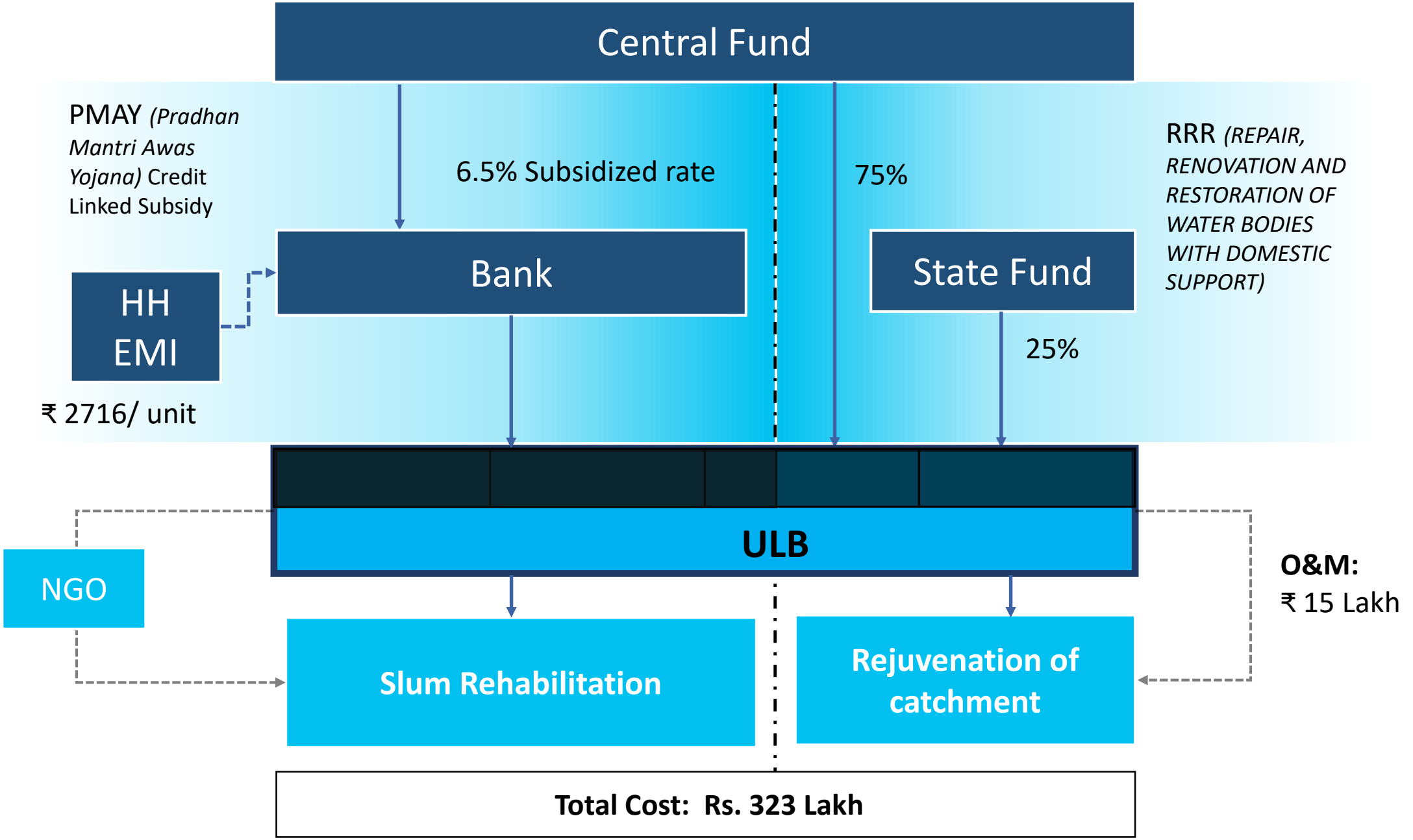
PHASE- II

Clearing the catchment

PHASE- III

Providing retention wall around the waterbody and introducing ground water recharge well *(with or without water storage for drinking)*

Lake and Flood Control



DESALSAR LAKE

PROPOSED DP 2025

Area: 65000 sqm

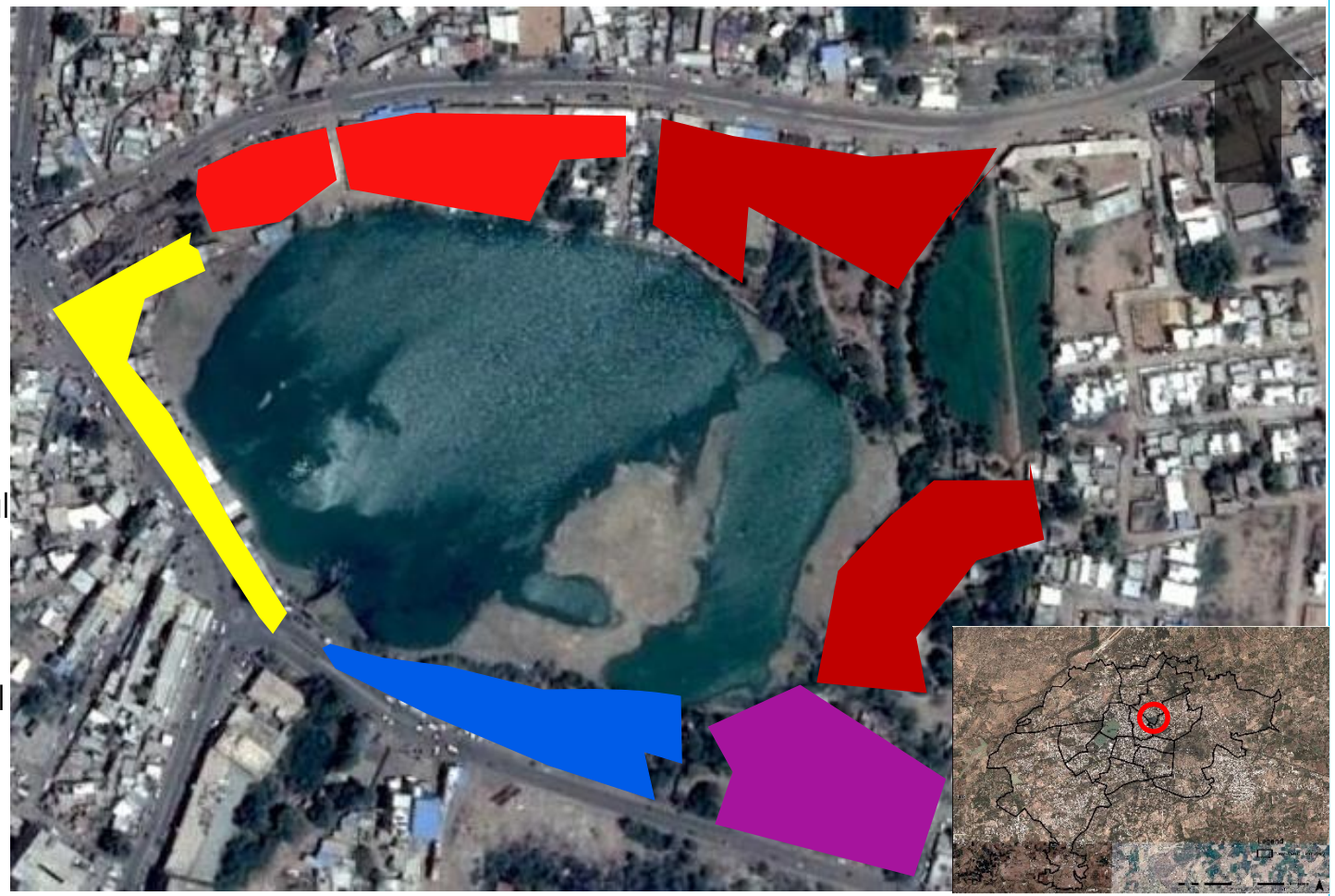
DESALSAR LAKE

EXISTING CONDITION (AS PER SURVEY)

Area: 65000 sqm

Legends:

- Institutional
- Residential
- Slum
- Commercial Area + Slum
- Commercial



WHY DESALSAR?

- Scale of lake
- deteriorating condition
- Commercial value
- Causes logging
- Rich ecological value
- SOURCE: Rain water, Grey Water and to some extentsewage water.
- LANDUSE : Surrounded by Commercial area, slums and G+3 buildings
- ACTIVITIES AROUND THE LAKE: Commercial, washing of clothes, fishing
- ECOSYSTEM: Lake has fishes, swans
- PRESENT CONDITION: The condition of the lake is highly deteriorating due to sewers, solid waste dumping and encroachment.

Source: **Primary Survey, Hunarshala & BHADA DP 2025**

DESALSAR LAKE

EXISTING CONDITION (AS PER SURVEY)

Area: 65000 sqm

Legends:

- Institutional
- Residential
- Slum
- Commercial Area + Slum
- Commercial

- Private Ownership
- Government Ownership

WHY DESALSAR?

- Scale of lake
- deteriorating condition
- Commercial value
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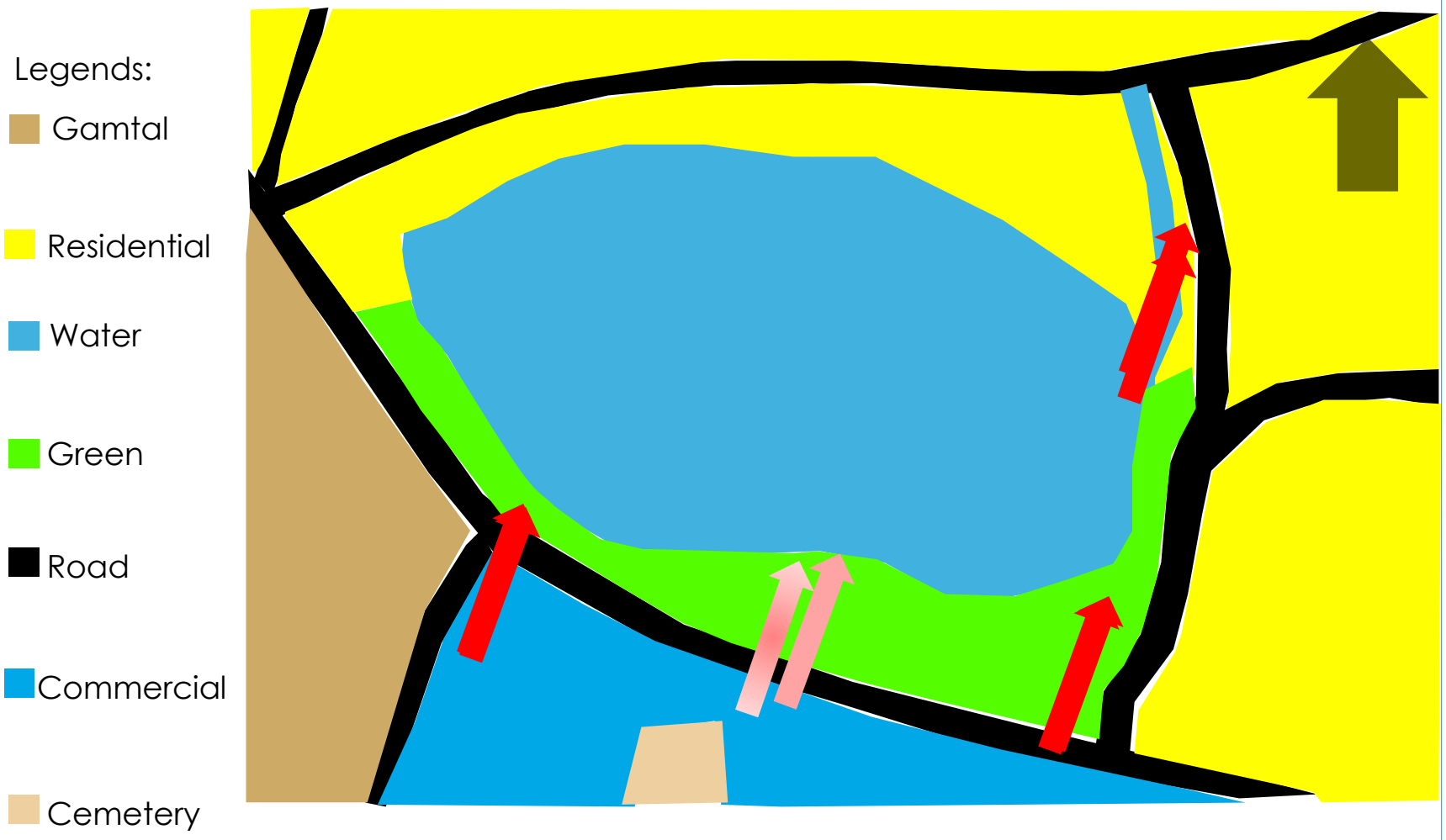
DESALSAR LAKE

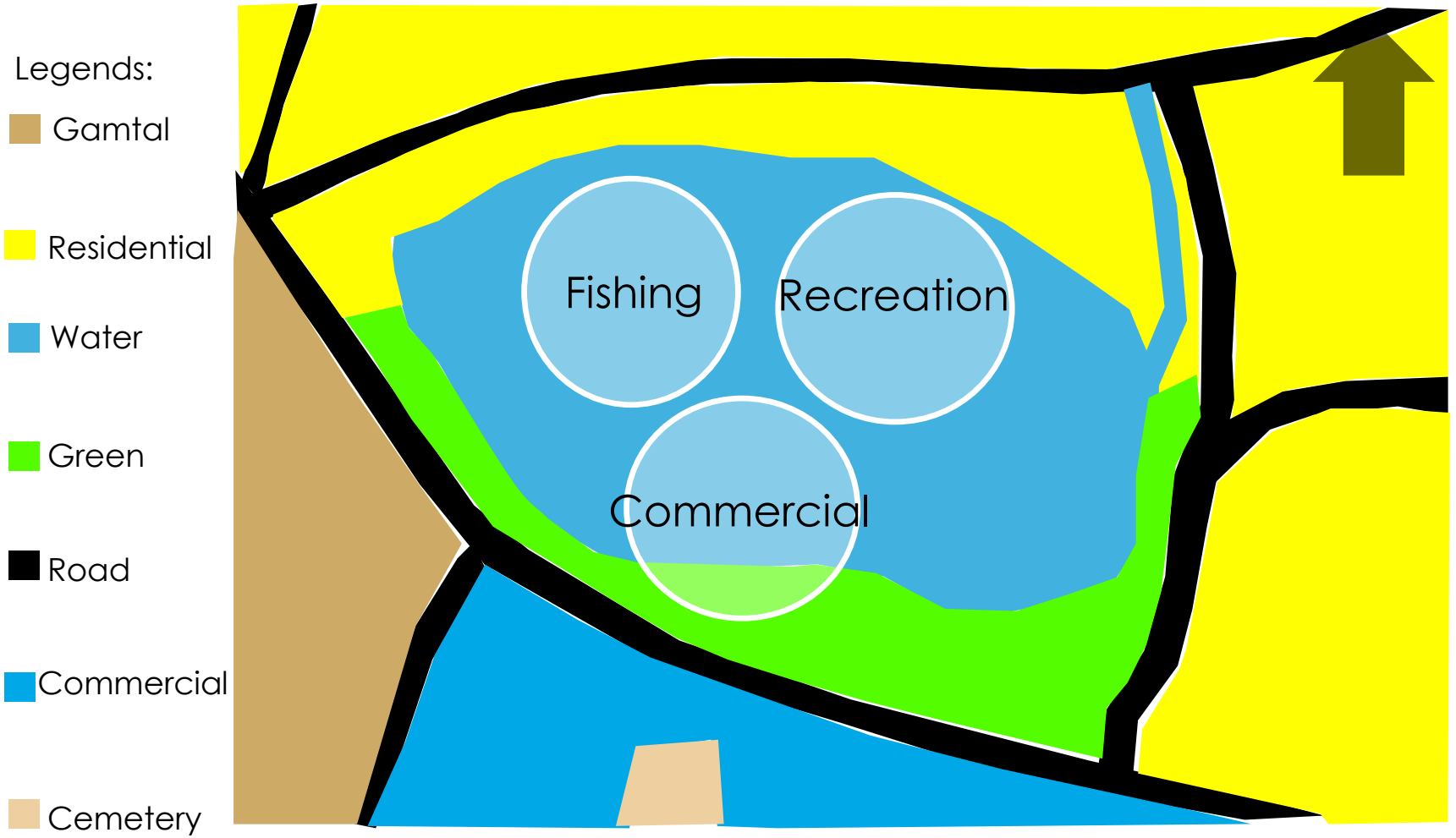


Existing Condition of Natural drains:

- 3 inlet drains (1 disappear and none marked in DP)
- 1 outlet drains (marked in DP)

Source: : Primary Survey, Hunarshala & BHADA DP 2025

DESALSAR LAKE



RECREATION

Providing natural ambience around the lake with rich ecology through integrated green spaces.

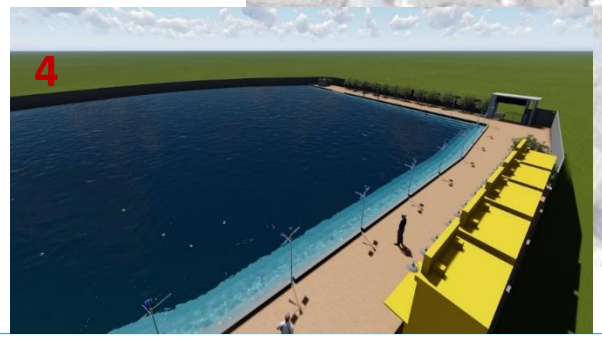
FISHING

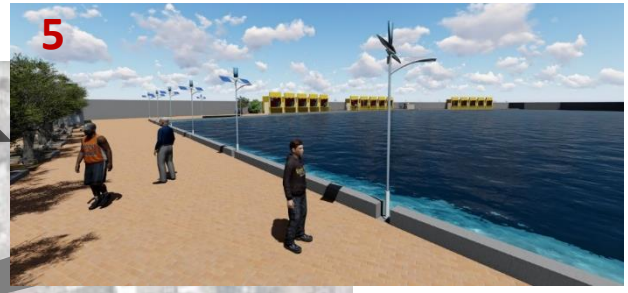
Promotion of better fishing activities and issue of license

COMMERCIAL

Renovation of existing shops under Pt. Deendayal Upadhay National Urban Livelihood Mission and to promote commercial activities

DESALSAR LAKE





DESALSAR LAKE

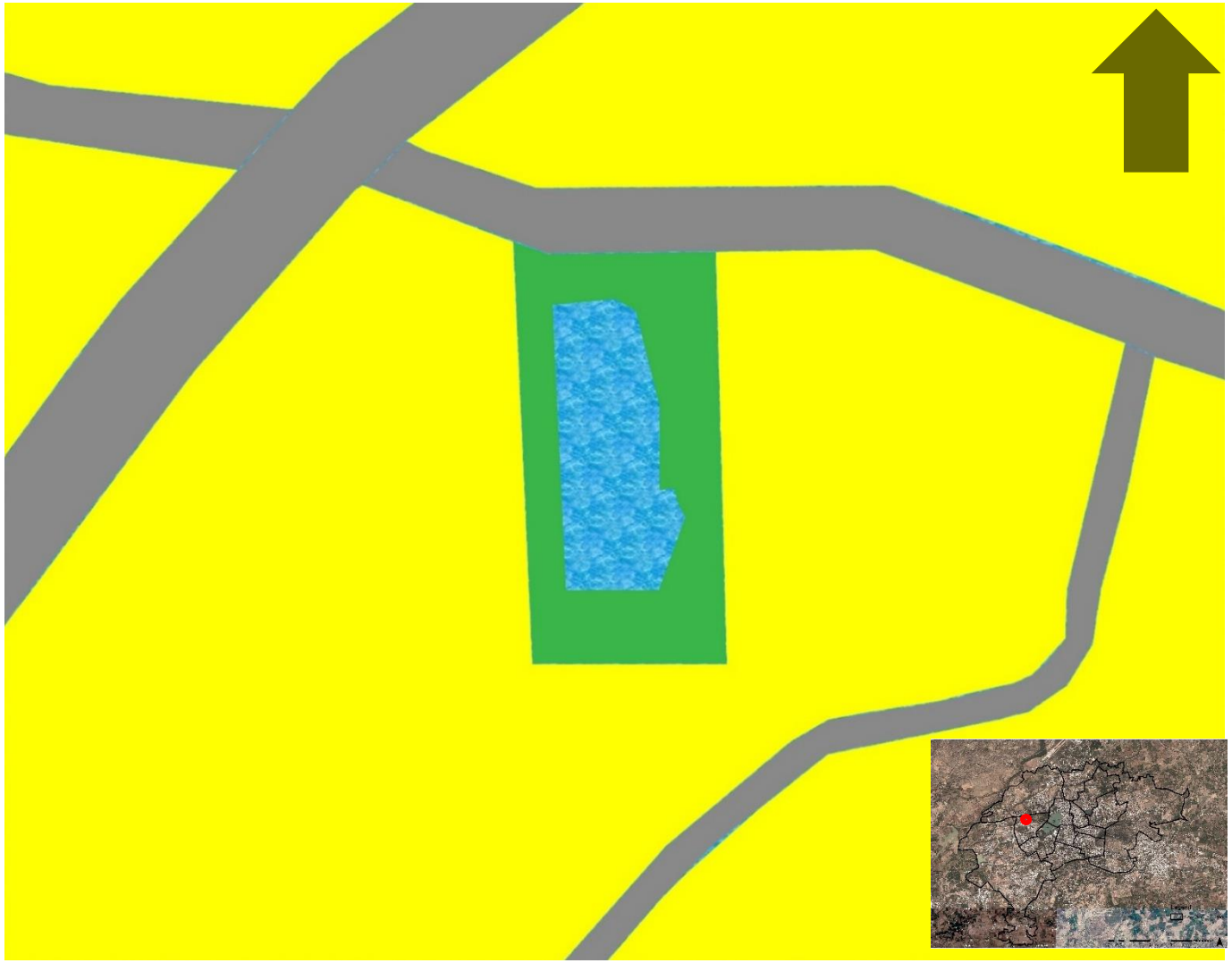
DOSRAI LAKE

Area 12500sqm

Proposed DP 2025

Legends:

- Residential
- Water
- Green
- Road



Source:: **Primary Survey & BHADA DP 2025**

DOSRAI LAKE

Existing Condition as per Survey

Area 12500sqm

Legends:

- Residential
- Water
- Institutional

DOSRAI LAKE

Area 12500sqm

Existing Condition as per Survey

WHY DOSRAI?

- Existing ecosystem and recharge structure in it
- Deteriorating condition of water
- Evergreen source of water
- Rich ecological value

- SOURCE: Sewerage
- LANDUSE : Surrounded by Residential G+2 Building
- ACTIVITIES AROUND THE LAKE: Shops, People washing clothes, littering
- ECOSYSTEM: Ground water recharge
- PRESENT CONDITION: The condition of the lake is highly deteriorating with high value of TDS & Solid waste dumping

Source:: **Primary Survey & BHADA DP 2025**

DOSRAI LAKE

Condition of Existing:

No formal inlet Channel

- 1 visible Out Channel (Primary Survey)
- None of In-let/Out-Let Channel is marked in DP

Source: **Primary Survey & BHADA DP 2025**

DOSRAI LAKE


1
DOSRAI LAKE


2


3


4


Road to Khari Nadi
8
4
3
1
2
6
5

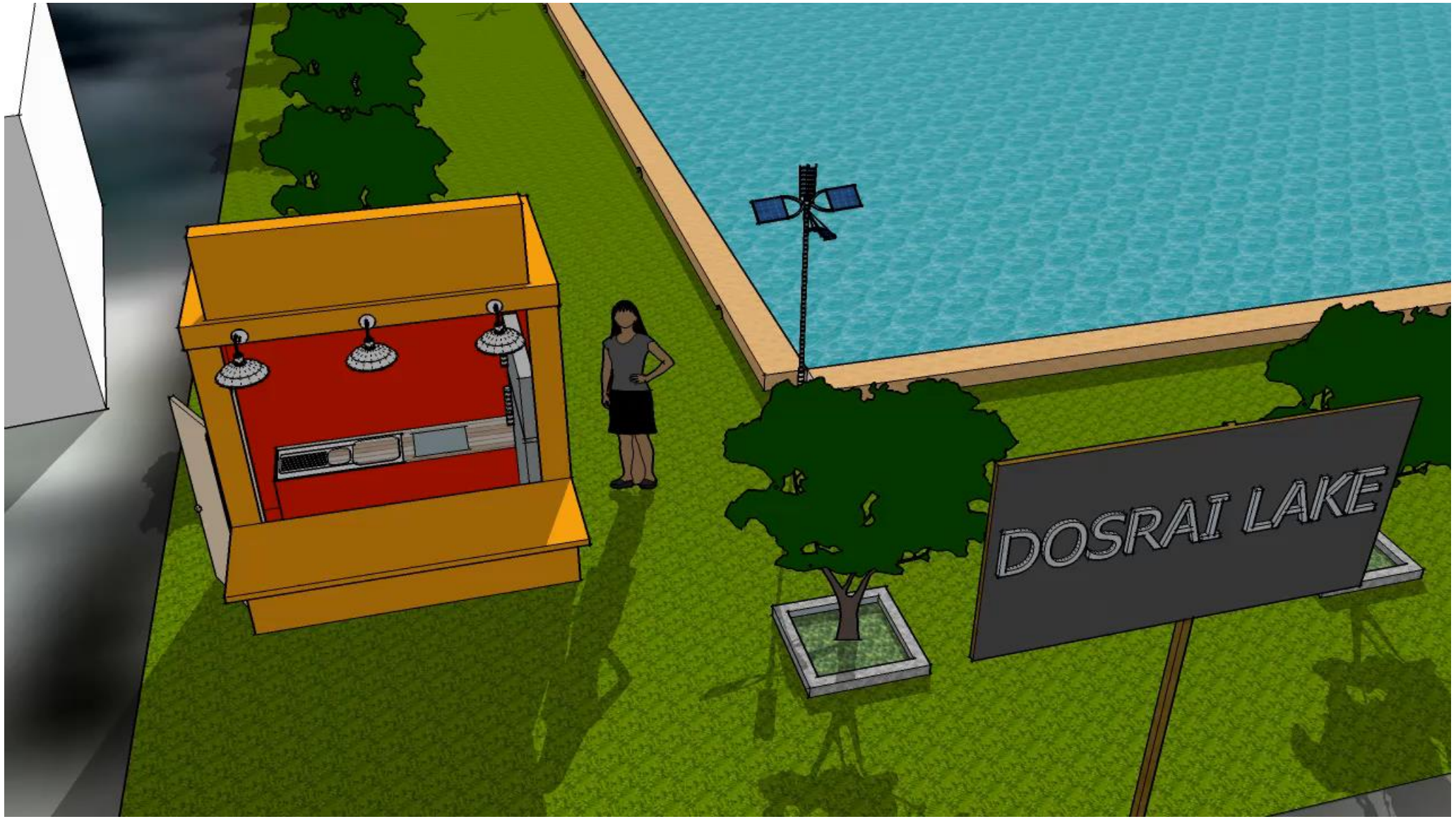

5
DOSRAI LAKE


6


7


8

DOSRAI LAKE



Lakes and Flood Control

Waste controls

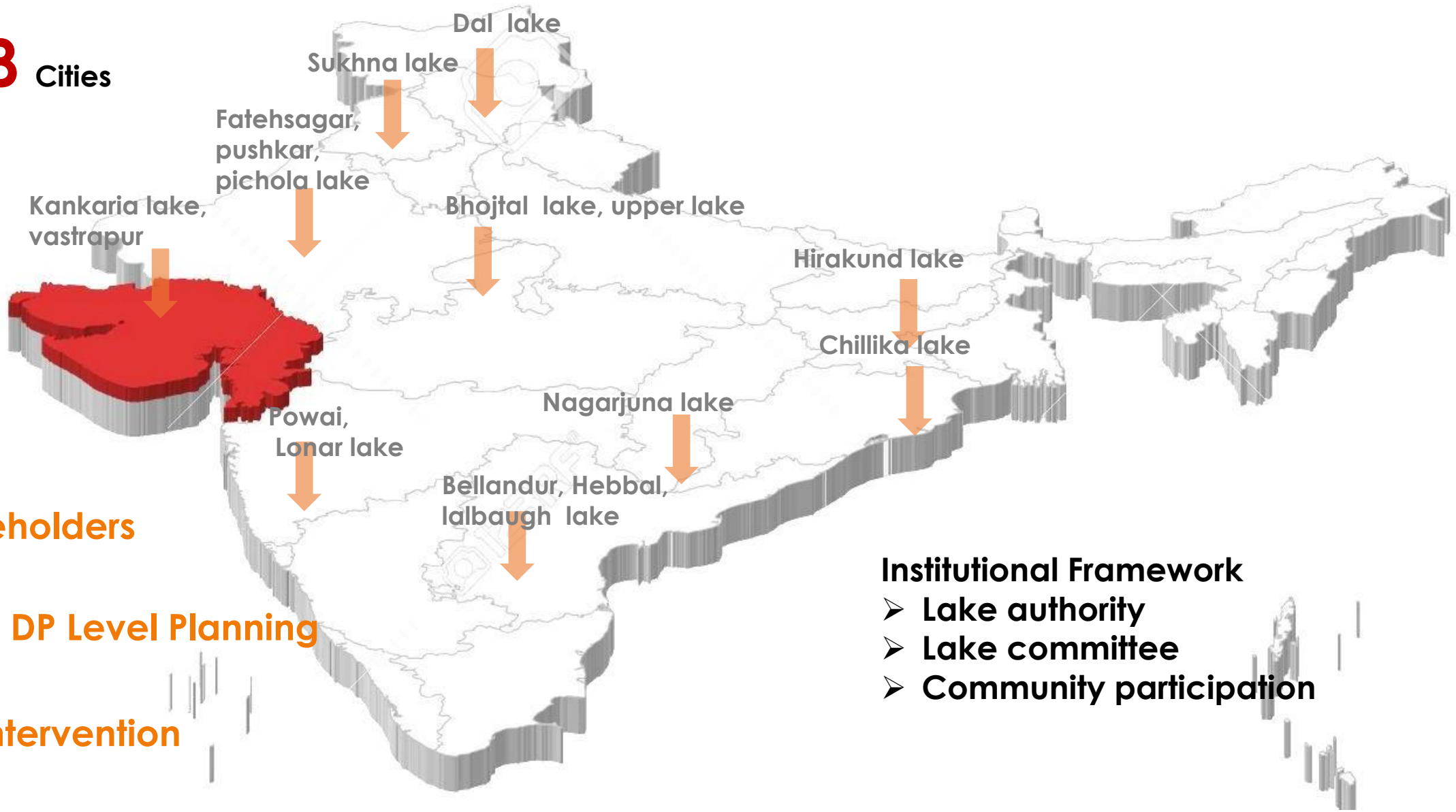
	Hamirsar	Pragsar	Rathi Talavadi	Desalsar	Dosrai
	Annual Cost				
Capital	610 Lakh (37%)	380 Lakh (23%)	323 Lakh (20%)	311 Lakh (19%)	13 Lacs (1%)
O&M	50 Lakh (39%)	30 lakh (23%)	15.5 lakh (12%)	32 Lakh (25%)	1.4 Lakh (1%)
Total	660 Lakh (38%)	410 Lakh (23%)	338 Lakh (19%)	333 Lakh (19%)	14.4 Lacs (1%)
Revenue	72 Lakh (54%)	22 Lakh (17%)	-	35 Lakh (27%)	2 Lakh (2%)

Name of Activity	Hamirsar	Desalsar	Rathi Talavadi	Dosrai	Pragsar
Area	491000sqm	65000sqm	16945sqm	12500sqm	112500 sqm
Issue	Lost heritage link, unorganised lake front	Inflow of grey water, solid waste and encroachment	solid waste and slum encroachment	Inflow of sewers, solid waste and encroachment	Dead lake became flat land by debris dumping
Proposal	Retrofitting of heritage links, ecological zone, lake front development	Commercial, Ecological Fishing and Recreation	Slum Rehab. and catchment clearing with provision of retention wall	Society level Approach for Recreation, Ecological	De-silting and profile cutting
Expenditure	CAPEX 610 Lakh OPEX 50 Lakh	CAPEX 311 Lakh OPEX 32 Lakh	CAPEX 323 Lakh OPEX 15.25 Lakh	CAPEX 13 Lakh OPEX 1.39 Lakh	CAPEX 380 Lakh OPEX 22 Lakh
Income	72 Lakh	Direct 25 Lakh Indirect 10 Lakh	Direct 25 Lakh (Recovery)	Indirect 1.5 Lakh (Property Tax)	15 Lakh

Lake and Flood Control

Case Study of 8 Cities

Ahmedabad
Bhopal
Bangalore
Chennai
Chandigarh
Guwahati
Hyderabad
Udaipur



Role Of Stakeholders

DP Level Planning

DCR Level Intervention

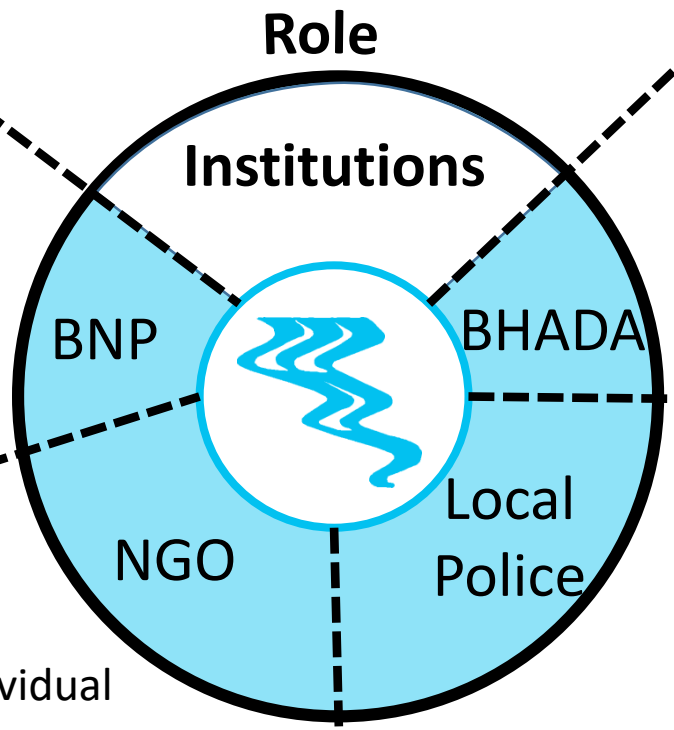
Institutional Framework

- Lake authority
- Lake committee
- Community participation

Source:

Lake and Flood Control

- Clearing encroachments around lakes & natural storm water lines
- Pre & Post cleaning of Drains & De-siltation of lake
- Issuing licenses to shopkeepers
- Active participation of Stakeholders
- Conducting meetings and Circulate MOM
- Evaluation of Authority performance



- Formulation of DCR
- Implementation of DCR
- Strict action against DCR Implementation defaulters

- To ensure no dumping of waste inside or around lakes
- In case any one found doing dumping of waste then strict action should be taken as per law

- Ensuring of every individual Participation
- Sensitization of area towards local people and visitors about lake conservation
- To ensure becomes continues process of lake conservation activity

Source:

AWARENESS AMONG CITIZENS

- To ensure lake conservation activity becomes a never ending process.
- Monthly meeting of ‘Lake Conservation Committee’.
- To ensure every individual Participation in any form like manpower, finance, technical support etc.
- To put hoardings, paintings along the major roads, streets and focus areas to sensitize both local people and visitors about lake conservation.
- To conduct poetry/drawing/essay competition to sensitize people about importance of environment conservation (lake conservation).
- To highlight the importance of history of lakes and importance through heritage walk.
- To initiate festival like ‘Lake Utsav’ or ‘Jal Utsav’ to show the importance of lakes.
- To start regular cleaning of lakes on weekends through ‘NGOs’ to make people aware about lake cleaning.

PROPOSED DCR INTERVENTION

- Separate water Tank for rain water harvesting (RWH).
- Provision of additional FSI for those who provides provision RWH.

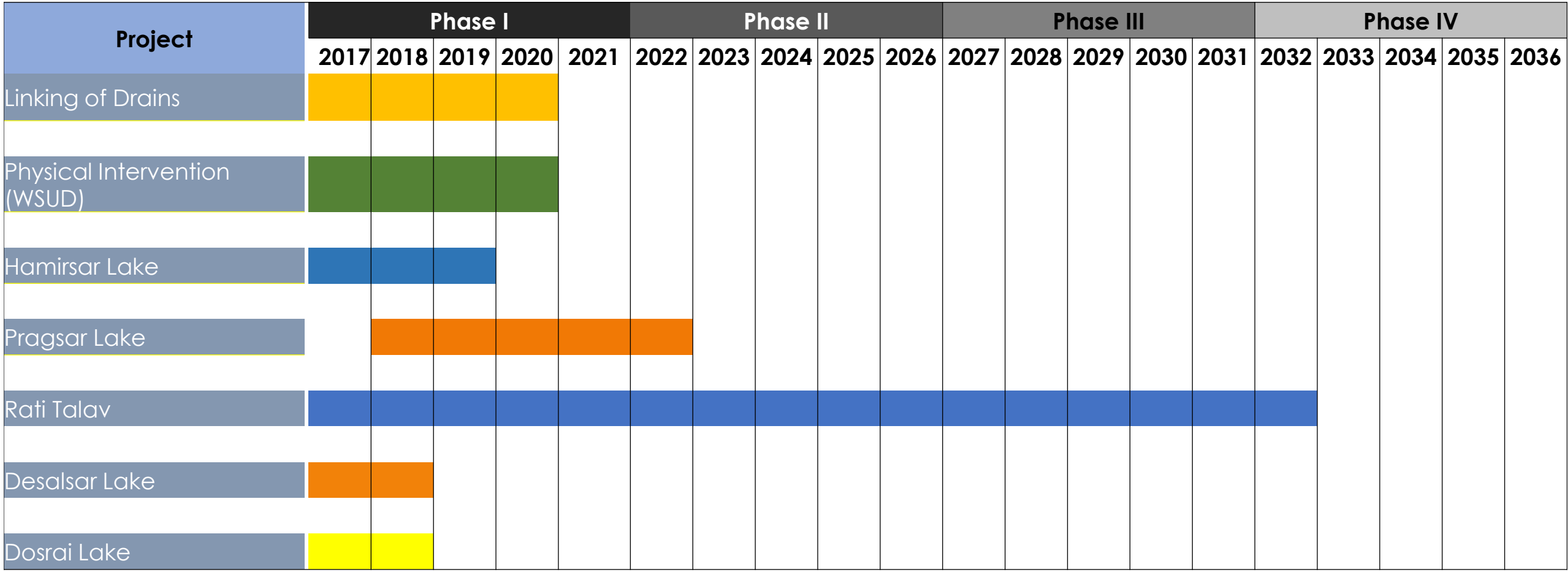
OR

- Compulsory provision of Rain water harvesting irrespective of area with strict legal backup.
- Minimum width of storm water drain should be 3m.
- Minimum 3m vertical level clearance from natural and storm water drains from mean level of drain/lake to floor level
- Apart from 9m horizontal clearance from demarcated storm water channel to property line (building end) based on water level of past 10 years.
- There should be minimum plinth level of 450mm.
- No construction zone in immediate vicinity of lakes.
- Provision of Strict action against individual person/people/ authority who violates the quality of lake and storm water drains.
- Provision of NOC should be made compulsory (from Sewage department, water department, lake authority, road department and electricity department, letter of land ownership from revenue department along with construction application during building plan approval from BHADA.

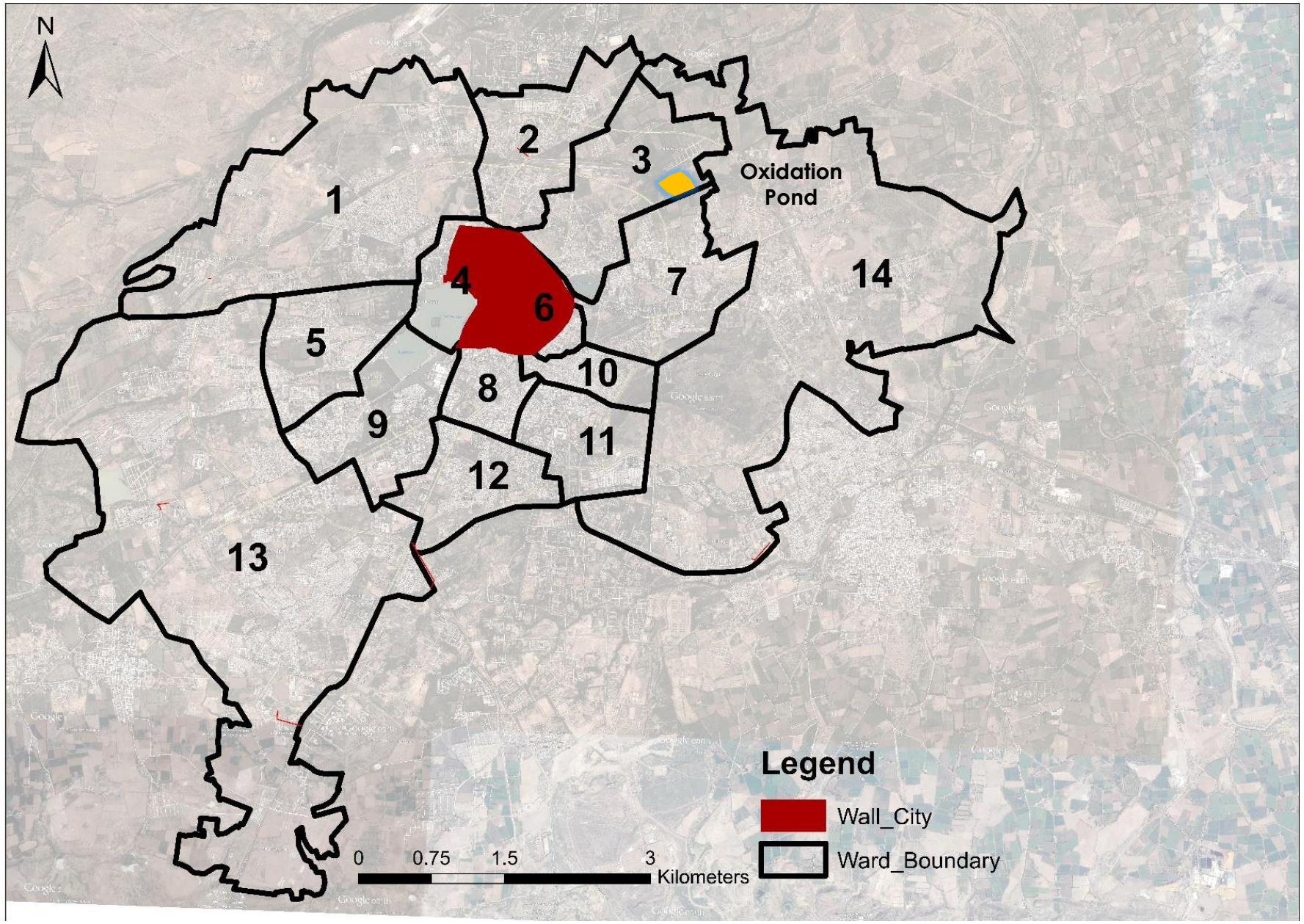
PROJECTS	IMPLEMENTING AGENCIES	CAPEX (in lakhs) PUBLIC	CAPEX (in lakhs) PRIVATE	OPEX (in lakhs) PUBLIC	OPEX (in lakhs) PRIVATE	REVENUE (in lakhs) PUBLIC	REVENUE (in lakhs) PRIVATE	ULB SHARE (Capex)
Linking natural drains and storm water drains	BNP Pvt. Contractor	790 (100%)	-	-	-	-	-	79 (10%)
Rain Gardens, In-filteration trenches, Camber improvement, Storm water line	BNP	518 (100%)	-	14.4 (37.5)	20 (62.5)	200 (100%)	-	51.8 (10%)
Hamirsar Lake	Lake Committee	415 (68%)	195 (32%)	50 (50%)	-	72 (88%)	-	-
Pragsar Lake	Lake Committee	380 (100%)	-	38 (100%)	-	22 (65%)	-	-
Rati Talav	Lake Committee	323 (100%)	-	15 (100%)	-	336 (Recovery)	-	-
Desalsar Lake	Lake Committee	311 (97%)	10 (3%)	32 (100%)	-	35 100%	-	73 (22%)
Dosrai Lake	Lake Committee	12 (96%)	0.6 (4%)	1.4 (100%)	-	1.5 (100%)	-	1.7 (12%)

Total Project Cost 2955 Lakh

Phasing

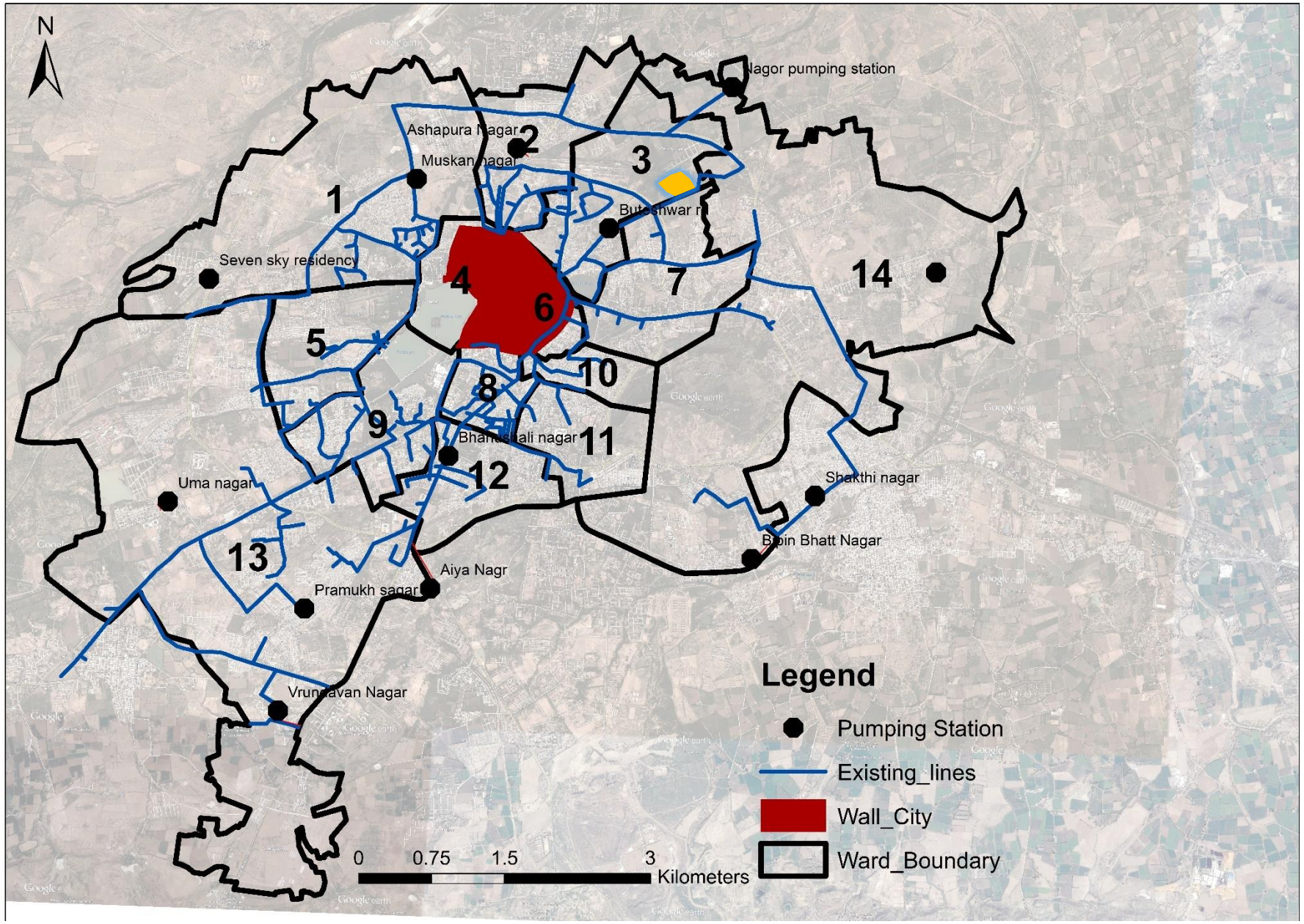

Project
Phase I
Phase II
Phase III
Phase IV
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
Linking of Drains
Physical Intervention (WSUD)
Hamirsar Lake
Pragsar Lake
Rati Talav
Desalsar Lake
Dosrai Lake

SANITATION &WASTE WATER



Pre- Earthquake

Underground Drainage of Gamtal was conveyed to **Oxidation Pond**



Pre- Earthquake

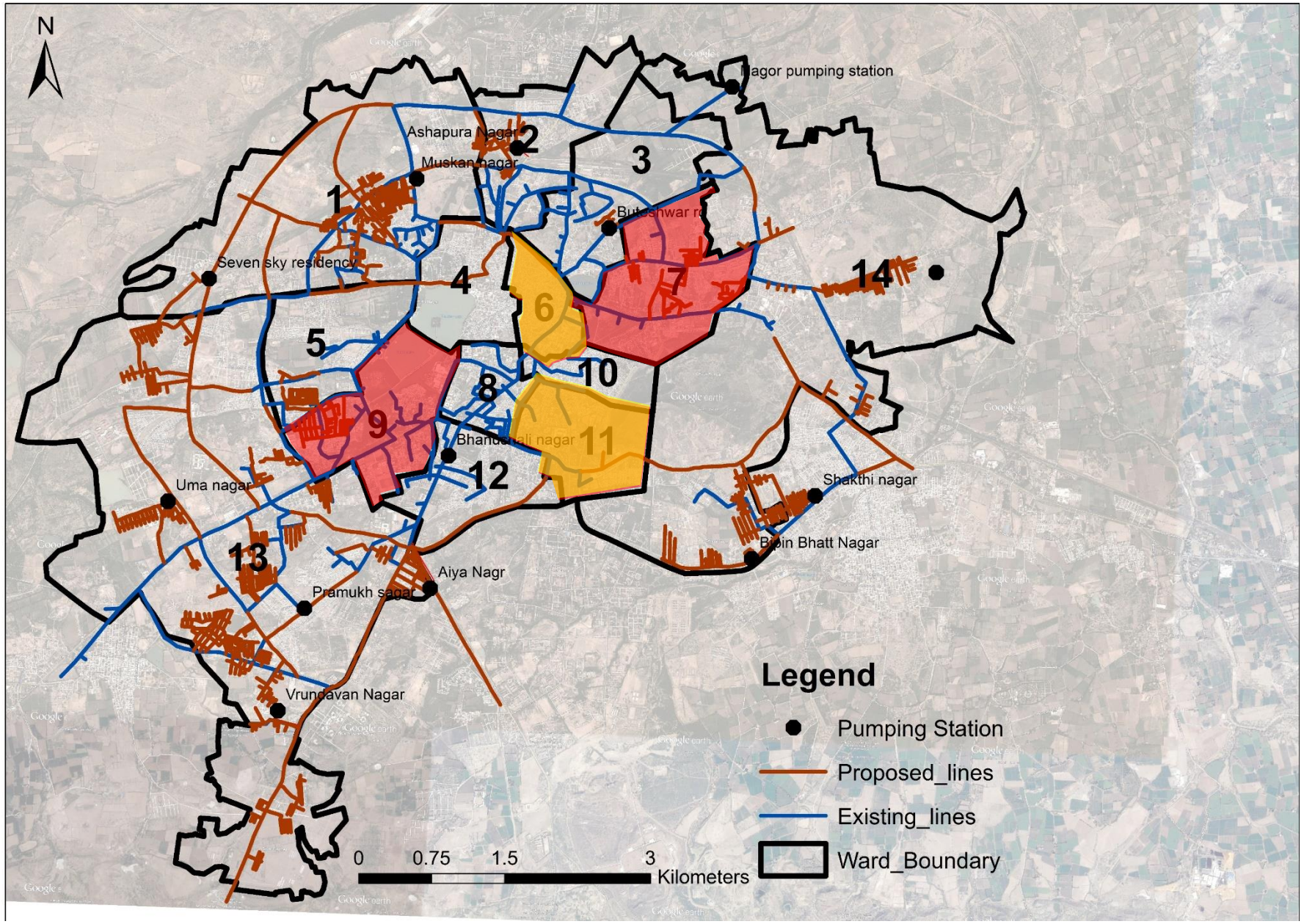
Underground Drainage of Gamtal was conveyed to **Oxidation Pond**

Post- Earthquake (2001-2006)

GUDC formed to implement projects in Gamtal & Construction of Bhuteshwar (GUDC)

Source: **Bhuj Gazetter | Sewerage DPR-2015**

Waste Water



Issues

- Choking of Sewer lines
- Physical lodging of complaints
- Redressal > 2 days
- Presence of Single Pit system- Frequent cleaning requirements
- Poor condition of Public toilets and school toilets.

Source: Primary Survey

OBJECTIVES

- To ensure safe & adequate public sanitation
- To Improve service Delivery
- To develop Reuse strategies for conservation

PROJECTS

1. **School and Public Sanitation**
2. **Feasibility and Relevance of Underground Drainage System**
3. **On-site sanitation**
4. **Complaint Redressal Mechanism**
5. **Reuse of WW in Parks & Institutions**

Sanitation

- Schools are important for cognitive, creative and social development.
- Focussing of school sanitation is like nurturing young impressionable minds for better future with good sanitation habits.

Source: ***Primary data,Aashapura Prathmik shala,2016*** **pc: Nikita Popat(2016)**

School Sanitation

NUSP, 2008

NUSP, 2008: 100% Sanitation coverage. Sanitation Rating.

Sarva Shiksha Abhiyaan

SSA: Focused upon the WASH components for school sanitation & IEC

MGSM : *Swachh Bharat, Swachh Vidhyalaya.*

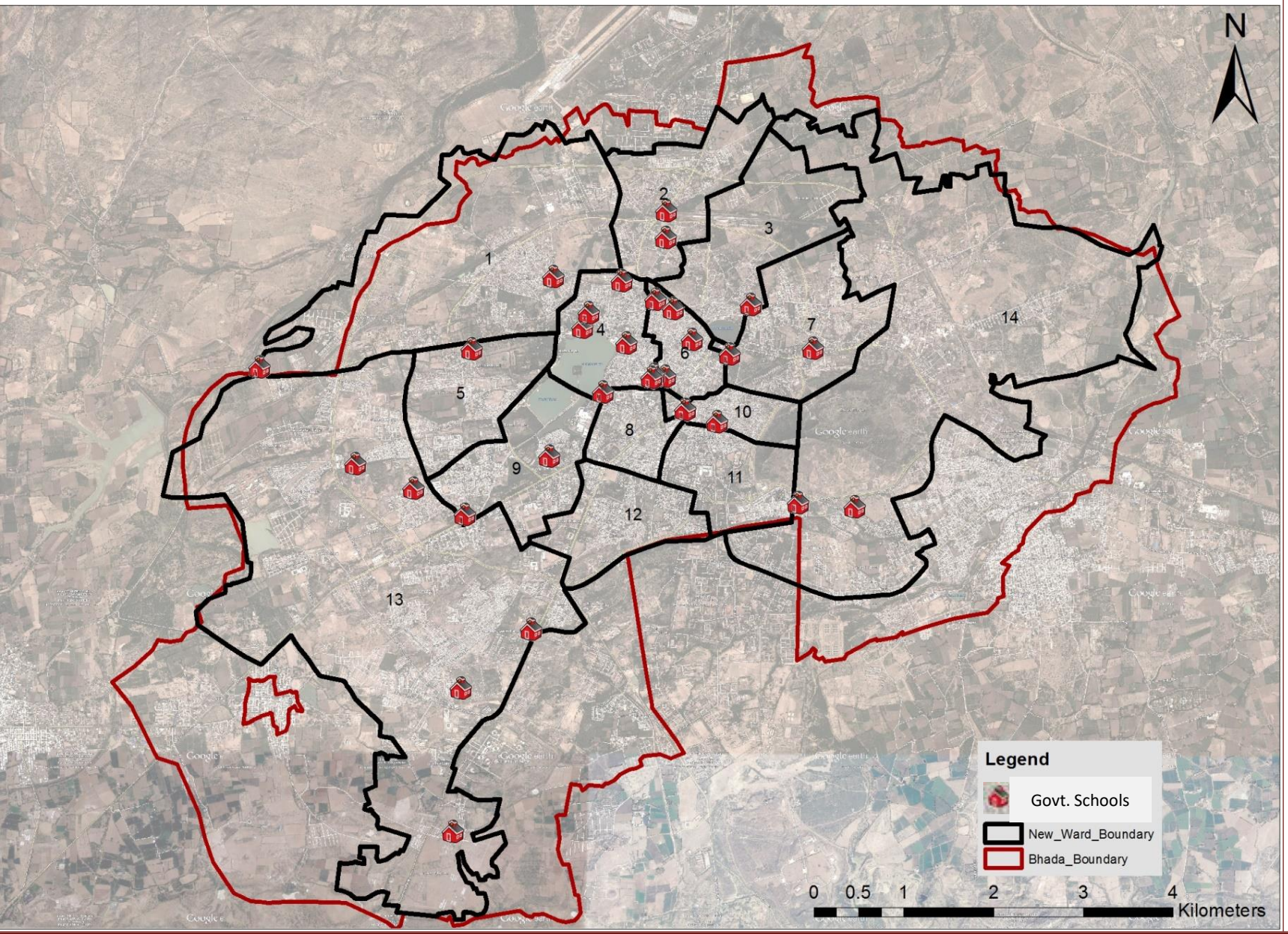
MGSM: *IEC & O&M Shala Swachhta Index & Puraskara.*

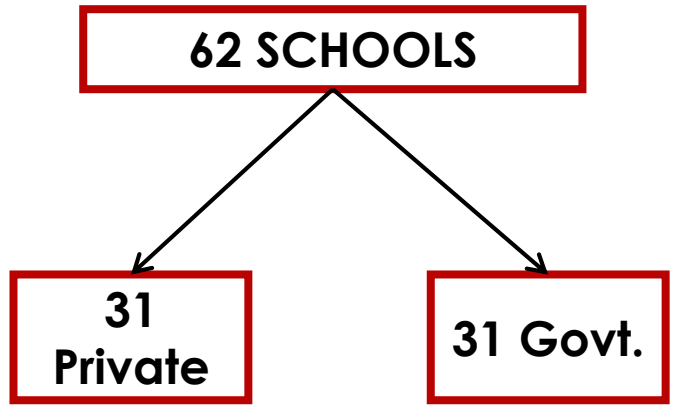
Swachh Bharat Mission

SBM: *Bal Swachhta Brigade,* IEC, Capacity Building, Community & ppp involvement.

- Changing approach over the years as reflected in the policy framework.
- Students as catalyst for the change.
- Performance based monitoring.
- SMCs as Steering link.

School Sanitation



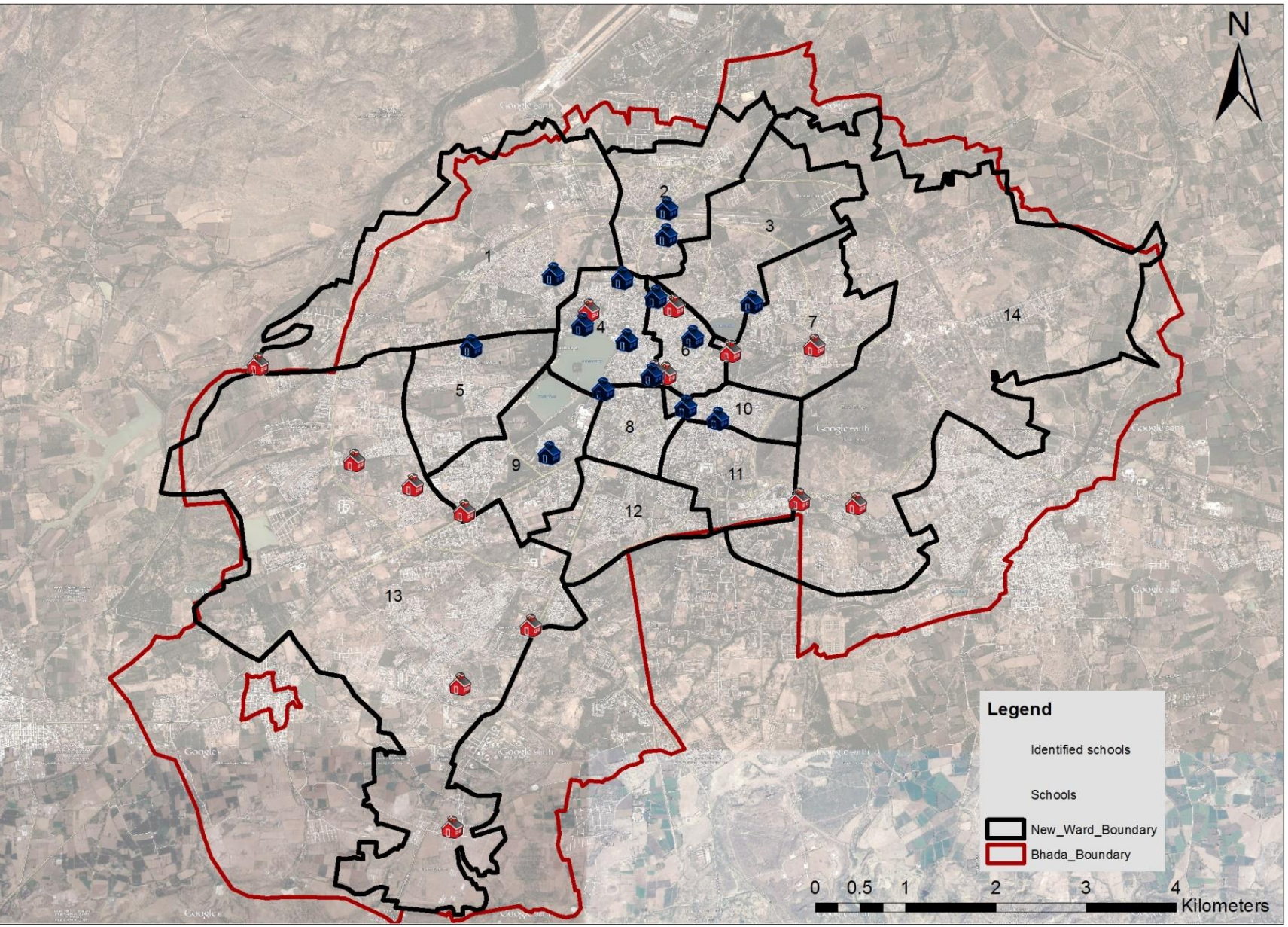


Total school population is 9,250 of which 5,186(56%) are boys & 4,064(44%) are girls.

Only 50% schools have adequate sanitation Infrastructure while in rest functional infrastructure gap is as high as 85%.

Source: **DISE 2013-2014, Primary data survey, 2016**

School Sanitation



15 Schools have been identified which lack sanitation infrastructure.

Total requirement of Toilet seats as per norm SBM:
Boys:**70**
Girls:**49**

The following schools shall be considered:
Shala 1,2,3,4,6,7,10,13,15,16,19,21,24,Al red High school.

Source: **DISE 2013-2014, Primary data survey, 2016**

School Sanitation

Issues

Schools Maintained by Trust/NGO

Drinking water

Separate Toilet Block

Wash room

Schools Maintained by local body

Urinals

Drinking water

Wash room

- Inadequate Sanitation facility for Girls and Boys.
- Sanitation requirement for CWSN not considered.
- Good Quality drinking water facility to be ensured with regular O&M.
- Maintenance of facility is poor & irregular.
- Inadequate funds from govt. for maintenance.
- No staff appointed for cleaning Toilets in many schools.

Source: Primary data survey,2016

School Sanitation

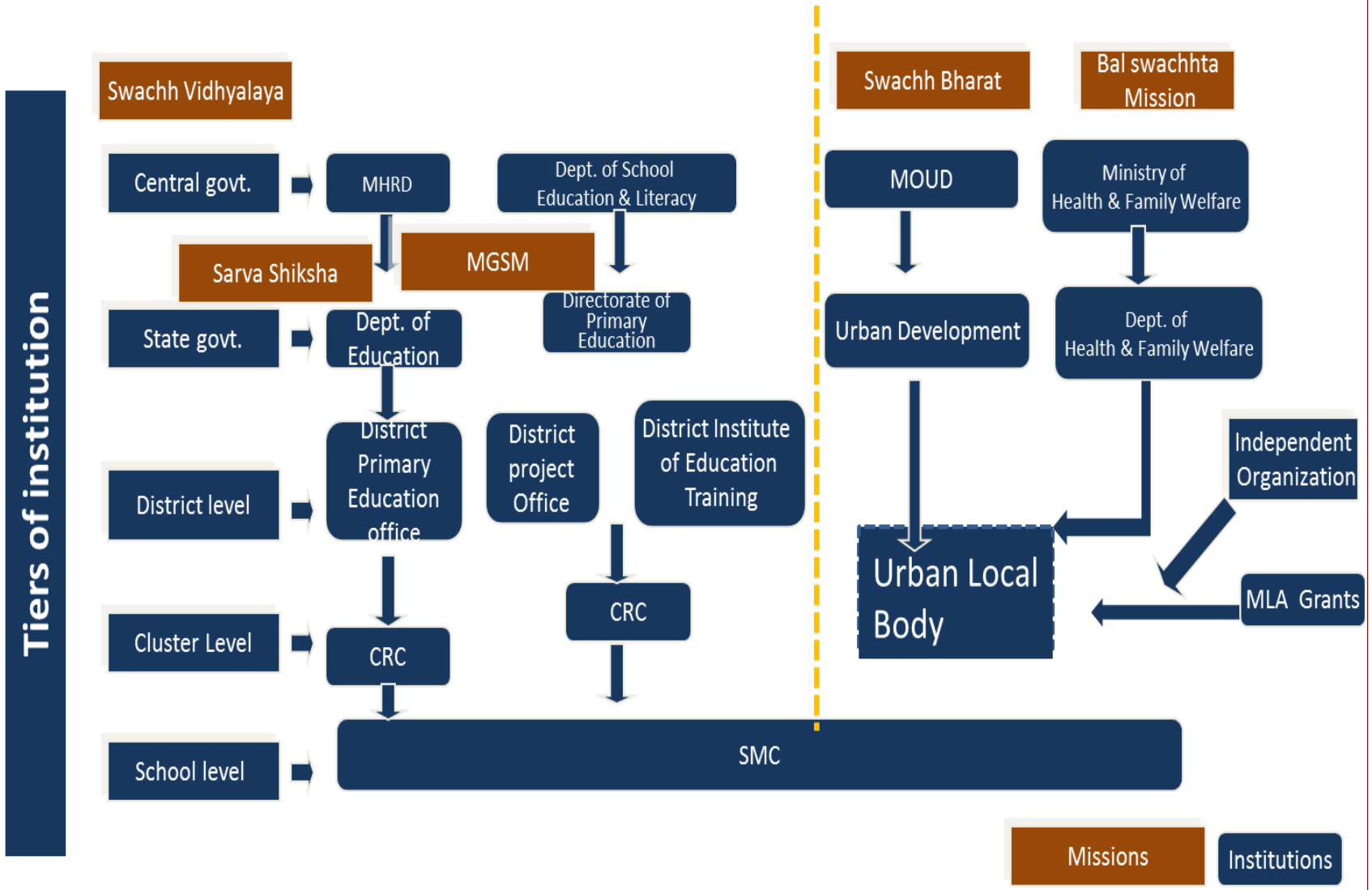
Clean Drinking Water
Adequate Sanitation Infrastructure
Hygiene & Menstrual Hygiene

IEC, Hygiene Education, Capacity Building

Maintenance & Monitoring

Source: Adapted from ASAL, UMC, 2014

Institutional Structure for Education(Bhuj)



School Sanitation

- Functioning of CRCs & SMCs needs to be mobilised.
- SMCs not formed in all the schools.
- To institutionalise ULB one member from elected party to be in SMC.
- Grant received by each school under GoG, for O&M of facilities is 4,000/- TLM grant 12,000/- School development grant.
- MLA grants have been mobilised in past for school.

Source: Adapted from ASAL, UMC, 2014

Capital cost

- Boys: 70 seats
  Girls : 49 Toilet seats
  Rs 26 lacs
- Drinking water: Maintenance of RO system.
  Rs 16 lacs

O&M Contract: Rs 2.6 lacs/ Annually

- Refurbishment of Existing Infrastructure.
  Rs 5 lacs
- **Pro-Bono basis funds**

Maintenance & Monitoring

- Appointment of NGO to maintain sanitation facility of school for 5 years.
- NGO shall institutionalise workers and train them as sanitation force for schools.
- NGO shall Monitor all the work done in coordination with SMC formed.

O&M and Monitoring contract: Rs 5 lacs annually

Hygiene Education/IEC

- SMC should take efforts for initiating hygiene education as a part of curriculum.
- Swachhta Brigade: A student leadership initiative to promote behavioural change.
- Every school shall allocate monthly budget for IEC.

Source: DISE,2013-2014

Bal Swachhta Brigade

- Monitoring
- Expedite implementation
- Awareness amongst Peers

Sanitation Index

- SOP
- Daily, weekly, monthly & annual Monitoring
- Absenteeism Monitoring

Role: BSB & SMC

Appreciation

- Annual Appreciation/Award to develop motive for improvement.
- Recognition to swachhta Brigade.

Role: CMCs/ULB

Source: Adapted from ASAL, UMC, 2014

ભરનાર વિદ્યાર્થીનું નામ: _____ તારીખ: _____ ફોર્મ ક્રમ: _____

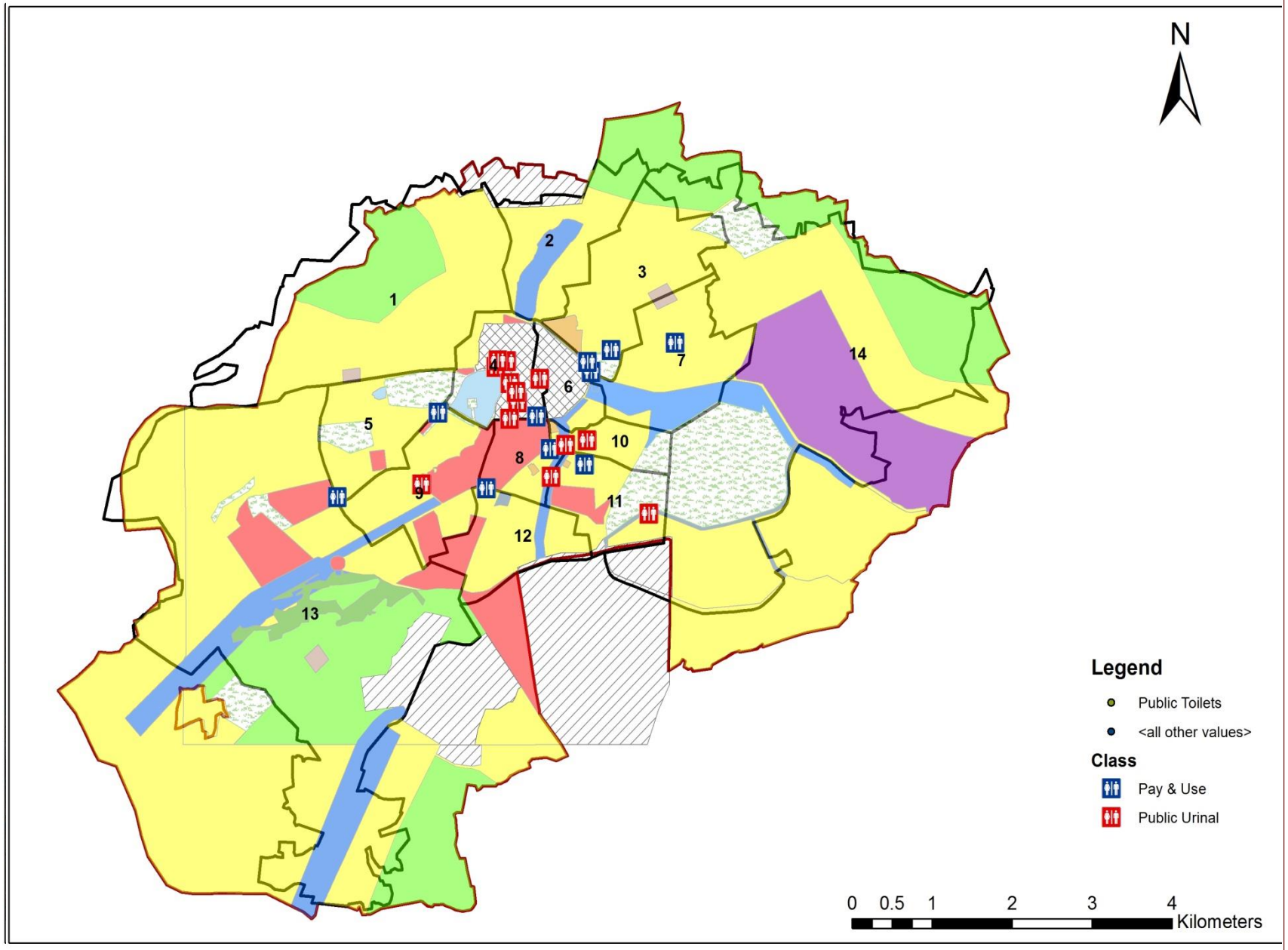
અમારા શાળાની સ્વચ્છતાની આજની પરિસ્થિતિ	 ગ્રેડ: એકદમ ચોખ્ખી	 ગ્રેડ: ચોખ્ખી	 ગ્રેડ: સારી	 ગ્રેડ: ગંદી	 ગ્રેડ: બહુ ગંદી
છોકરાઓના શૌચાલય અને યુરિનલ સીટની સંખ્યા તેની સ્વચ્છતા પ્રમાણેના ગ્રેડ મુજબ જણાવો. ★					
છોકરીઓના શૌચાલય અને યુરિનલ સીટની સંખ્યા તેની સ્વચ્છતા પ્રમાણેના ગ્રેડ મુજબ જણાવો. ★					
તમે તમારા શાળાની સ્વચ્છતાને કયો ગ્રેડ આપશો ? નિશાની (✓)કરો.					
- પીવાના પાણીના સ્થળની સ્વચ્છતા					
- હાથ અને ડીશ ધોવાના સ્થળની સ્વચ્છતા					
- મધ્યાહ્ન ભોજનનો શેડની સ્વચ્છતા					
- ઓફિસ/ વર્ગખંડ/ હોલ/ મેદાન(ચોગાન)/ અને પાર્કિંગની સ્વચ્છતા					
- લોબી, સીડી, ધાબુની સ્વચ્છતા					

શિક્ષકનું નામ: _____

★ (દા.ત.: જો તમને '૫' સીટ એકદમ ચોખ્ખી જણાય તો તે મુજબ "એકદમ ચોખ્ખી"ના ચોકઠામાં '૫' સંખ્યા લખવી.)

A stride from Open Defecation free to Open Urination free.

Public Sanitation



Public Sanitation

- **10 pay & Use**
- **13 Public Urinal**

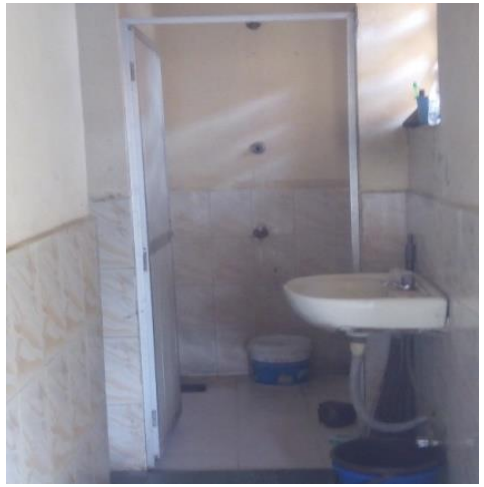
Pay & Use Toilets: Newly constructed under SBM.

Operated & Maintained by Aadarsh NGO.

Public Urinals mostly located in city area

Source: Primary data survey,2016

Public Sanitation




***Setu Office*_Pay & use Toilet**


Pay & use Toilet operated by trust

Public Urinals

New Built **Pay & Use Toilet**: Built Under SBM

Funding Pattern(Capital):

70% State Govt.(GMFB, Nodal Agency)
+
20% Bhuj Nagar Palika
+
10% NGO
(5years of O&M Extendable to 20years)

Public Urinals:
Operated & Maintained by ULB
Presently in bad condition & Non Functional

Source: Primary data survey,2016. pc: Aayushi shah

Civil works	Plumbing	Electrical & FF	Hygiene	General
• Connection of existing utilities within 30 m. • Repairs for all finish work • Adequate size of UGT & OHT • Structural Liability for 20 years • Consideration for Differently abled.	• Repairs of all leaks • 5 years warranty for pumps	• Connection & Deposit charges to UGVCL • Service design as per IS code of practice. • Use of LED lights must be promoted. • Class 2 Fire extinguisher	• Equipment for cleaning & Material shall be in the scope. • Enough staff for cleaning shall be appointed.	• Water & sewerage connection fee/Deposit shall not be charged. • Landscape maintenance • Sign boards • Cleaning premises up to 50 m.

To be Added

Needs Clarity

Source: Existing Contract 2015-2021, Adapted from GoG GR_SBM, 2014

Public Sanitation

Pay & Use

Nature of Contract: **BOT**

Capex +Opex to be recovered from **user charges & Advertisement rights.**

Cossessionaire period: **5yrs**

For 5 Years: IRR of the project : **-15%**

Improving Returns

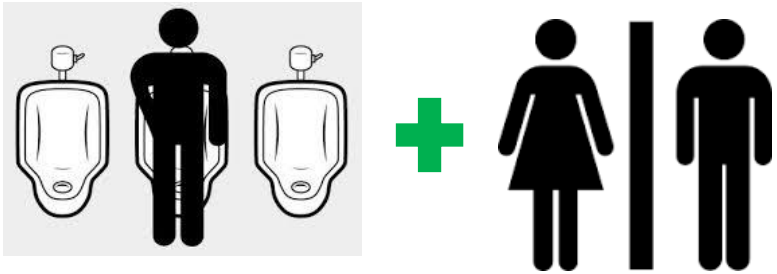
Increasing contract period

For 10 Years: IRR =6%

For 20 Years: IRR = 14%

Brings motivation to investors.

Sanitation Package



Public Urinals + Pay & Use

- In the vicinity of Pay & Use Toilets
- Operations Can be linked along with Pay & Use Toilets
- Advertisement rights for the same shall be issued which can be leased out.

For 10 Years: IRR =21%

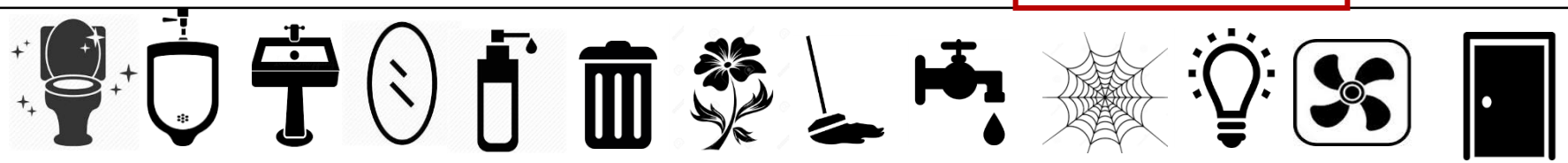
For 20 Years: IRR = 23%

Source: Field Information & Desk analysis, 2016

Conventional O&M

Performance based

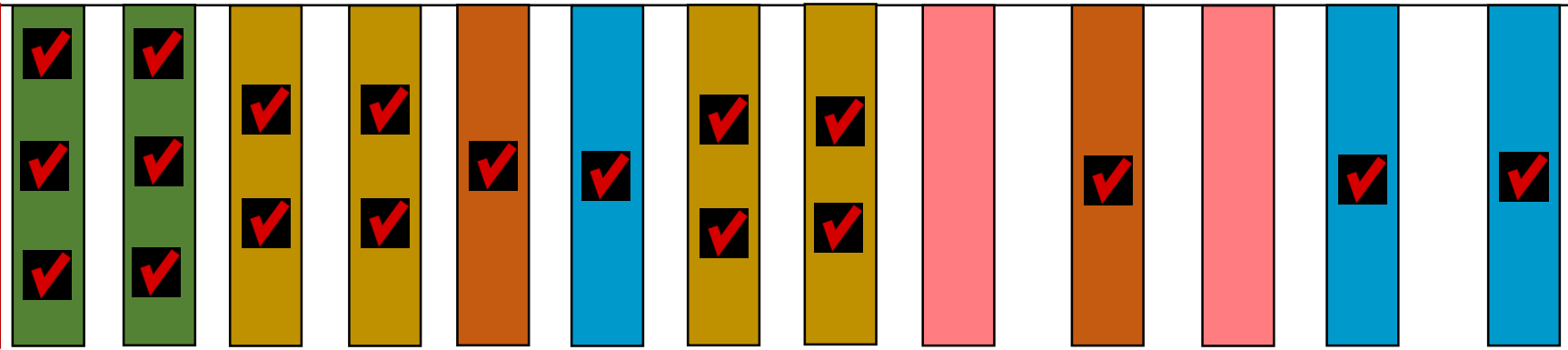
SOP



Signature Supervisor

User Feedback

Frequency



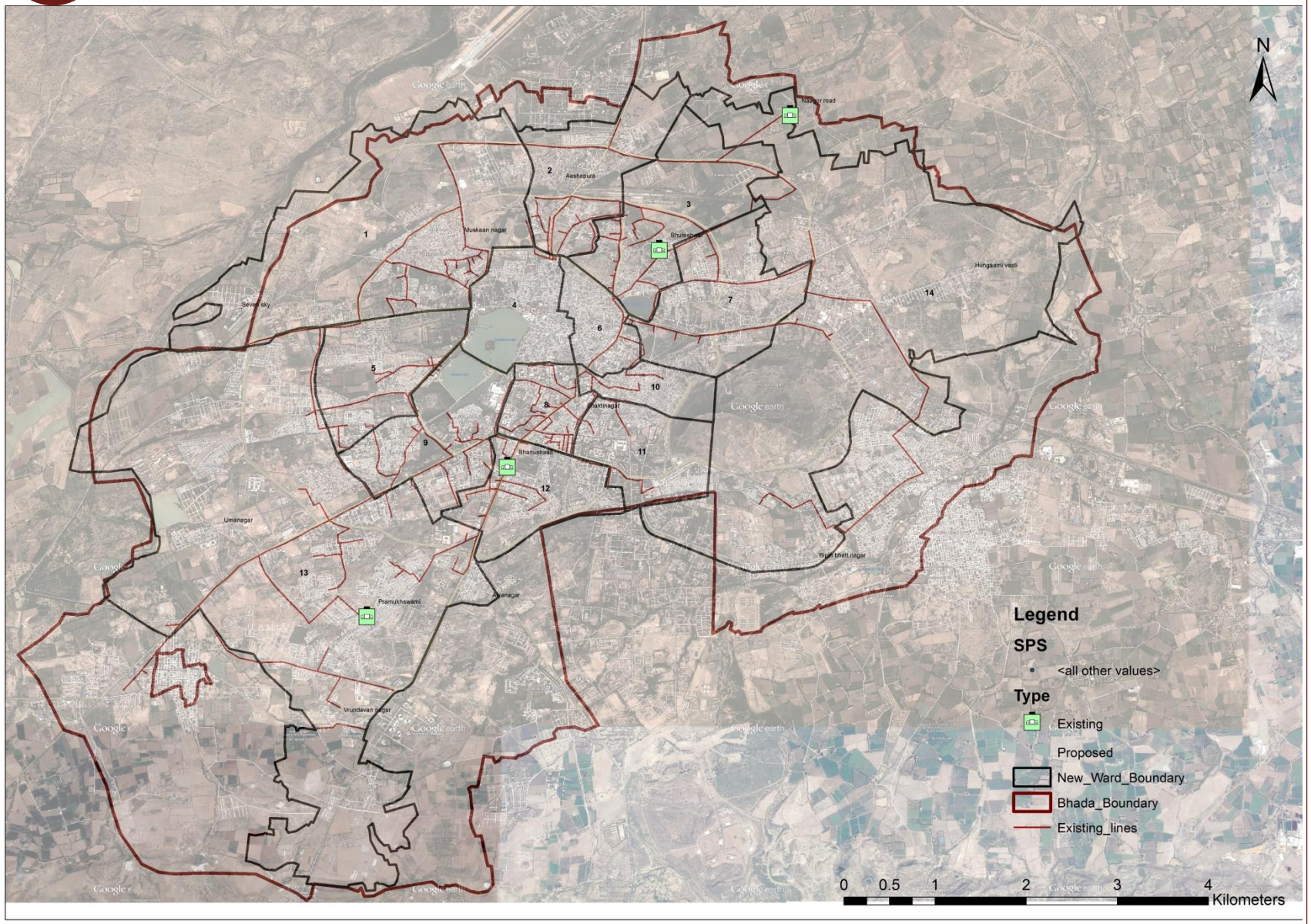
Date:_____

Frequency	Thrice/day	Twice/day	Once/day	Once a week	Repair/Required

Feasibility & Relevance of Under Ground Drainage

Conveyance System

Waste Water



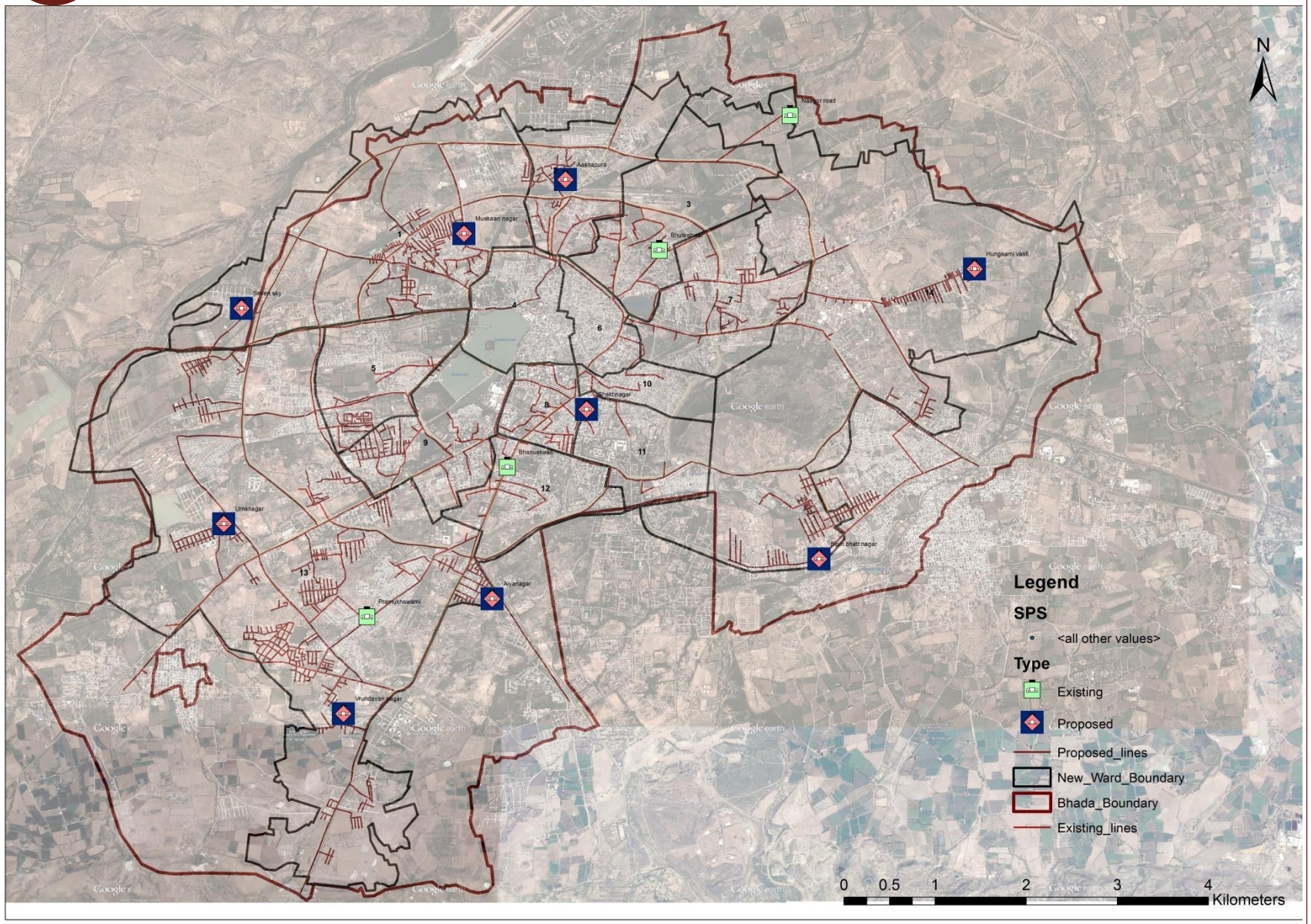
GUDM implemented Network post Earth quake in the city with 4 SPS.

Non screen Chambers were not installed & hence WSP & SPS were non functional.

Bhanushali SPS was Operational since WW was flowing under Gravity.

Source: Bhuj UGD DPR,2013

Conveyance System



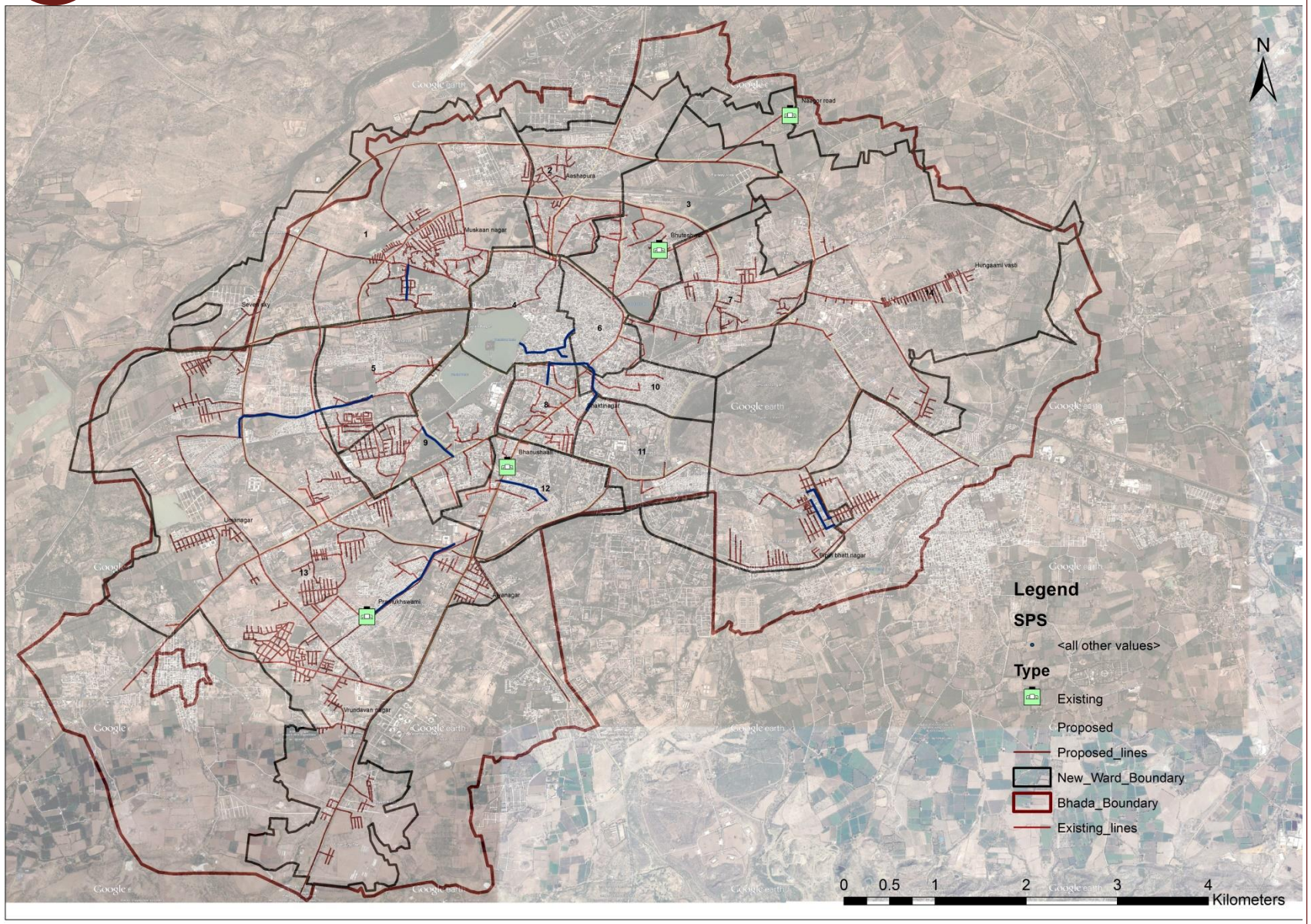
Waste Water

- 90.48 km of Network was laid in new growth areas.
- (Mainly Ward 13& 14).

- 9 new SPS were installed during 2013--2015

Source: Bhuj UGD DPR,2013

Conveyance System

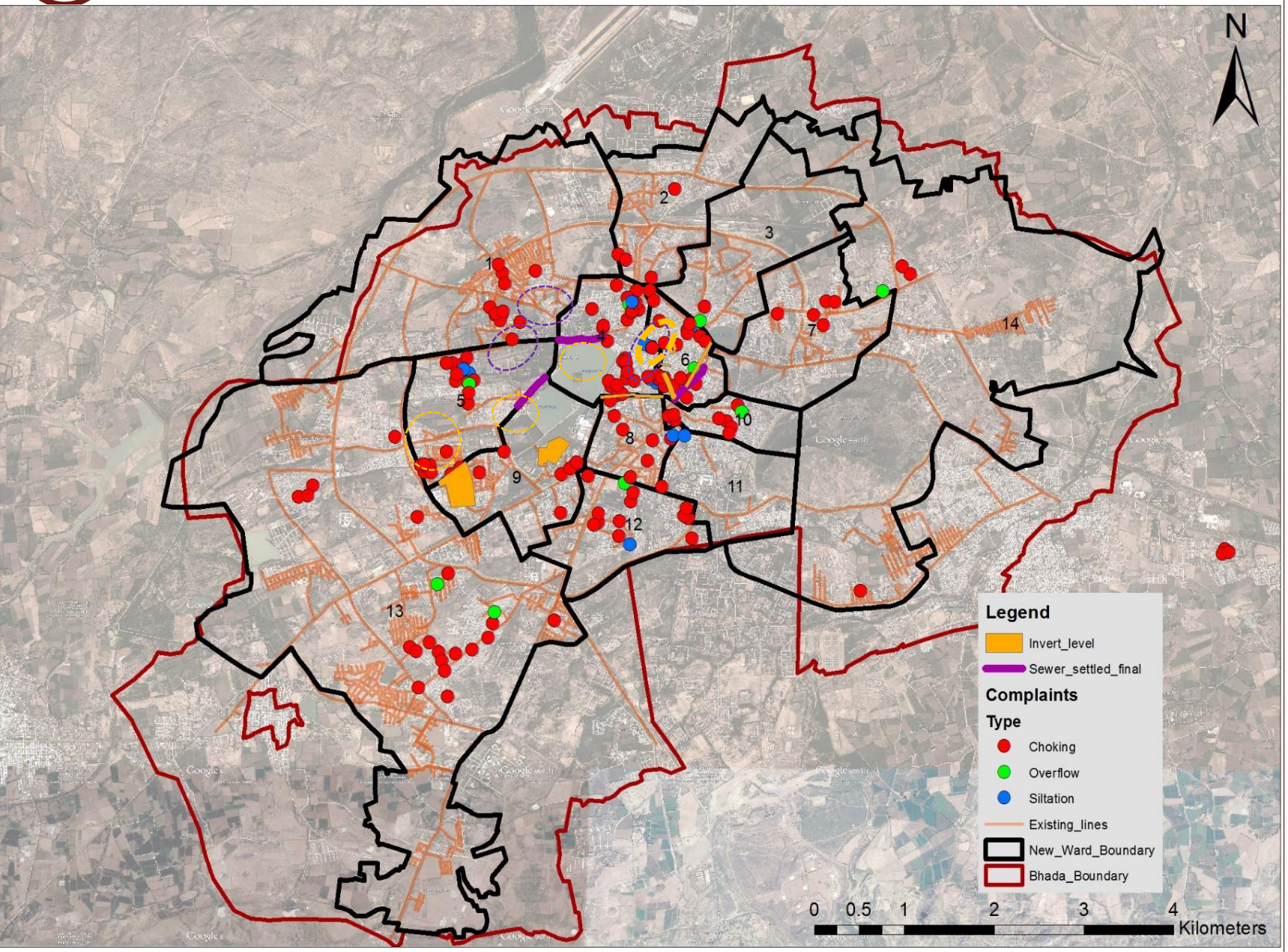


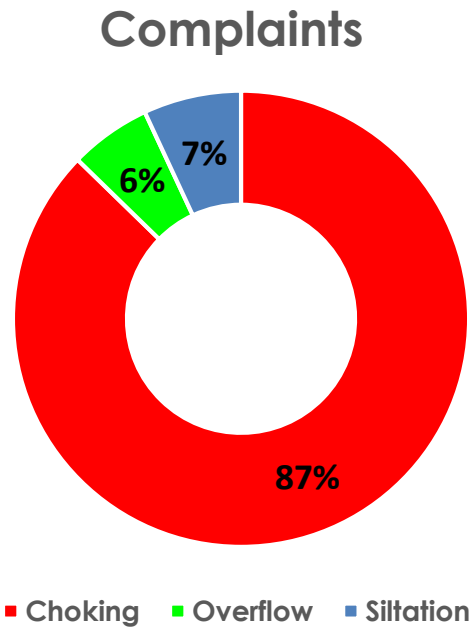
Waste Water

- 2.79 km of Existing lines were replaced as they were defunct.
- Some parts were collapsed, structurally settled due to over loading & to match I.L. for extended network with Vertical Drops.

Source: Bhuj UGD DPR,2013

Waste Water



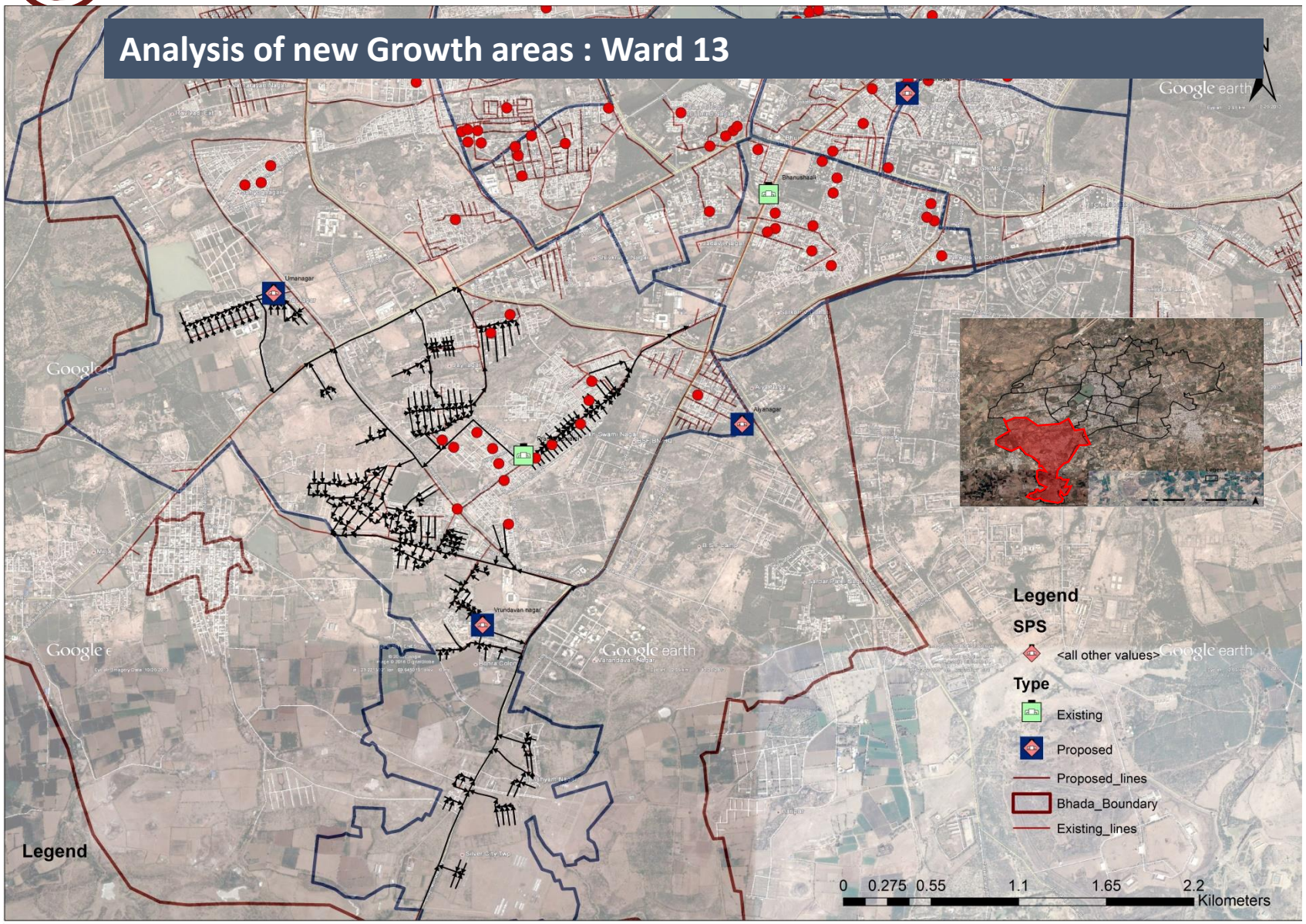


Chocking complaints were observed in the areas where in new system had been recently laid.

**Complaints for 9 days were mapped for the month of September,2016.*

Source: Complaints from Bhuj Nagar Palika records,2016

Waste Water



Design Consideration of the system:

Water Supply: 140 lpcd

Sewage Generation: 80% of Water supply (112 lpcd)

Also water supply here ranges from 104-114 lpcd.

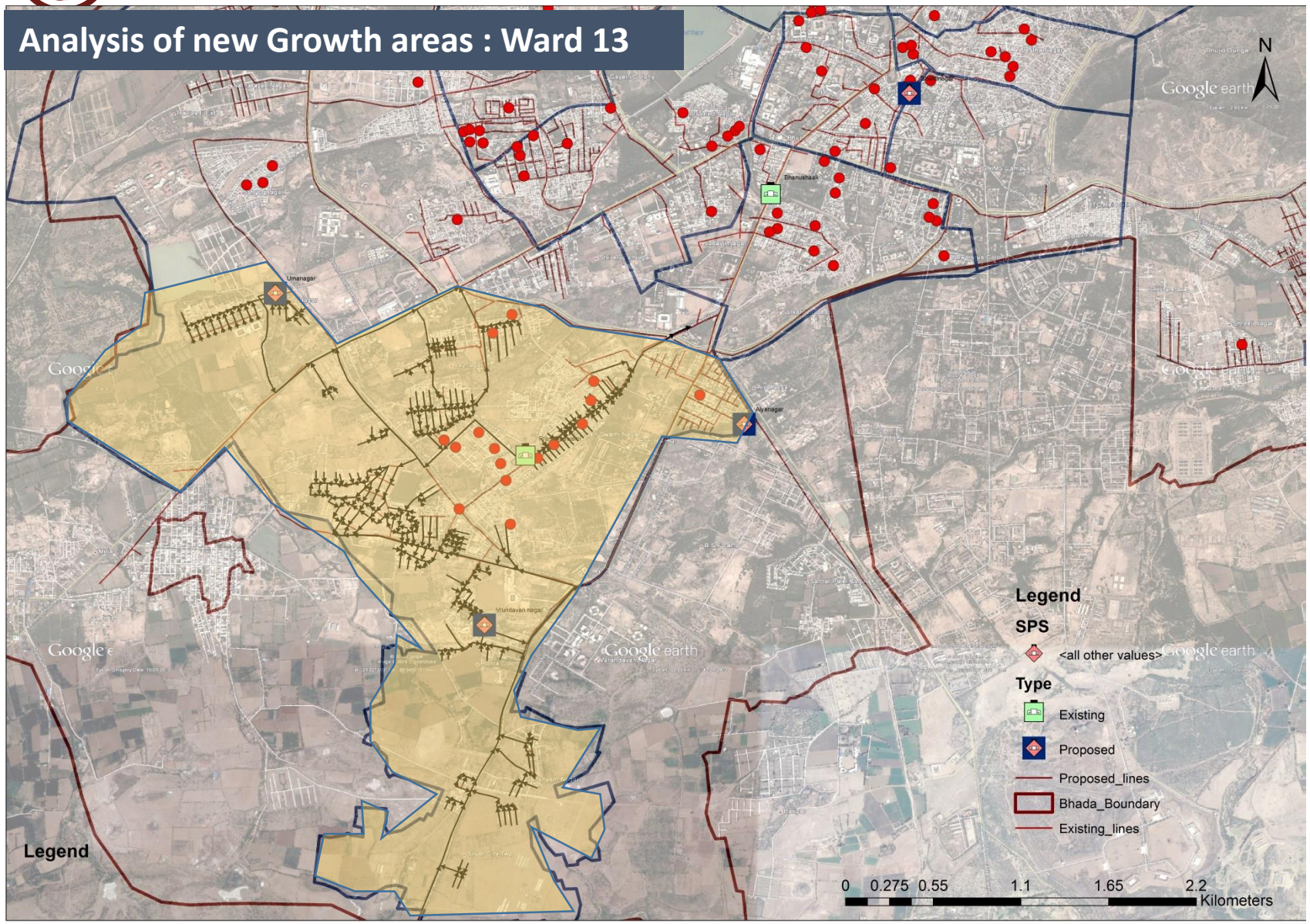
Supply frequency is very unreliable; **twice a week.**

Sewage generation (83 lpcd)

The design suggests external flushing due to less flow generation.

Source: Bhuj UGD DPR,2013

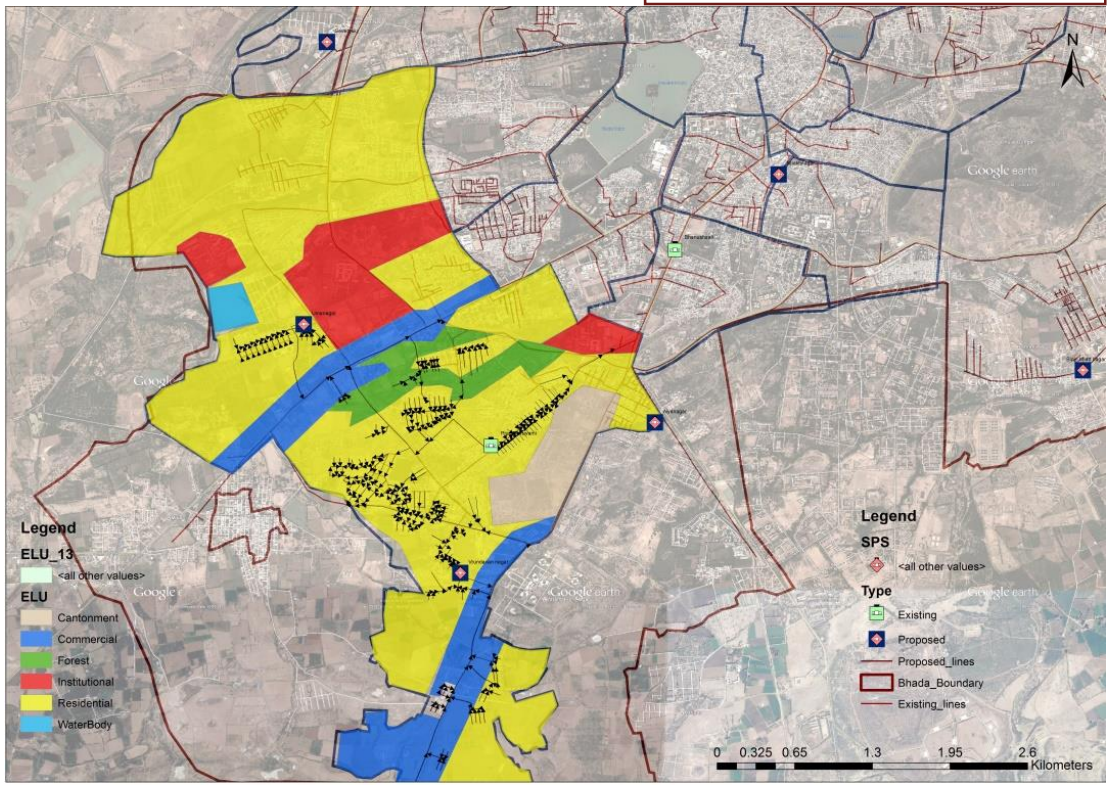
Analysis of new Growth areas : Ward 13

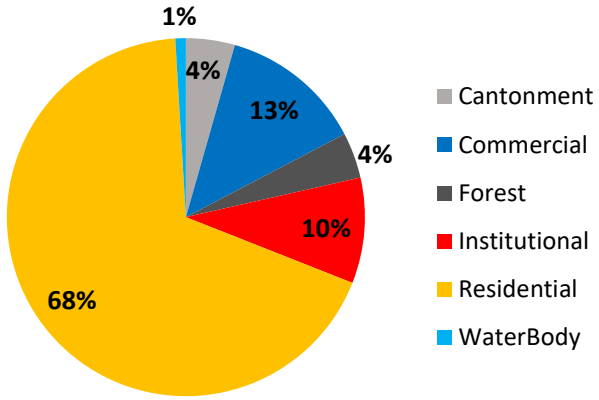


Ward:13_ South part		
Sample Area	763 (14% of Total)	ha
Population	18,513	Nos.
Net Density	0.0062	per sqm area
HH	4114	Nos.

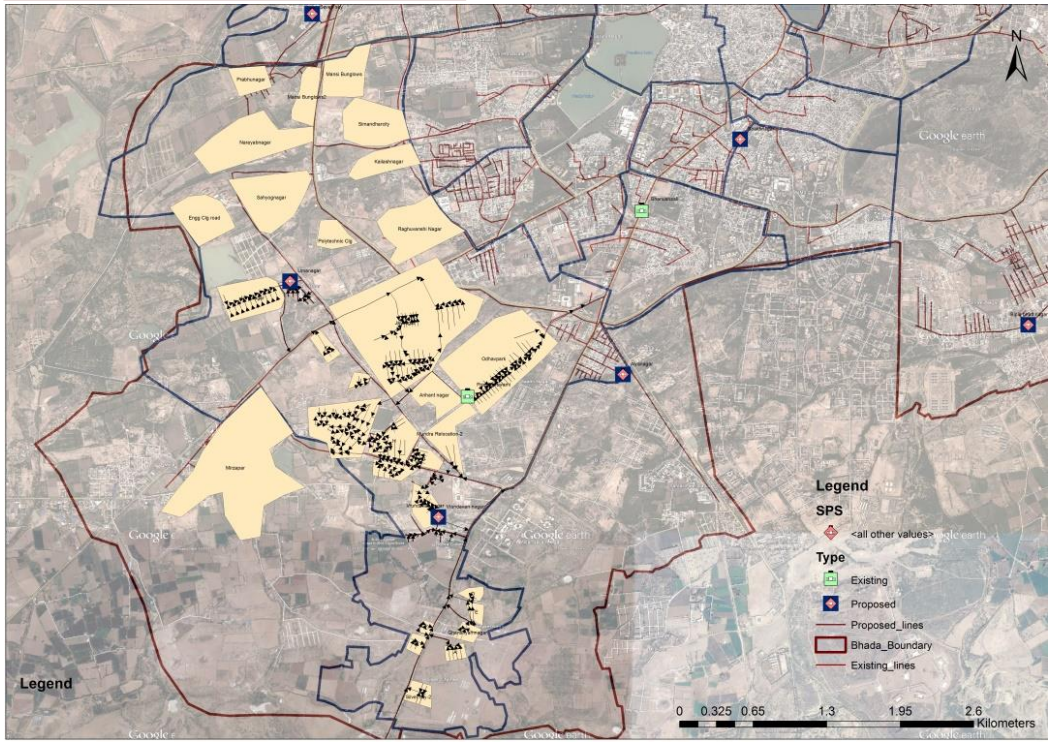
Source: Bhuj UGD DPR,2013

Existing Land Use



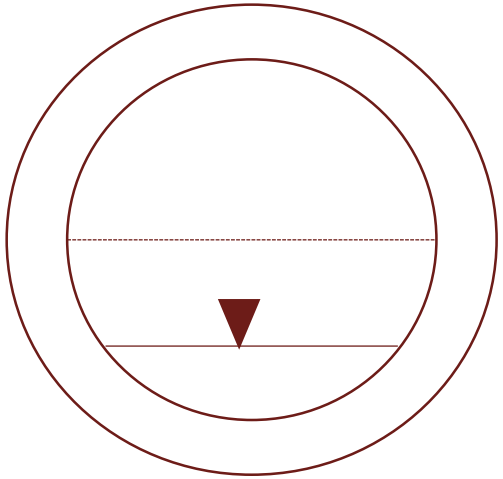


Built v/s Open



Settle Area	**300 ha**
Built V/s Open	**39%**
FSI used_2015	**0.47**

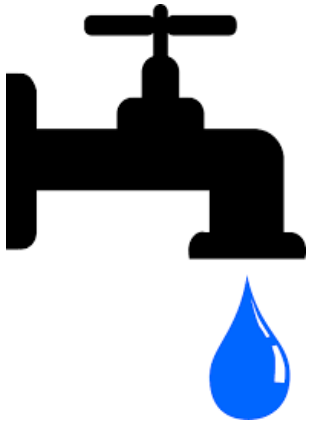
Source: DP 2021, Primary data,2016



20% Capacity utilised

Current Scenario	Designed scenario
q/Q ratio = 0.0652	q/Q ratio = 0.997
d/D ratio = 0.11	d/D ratio = 0.8
Vmin = 0.537 m/sec	Vmin = 0.6

To improve this situation



Improve Water Supply 165 lpcd
(At ultimate design period)

q/Q ratio = 0.592

d/D ratio = 0.56

Vmin = 0.72 m/sec

Improve Network Density

Population:18,513 (13% of Total)

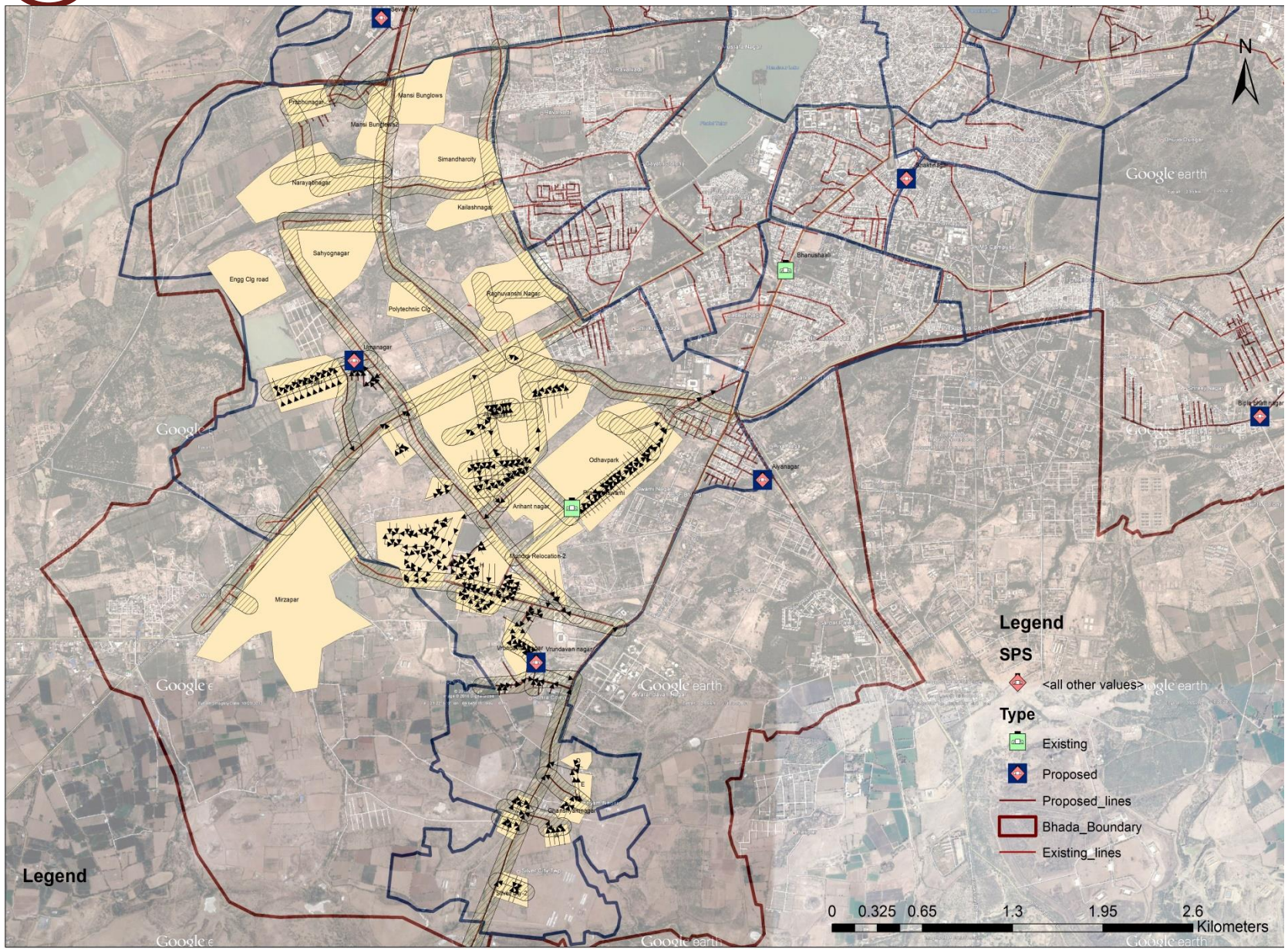
Length: 43,383 m

Current Network Density :
1 connection/10 meter

Network Density
(Core City): **3.5 connection/10 m**

Source:

Conveyance System

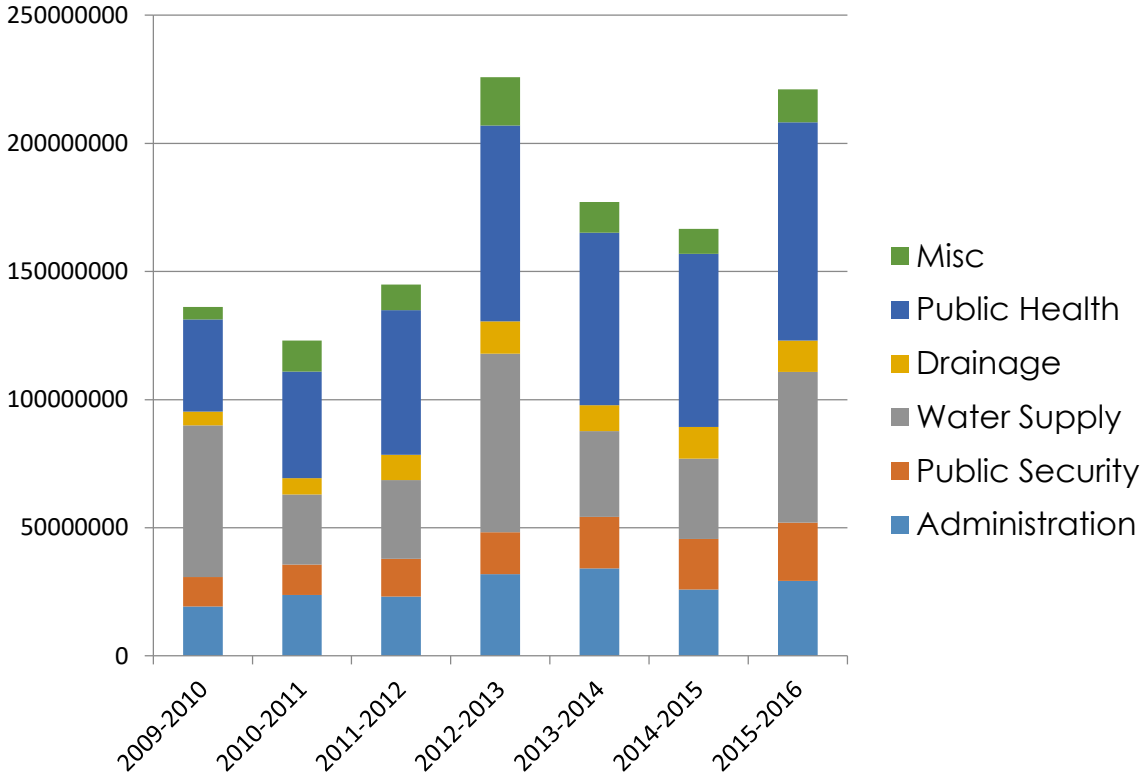


Waste Water

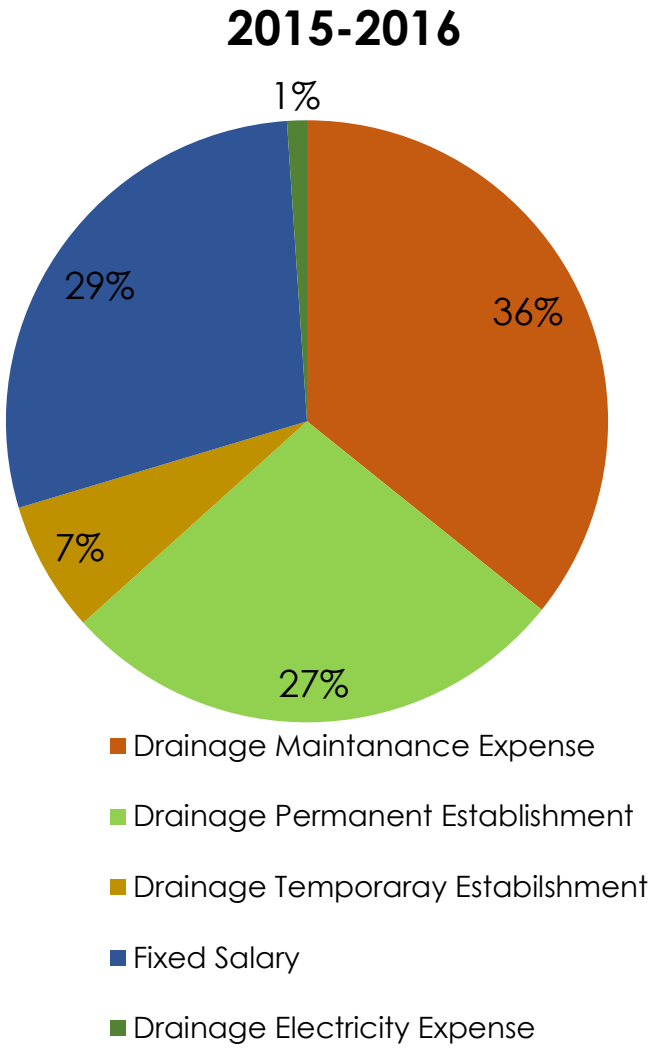
Year	2011	2015	2025	2035	2045
Population	18,513	22,171	28,188	33,525	40,382
ND	0.427	1.4	1.78	2.117	2.55
d/D	0.11	0.172	0.194	0.213	0.234
Vmin	0.537	0.641	0.688	0.726	0.765
Connections	4114	4926	6264	7450	8973

Should sewerage connections be mandated?

The GOA Sewerage System and Sanitation Services Management Act, 2008 Appendix C 2.2.



6% of Total Revenue expenditure is made for Drainage.



Cost recovery: 77%

Collection efficiency: 49%

Source: Municipal Finance data

Sr. No.	Treatment process	Land Requirement (ha)	Energy (kwh)	Capital	OnM per Annum	Comments
1	ASP	0.15	200	55,00,000	6,00,000	Sludge disposal/ Management
2	Biological Fileration & Oxygenated Reactor (BIOFOR)	0.08	277	110,00,000	12,00,000	Required high chemical dosing, sludge management
3	Fluidized Aerated Bed (FAB)	0.06	135	70,00,000	9,50,000	Reliance of filter media & flocculants
4	Submermerged Aeration Fixed Film(SAFF)	0.05	390	90,00,000	14,00,000	Clogging of Reactor due to absence of primary Sedimentation, skilled manpower
5	CASP	0.14	175	110,00,000	14,00,000	No primary treatment required, skilled manpower
6	Upflow Anaerobic Sludge Blanket (UASB)	0.2-0.3	12.5	35,00,000	1,50,000	Not a standalone treatment system, requires Tertiary treatment to meet output standards.

Source: DWMM report, IIT kharaghpur.2012

Waste Water

Cost of Treating Water: ₹ 3/kL

Scope of Reuse:

Land scape Area: 7000 sq. m

Resources used: Bore-well

Daily Water Requirement for Landscaping & Non-potable uses: ₹ 7kL/day

Cost of extraction & Treatment of water: ₹ 3.7/ kL

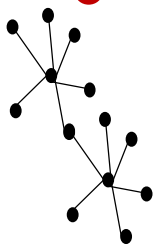
Willing to reuse Treated water.

Target Areas for Reuse: Resorts & party plots

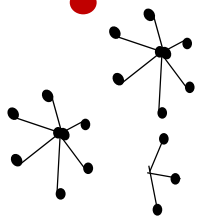
Source:

O&M Centralised v/s Decentralised system

Municipality Perspective



Centralised Sewer network



Decentralised System

	Centralised Sewer network		Decentralised System	
	Conveyance	Treatment	Conveyance	Treatment
Capital Investment	₹ 1394	₹ 96.61	₹ 1157	₹ 57.75
O & M Exp.	₹ 95.75	₹ 4.17	₹ 50.2	₹ 12.55
Revenue	User Charge ₹ 32.4		User Charge+ sale of Treated Water+ Fertilizer ₹ 63.4	

Funding

50% of Capital
72lakhs

GoI Contribution

40% of Capital
58 lakhs

GoG Contribution

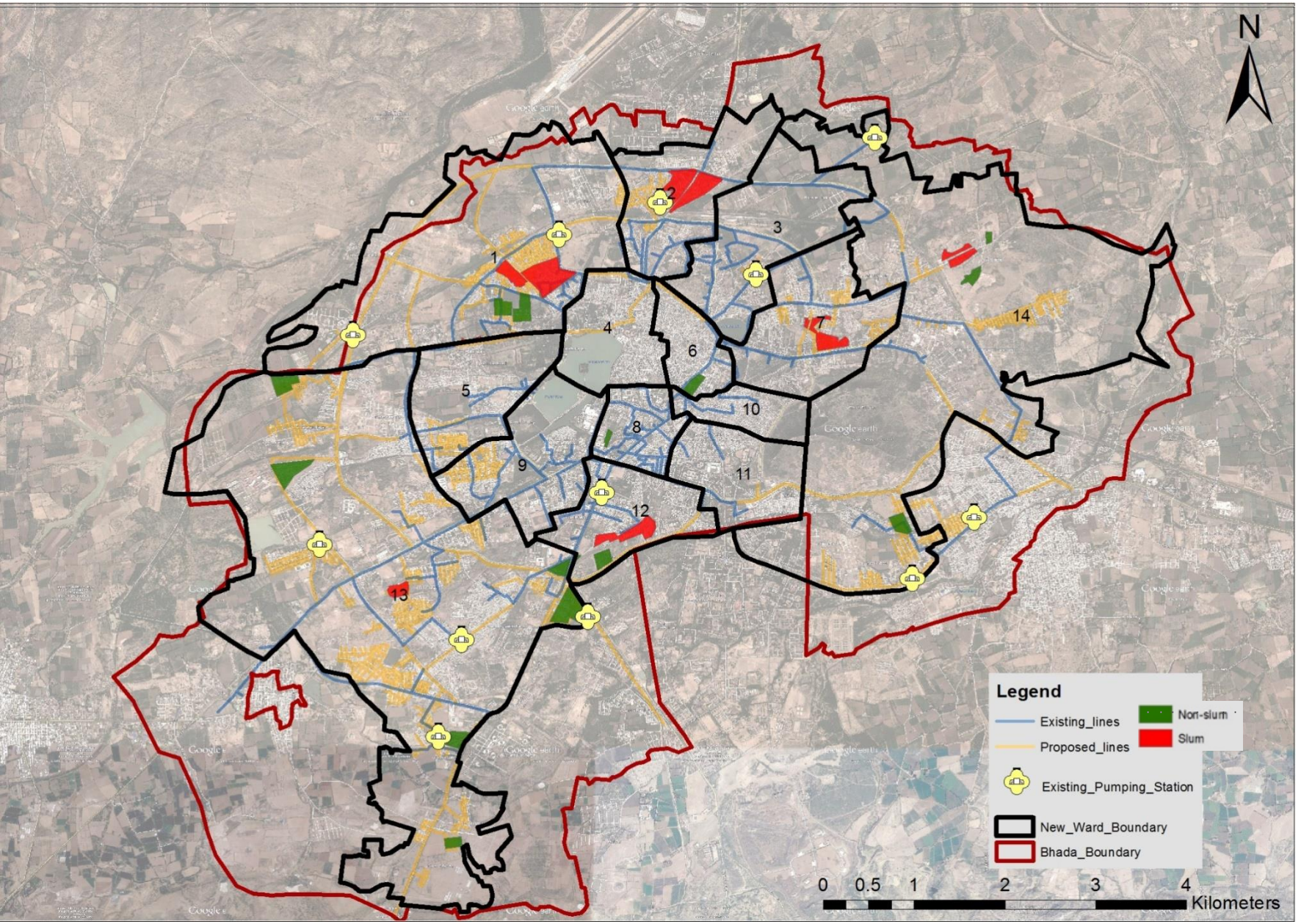
10% of Capital
14 lakhs

BNP Contribution

Source:

On-Site Sanitation System

Waste Water



Concentration of On Site Sanitation systems higher in the peripheral wards 13 & 14

4700 HH's dependent

72% Sewerage Coverage

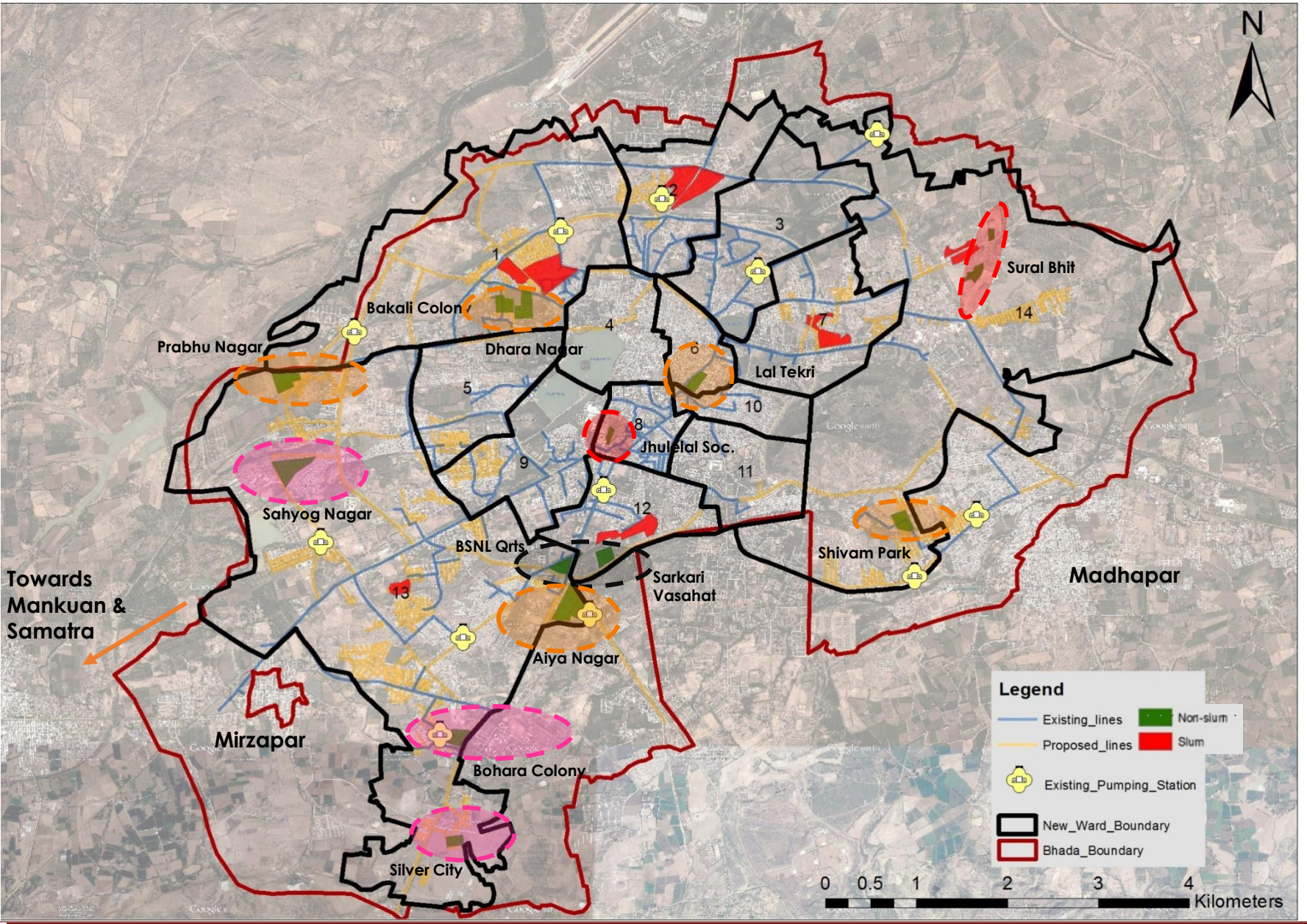
Post laying of new sewer lines by GWSSB in 2013, the concentration of On Site Sanitation systems reduced

Existing On Site Sanitation Systems in Non-Slum areas

2000 HH's in Urban Bhuj are still depending On-Site Sanitation Systems

Source: Census 2011, DPR for BHUJ UGD Project

Waste Water



Presence of On Site Sanitation Systems

Areas with Proposed Sewer lines in the vicinity

Areas with sewer lines but not connected

Areas with No Sewer lines in the vicinity

Areas at a lower invert than the nearest sewer line

Source: Primary Survey in Bhuj, 2016

Despite of Bhuj having 72 % coverage of Sewer lines, **Why are the Septic Tanks not connected to Sewerage lines ??**

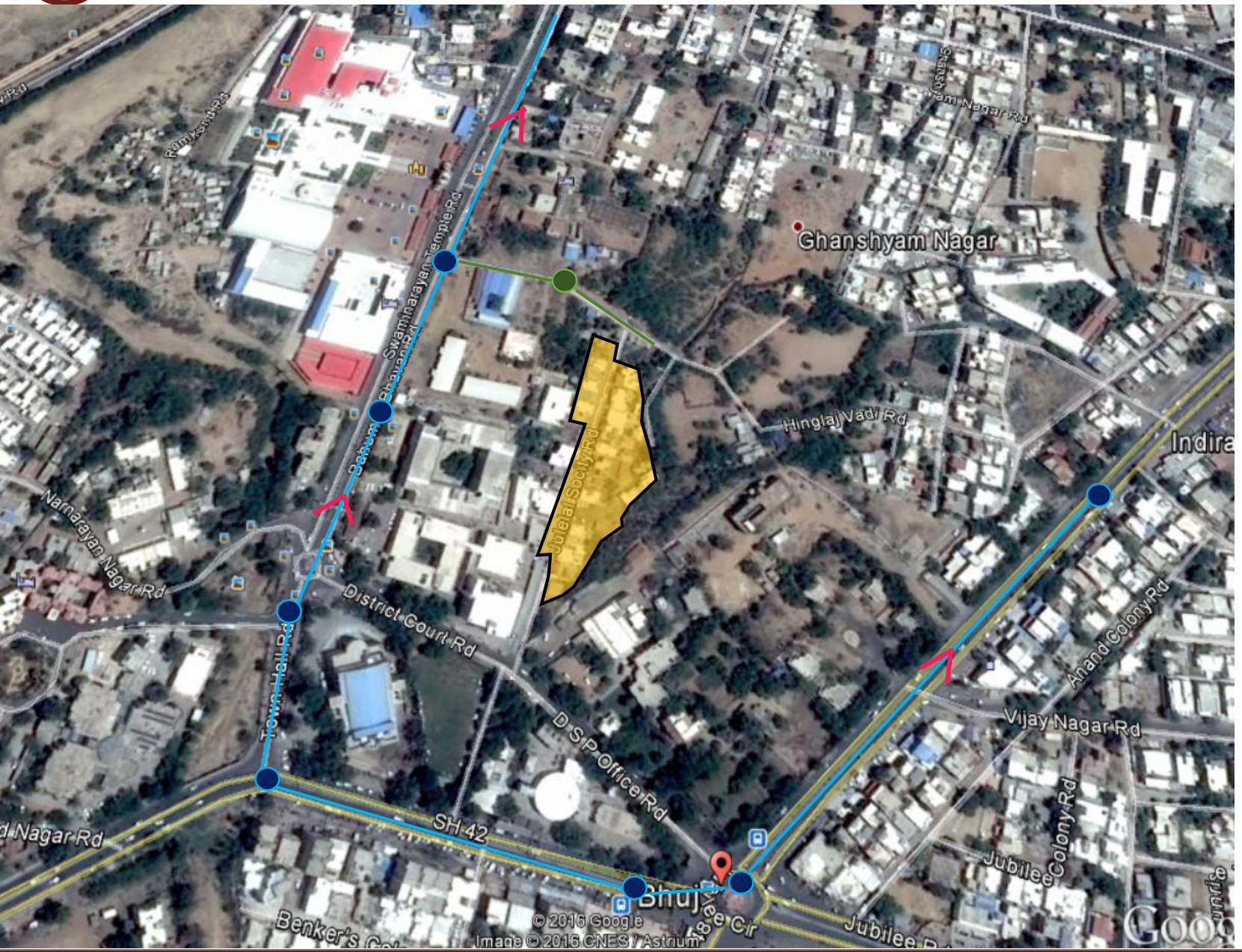
Level Difference for connection of Septic Tanks to Sewer lines

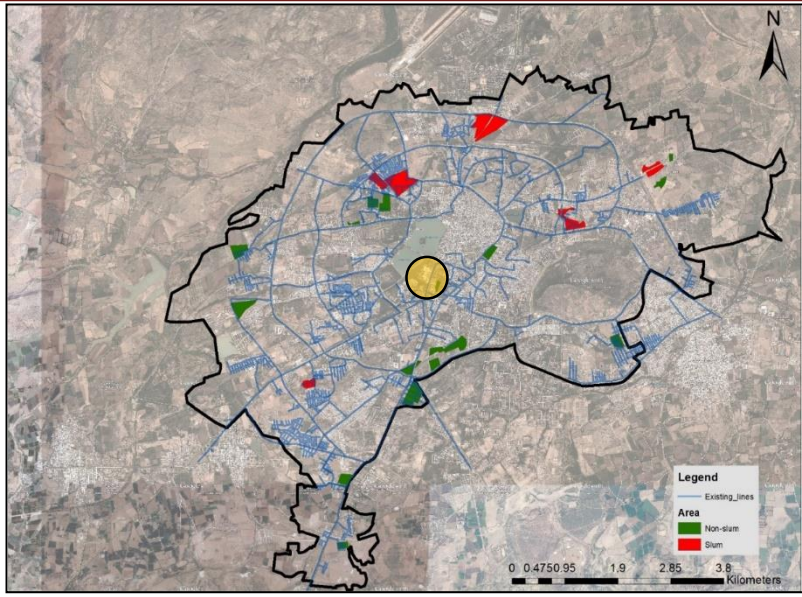
No sewer lines in the vicinity of Septic Tanks

Unwillingness to connect to Sewer lines due to initial connection charges & backflow of sewage

Pilot Site

Waste Water





- Jhulelal Society

  No. of HH's : 50

  Area : 5000 Sq.mt

  Individual Single Pit System

Main Sewer

Pipe Sewer

- Society within the vicinity of sewer lines & at a lower level than the surrounding area
- Frequent emptying of septic tank required due to invert issue

Source: Google Images, Primary Survey in Bhuj 2016

Waste Water

Avg. size of Septic Tank : 5' x 4' x 20'

Single Pit Systems with all sides Lined & Exposed bottom

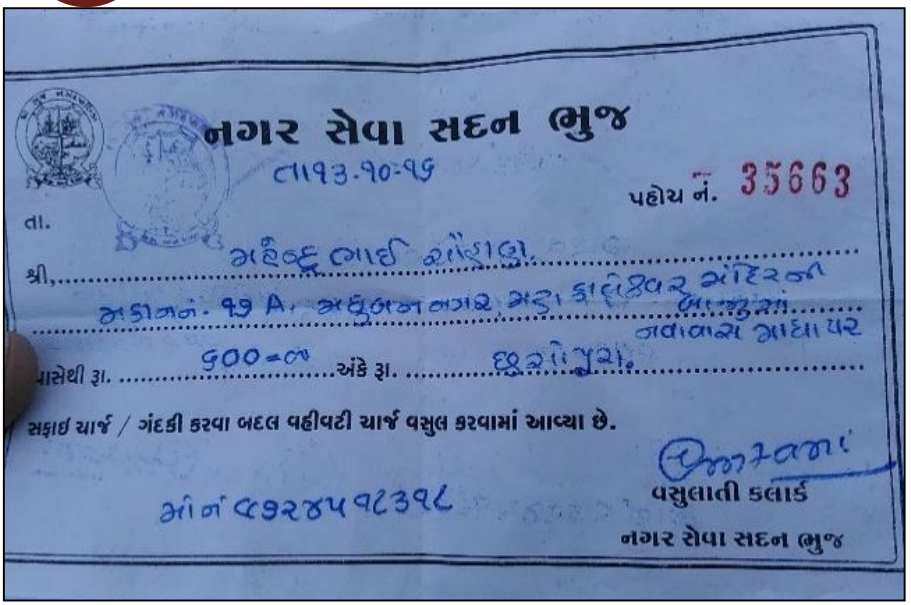
Depth > 20 feet

Grey Water + Black Water discharged in Single Pit Systems

Frequent Emptying of Pit required due to heavy inflow of Organic Waste

Desk + Telephonic Complaints for Emptying of Pits

Source: Primary Survey in Bhuj, 2016; Picture courtesy Anuj



નગર સેવા સદન ભુજ

તા. 13-10-15 પહોચ નં. 35663

શ્રી, મહેન્દ્ર ભાઈ રાઉલજી

મકાન નં. 99 A. અંબુબા નગર મફા કાલેશ્વર મંદિરની બાજુમા નવાવાસ મોટા પર

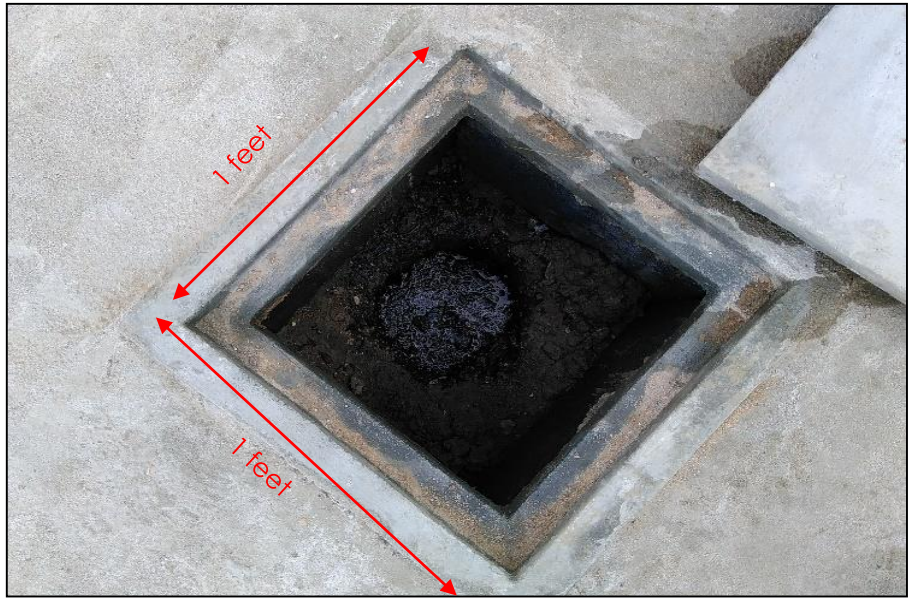
વાસેથી રૂા. 600-00 અંકે રૂા. છસો પુરા.

સફાઇ ચાર્જ / ગંદકી કરવા બદલ વહીવટી ચાર્જ વસુલ કરવામાં આવ્યા છે.

વસુલાતી કલાર્ક

નગર સેવા સદન ભુજ

આ નં ૯૭૨૪૫૯૮૩૯૮



Rs.150 Charged for Emptying within Bhuj & Rs.400+ Rs.6 / km charged for outside Bhuj areas

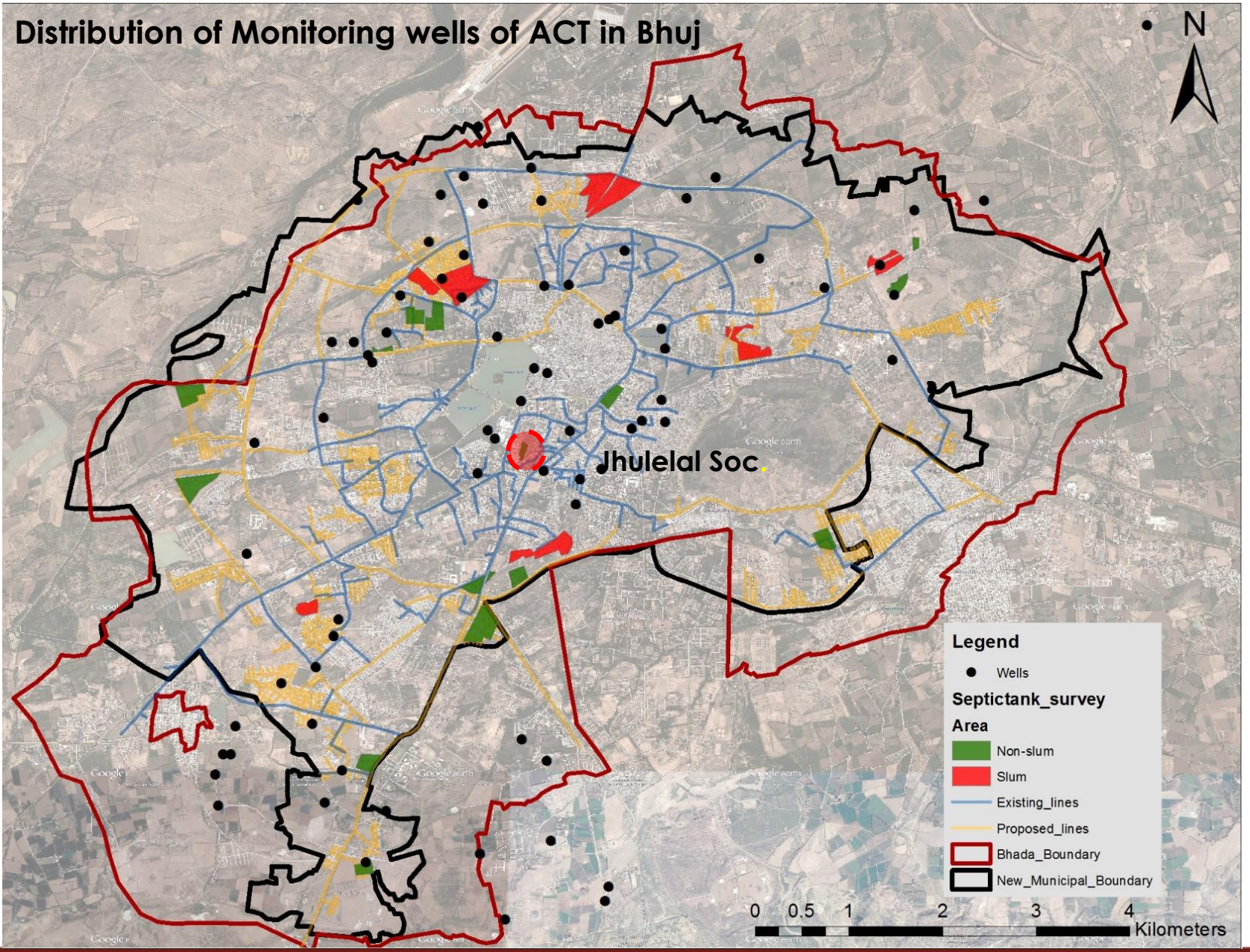
Narrow Access Chambers

Motorized Emptying of Liquid Effluent by BNP owned vehicle

Discharge of Efffluent in nearest sewer manhole or in the Agricultural fields

Source: Primary Survey in Bhuj, 2016; Picture courtesy Anuj

Waste Water



Nearest well is at a distance of more than 500 from Jhulelal Society

As per our HH survey, the Drinking Water in Ward 8 (Jhulelal Society) is Supplied by RTO Sump at **120 Lpcd**

Water Table depth > 100 feet

Infiltration rate of Sandy Soil 50 Lits./Sq.m./day

- Capacity of Single Pit : 11 Cum
- Frequency of Emptying the Pit is 33 days

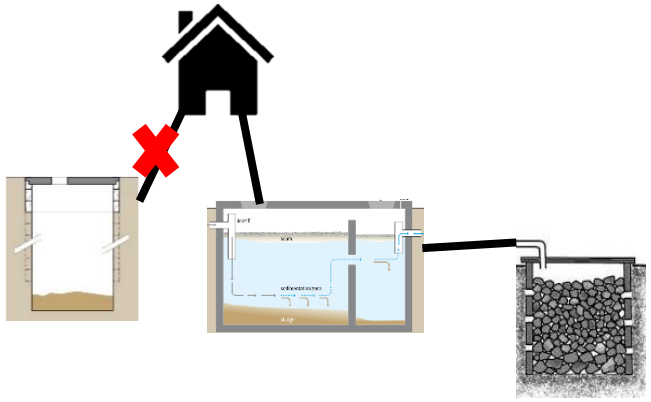
Source: ACT, Primary Survey in Bhuj 2016

Prevalent Single Pit System in Bhuj can be considered as **Insanitary in the Urban Context** under the Swacch Bharat Mission

Upgradation of the Single Pit System

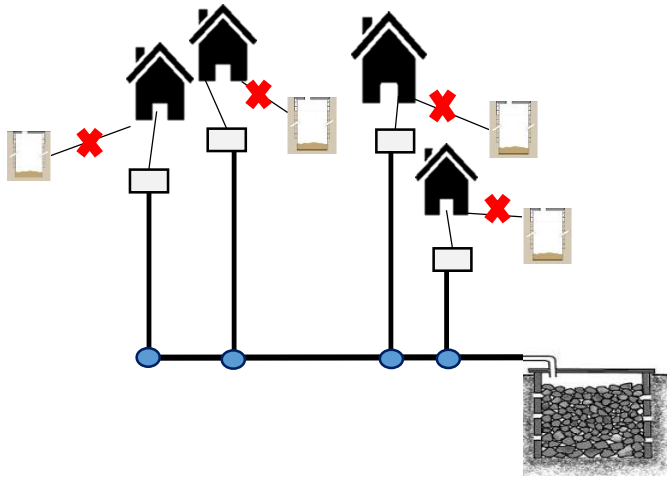
OPTION 1

Conversion of Individual Single Pit into Septic Tank + Soak



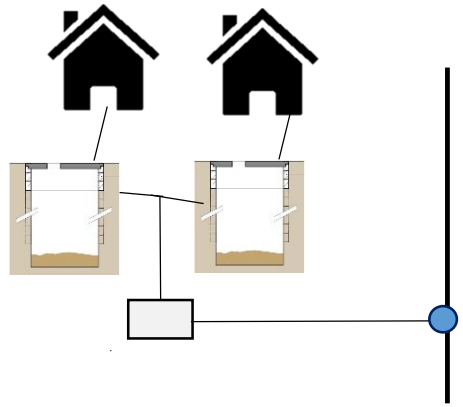
OPTION 2

Providing Interceptor Tanks + Small Bore Sewers + Common Soak Pit



OPTION 3

Pumping Effluent to the nearest Sewer Manhole



	Cast in-situ Septic tank	Precast Septic tank		
Capital Investment	₹ 16,800	₹ 18,700	₹ 21,250	₹ 11,600
O & M Exp.	₹ 200	₹ 200	₹ 250	₹ 910

Source: SBM Guideline, SOR, GWSSB

Option 1: Conversion of Individual Single pit into Septic tank + Soak Pit

Capital Investment ₹ 16,800

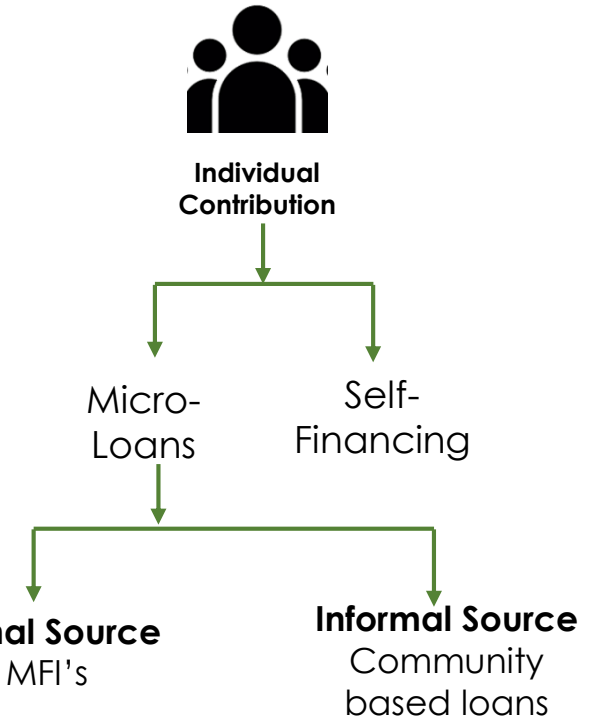
GoI Contribution ₹ 4,000

+

GoG Contribution ₹ 2,000

+

Individual Contribution ₹ 10,800



Micro-Financing Egs. in Sanitation

- Mizoram House Holder : Loan Rules 1980 (Const of Septic Tank & Water Tank)
- SEWA
- Bharathi Women Development Centre
- GUARDIAN
- HunnarShala + Kutch Mahila Vikas Mandal in Bhuj

	GUARDIAN	Water Credit WASH initiative
Eligibility	Women Only Member of Joint Liability Group	Women Only Member of Joint Liability Group
Loan Size	₹ 20000	₹ 24000
Interest Rate	24 %	20 %
Tenure in Months	17	24
Collateral	Not required	Not required

Source: MGSM Guideline, Evaluating the potential for Micro finance in India, Sophie Tremolet, May 2013.

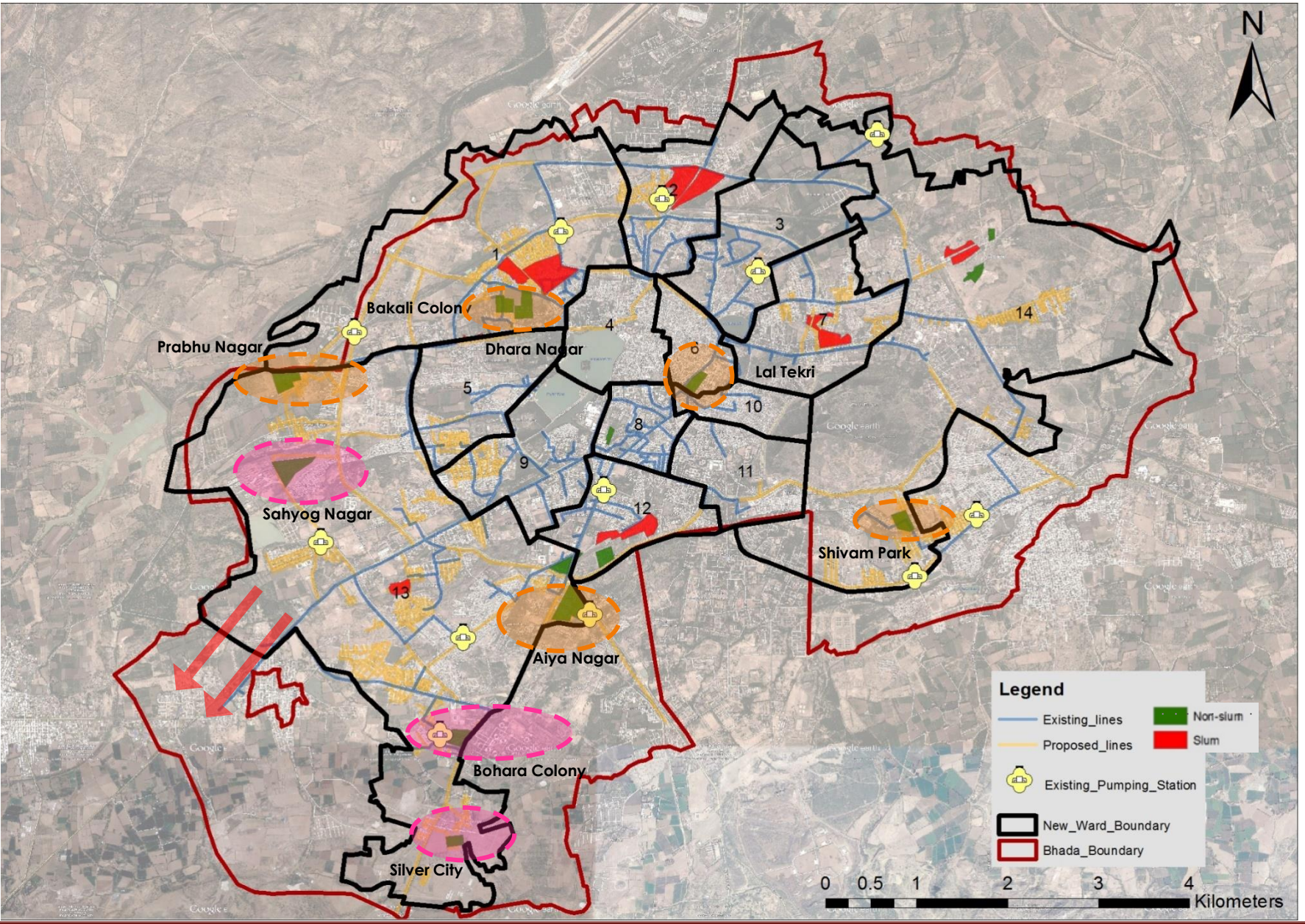
Despite of Bhuj having 72 % coverage of Sewer lines, **Why are the Septic Tanks not connected to Sewerage lines ??**

Level Difference for connection of Septic Tanks to Sewer lines

No sewer lines in the vicinity of Septic Tanks

Unwillingness to connect to Sewer lines due to initial connection charges & backflow of sewage

Areas with No Sewer Lines



Areas with Proposed Sewer lines in the vicinity

Areas with sewer lines but not connected

New Growth Areas

Source: Primary Survey in Bhuj, 2016

Areas with No Sewer Lines

SBM recommends that any WW generator within 30m distance of UGD should connect to the sewer line

User Perspective

	Connecting to Conventional Sewer network	On Site Sanitation System
Capital Investment	₹ 18,900 *Laying of sewer line + Connection fee*	₹ 16,800 *Construction of Septic Tank + Soak Pit*
O & M Cost	₹ 1100 per annum *Annual Sewerage fee + Misc. Repairs*	₹ 200 per annum *Cleaning & Desilting of Septic tank*

Source: SBM Guideline, SOR, GWSSB

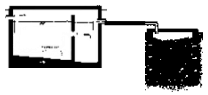
Areas with No Sewer Lines

SBM recommends that any WW generator within 30m distance of UGD should connect to the sewer line

User Perspective

Connecting to Conventional Sewer network

On Site Sanitation System



Other Concerns

- Availability of Flushing water
- Obtaining of Connection Permission from BNP
- Probability of backflow of sewage in premises
- High Repair cost in case of damage

- Available area for construction
- Higher Dependency on BNP for Maintenance

Source: SBM Guideline, SOR, GWSSB

Existing Areas with No Sewer Lines

Municipality Perspective

Conventional Sewer network

Capital Investment	₹ 32.5 Lakhs per Km *Expansion of Conventional Sewerage Network*
O & M Exp.	₹ 0.15 L per annum *Operations of Sewerage Pumps* + ₹ 1.2 L per annum *Op. & Maint. of Sewer lines* ₹ 1.35 L per annum
Revenue	₹ 0.65 L per annum *Sewerage Charges + Fees*

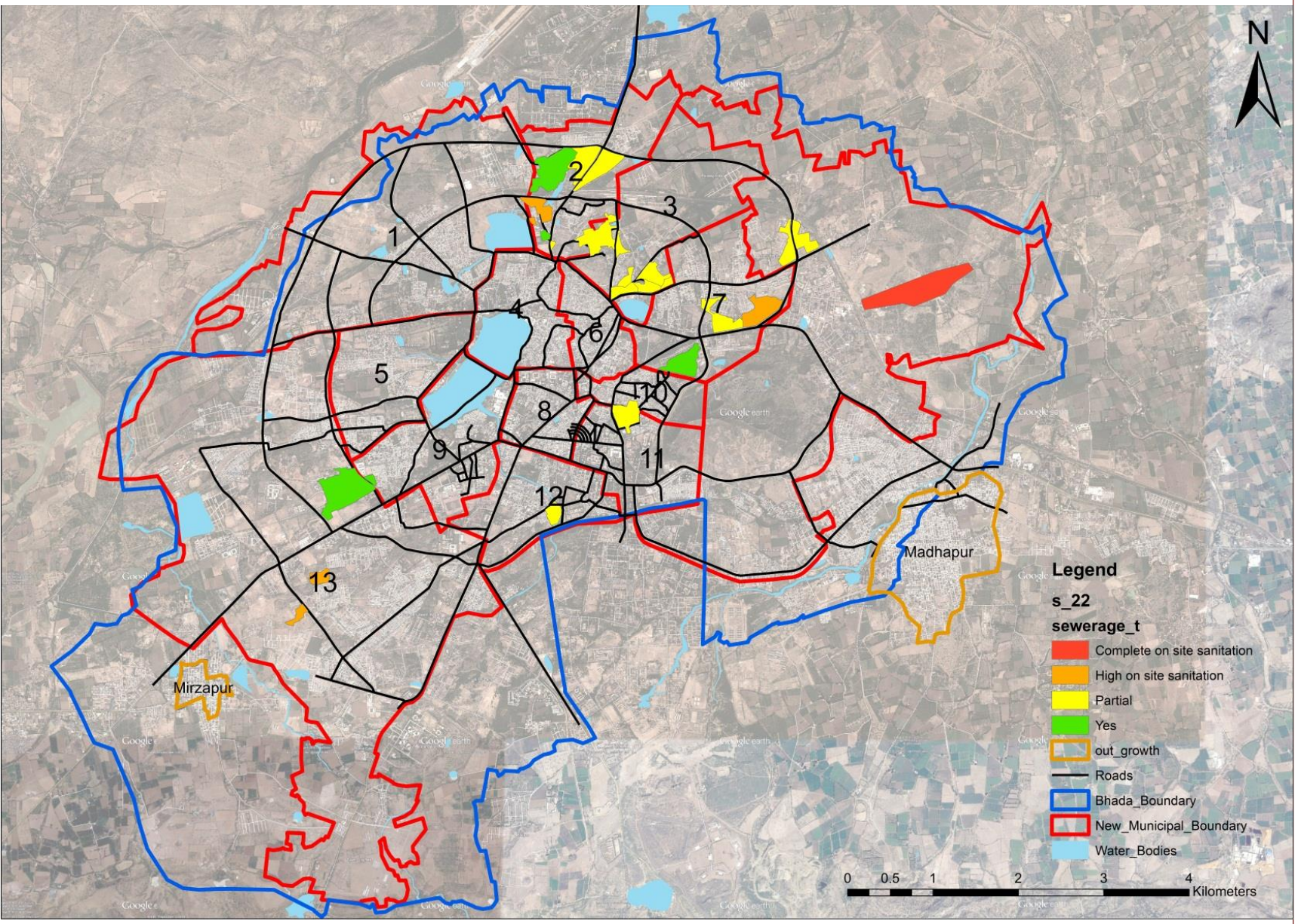
Other Concerns

- High Initial Capital Cost
- Requires experts for Design & Construction
- Higher Staff strength for O & M of sewerage system
- Frequent Inspections for smooth functioning
- Minimum velocity of flow to be maintained
- Difficulty in Extending the network

Source:

On-Site Sanitation in SLUMS

Waste Water



SEWER CONNECTION TYPOLOGY

- CONNECTED WITH SEWER LINE
- PARTIALLY CONNECTED
- HIGH ON-SITE SANITATION
- COMPLETE ON-SITE SANITATION

Source: Urban Setu, Primary Survey

Waste Water

PRESENT SCENARIO

- Sewer overflow and chock up
- Construction of soak pits

Source: Primary Survey in Bhuj, 2016; Picture courtesy; Niyati

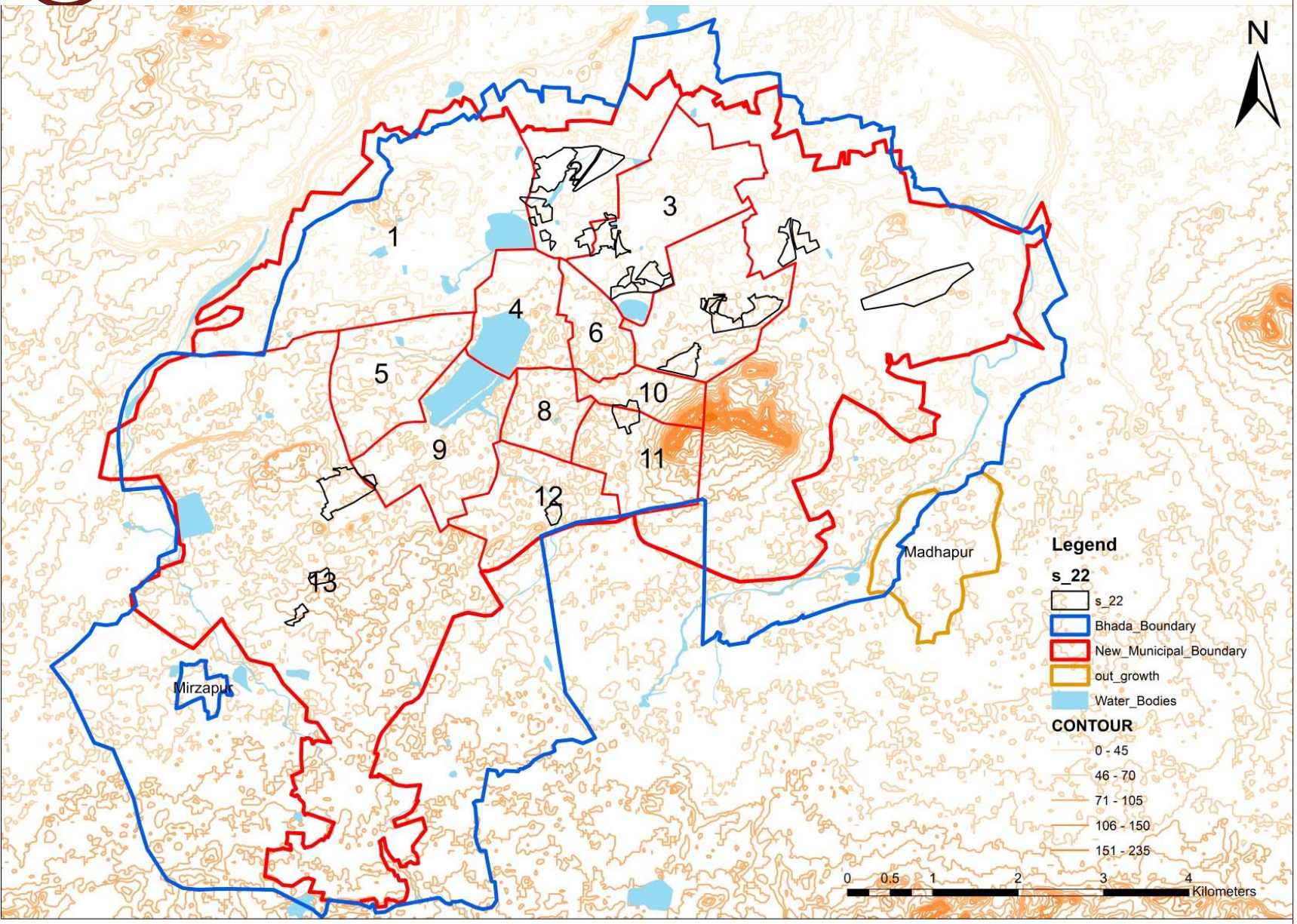
NGSP toilets

- With the goal of becoming open defecation free city.
- 8441 individual toilets has been constructed.

Source: Primary Survey in Bhuj, 2016; Picture courtesy Niyati

Waste Water

CONTOUR ELEVATION



Source: Primary Survey in Bhuj, 2016; Picture courtesy Niyati

COMMON SEPTIC TANK

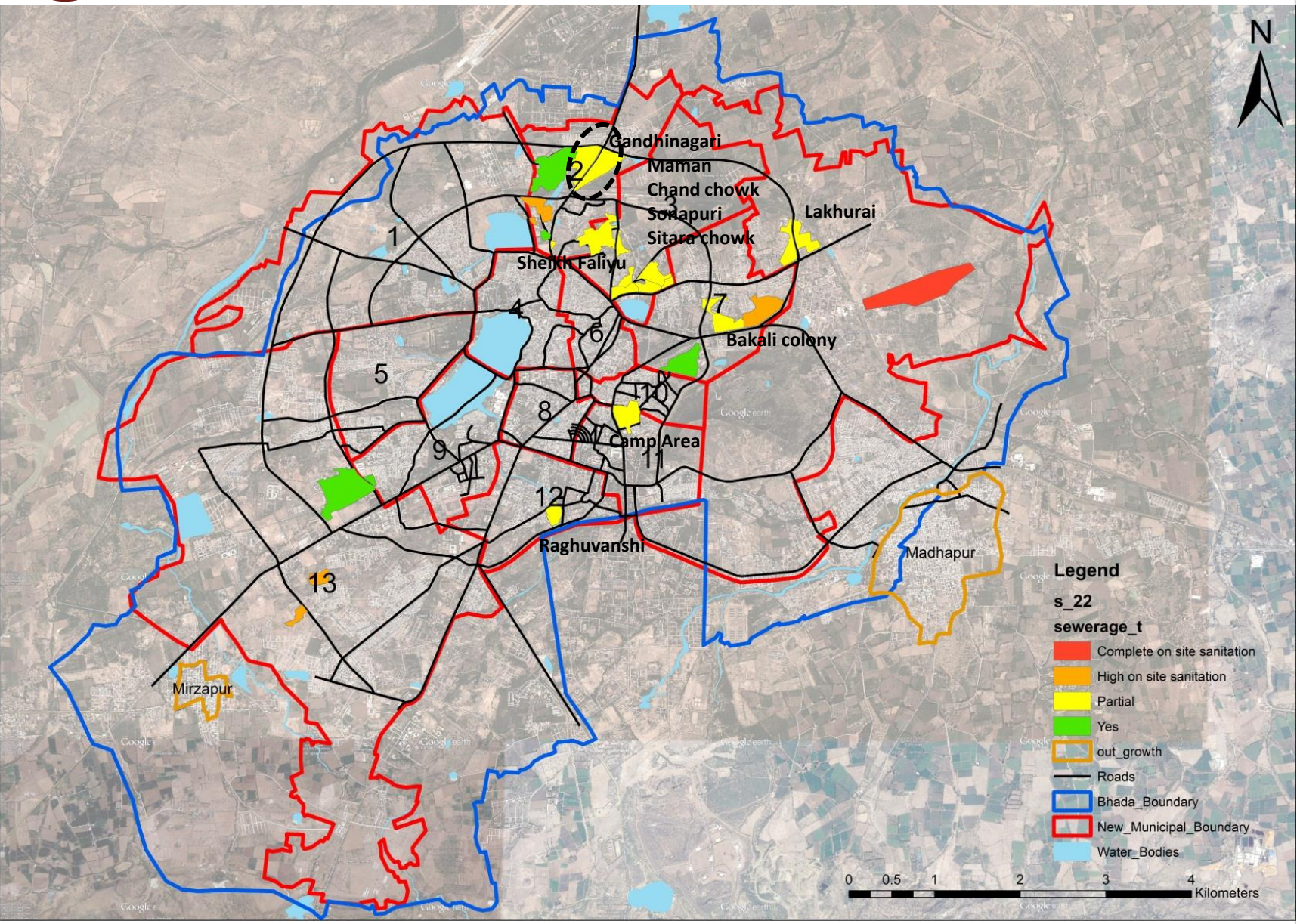
- **Ward 2**

  Police quarters 36

  Police quarter- C lane

Source: Primary Survey in Bhuj, 2016; Picture courtesy Niyati

Waste Water



SEWER TYPOLOGY

PARTIALLY CONNECTED

- **Gandhinagari**

Ward 2

Population- 1956

No of HH- 403

Source: Primary Survey in Bhuj

SEWER TYPOLOGY

PARTIALLY CONNECTED

- **Gandhinagari**

Ward 2

Population- 1956

No of HH- 403

Source: Google Images, Picture Courtesy, Niyati

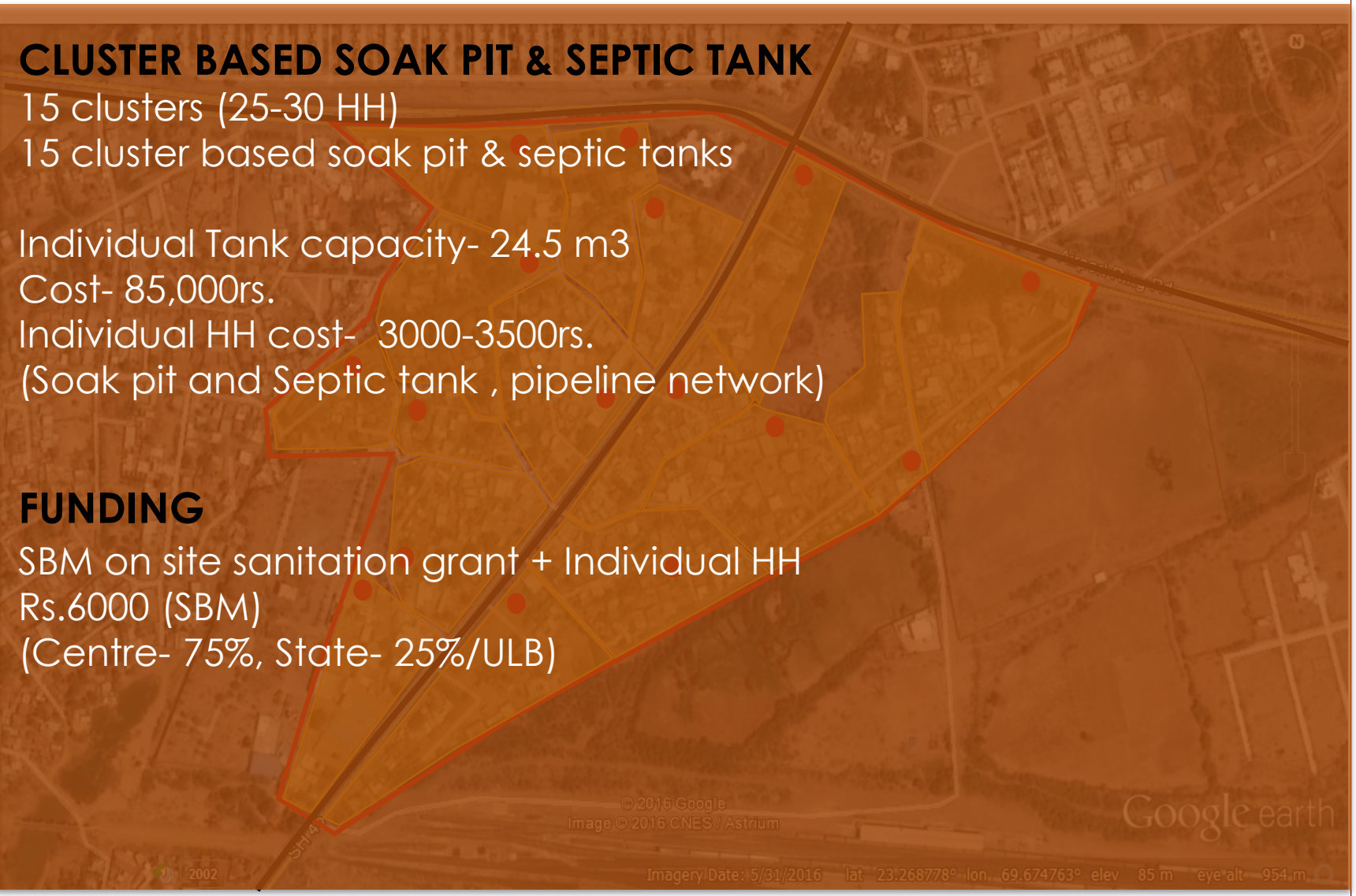
CLUSTER BASED SOAK PIT & SEPTIC TANK

15 clusters (25-30 HH)
15 cluster based soak pit & septic tanks

Individual Tank capacity- 24.5 m3
Cost- 85,000rs.
Individual HH cost- 3000-3500rs.
(Soak pit and Septic tank , pipeline network)

FUNDING

SBM on site sanitation grant + Individual HH
Rs.6000 (SBM)
(Centre- 75%, State- 25%/ULB)



SEWER TYPOLOGY

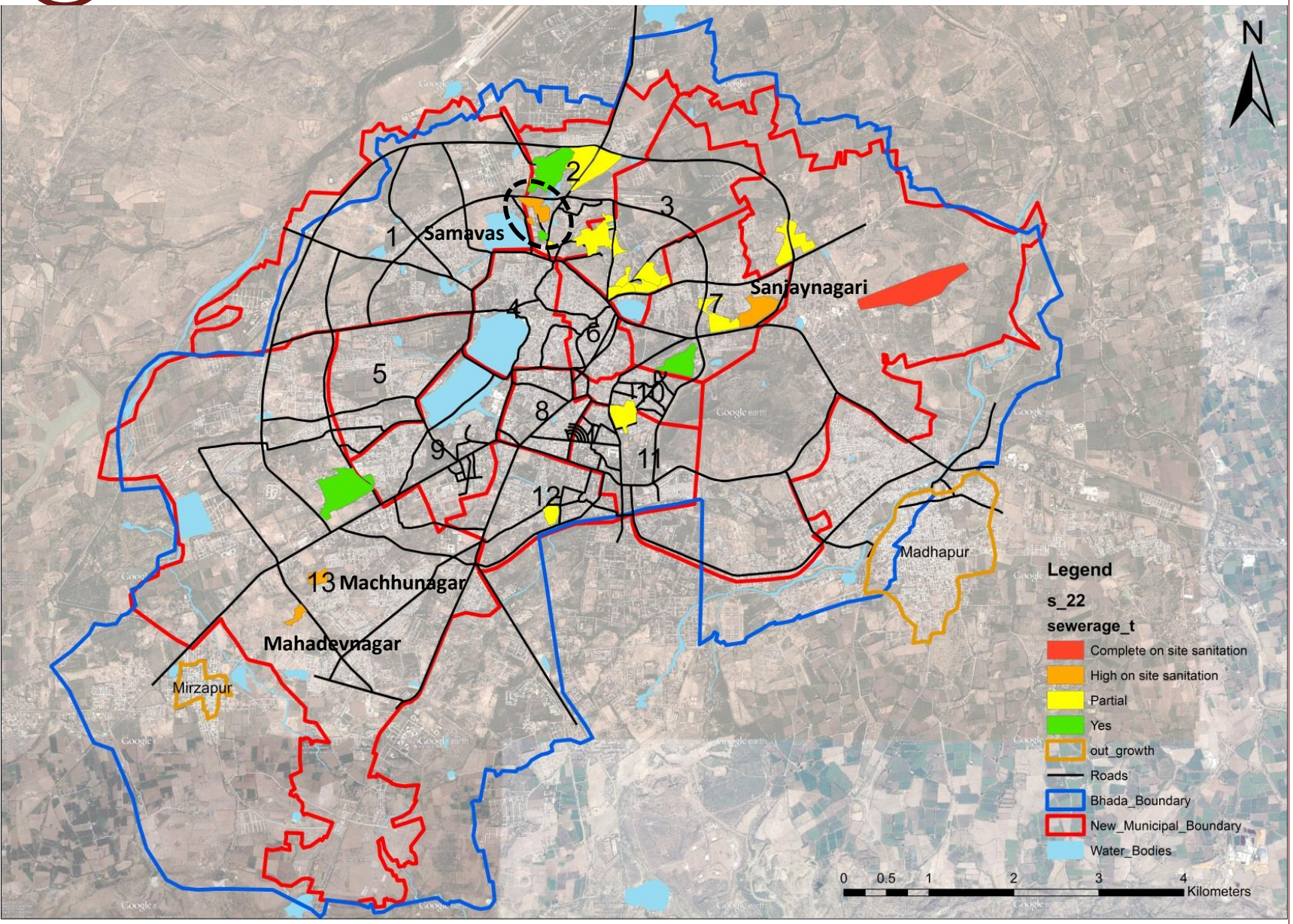
PARTIALLY CONNECTED

- **Gandhinagari**

Ward 2
Population- 1956
No of HH- 403

OPTION 2

Waste Water



SEWER TYPOLOGY

HIGH ON SITE CONNECTIONS

- **Samavas**

Ward 2

Population- 783

No of HH- 185

Source: Primary Survey in Bhuj

INDIVIDUAL SOAK PIT & SEPTIC TANKS

185 tanks
Capital investment – Rs.16,800 (per HH)
Operation and maintenance – 200-300rs /2 year

FUNDING

Grant + individual share
Rs.6000 (SBM)
Toilet + Individual Tank
(Centre- 75%, State- 25%/ULB)

OPTION 1

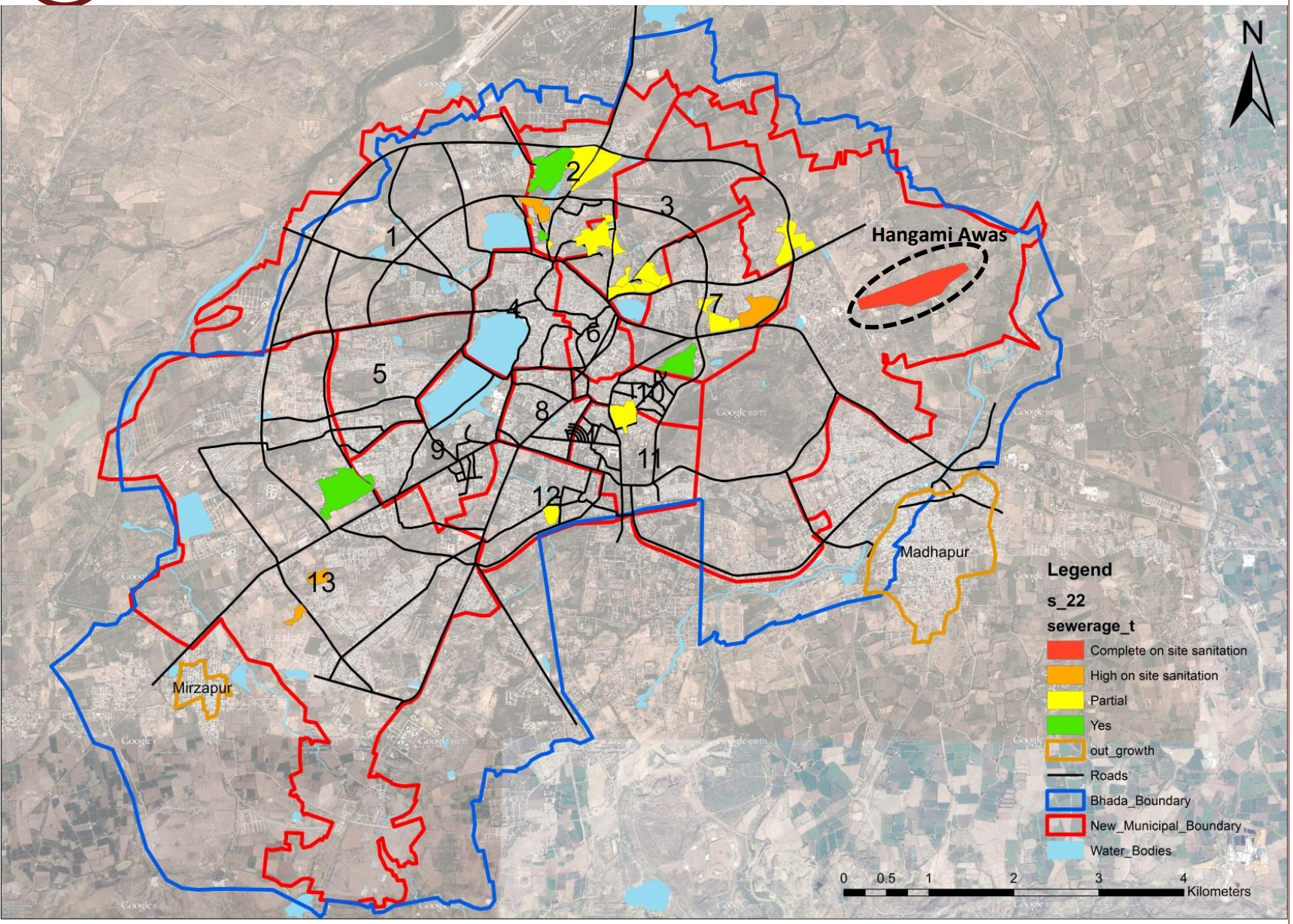
SEWER TYPOLOGY

HIGH ON SITE CONNECTIONS

- **Samavas**

Ward 2
Population- 783
No of HH- 185

Source: Guidelines for Swachh Bharat Mission (SBM), Ministry of Urban Development



SEWER TYPOLOGY

COMPLETE ON SITE CONNECTIONS

- **Hangami Awas**

Ward 14

Population- 305

No of HH- 100

Source: Primary Survey in Bhuj

INDIVIDUAL SOAK PIT & SEPTIC TANKS

100 tanks

Capital investment – Rs.16,800 (per HH)

Operation and maintenance – 200-300rs /2 years

FUNDING

Grant + individual share

Rs.6000 (SBM)

Toilet + Individual Tank

(Centre- 75%, State- 25%/ULB)

SEWER TYPOLOGY

COMPLETE ON SITE CONNECTIONS

- **Hangami Awas**

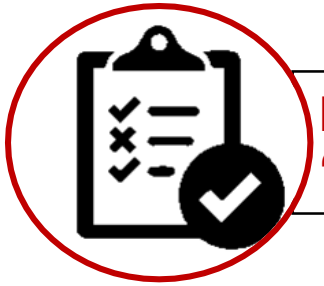
Ward 14

Population- 305

No of HH- 100

Source:Guidelines for Swachh Bharat Mission (SBM), Ministry of Urban Development

Implementation framework under SBM



Preparation of DPR "SLUM SANITATION PLAN"

Nagarpalika/ NGO/ Private party

- Scope of work
- Strengthening the existing data
- Technology option
- FINAL SLUM SANITATION PLAN

COMMUNITY MOBILIZATION

NGO

- Identification of NGO
- Awareness generation and launch of 100% sanitation campaign
- Identification of barriers in implementation
- Action plan with alternative financing options

VERIFICATION WITH MUNICIPALITY

NGO & Nagarpalika

- Status report
- Final draft
- Final sanitation plan with contract details
- Suggestions for the action plan

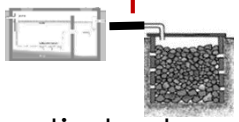
Source: Guidelines for Swachh Bharat Mission (SBM), Ministry of Urban Development

CONVEYANCE OF SEPTAGE

Emptying of tanks

BNP owned emptier can empty 7 tanks / day

2000 HH having On-Site Sanitation



~1200 Single Pit System (every 33 days)

800 Septic tanks (Once in 3yrs.)

CASE 1 :

Business As Usual

All Single Pits are Upgraded to Septic tanks

- No. of tanks to be cleaned/year: 2000/3 (667 Nos.)
- Existing emptier is enough to address the complaints

Tanks required to be Emptied / day

38 Nos.

NO NEW INVESTMENT REQUIRED

To clean 38 tanks, ***4 new emptiers*** *will be required*

1. Nagar Palika procures & Operates
2. Private Party is given contract to procure, operate & maintain

Option 1: BNP procuring & operating 4 additional Septage Emptier

₹ Capital Cost = 22 Lakhs

O&M Cost = 21.5 Lakhs (annually)

Est. Revenue = 13.2 Lakhs (annually from User Charges)

BNP incurs expense of 8.3 Lakhs p.a.

Benefits	Drawbacks
• Experience in operations • Familiarity of Area • Known complainants • Asset Creation	• Capital for Investment • Difficulty in procuring Emptiers • Shortage of Staff • Additional O & M Cost

Funding Options

Capital Investment — ₹ 22 Lakhs

GoI Contribution — ₹ 11 Lakhs (50% of Project Cost)

20% + 40% + 40%

Release of 11 lakhs in Instalments

GoG Contribution — ₹ 8.8 Lakhs (40% of Project Cost)

BNP Contribution — ₹ 2.2 Lakhs (10% of Project Cost)

Source: Primary Survey in Bhuj, 2016; AMRUT Guidelines

Emptying of tanks

Option 2: Private Agency to Procure, Operate & Maintain the Emptier

BNP floats Tender for Emptying of Septic tanks

↓

Appoints the Agency for emptying

Details of Contract

- Cost of work: 30 lakhs
- Duration: 1 year
- Areas of Operation: Entire Bhuj (for all 14 wards)
- Vehicles required: 4 Emptiers (5000 Lits each)
- **Payment method: Fixed fee per cleaning @ Rs.300**
- Transportation Cost: Included in the Fee
- Disposal of Septage: At BNP specified manholes/Treatment facility

Scope of Work:

- Maintaining & Updating of Database of every HH Septic tank cleaned.
- Use of Mechanised Desludging machinery for Emptying process
- Cleaning of the area in case of any spillage of Septage
- Co-ordination with BNP & treatment facility service provider
- Maintaining vehicle trip register of every emptying service
- Faecal Sludge to be disposed at Treatment facilty/ BNP specified manholes only
- Submission of monthly report of services to BNP

Source:

TREATMENT & DISPOSAL

Treatment of Septage

MoUD Septage advisory note recommends Sludge Drying Beds for treatment of Septage for Cities like Bhuj

Option 1: Sludge Drying Cycle 15 days

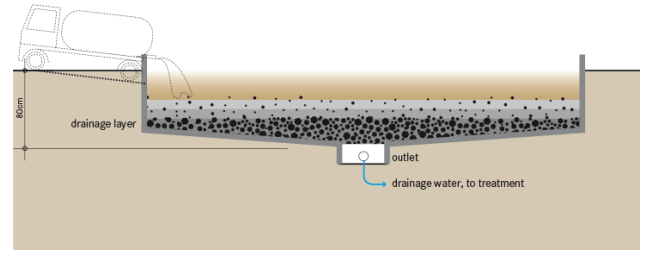
Unplanted Sludge Drying bed			
Sr.No.	**Description**	**Qty.**	**Unit**
1	Quantum of Sludge to be treated	35	Cum./day
2	Single Drying Bed area (12m x 10 m)	120	Sq.mts.
3	Max. septage depth	0.3	Metres
4	Capacity per bed	36	Cum.
5	Sludge drying cycle	15	days
6	Total No. of sludge drying beds required (SDB)	15	Nos
7	Total site area (SD Bed area + 10% SD bed area + area of office and dried storage + area of ancillary units)	**2430**	Sq.mts.

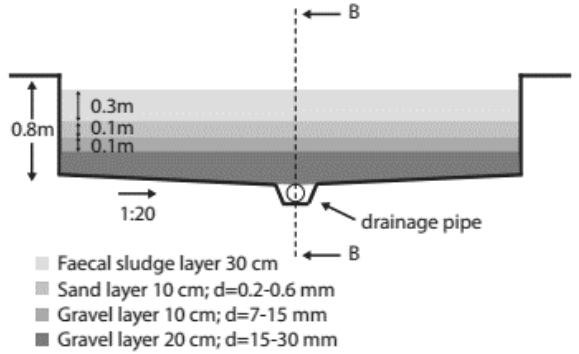
Option 2: Sludge Drying Cycle 2 years

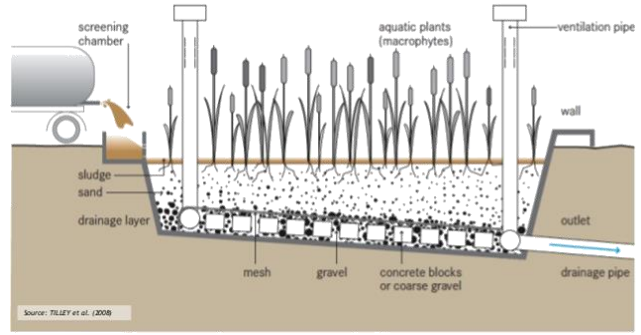
Planted Sludge Drying bed			
Sr.No.	**Description**	**Qty.**	**Unit**
1	Quantum of Sludge to be treated	35	Cum./day
2	Single Drying Bed area (12m x 10 m)	120	Sq.mts.
3	Max. septage depth	1.5	Metres
4	Capacity per bed	180	Cum.
5	Sludge drying cycle	2	Years
6	Total No. of sludge drying beds required (SDB)	61	Nos
7	Total site area (SD Bed area + 10% SD bed area + area of office and dried storage + area of ancillary units)	8784	Sq.mts.

Capital Cost = 38 Lakhs

O&M Cost = 7.8 Lakhs (annually)



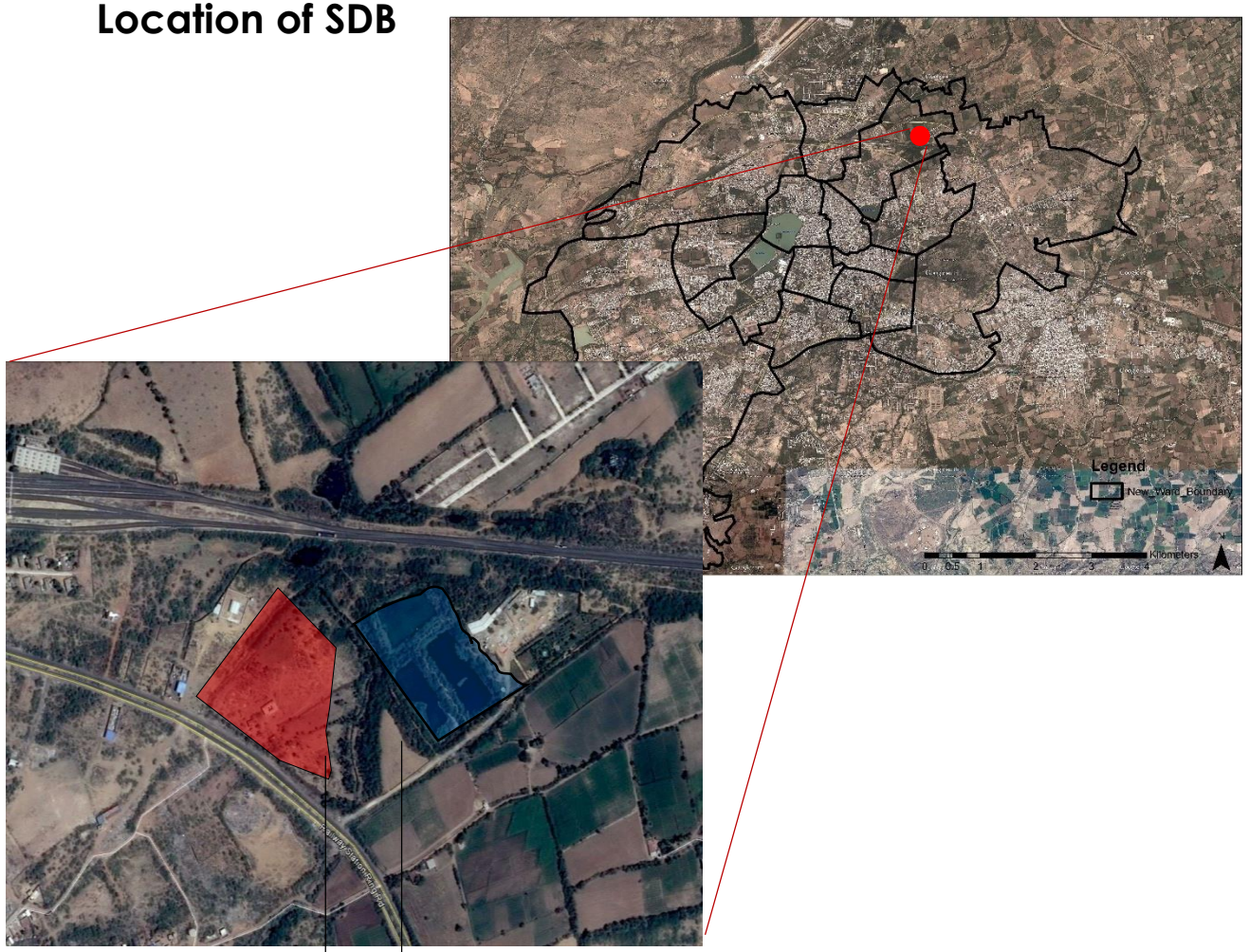




Source: PAS, Exploring PPP opportunities for smaller towns in Maharashtra, 2014.

Treatment of Septage-Co-Composting

Location of SDB



Co-composting

- Faecal Sludge Drying
- Windrows Composting of dried FS + Organic Waste

Dried Sludge from SDB: 7 Cum. / month

FS : Organic Waste mixing ration = 1 : 3

Organic Waste required : 21 Cum. / month

Raw compost production : 28 Cum./month

(Assuming density as 0.5)

Qty of Compost Produced : 14 MT / Month

Transfer of Compost to Proposed Zero Waste Centre near GIDC

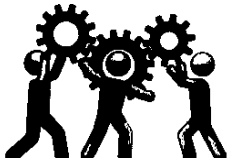
Source: Co-composting of Municipal Solid Waste & Faecal Sludge in Kushtia Bangladesh, Enyetullah Iftekar

Upgradation of the Pit System & Systematic Emptying of Septic tanks requires special Awareness drive

Target Groups

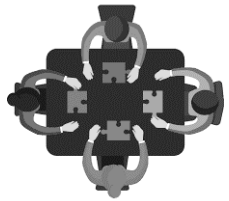
- Households with Single Pit System
- Upcoming new growth areas
- Local Contractors

Implementing Actors



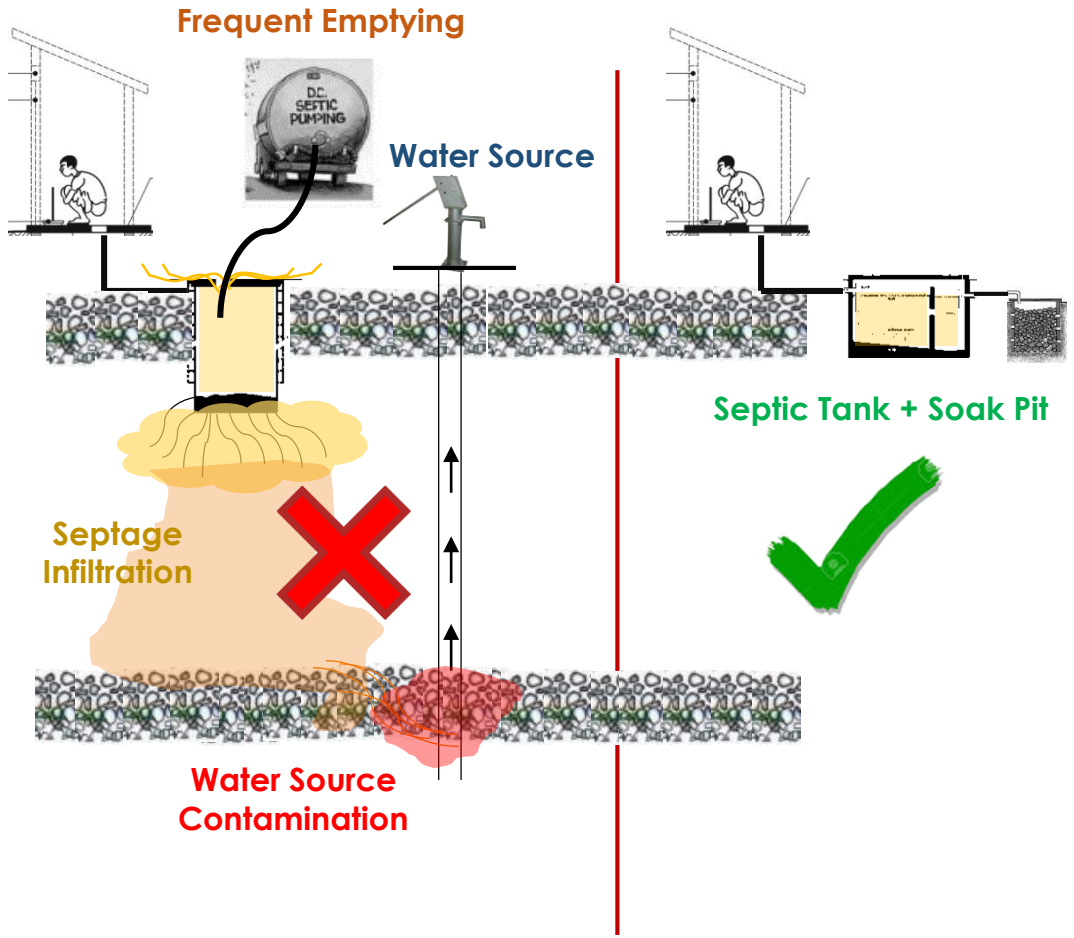
- BNP
- Education Institutes
- NGO's
- Local Cable Operators
- Religious Institutes
- Political Leaders

Mode of Implementation



- Electronic Media
- Print Media i.e. Posters
- Local Cable Channel
- Meetings & Fairs
- Printing on the back of Property Tax Bill

Sample Posters



Existing provisions in DCR of BDA

- Septic Tanks / Soak Pit / On-Site Sanitation to be constructed only after permission from Corporation
- Standard size of Septic tanks to be laid down based on users
- De-sludging of Septic tanks to be Mechanical
- Levying of Sanitation tax for regular cleaning of Septic tanks
- Permission of OSS / sewer connection to be given in tandem with water connection

Proposed Amendments in DCR of BDA

- Septic Tank should be at least 12mts away from any drinking water source
- Septic tanks should be 2mts away from any habitable structure
- No legal provisions for Septage management
- No Building regulations to check the Design & Construction of the OSS

Public Health Byelaws-Ahmedabad

- Waste water generators will have to submit Sewer Plans signed by Professionals Engineers registered with Corporation to obtain necessary approval for connection to Municipal Sewer (within 30mts)
- Septic Tank / Soak Pit / On-Site Sanitation to be constructed only after permission from Corporation
- No Effluent from Septic tank to be allowed in Open Drain or Water Body
- De-sludging of Septic tanks to be Mechanical

Model Building Bye Laws-2016

- **Buildings** having minimum discharge of **10KLD** should incorporate **Waste Water Recycling system** and use it in Horticulture.

Source: BHADA-DCR, Public Health Byelaws-Ahmedabad, Model Building Byelaws-2016

Waste Water Reuse

Projects

AMRUT

- Recycling and reuse of wastewater

SBM

- In order to reduce net water demand, recycling and reuse of wastewater must be part of the water-sewerage system planning

SLB indicator – MoUD

- Extent of reuse and recycle of Sewage – 20%

National Urban Sanitation Policy (NUSP), 2008

- Endorses reuse of reclaimed water, and recommends a minimum of 20% reuse of wastewater in every city

Water (Prevention and Control of Pollution) Act of 1974

- Industries and local bodies are mandated to treat wastewater to the defined quality level before discharge (norms are given)

National Water Policy (2012)

- Reuse of reclaimed water as an important factor for meeting environmental objectives and suggests preferential tariff to incentivise reclaimed water over freshwater.

Need of Project

Global Goals
Amrut Reforms
Bhuj- A water scarce region

Broad Scope of Reuse

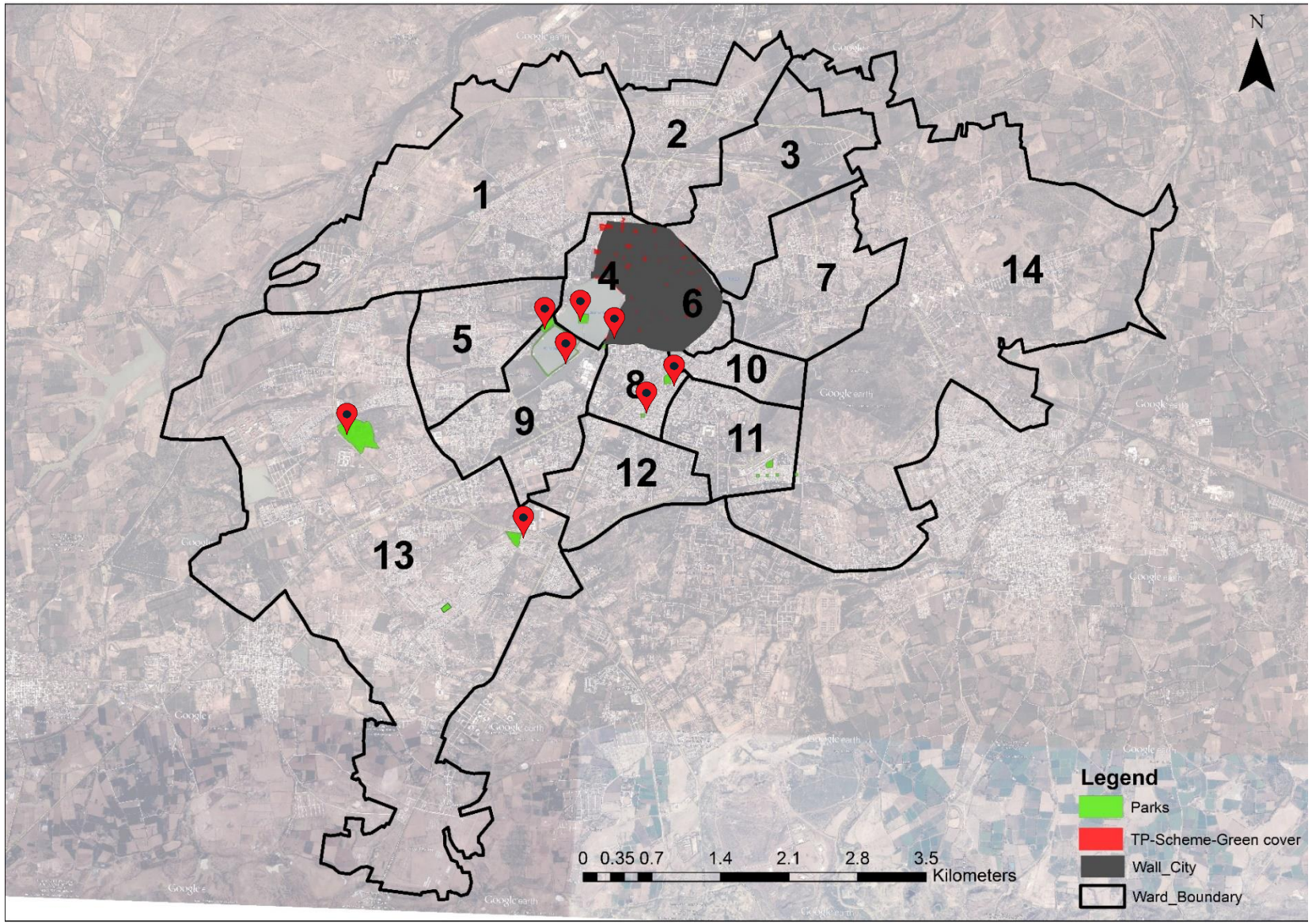
Industries
Streets
Lakes
Parks
Institutions

Source: MOUD.gov.in

At present, **0%** sewage is treated in city

	Direct uses	Indirect uses
Treated sewage	-	-
Untreated sewage	Agriculture irrigation 	Lakes Eg. Desalsar lake

Present Practice
Intervention



Khengarji Park
Rajendra Park
Walk way
Madansinghji Park
Purshottam Park
Hill Garden
Dada Dadi park
Punit Van

8 Total

5 Managed by BNP

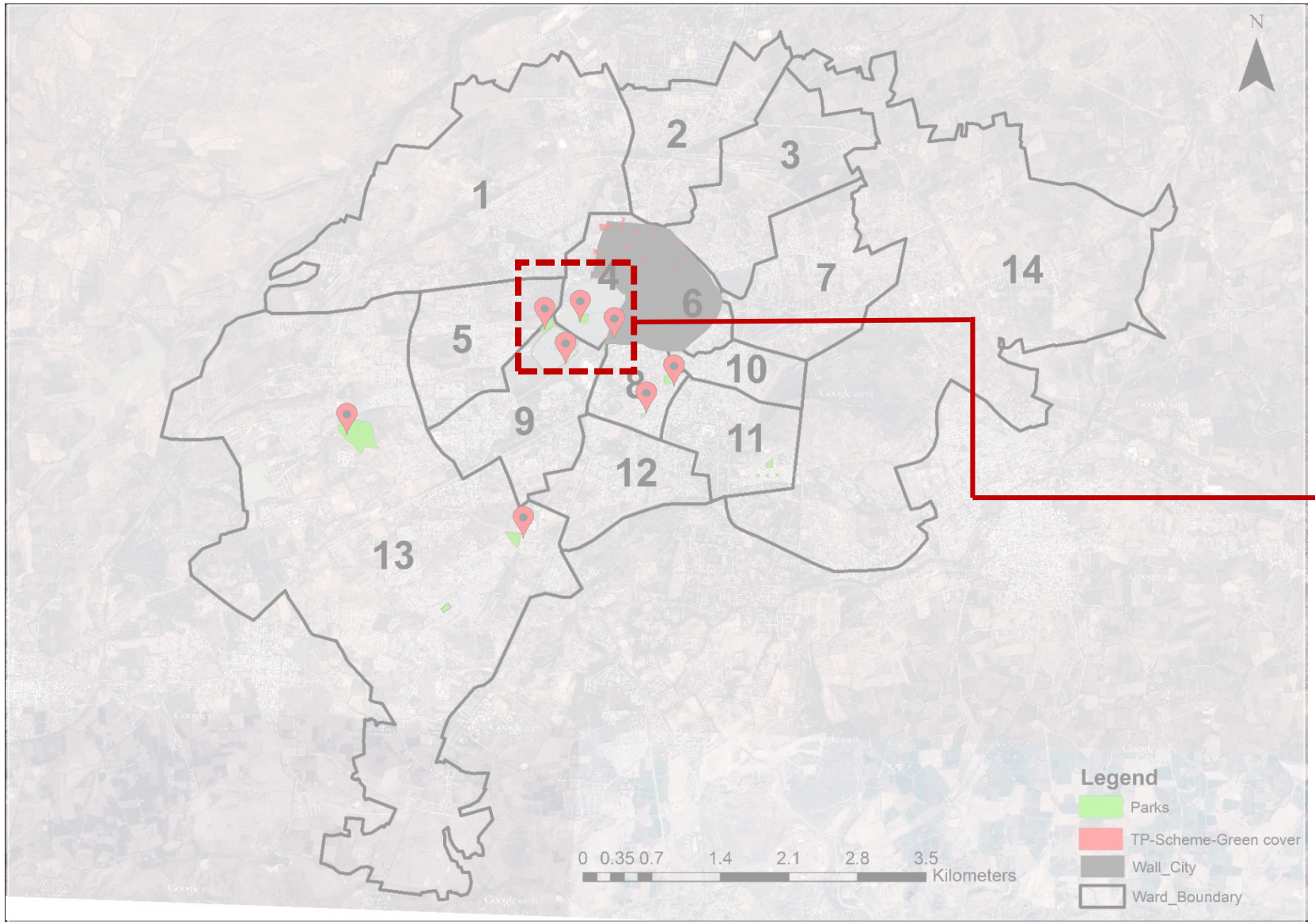
3 Active

Source: Primary Survey-BNP, Decentralized Waste water treatment and Reuse-CSE

Waste Water

Present Practice

Intervention



Khengarji Park
Rajendra Park
Walk way

Madansinghji Park
Purshottam Park
Hill Garden
Dada Dadi park
Punit Van

8 Total

5 Managed by BNP

3 Active

Reuse in Parks

Option 1
Bhuj Nagar Palika

BNP
WWT Provider

	Funding / Scope of Work
BNP	Capex Feedback monitoring
WWT	O&M Expense

Cost Benefits

Present ₹ 33.09 — Cost of Treating Waste Water **Per KL** — ₹10.39

Savings on Electricity cost

Case 1: Business as usual	Case 2: O&M by WWT provider
Depletion of water level **1.5 m/Year**	**IRR: 10.06%**
NPV ₹ -5.2 Lakh	**NPV ₹ 765**

It will take at least **7 Years** to recover capex form savings

Option 2
Private Agency
(BOT)

Option 3
Private agency + BNP
(PPP)

Source: Mother Dairy, Ahmedabad | Amul Parlor, Ahmedabad

Option 1
Bhuj Nagar Palika

Option 2
Private Agency
(BOT)

Option 3
Private agency + BNP
(PPP)

BNP
Amul
WWT Provider

BOT	Funding / Scope of Work
BNP	Feedback Monitoring
Amul	Capex O&M Expense

Cost Benefits

BNP
₹ 1.26 Lakh monthly

25% Electricity & Repairing

75% Staff

Amul
Pessimistic Approach

IRR
-0.11%

A loss of **30K** Monthly

Amul Perspective

1. Agenda is to promote AMUL and not focused on making profit from parlour.
2. Only 10% of their consumers were from the park- **Location is crucial**

Sales

Location

Profit	**Category A**
No Margin	**Category B**
Loss	**Category C**

Margin

Manufacturer
Distributor 8%
Retail 7%
Bhuj Specific

Income		Monthly		
Amul Parlour		Category A- Rs 100000/day	Category B- Rs 80000/day	Category C- Rs 20000/day
Margin	5%	₹ 150,000.00	₹ 120,000.00	₹ 30,000.00
	10%	₹ 300,000.00	₹ 240,000.00	₹ 60,000.00
	15%	₹ 450,000.00	₹ 360,000.00	₹ 90,000.00

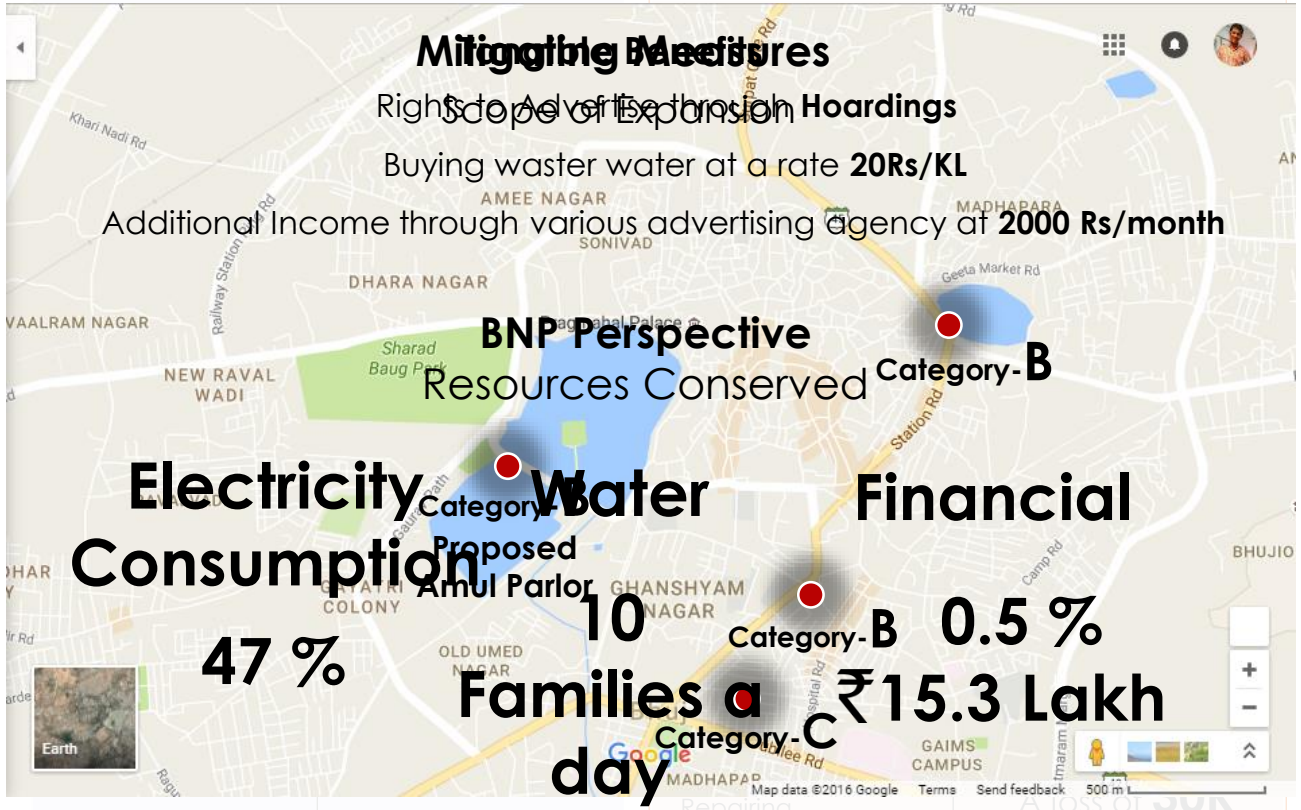
Source: Mother Dairy, Ahmedabad | Amul Parlor, Ahmedabad

Waste Water

Option 1
Bhuj Nagar Palika

Option 2
Private Agency
(BOT)

Option 3
Private agency + BNP
(PPP)



BNP
Amul
WWT Provider

PPP	Funding / Scope of Work
BNP	Feedback Monitoring Partly Funding Capex
Amul	Partly Funding Capex O&M Expense

Amul Cost Benefits

Central : State : ULB | 50 : 40 : 10

Amul	BNP
Pessimistic Approach IRR **0.247%**	**₹ 1.26** Lakh monthly **25%** Electricity & Repairing **75%** Staff

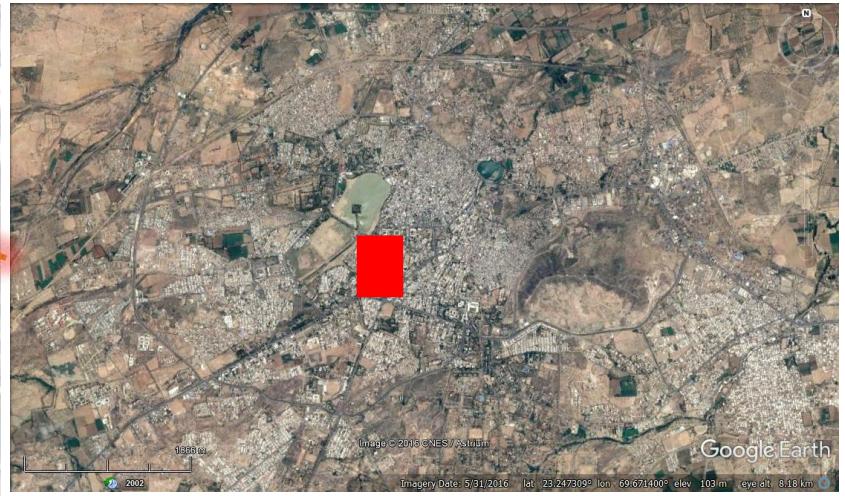
Intangible Benefits

Building up Goodwill in public interest-**CSR**

Promoting the Brand at no cost.

Source: Mother Dairy, Ahmedabad | Amul Parlor, Ahmedabad | Hoarding Board Agreement-BNP

Waste Water Reuse in Institutions



Institution buildings – 10
Hostels – 2

Area available – 750 sq m

Water requirements
- Institution buildings – 45 lpcd
- Hostels – 135 lpcd

Water requirements
- Institution buildings – 105 KLD
- Hostels – 24 KLD

Flushing requirement – 20 lpcd

Flushing requirement – 50 KLD

Source:

Technology	Area/ 50 KL	Capital cost(Rs/ 50 KLD)	O & M cost (Rs/ 50 KLD/Year)
Soil Biotechnology	500 sq m	13 lakhs	1 lakhs
Fixed film Bio filter technology	125 sq m	18 lakhs	1.5 lakhs
DEWATS	500 sq m	25 lakhs	2.85 lakhs
Phytorid	100 sq m	10 lakhs	1.5 lakhs

Source: **Decentralized wastewater treatment and reuse by CSE**

Cost	Through dual plumbing	Through tanker for other uses
Capital cost	20 lakhs	5 lakhs
O & M cost	20,000 rs/annum	2 lakhs /annum
Revenue		

	Standards	Demand	Rs/day
Total water demand for institution	As per 45 lpcd	130 KLD	500 Rs
Flushing demand	As per 20 lpcd	50 KLD	194 Rs
Other than flushing demand	Remaining 25 lpcd	80 KLD	306 Rs

Dual plumbing + 1 tanker (optional)

After the operation of technology, the BNP would be saving 70,000 / annum

For dual plumbing

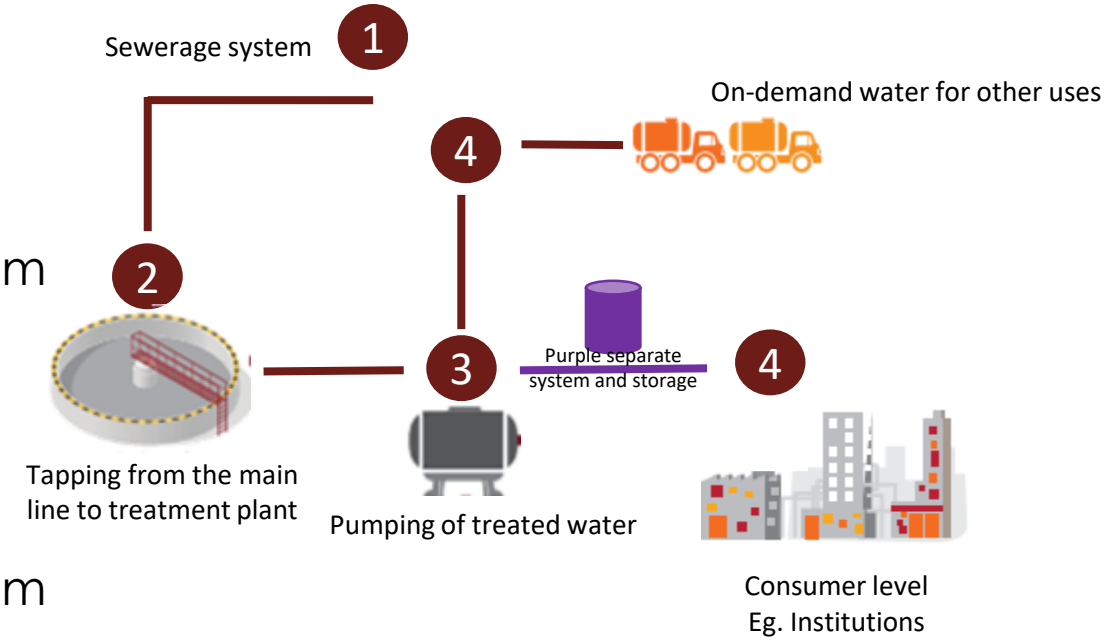
Total capital cost including technology cost – 30 lakhs

Total O&M cost including technology cost – 1.7 lakhs/annum

Including tanker cost (As on demand)

Total capital cost including technology cost – 35 lakhs

Total O&M cost including technology cost – 3.7 lakhs/annum



Source:

Total capital cost including technology cost – 38 lakhs

Total O&M cost including technology cost – 3.2 lakhs/annum

Option 1

- If BNP handles the project

Atal Mission for Rejuvenation and Urban Transformation

- Central 50% - 21 lakhs
- State 40% - 16 lakhs
- ULB 10% 4 lakhs

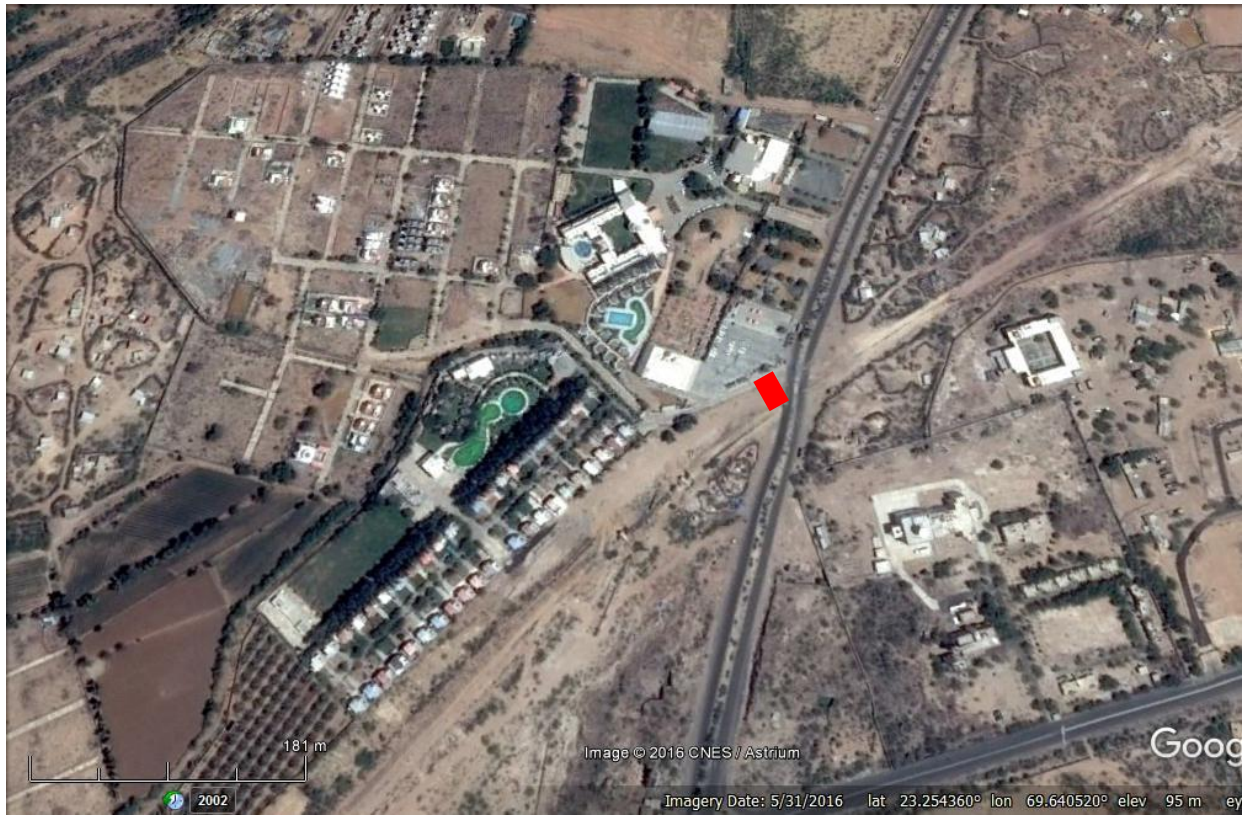
Option 2

- If BNP handover the operation and maintenance to the private sector,
- Central 50% - 21 lakhs
- State 40% - 16 lakhs
- Private 10% - 4 lakhs

Certain incentives has to be given for private sector to operate
eg. Selling of treated water

For the existing situation, at individual building level it can be done if it is used as some other non-portable uses but at a community level it is difficult to execute

But, in the outskirts of the city or construction of new buildings, these kind of decentralised wastewater treatment can be used



Source:

Summary

PROJECTS	IMPLEMENTING AGENCIES	CAPEX (in lakhs)		OPEX (in lakhs)		REVENUE (in lakhs)		ULB SHARE
		PUBLIC	PRIVATE	PUBLIC	PRIVATE	PUBLIC	PRIVATE	
Public & School Sanitation	BNP Pvt. Contractor	-	-	-	-	-	-	-
Feasibility & Relevance of UGD	BNP NGO	57 (11.8 %)	-	69.5 (67.8 %)	-	63.4 (83 %)	-	-
On Site Sanitation	BNP	60 (12.4 %)	-	29.3 (28.6 %)	-	13.7 (18 %)	-	6
On Site Sanitation in Slums	BNP NGO Pvt. Contractor	330 (68.2 %)		-				-
Reuse of Waste water in Parks	BNP Pvt. Contractor	1.80 (0.4 %)	0.20	-	18.49	-	14.88	-
Reuse of Waste Water in Institutions	BNP NGO CSR	35 (7.3 %)	-	3.7 (3.6 %)	-	-	-	3.5

Total Project Cost 484 Lakhs

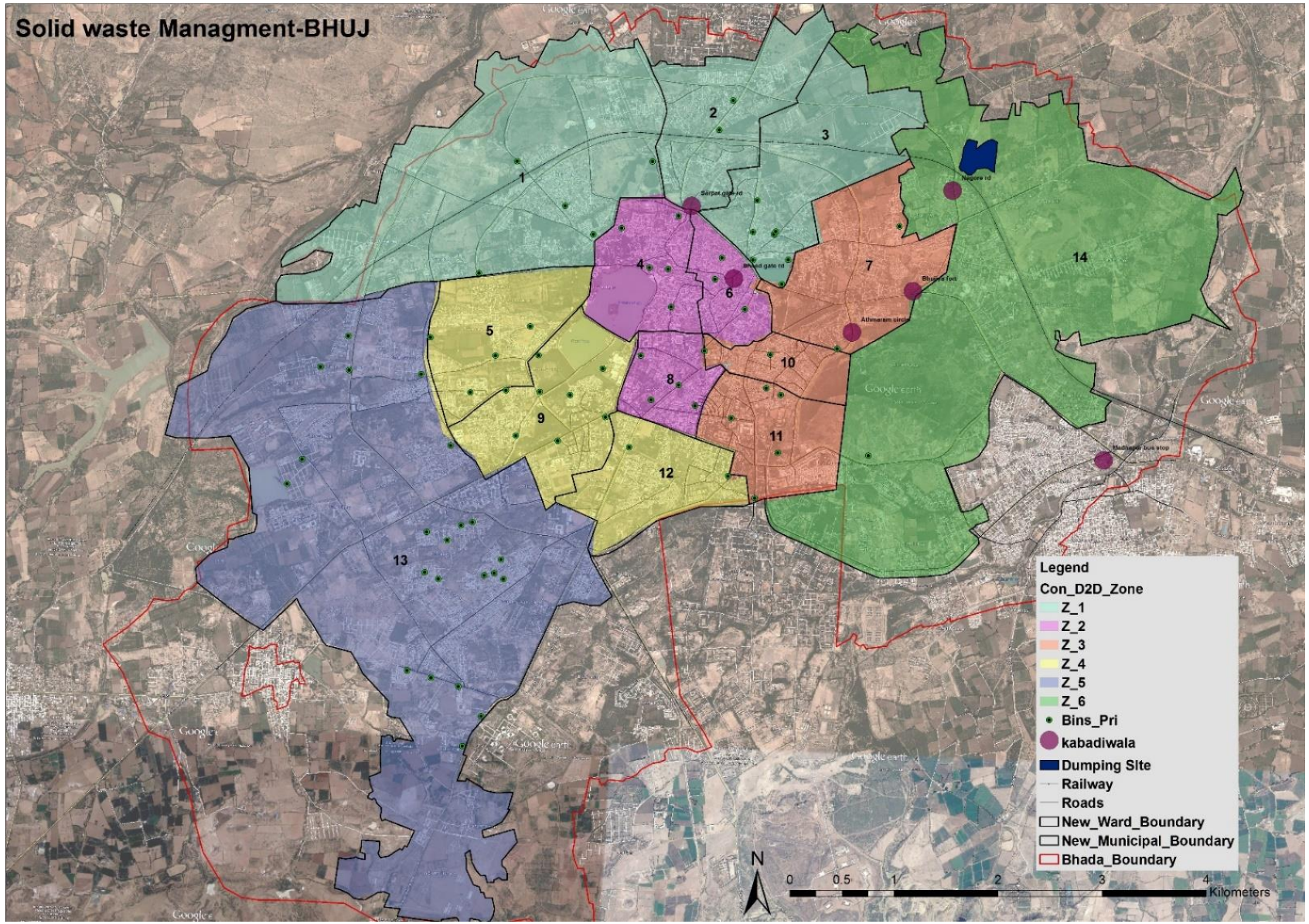
Project	Phase 1		Phase 2		Phase 3		Phase 4	
	2017	2018		2019		2020		2021
Decentralize WWT	DPR & Awareness Drive							
On-Site sanitation								
On-site sanitation Slums								
WW Reuse in Parks								
WW Reuse in Institutions								

SOLID WASTE MANAGEMENT

SOLID WASTE MANAGEMENT

Source Of Waste	Collection & Transportation	Secondary Storage	Waste Processing	Post Transportation	Safe Disposal
Household And Commercial Waste	 3 Pvt Contractor	 Community Bins	X	X	 Open Dumping
Street Sweeping	 1 Pvt Contractor	Directly Goes to			
Construction & Demolition Waste	NO COLLECTION				
Bio-Medical Waste	Detromect Pvt Agency				Incineration at Regional Level

PRESENT SCENARIO



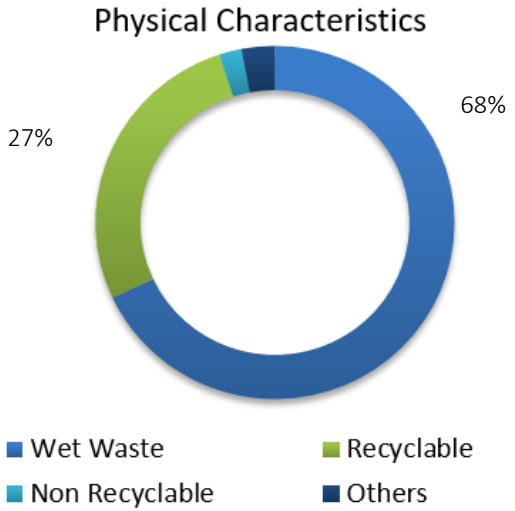
SOLID WASTE MANAGEMENT

D2D contract = 3 contractor
Collection –36 TPD
125 employees | 35 tractors
Community Bin = 88

Street sweeping contactor = 1
Collection – **47 TPD**
300 employees | 25 tractors

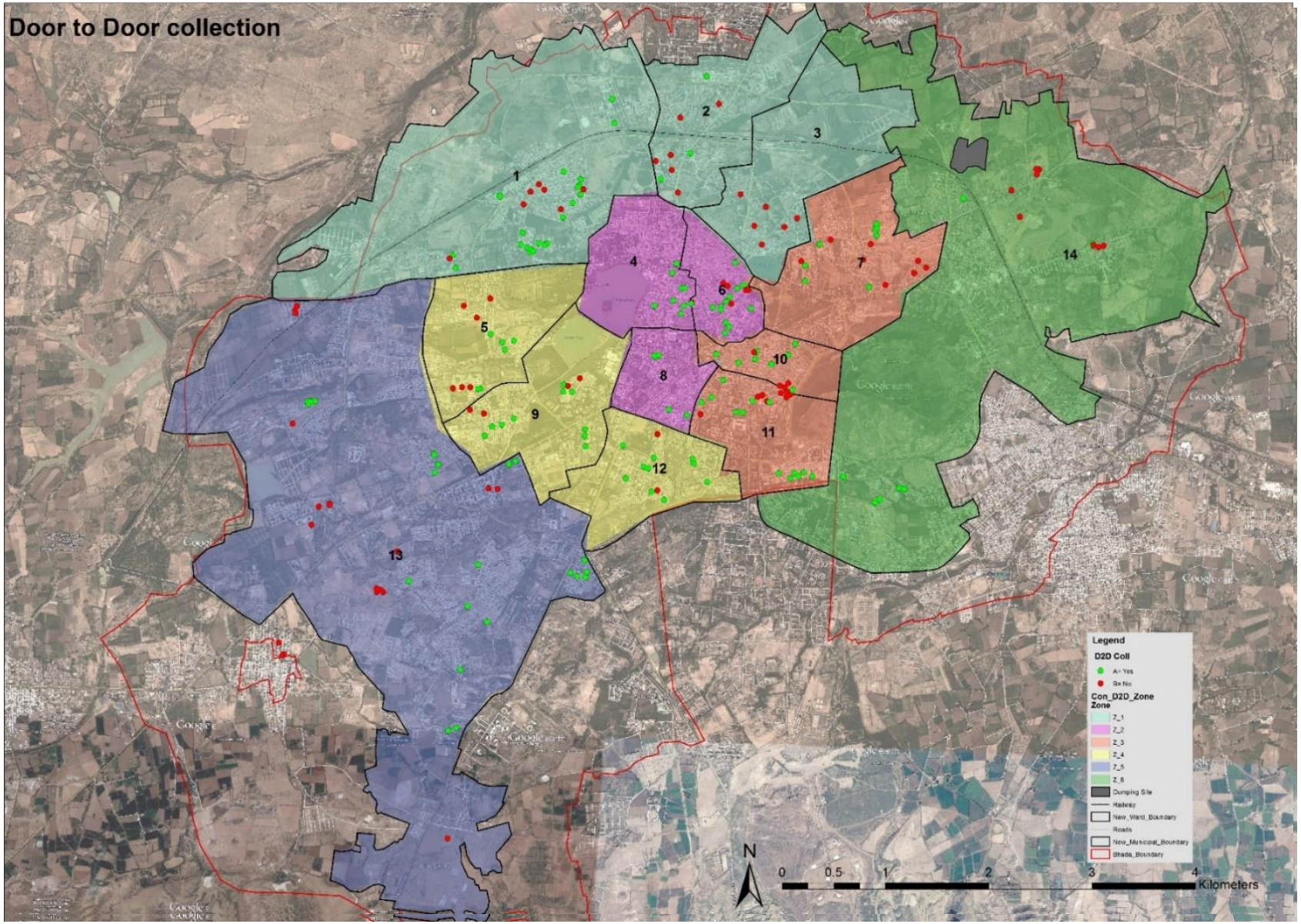
Rag pickers family = 110

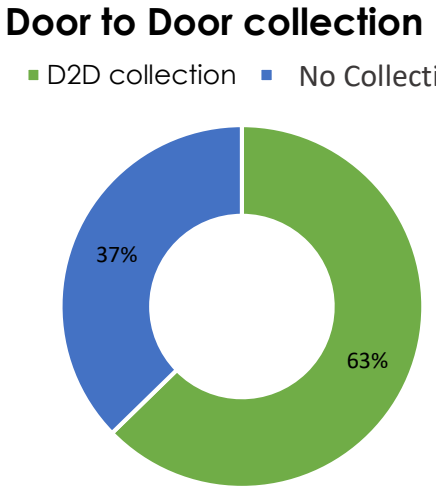
Open dump site:
Area = 9 Ha
Distance from city center = 6 km

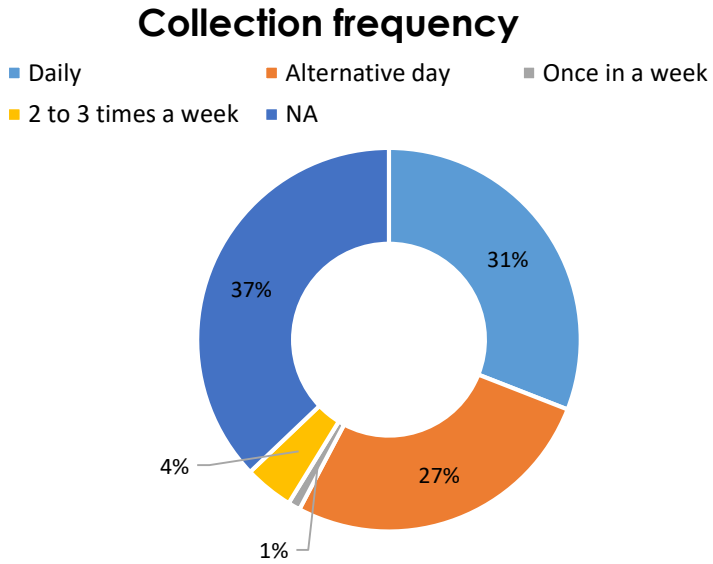


Source: Bhuj Nagar Palika, Primary Survey

PRESENT SCENARIO

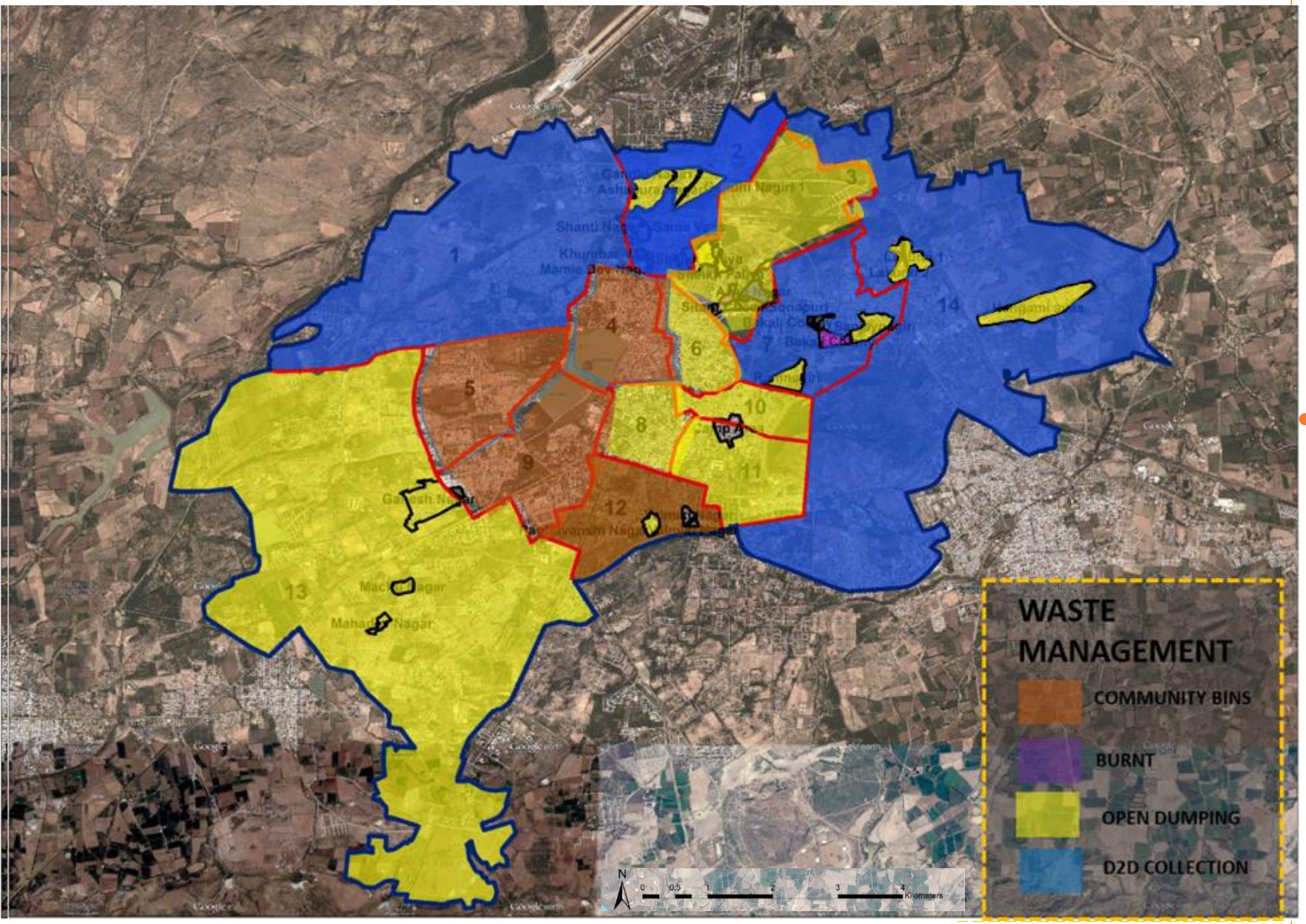






Source: Bhuj Nagar Palika

PRESENT SCENARIO - SLUM

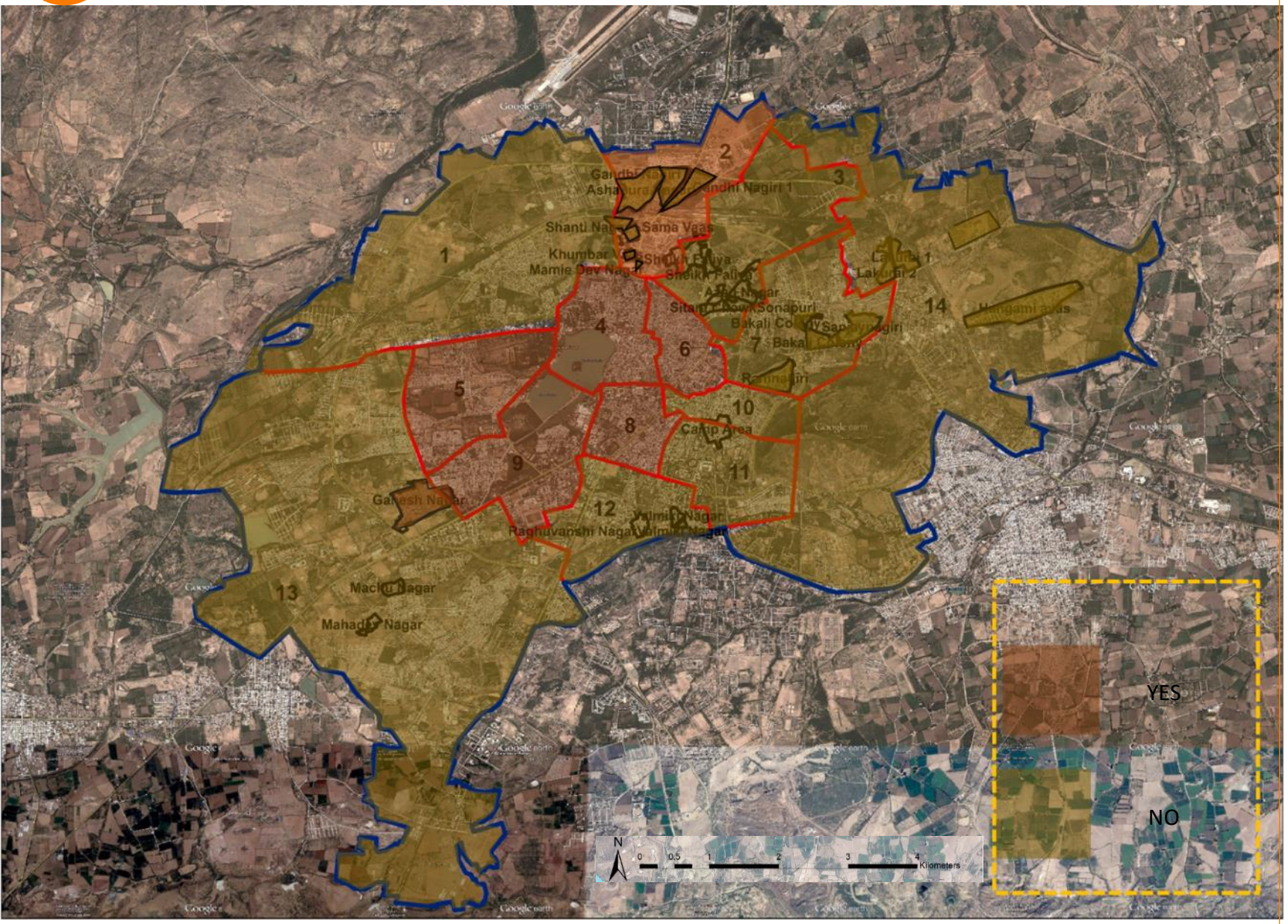


- The slum pockets mostly do not have door to door collection.
- Where as in comparison, the wards apart from the slums have regular waste collection
- **Waste is collected only during festive seasons**

- The slum pockets mostly have open dumping except a few who burn
- The wards at the centre of the city have community bins, while ward no 6,8,10,11 and 13 have open dumping
- This map shows that overall the open dumping is more in slums than in the city

Source: Primary Survey

PRESENT SCENARIO - SLUM

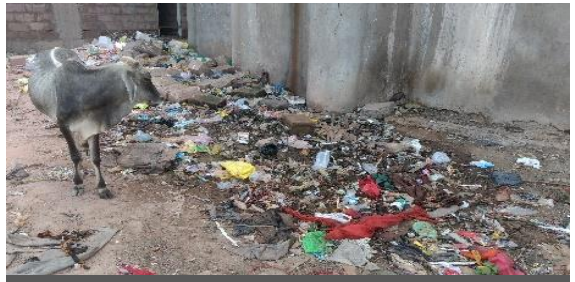


- The centre of the city and ward 2 has street sweeping done regularly by BNP
- Where as the slums and few of the wards like 3, 7,10, 11, 12 are left uncovered

Source: Primary Survey

SUMMARY - ISSUES

Source



OPEN DUMP AND BURNING

RANDOMLY PLACED BINS

Collection

EMPTYING OF COMMUNITY BINS

LESS FREQUENCY OF D2D COLLECTION

NO COLLECTION IN SOME AREAS

Transportation

TYPE AND NO OF VEHICLES

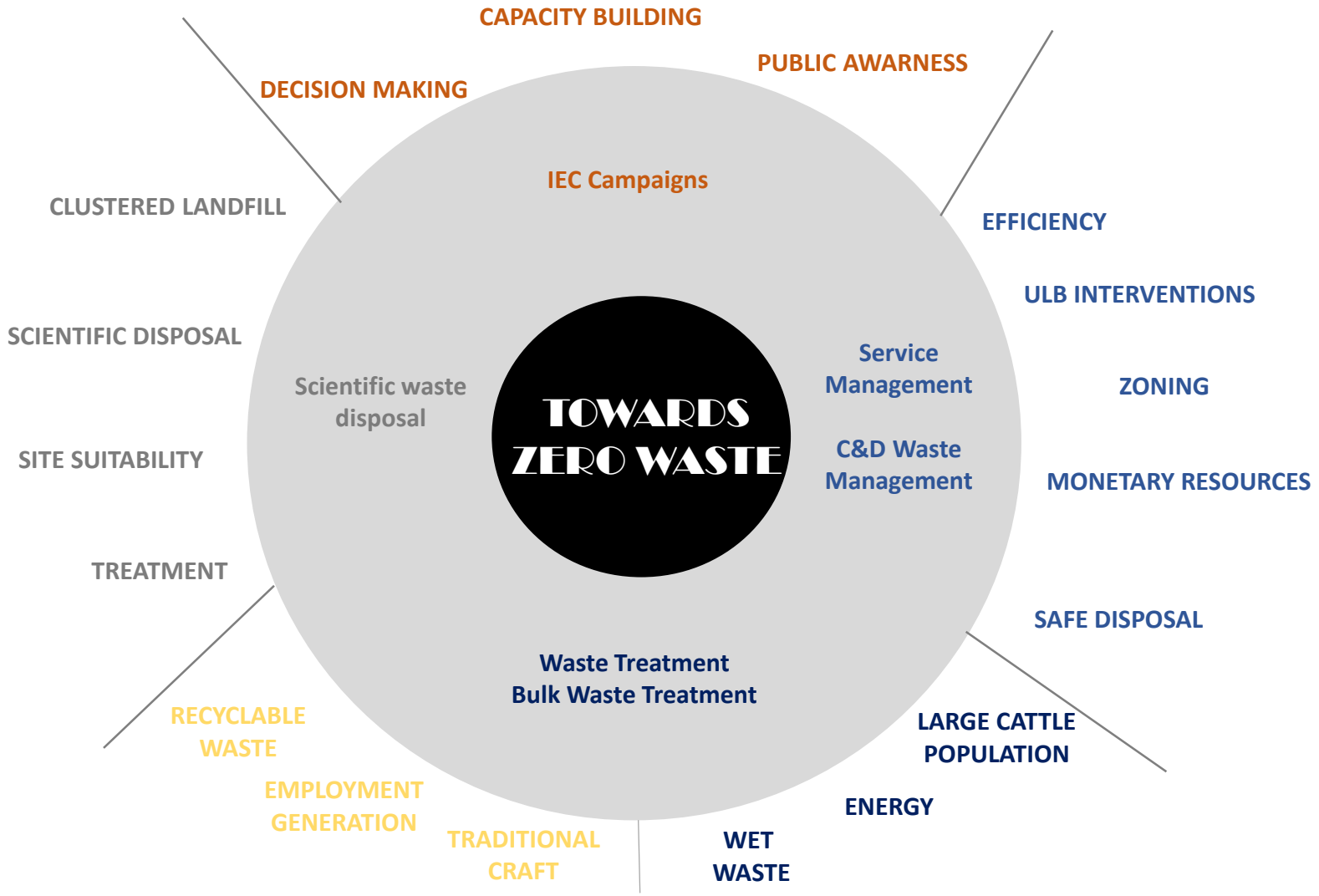
NARROW ACCESS

Treatment and Reuse

RAG-PICKERS

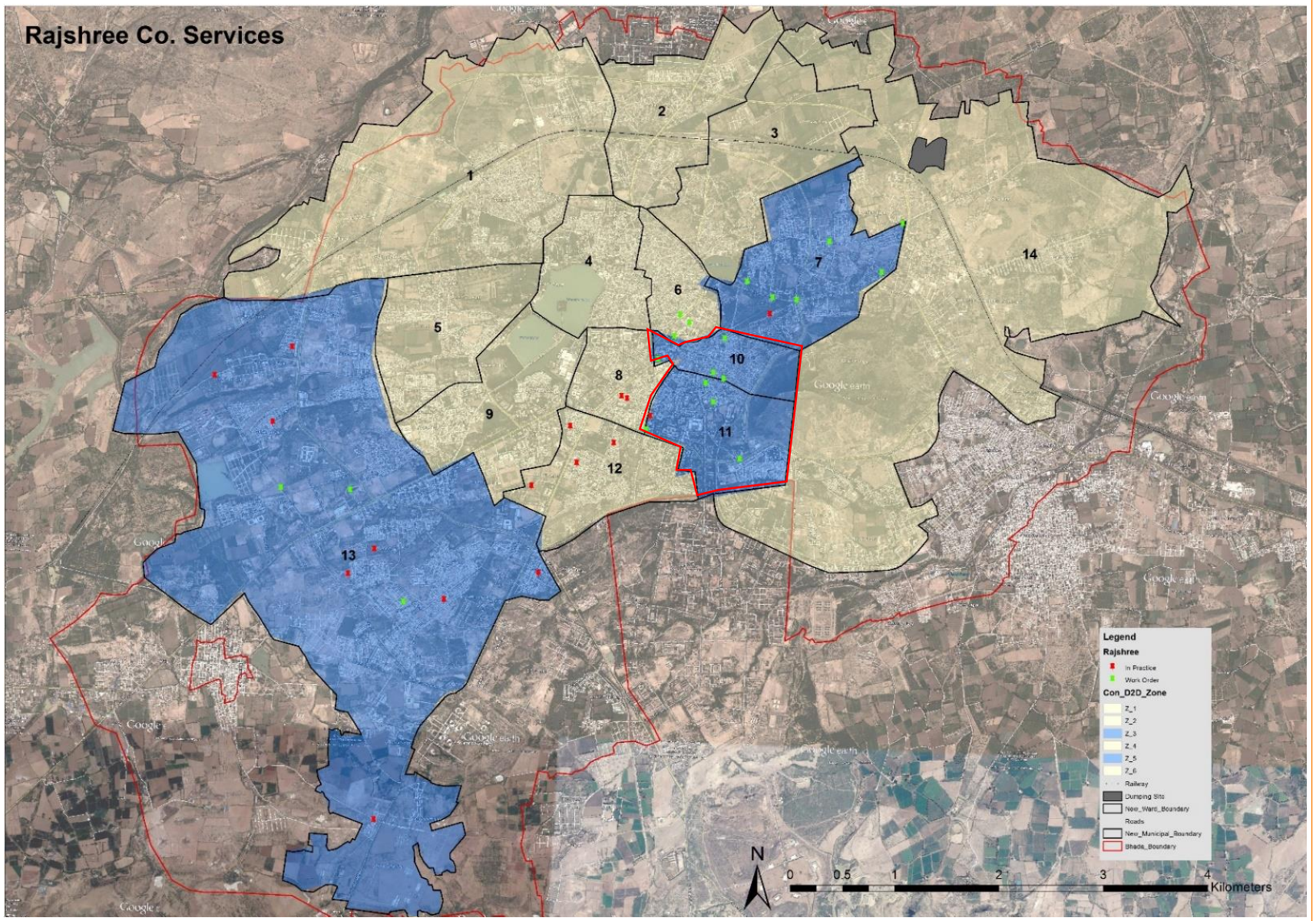
ENCROACHED LAKE

ENCRBURNING


CAPACITY BUILDING
PUBLIC AWARNESS
DECISION MAKING
IEC Campaigns
CLUSTERED LANDFILL
EFFICIENCY
ULB INTERVENTIONS
SCIENTIFIC DISPOSAL
Scientific waste disposal
TOWARDS ZERO WASTE
Service Management
ZONING
SITE SUITABILITY
C&D Waste Management
MONETARY RESOURCES
TREATMENT
SAFE DISPOSAL
Waste Treatment
Bulk Waste Treatment
RECYCLABLE WASTE
LARGE CATTLE POPULATION
EMPLOYMENT GENERATION
ENERGY
TRADITIONAL CRAFT
WET WASTE

SERVICE IMPROVEMENT

SOLID WASTE MANAGEMENT



MAMAN TRADERS

Ward Served– **1,2,14**
Tractors– **12**
Manpower– **36**
Properties Served– **14102**
Efficiency of collection: **47%**

RAJDEEP ENTERPRISE

Ward Served– **4,5,6**
Tractors– **9**
Sakhi Mandal- **15 Sakhi**
Manpower– **51**
Properties Served– **10,425**
Efficiency of collection: **68%**

RAJSHREE CO. SERVICES

Ward Served– **7,13**
Tractors– **15**
Manpower– **45**
Properties Served– **23704**
Efficiency of collection: **42%**

Source: Bhuj Nagar Palika

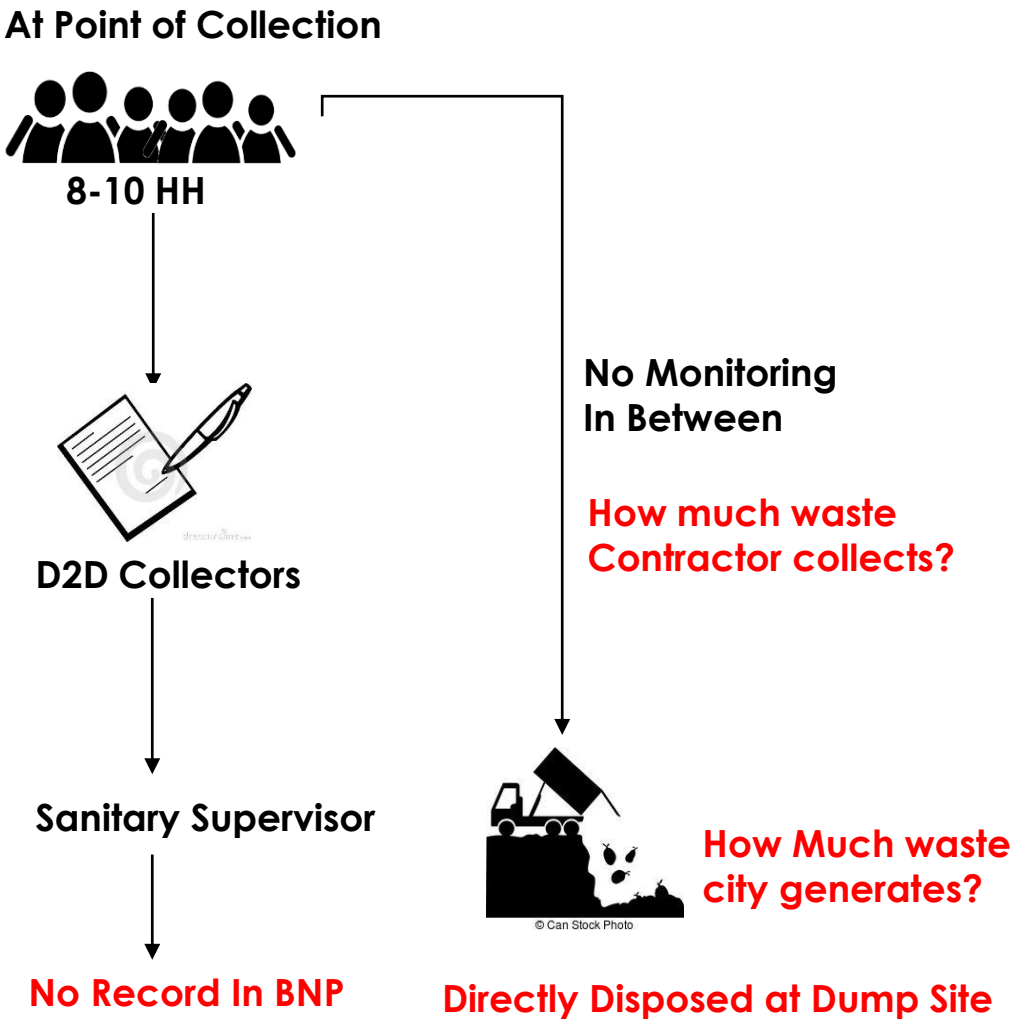
Issues

Contractual Flaws:

- **Lack Of Coordination** between the **agencies** as well as **with BNP**.
- Mode of Payment : **35 Rs/Property**.
- **Scope Of work** mentions only:
  - Has to collect the waste from the given service areas (i.e. wards).
  - Has to collect residential and non-residential waste.
- Contract is not talking about Equipment and Infrastructure needs, manpower needs, Collection mechanism and Monitoring.

Open Dump and Littering

Monitoring Of D2D Contract



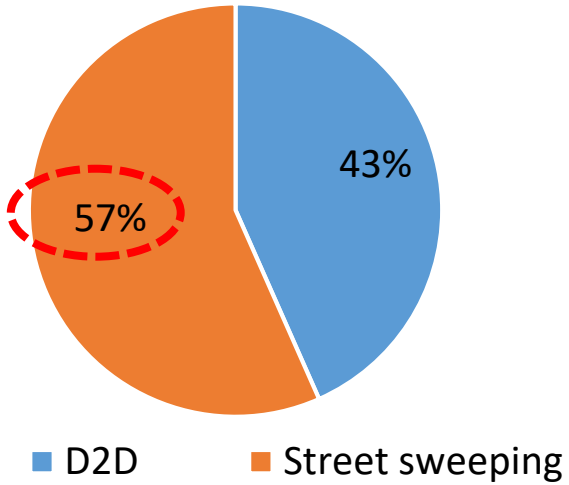
Source: Bhuj Nagar Palika

STREET SWEEPING CONTRACT:

- Mode of Payment : **44,00,000 Rs/month Lump-Sum Contract**
- **Scope of work:**
  - Has to sweep the streets.
  - **Has to collect all the dump from the streets and sides of the streets.**
  - Has to dispose the waste to dump site.

Littered Streets and extra load on Labors

Waste Collected By Contractor



No monitoring of services by BNP

Contract is terminated on 10th October By The CONTRACTOR

Because of,

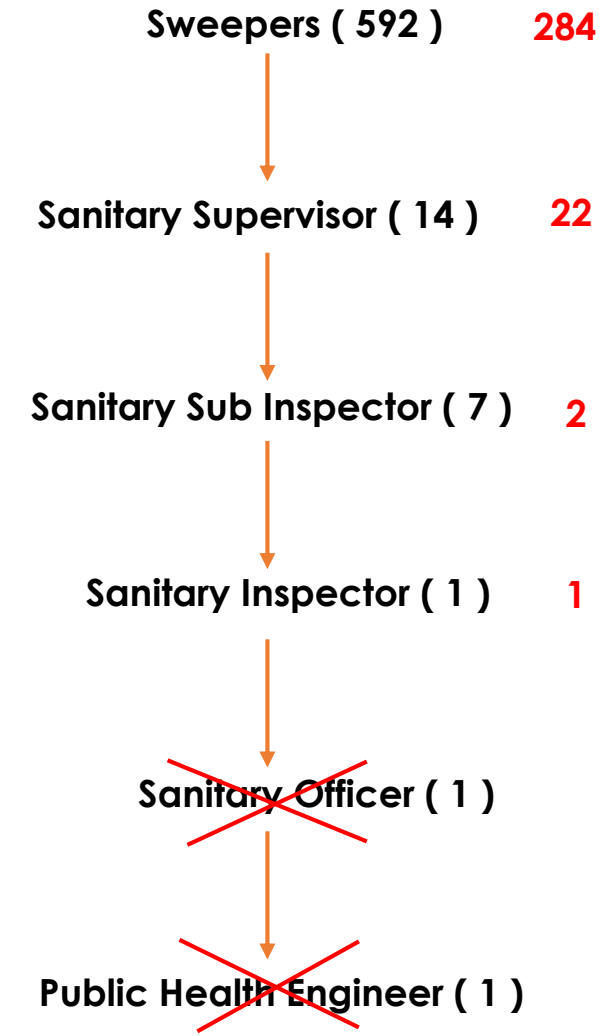
PAYMENT ISSUES

Source: Bhuj Nagar Palika

COMPLAINT REDRESSAL

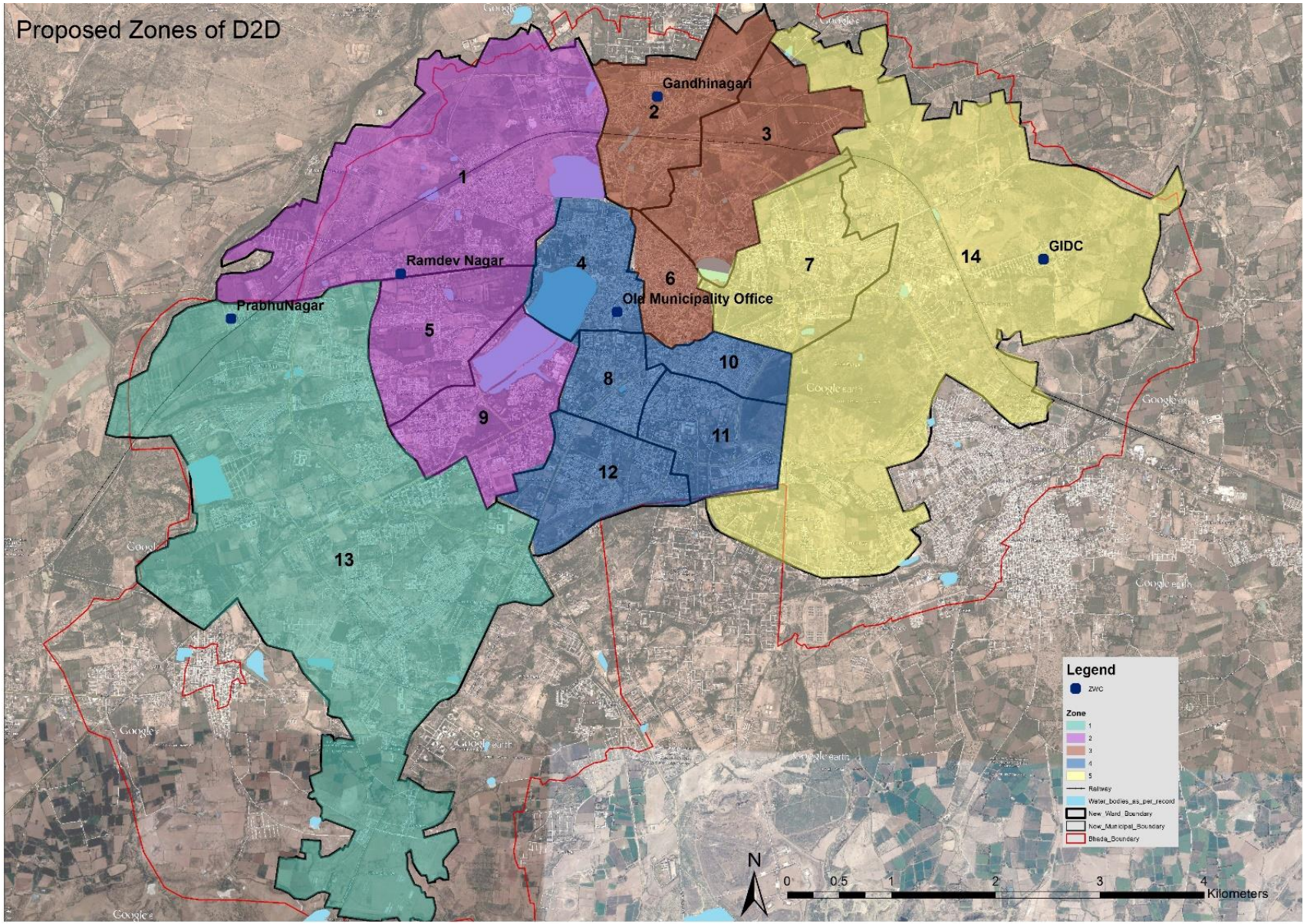
- Complaints : **90 per day**
- Complaint registration:
  - **Telephonic (Under MSGM) : 30-40**
  - **Desk registration : 40-50**
- **Nature Of Complaint:**
  - Primary Collection : D2D collection
  - Secondary Collection : Bin emptying, street sweeping
  - Tree Cutting and Collection
  - Dead Animals
- Maximum complaints: Dead animals and Open dump
- **Redressal Time : 2 days**

ADMINISTRATION



HOW CAN WE IMPROVE THE COLLECTION AND TRANSPORTATION SERVICES?

DOOR/GATE TO DUMP



SOLID WASTE MANAGEMENT

ZONES	Ward Covered	Property Covered	Trip required Per Day
1	13	7539	5
2	1,5,9	7156	5
3	2,3,6	7083	5
4	4,8,11,12	6081	4
5	7,10,14	8127	5
	Total Trips		**28**
	Total Vehicle		**24**

Parameters Considered:

- Density Of Each Ward,
- Average round trip distance is 45 Km.
- Residential & Non-residential Properties Taken.
- Vehicle Capacity = 1 MT & Density of Waste = 650 kg/m3

Manpower Required = 24 Drivers
48 Helpers

Timing Of Collection :

- Residential = **7:00 a.m. to 1:00 p.m.**
  3:00 p.m. to 6:00 p.m.
- Non Residential = **2:00 p.m. to 6:00 p.m.**

Source: Toolkit for PPP framework in MSWM, CPHEEO Manual on MSWM-2016

COLLECTION MECHANISM

Primary Collection Chain

Societies, Apartments, Gamtal, Slums

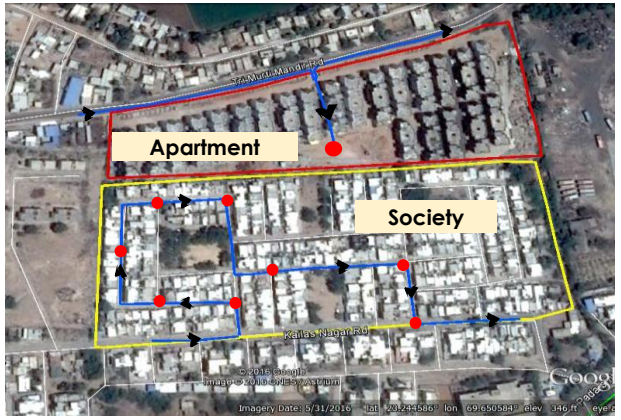
Commercial Shops, Complex Institutional Building

Chhota Hathi

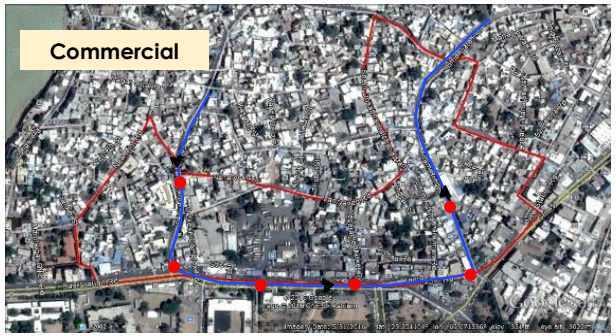
Handcart Lorry

Zero waste Centre

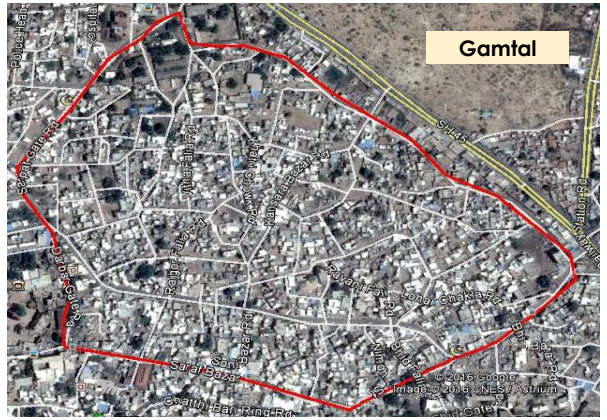
Collection Point



Collection Point :
In Society : Every 300-500 mt
Apartment : One Point Only
Mode of Collection : TATA ACE



Collection Point :
Complex : At Gate
Shop Establishments : Every 200-300 mt.
Mode of Collection : Vehicle



House to House Collection
Mode of Collection : 6 bin Handcart lorry

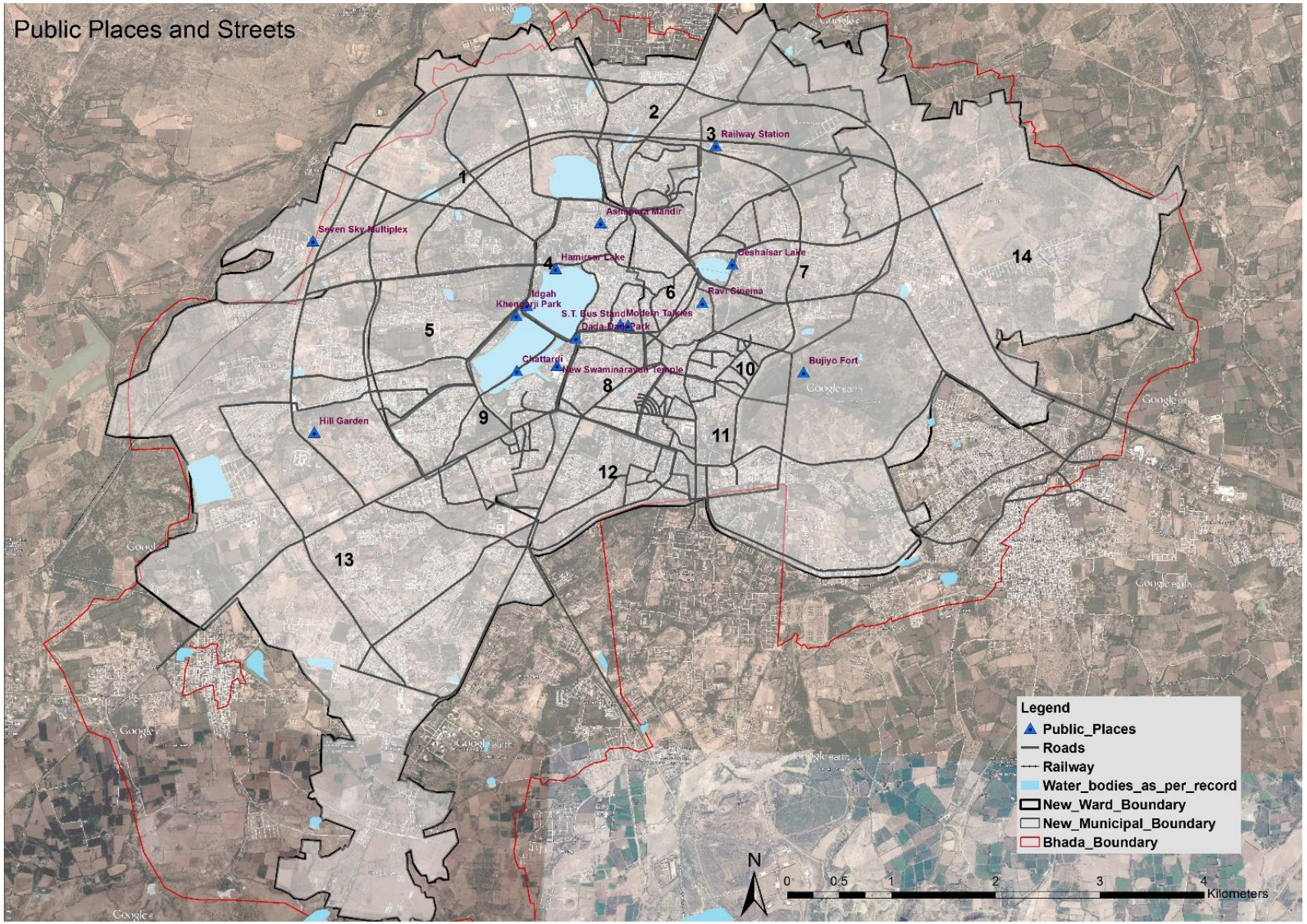
Collection Point : On The peripheral Roads
Mode of Collection : Vehicle

Collection point

Route of Vehicle

Source: Solid Waste Management of Ahmedabad City, Google Earth

STREET SWEEPING



- Total Road Length : **390 Km**
- Total No of **Sweepers Needed (max)= 592**
  - **60% Roads** to be swept **daily** than **sweepers needed= 355**
- **Deficit In Sweepers = 284**

- Total No of litter Bins at the **Pubic Place = 97**

- Total No of **Vehicles Needed= 6**

- **Timing Of Street sweeping :**
  1. 7:00 a.m. to 12:00 p.m.
  2. 9:00 p.m. to 12:00 a.m.

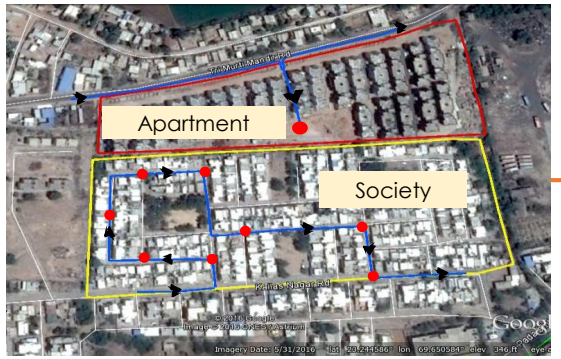
Assumption:
- 60% of Total road length should be swept daily.
- Emptying of litter bins = Daily

Parameters Considered:
- Sweeper/road length = 1:660 (Avg)
- Quantity of litter Bins based on local condition.

Source: **Toolkit for PPP framework in MSWM, CPHEEO Manual on MSWM-2016**

MONITORING MECHANISM

DOOR OR GATE TO DUMP



Residential And Non Residential Collection Point : **GPS Tracking**

Collection vehicle :GPS enabled TATA ACE, **Tracking of Routes**

ZERO WASTE CENTRE

GPS device at ZWC to track vehicle

Weighbridge to monitor the quantity of waste

STREET SWEEPING AND LITTERING ON PUBLIC PLACE

Street Sweepers: Equipment- Worker Logbook

Litter Bins: RFID TAG

Collection From sweepers and Bins: GPS enabled **TATA ACE, Tracking of routes and bins location.**

LANDFILL SITE

Source: Solid Waste Management of Ahmedabad City, Site Visit Report- Meher Bhagia, Google Earth

Vehicle Log Book

Vehicle No: Date:

Driver's Name: Shift:

Ward and route served: No of Trips:

Starting Time of Job:

Finishing Time of Job:

Total Km of one trip:

Workers Log Book

Name of Worker: Date

Equipment: Shift

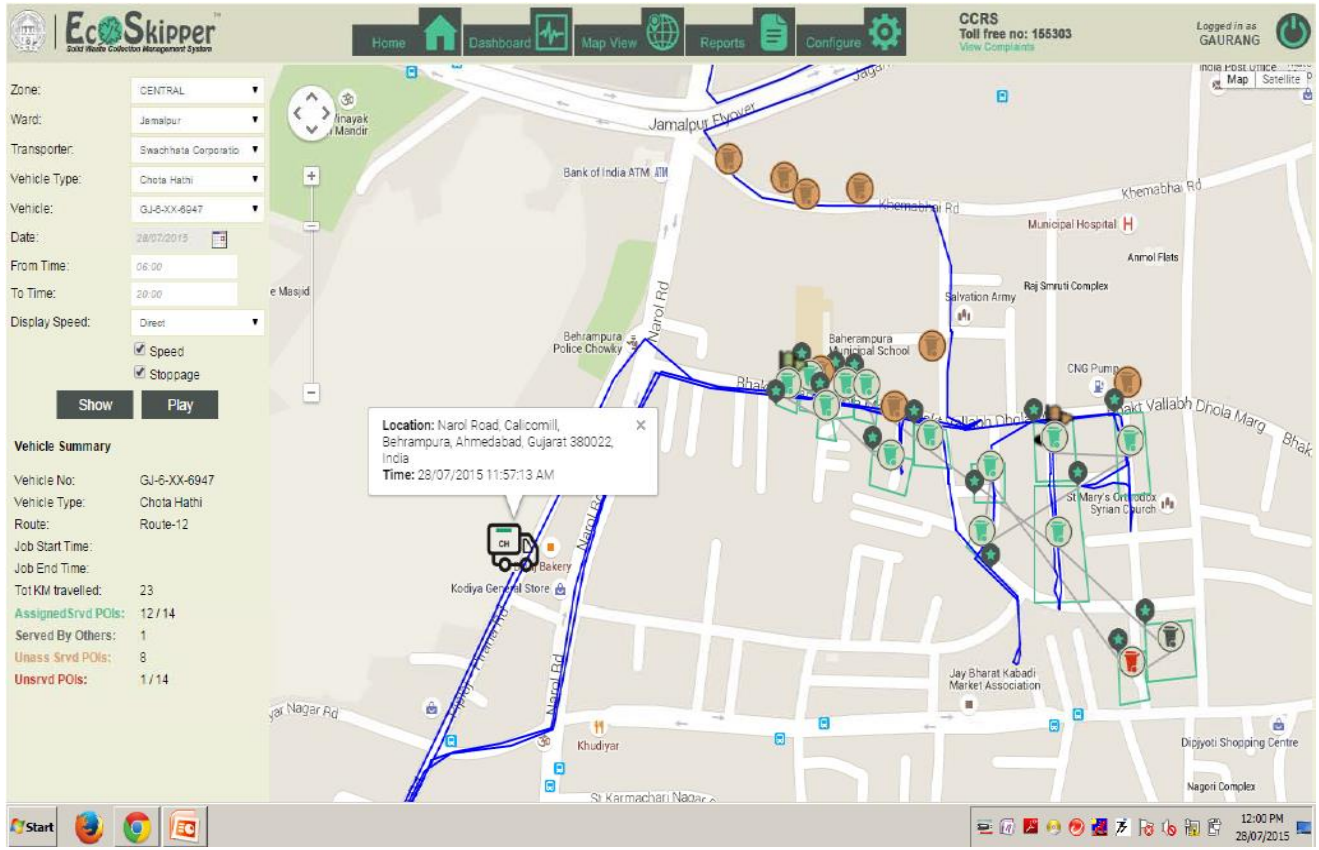
Ward and route served: No of Trips:

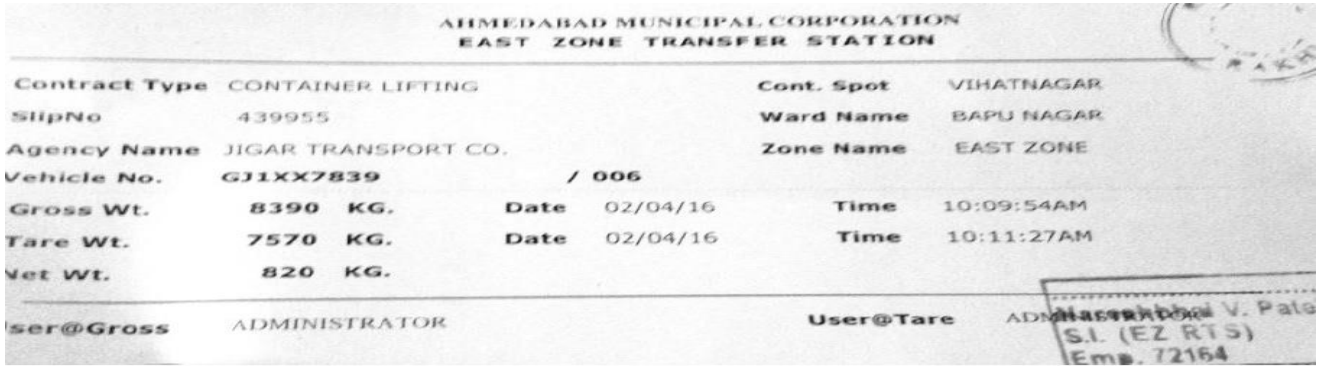
Starting Time of Job: Road length to be swept:

Finishing Time of Job:

No of HH to be served :

- Maintained By: **Sanitary Supervisor and Contractor's supervisor**
- Reported to: **Sanitary sub inspector of particular ward or zone.**





AHMEDABAD MUNICIPAL CORPORATION
EAST ZONE TRANSFER STATION

Contract Type	CONTAINER LIFTING	Cont. Spot	VIHATNAGAR
SlipNo	439955	Ward Name	BAPU NAGAR
Agency Name	JIGAR TRANSPORT CO.	Zone Name	EAST ZONE
Vehicle No.	GJ1XX7839 / 006		
Gross Wt.	8390 KG.	Date 02/04/16	Time 10:09:54AM
Tare Wt.	7570 KG.	Date 02/04/16	Time 10:11:27AM
Net Wt.	820 KG.		
User@Gross	ADMINISTRATOR	User@Tare	

S.I. (EZ RTS)

DAILY REPORT CONSIST OF :

GPS TRACKING SYSTEM:

- **Vehicle No and Driver's and helper's detail.**
- **Daily Route Map** of Each Vehicle with **Vehicle No like GJ-23-1994** with zone and ward of serving.
- **Starting time and finishing time of services.**
- **Total Km Travelled.**
- **Stoppage time at location of each collection point.**
- **Served and Unserved Collection Point by each Vehicle.**

From ZWC:

- **No of trips by each vehicle.**
- **Total quantity of waste collected by each vehicle in each trip**

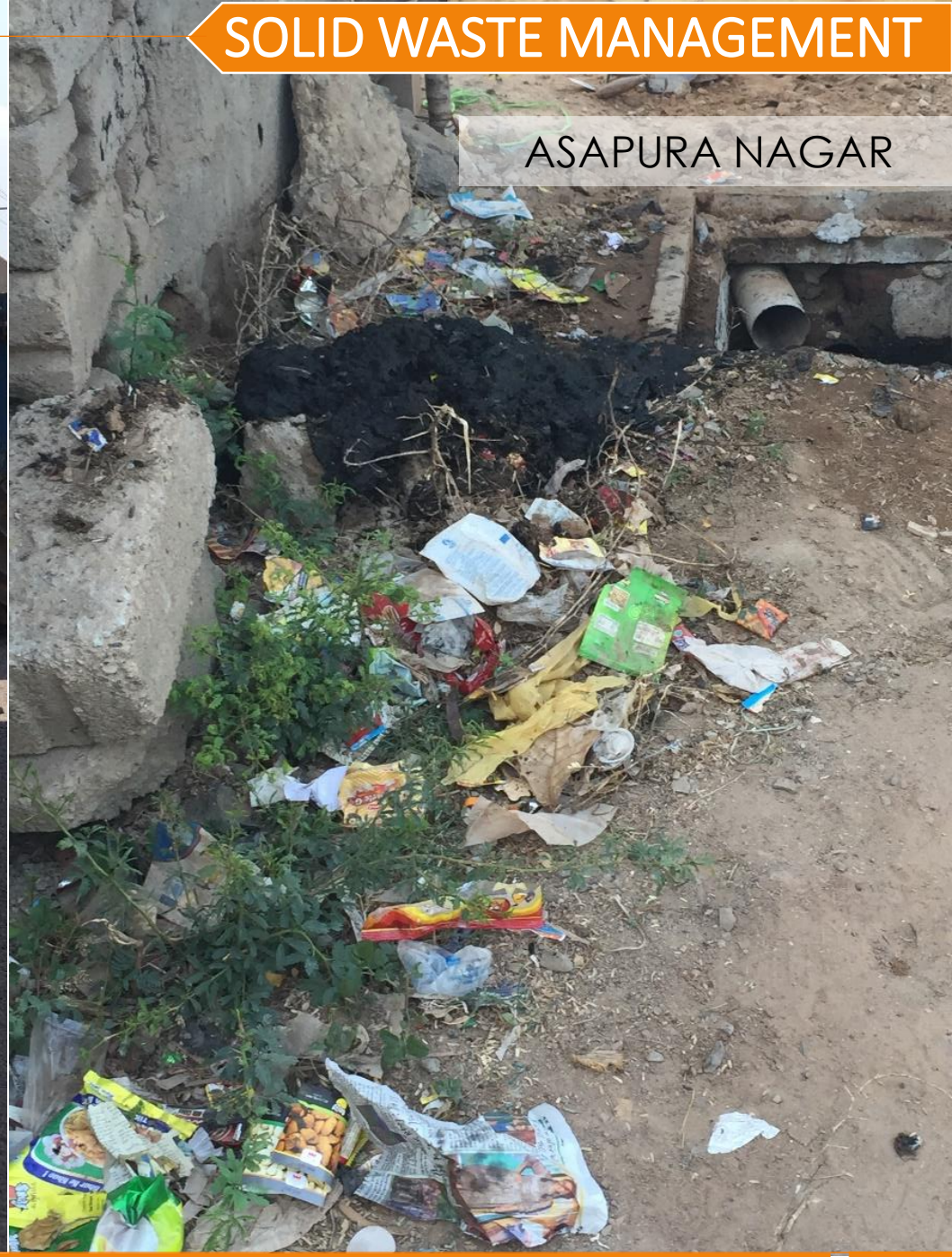
Submitted to: Directly Submitted to **Sanitary Inspector.**

Source: Solid waste Management - Ahmedabad

SOLID WASTE MANAGEMENT

CAMP AREA

ASAPURA NAGAR



Source: Primary Survey

CAMP AREA

Source: Primary Survey

ISSUES-SLUM

GANDHINAGIRI

Source: Primary Survey

ISSUES-SLUM

SOLID WASTE MANAGEMENT

SAMAVAS

SHANTINAGAR

SHIVANAGAR

Source: Primary Survey

ISSUES

- DOOR TO DOOR COLLECTION
- MANAGEMENT OF SOLID WASTES

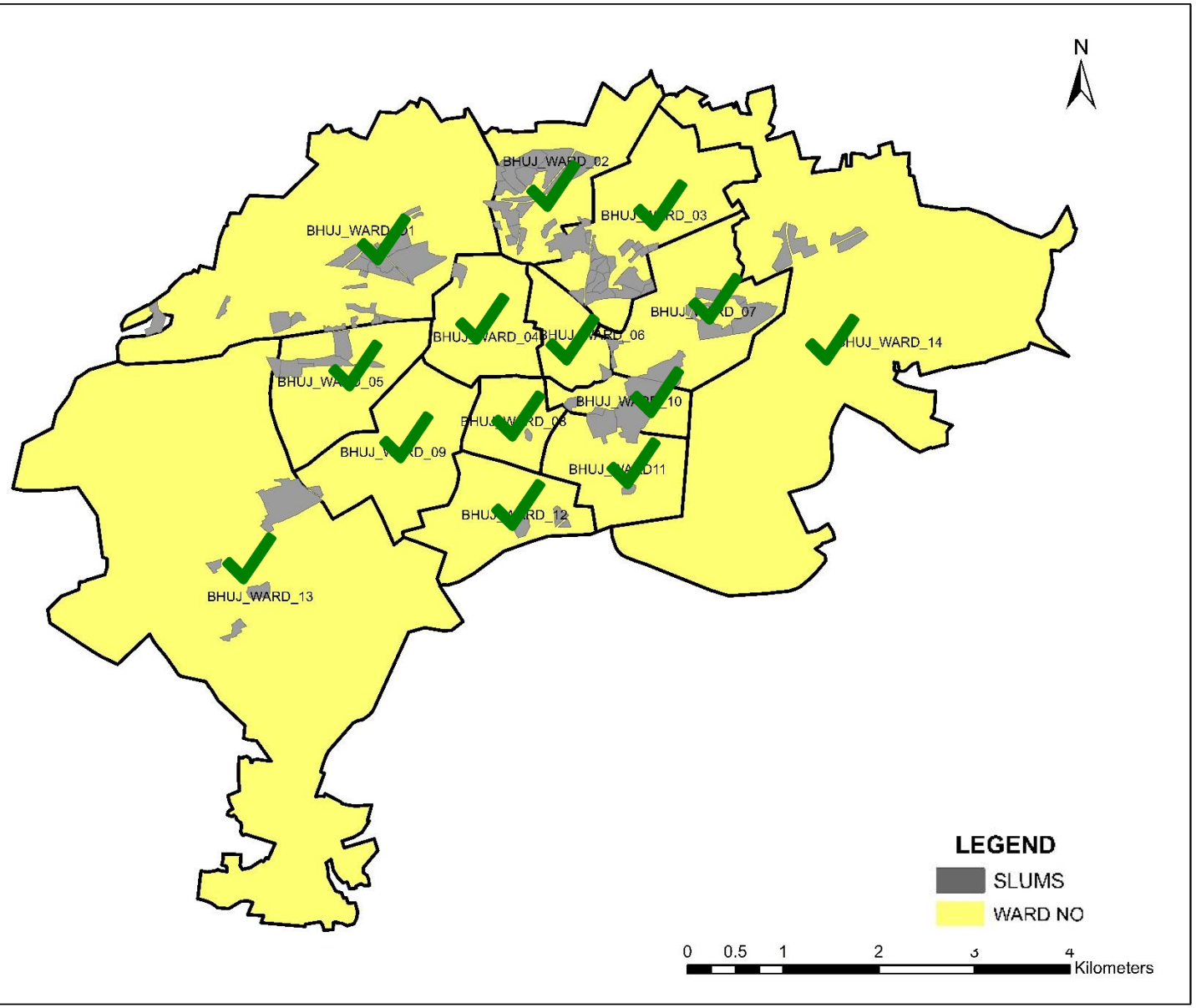
PUNE

- Ghanta Trucks are expected to collect garbage daily from the gates of the buildings
- A team of two waste collectors collects segregated waste from 300-400 households, offices or commercial establishments in separate bins using manual pushcarts by blowing the whistle
- The PMC partially subsidizes the cost of collection from slums to the tune of Rs. 5 per household per month.
- 1 Swacch Mitra for 50 HH for monitoring the collection daily

AHMEDABAD

- Ramapir No Tekro is the largest slum of Ahmedabad of over 1.5 lakhs
- The narrow alleys remained dirty and were not served by AMC
- AMC appointed few waste pickers from the society but gradually stopped
- SEWA took the initiative therefore and organized 49,240 waste pickers and cleaners
- Waste collection is done between 8am-12pm with the help of six containers of handcarts and the area where it was unreachable, there two women would go and collect in a plastic container and the collected waste is dumped into AMC container truck
- Therefore, the waste pickers now had a monthly salary of 4000 and the slum became a better place to live in henceforth.

Collection Mechanism



SAHJEEVAN can take the initiative and organize the waste pickers

HH: 10999

User Charges: 7/ HH/Month

Swacch Doot: 37

Handcarts: 37

Cost: Rs 1, 29, 500

Working Hour: 6:30 AM -12 AM

Dry waste collected once a week and taken to ZWC

Wage: Rs. 2000

Total Bins: 43

Capacity Of Each Bin: 240 Litres

Cost Of Each Bins: Rs. 2, 355

TOTAL: Rs. 1, 37, 520

Lorry carries the wastes from the bin

43 Collection Points

Source: CPHEEO, SOLID WASTE MANAGEMENT , AHMEDABAD, http://i.dailymail.co.uk/i/pix/2014/01/15/article-2539639-1AAD7EC400000578-635_306x303.jpg

COLLECTION MECHANISM

WARD 10, COLLECTION POINTS

Collection Points: 4 , No Of Bins : 4

SOLID WASTE MANAGEMENT

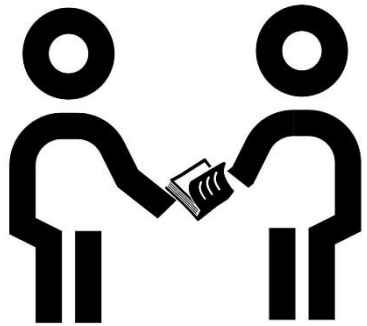
2439 HHs

908.73 KG

Working hour duration: 6:00am-12pm
No Of Swacch Doot: 8
No Of Handcarts : 8
TRIPS: 2

Source: CPHEEO

Monitoring



LOG BOOK (IN GUJRATI)

TIME:
WASTE COLLECTED:
YES/ NO

PLACE YOUR THUMB PRINT/ SIGNATURE HERE:

MONITORING

The supervisor hands over a log book to the Swacch Doot

The Log Book has details of the Time, Collection and signature/ Thumb Print

The Swacch Doot needs to do the necessary

The supervisor then hands over the log book to the BNP

This way the record is maintained

Source: http://bhujbolechhe.org/en/users/bhuj-nagarpalika

PARAMETERS/CITY	ANAND	JADASAN	PAMMAL	AHMEDABAD
Type of Contract	**Integrated Contract** with Street Sweeping and D2D	Integrated Contract with Street Sweeping and D2D	**D2D – Contracted to NGO** **Street Sweeping - ULB**	Integrated Contract with Street Sweeping and D2D
Scale of Contract	City wide	City wide	City wide	Zone/Ward Level
Payment Parameters	12 Rs/HH/month	Minimum Wage of labors given to Sakhis by Contractor	10 Rs/HH/month	S.S. : Rs/ running mt or Rs/ Sq mt D2D : Rs/ Property
Collection of User charges	Contractor	Contractor	ULB	ULB
Levying fees and Penalties	**For each complain:** deduction of Some amount	**For each complaints** : 10 rs deducted from workers salary **Littering on public place** : 500 rs **Littering by commercials** : 200 rs	-	**Not serving Point Of Interest Compensation fees and administration fees levies on Contractor**
Monitoring of Services	Contractor + ULB	Contractor + ULB	Self Help Group	Contractor + ULB
Complaint Redressal	Contractor + ULB	Contractor + ULB	NGO	Contractor + ULB

INTEGRATED CONTRACT

FOR

COLLECTION AND STREET SWEEPING

Source: Urban Solid Waste Management in Indian Cities-PEARL, WHAT WORKS- UMC report

OBLIGATIONS

OBLIGATIONS	BHUJ NAGAR PALIKA	CONTRACTOR
Manpower and Infrastructure Obligations	1. **Infrastructure** should be provided as per the needs. 2. **Proper route map, zoning and ward served** has to be given to the contractor. 3. **Vehicles have to have proper identification**: green color and Bhuj Nagar Palika written on it.	1. Has to **employ adequate no of workers** as per BNP's work order. 2. **Vehicles have to have zone wise complaint number** written on it. 3. Has to **employee SWACHH DOOT in SULMS**.
Service Obligations	1. **Facilitating the contractors for better Services.**	1. **Door / Gate to ZWC** has to be carried out according to the BNP's plan. 2. **Street sweeping and emptying of bins** in public spaces should be carried out. 3. **Operation and Maintenance of the equipment and vehicles** should be done regularly. 4. Slums should be treated with equity. 5. **Drain Cleaning for a particular time period.**
Monitoring Obligations	1. **Ward wise supervisor** has to be there with contractor's supervisor for further **monitoring daily.** 2. **ICT database consultancy** has to be contracted out for proper decoding of **GPS and RFID system.** 3. **Complaint redressal mechanism** should be established by BNP in accordance with contractor.	1. **Ward wise supervisors** has to be employed for monitoring. 2. **Daily report of service** should be given **to BNP.**
Financing Obligations	1. **Incorporating Grants** and transferring them in needs. 2. **User-fees and penalties** collection is done by BNP. 3. **Payment should be on monthly basis** to the contractor within 30 days of bill submitted.	1. **Penalties should be given to the BNP as per the report and complaints.**

Contract Period	**3 years**
Bidding Variable	**Charge of Rs. 2060 per tons waste** collected and Transported To Zero Waste Centre.
Total Project Cost	176 Lakhs
Investment by Contractor	**0% By Private Contractor**
Technical Criteria for Bidding	
• **Minimum 3 years experience** in the collection and transportation of waste • **Initial Implementation and Operation plan** should be prepared and submitted at the time of bidding.	
Financial Criteria for Bidding	
• 80 % for 1 Year, 40% for 2 years, 20% for 3 years of total project cost should be done	
Risk Allocation	
Investment Risk	**100 %** By **Bhuj Nagar Palika**
Operational Risk	**100%** By **Private Contractor**, Quantity Risk
Financial Risk	**Both** by Private Contractor and Bhuj Nagar Palika

Source: SWM PPP Toolkit, CVC Guideline

Contract Period	**3 years**
Bidding Variable	**1.35 Lakhs per Month plus contractor's Profit**
Total Project Cost	**16 Lakhs**
Investment by Contractor	**100% By Private Contractor**
Project Scope or Operator Obligation	
• **Installation** of **GPS and RFID technology** based solution for the vehicles • **Monitoring of ICT technology** based on the predefined routes and collection points. • **Everyday report of ICT system** Should be given to the BNP. • **Training** should be given to the **BNP staff and Contractor's employee**.	
ULB Obligation	
• **Give all assistance to the operator** about Routes and Collection Points. • **Payment** on the **monthly basis** to the Operator within 30 days of receipts. • BNP should be verified **the physical correctness of system generated reports timely.**	
Risk Allocation	
Investment Risk	**100 %** By **Operator**
Operational Risk	**100%** By **Operator**

Source: SWM PPP ToolKit

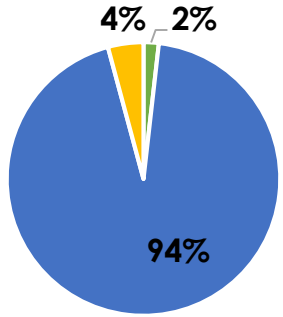
CAPITAL COST OF THE PROJECT = **176 Lakhs**

स्वच्छ भारत
एक कदम स्वच्छता की ओर

GoI = 75%
132 LAKHS

GoG=25%
44 LAKHS

OPEX OF THE PROJECT = **59 Lakhs per Month**



Infrastructure **Labor Salary** **Administration Salary**

RECOVERY

PAYMENT

1. **USER CHARGES**
2. **14th FC Grant**
   Basic Grant
   =33.69 Cr for Bhuj
3. **Advertisement Charges and Parking Charges, etc.**

CONTRACTOR'S PAYMENTS= 2060 Rs/MT

Source: SBM GUIDELINES-2016

USER CHARGES

PRESENT

62 Lakhs Rs Per Month

112 Rs Per Property Per Month

FLAT charge:

114 Rs Per Property Per Month

5 Rs Per Property Per Month

(0. 32 paisa per capita per Month)

Collection of User Charges = 71%

Recovery From User Charges= 3%

PROPOSED

60 Lakhs Rs Per Month

107 Rs Per Property Per Month

Category Based Charge:

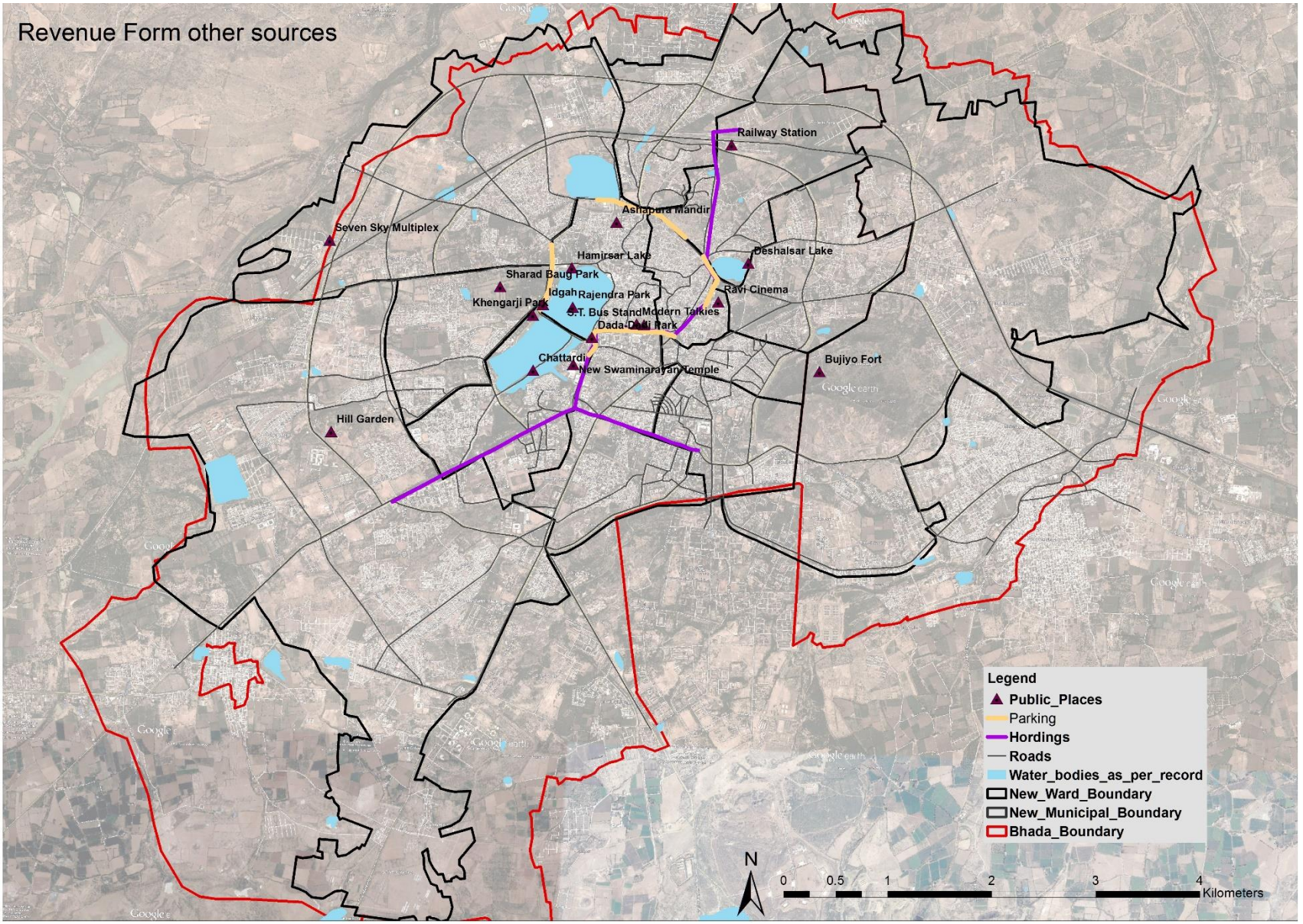
1. **Residential = 54** Rs per property per Month (50% of actual)
2. **Non Residential = 107** Rs per Property per month (100% of actual)
3. **Slum = 7** Rs per Property Per Month

Collection of User Charges = 100%

Recovery From User Charges= 49%

Source: SBM Guidelines, CPHEEO Manual-2016, BNP

ADVERTISEMENT AND PARKING



Pole Kiosk @ major roads

Uni-Pole Hording @ Public Places

On The Major Roads.

Income Generated = **20** Lakhs Per Month

Cost Recovery = **49 %**

Source:

For citizen:

- For **Open dump** nearby its premises: **200 rs**
- For littering on **Public Places: 500 rs**
- For littering by **commercials**: **300 rs**

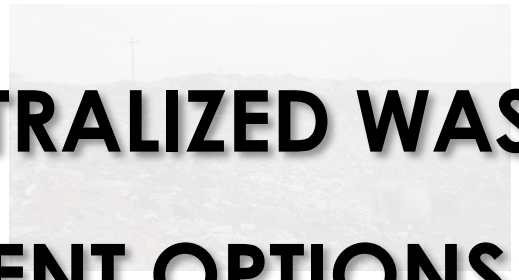
For Contractor:

- For **each** collection **complains at property level** : **per property user charge** will be **deducted.**
- For **litter bins, 200 Rs** for **each bin** that is not emptied.
- For **Illegal Dumping: 1000 Rs**
- At ZWC, If it is found that the Vehicle is filled up with **stone, boulders**, etc to Over weigh than: **per MT Tipping fee will be deducted**.

EFFICIENT UTILIZATION OF WASTE

ISSUES





No Segregation

No treatment

Pressure on existing Dump Site

Waste Pickers work in a very insanitary

ESTABLISHING DECENTRALIZED WASTE CENTERS & TREATMENT OPTIONS

POTENTIALS

100.24 MT

2.32 MT

30 Lakhs p.m.

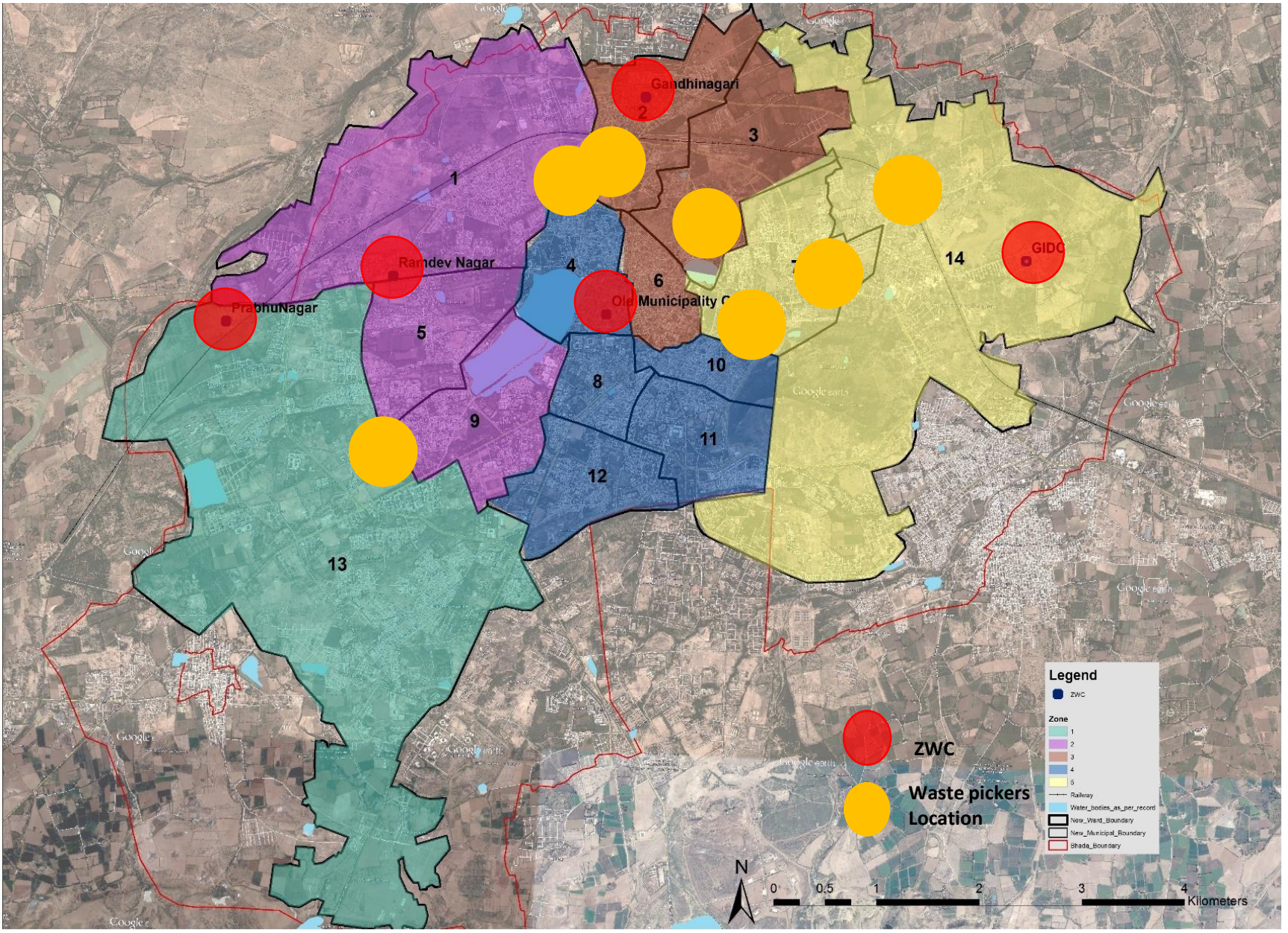
27.065 MT

131

Shahjeevan has proposed Zero waste centers to mainstream the waste pickers.

Source: Primary Survey, Sahjeevan DPR

ZWC & WASTE PICKERS



CLUSTERS OF WASTE PICKER FAMILIES

Ashapura jogi vas: 10 Families

Shirva Mandap: 20 Families

Desalsar Talav: 22 Families

Ramnagari: 11 Families

Lakurai: 14 Families

Sanjaynagari: 2 Families

Vansfoda: 52 Families

Ward Covered	No of Properties	Pop	Waste Generated
7,14	8127	38408	23 MT
2,3,6	7083	32606	19 MT
1,5,9	7156	32019	19 MT
4,8,10,11,12	6084	26167	15 MT
13	7539	27861	16 MT

Integration of waste pickers in zero waste centers for sorting & recovery of waste

Source: **Primary Survey, Sahjeevan DPR**

COMPOST TECHNOLOGIES

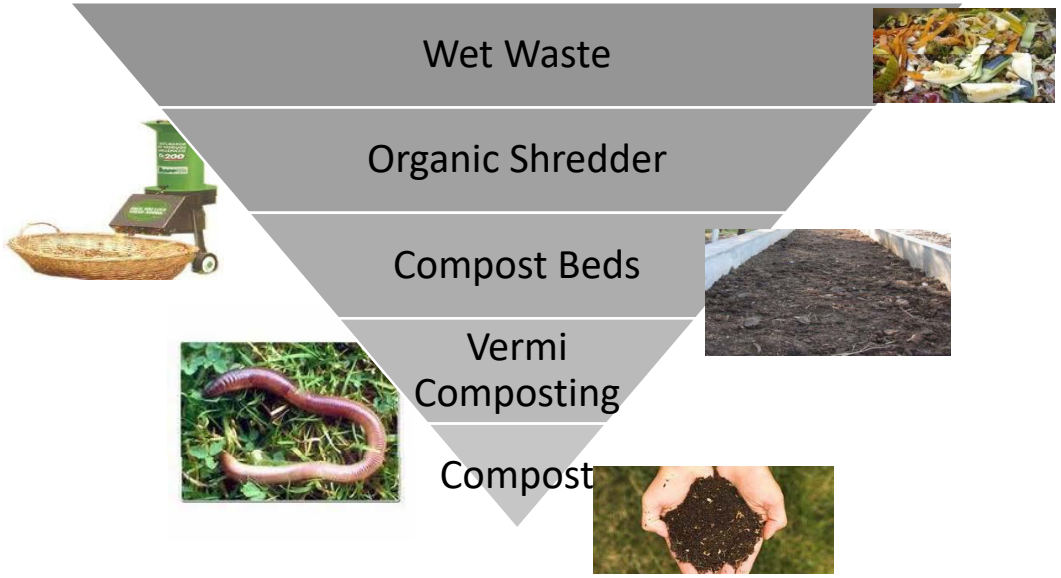
PARAMETERS	CENTRALIZED			DECENTRALIZED
	Windrow	Aerated Static Pile	In-Vessel	Vermi-compost
General	Simple for large scale & municipal use	Effective for farm	Large scale for commercial use	Small scale
Amount Of Waste To Be Treated	120 tonnes	1-500 tonnes	1-300 tonnes	12-18 tonnes
Land Requirement	330 sq. m/ ton	100 sq. m/ ton	133 sq. m/ ton	120 sq. m/ ton
Time	8 weeks	5 weeks	4 weeks	8-10 weeks
Financial Implications	Costly	Costly	Very Costly	Moderate but purchase of exotic earthworms are expensive
Odour	Issue if turning is not adequate	Moderate but can be controlled	Minimum	None

Source: Manual on SWM, 2016

DECENTRALIZED COMPOST

SEMI-MECHANIZED VERMICOMPOSTING

- Land requirement- 120 sq. m/ton.
- Capacity- 12-18 TPD

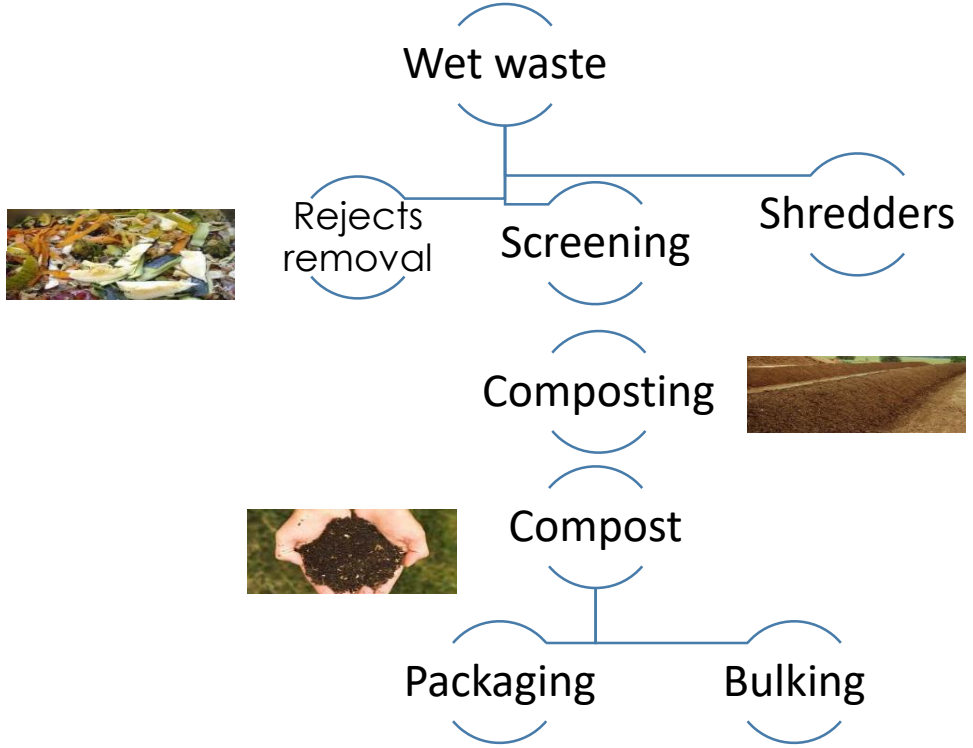


Total of 10 waste pickers will be involved in each ZWC for decentralized Treatment of waste

CENTRALIZED COMPOST

WINDROWS COMPOSTING

- Land requirement- 330 sq. m/ ton.
- Capacity- 70 TPD



Total of 23 waste pickers will be involved in Centralized Treatment Plant

Source: Manual on SWM, 2016

POLICY DIRECTIVES FOR INTEGRATION OF INFORMAL WASTE PICKERS

National Environment Policy, 2006	• It acknowledges the informal waste sector and states, "Give legal recognition to, and strengthen the informal sector systems of collection and recycling of various material.
National Action Plan on Climate Change, 2009.	• It stresses the need for giving legal recognition to the informal sector, which it recognizes as the "backbone of India's highly effective recycling system."
SWM Rules, 2016	• Recognizes the role of informal sector in waste management, and emphasize on establishing a system for integration of these waste collectors in order to facilitate their participation in SWM.

SCOPE OF WORK OF THE WASTE PICKERS

- Loading & Unloading of waste
- Sorting of Recyclable waste
- Segregation of Recyclable waste
- Transporting of the segregated inert & wet waste
- Processing at compost plan
- Set up and management of recyclable waste take back to sell in scrap market.

CAPACITY BUILDING

Improvement of Managerial skills with the help of NGO's or SHG's

Training in sorting, segregation & composting techniques

Formalization of the waste workers organization

Environment & health aspects

Maintenance of work ethics

Hygiene & safety at work

Source: Manual on SWM, 2016, Primary Survey

	BNP	WPA
CENTRAL OFFICE	CO, SWM	Central Office Staff
ZONAL OFFICE	Zonal Officer, SWM	ZWC Coordinator
WARD LEVEL	Ward Officers	Ward Coordinator
FIELD STAFF	Sweepers	Field workers

An NGO will act as the facilitator between BNP & WPA

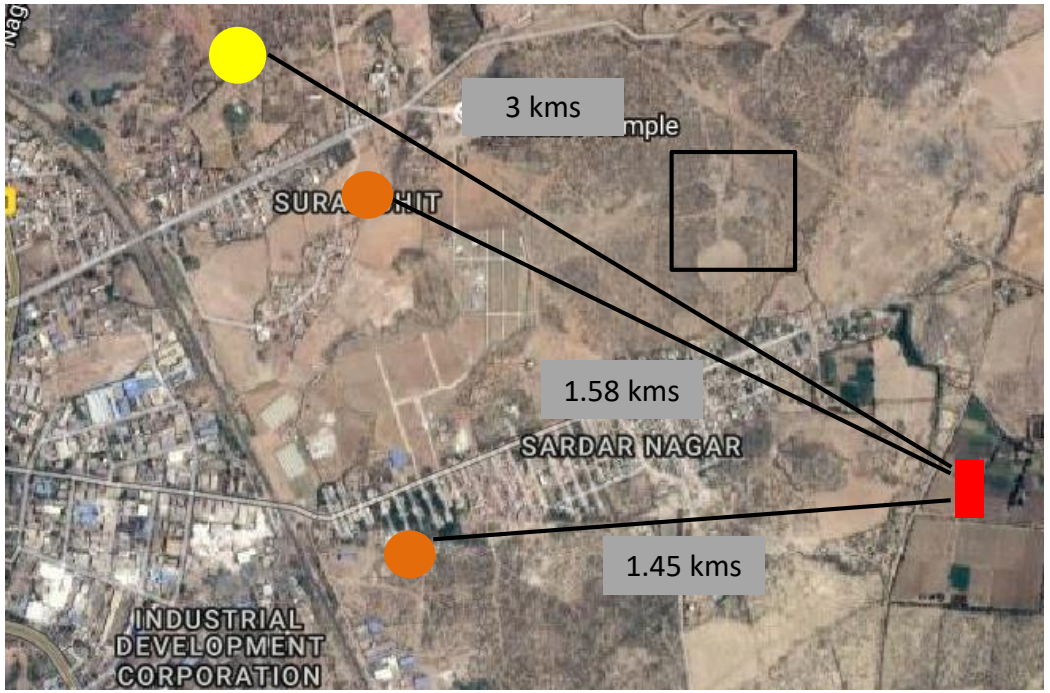
The waste pickers organization will be formalized in the later phases of the project, such that all its member will be given an identity card and also pay an annual membership fee, for systematic functioning of the ZWC.

Number of Waste Pickers to be involved in each ZWC in case of decentralized treatment

- 2 Supervisor (BNP Jr. Engineer)
- 12 for waste segregation
- 8 for sorting of waste
- 8 for storage of dry waste
- 10 people for processing of waste in the compost plant
- 2 drivers to transport the remaining inert waste after processing
- 4 helpers

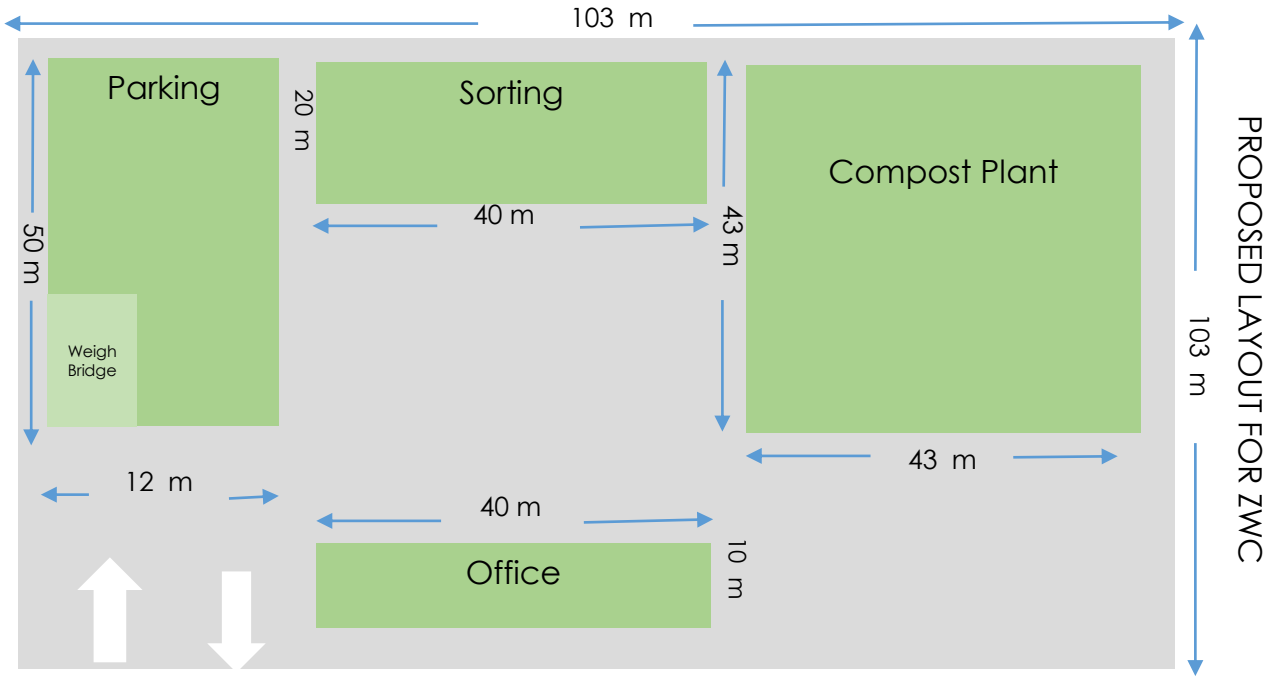
Total of 46 waste pickers will be deployed for each ZWC

WHY GIDC ZWC?



- GIDC ZWC, falls under SW zone 5
- Cover wards 7 & 14
- Lakurai & Sanjaynagari cluster of waste picker families are in close vicinity to the ZWC

Total Waste Transported to the ZWC: 23 MT



CRITERIAS FOR LOCATION OF ZWC

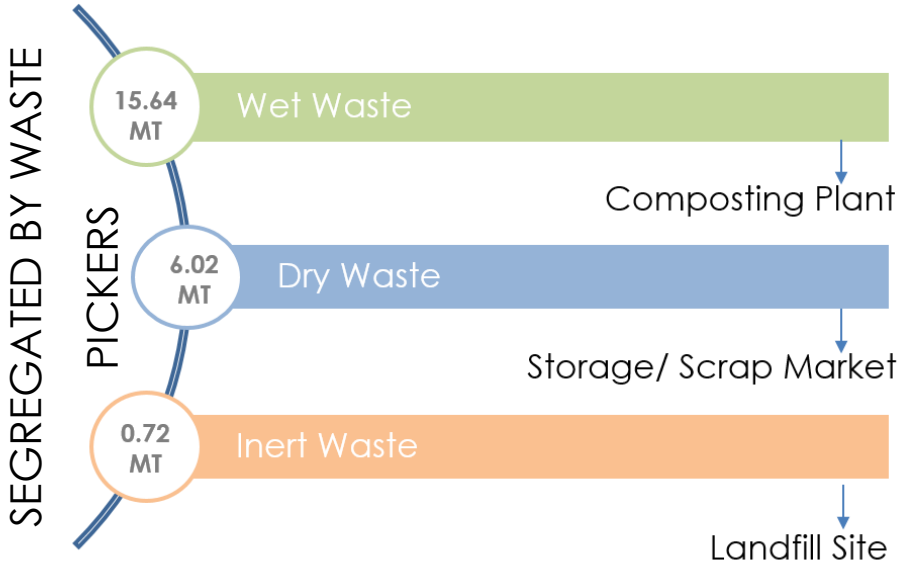
- Land availability (10 ha)
- In a 3 km distance from the landfill, this will reduce transportation cost.
- Away from residential vicinity
- Waste pickers family location around the center.

Covers maximum number of Properties (8127) & Population (38408)

Generates highest quantum of waste (23 MT)

Source: Primary Survey, Shahjeevan DPR

PILOT PROJECT



Land required per tone is 120 sq. mt.

Land required for 15 MT is 1800 sq. mt.

Capacity: 15 MT per day

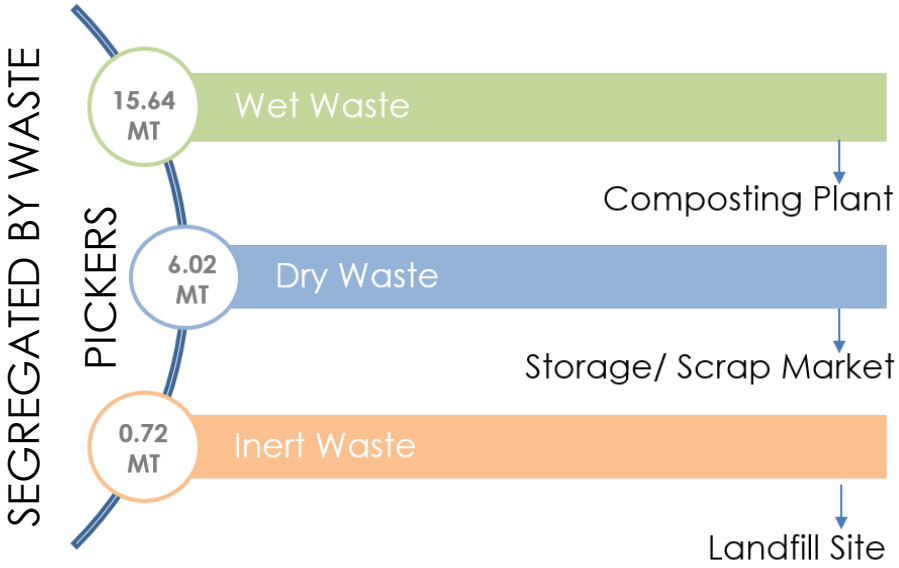
Efficiency at 50 %

Compost Produced 7.82 MT

- 2 Supervisor (BNP Jr. Engineer)
- 2 Coordinators (waste pickers)
- Waste Segregator 12 (waste pickers)
- Sorting of waste 8 (waste pickers)
- Storage of waste 8 (waste pickers)
- Processing of waste 10 (waste pickers)
- Drivers 2 (waste pickers)
- Helpers 4 (waste pickers)

- No. of Tractors: 2
- Capacity of each Tractor: 1.2 MT
- Quantum of inert waste is low in this ZWC so the waste will be transferred every two days to the landfill (1 trip by 1 tractor)

PILOT PROJECT



Land required per tone is 120 sq. mt.

Land required for 15 MT is 1800 sq. mt.

Capacity: 15 MT per day

Efficiency at 50 %

Compost Produced 7.82 MT

Capital Cost: Rs. 35 lakhs approx.

O&M Cost: Rs. 2.11 Lakhs p.m. approx.

Revenue Generated Rs. 2.4 Lakhs p.m.

CAPITAL COST OF THE PROJECT = **35 Lakhs**

स्वच्छ भारत
एक कदम स्वच्छता की ओर

GoI = 75%

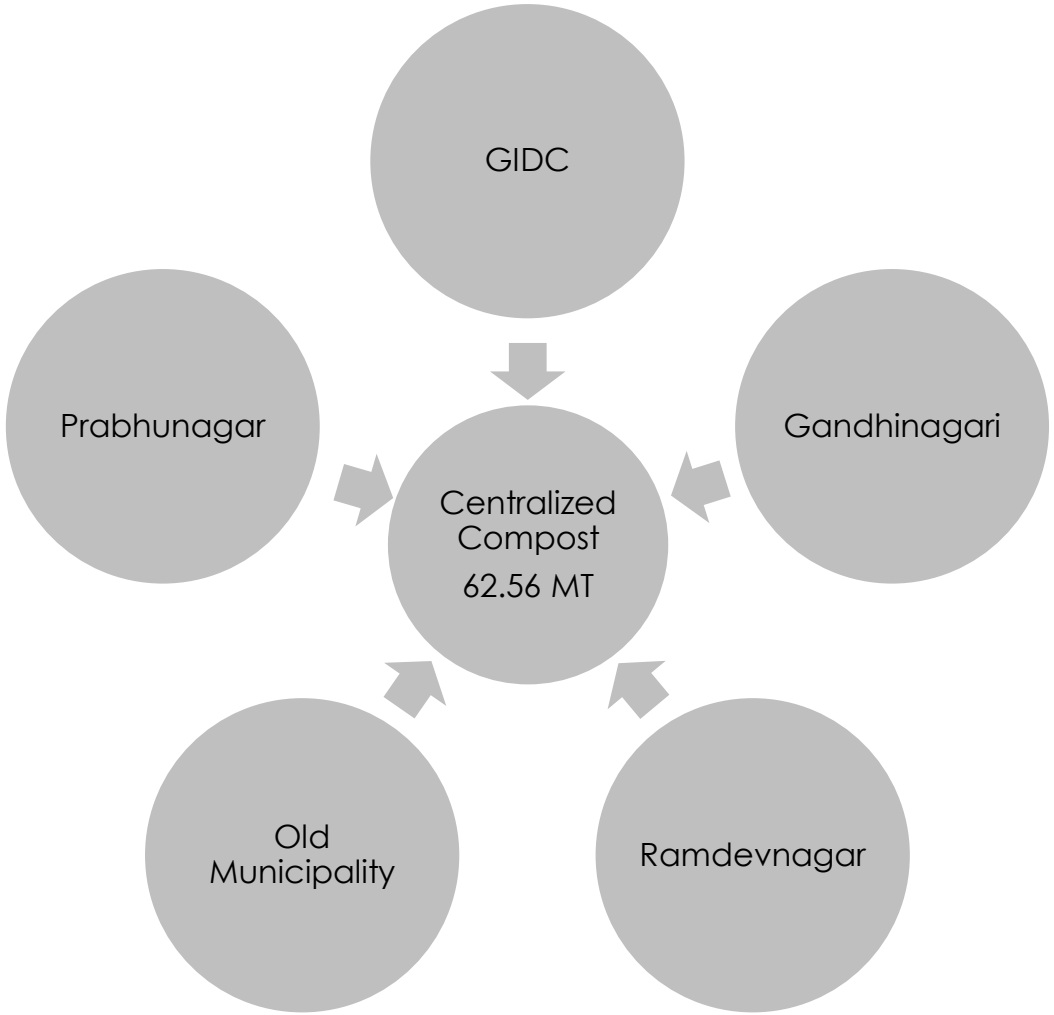
26 LAKHS

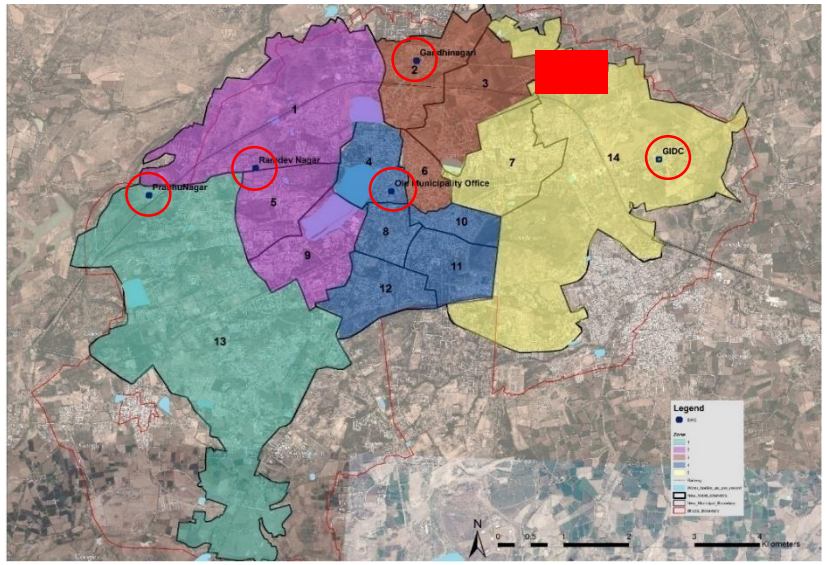
GoG=25%

9 LAKHS

Source: Primary Survey, Shahjeevan DPR, http://www.iibm.ac.in/pdf/Vermicompost%20Production%20Unit.pdf

CENTRALIZED TREATMENT





Site selected near existing dumpsite

Land required per tone is 330 sq. mt. Land required for 70 MT is 23,100 sq. mt.

Capacity: 70 MT per day

Efficiency at 30 %

Compost Produced: 18.77 MT

Source: Primary Survey, http://www.slideshare.net/excelind/composting-technologies-by-excel-industries-limited

CENTRALIZED TREATMENT

- No. of Tractors: 5
- Capacity of each Tractor: 1.2 MT
- Trips: Minimum of Two trips by each tractor daily.

WET WASTE ALONG WITH INERT WASTE FROM ALL ZWC

↓

COMPOST PLANT

↓

PROCESSING

↓

PACKAGING

↓

SELLING IN THE MARKET

- General Manager 1 (BNP Jr. Engineer)
- Shift in-charge 2 (waste pickers)
- Plant Operator 3(waste pickers)
- Accounts Officer 1 (BNP)
- Transfer of waste 7 (waste pickers)
- Processing of waste 6 (waste pickers)
- Drivers 5 (waste pickers)
- Helpers 5 (waste pickers)

Capital Cost: Rs. 5 Crore

O&M Cost: Rs. 14 Lakhs p.m.

Revenue: Rs. 2.5 Lakhs p.m. approx.

Source: Primary Survey, http://www.slideshare.net/excelind/composting-technologies-by-excel-industries-limited

THREE VARIANTS OF REVENUE SHARING

FIRST SCENARIO

TOTAL REVENUE FROM RECYCLABLE WASTE

Rs. 26512

TOTAL REVENUE FROM COMPOST

Rs. 11730

TOTAL REVENUE

Rs. 38242

BNP (40%)	WASTE PICKER (60%)
Rs. 15300	Rs. 23000

PER WASTE PICKER PER MONTH

AVERAGE INCOME

Rs. 8000

Approx.

SECOND SCENARIO

TOTAL REVENUE FROM RECYCLABLE WASTE

Rs. 26512

TOTAL REVENUE FROM COMPOST

Rs. 11730

TOTAL REVENUE

Rs. 38242

BNP (Compost)	WASTE PICKER (Recyclable)
Rs. 11730	Rs. 26512

PER WASTE PICKER PER MONTH

AVERAGE INCOME

Rs. 9500

Approx.

THIRD SCENARIO

TOTAL REVENUE FROM RECYCLABLE WASTE

Rs. 26512

TOTAL REVENUE FROM COMPOST

Rs. 11730

TOTAL REVENUE

Rs. 38242

BNP	WASTE PICKER
No Share	Rs. 38242

PER WASTE PICKER PER MONTH

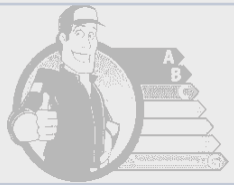
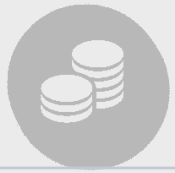
AVERAGE INCOME

Rs. 13000

Approx.

At present the average salary of a waste picker ranges from 6000 to 8000

WHICH OPTION IS MORE SUITABLE IN CONTEXT TO BHUJ?

PARAMETERS	WINDROW	VERMI-COMPOST
	23,100 sq. mt.	1,800 sq. mt.
	20 MT/Day	15 MT/Day
	30 %	50 %
	Rs. 5 Crore	Rs. 23.5 Lakhs
	Rs. 14 Lakhs p.m.	Rs. 2.11 Lakhs p.m.
	Rs. 2.5 Lakhs p.m. approx.	Rs. 2.4 Lakhs p.m. approx.

DECENTRALIZED TREATMENT OF WASTE

Vermi Compost takes **two weeks more to give the end product**

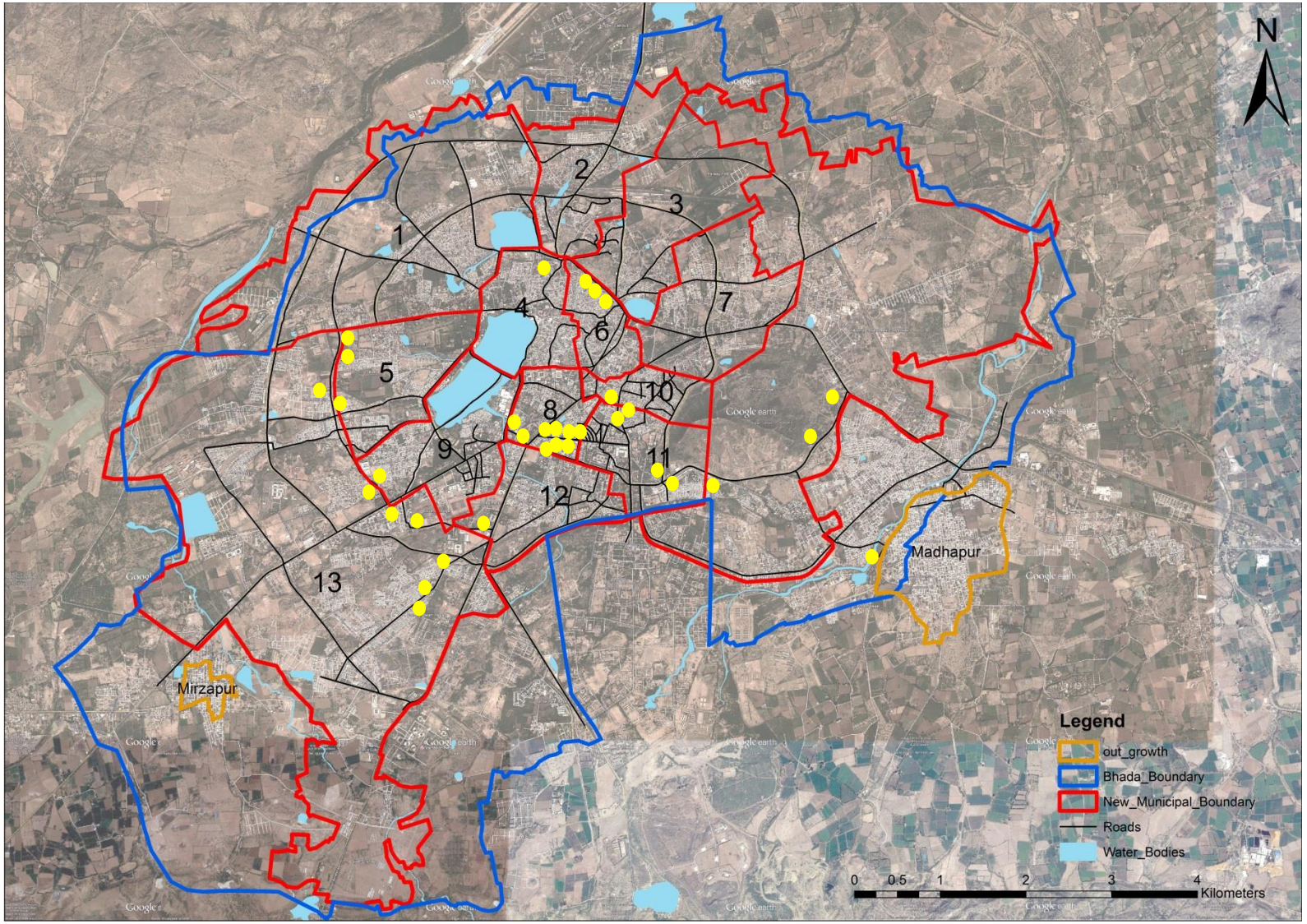
But the **investment is less** in decentralized treatment.

Revenue generated from one Vermi-compost plant is **almost equal to the entire revenue generated from compost plant.**

Source: Sahjeevan DPR, Manual on SWM

WASTE TO ENERGY

PRESENT SITUATION



- 30- estimated hotels and restaurants.
- 50- major hotels and restaurants.
- restaurants and hotels generated over 13 million tonnes of waste in 2011*.
- About 20-25% of the food generated by the hotels and restaurants is wasted in India*.

- Wastage of Food and Cost
- Wastage of Food and Increase in prices of food upto 40%-50% in India**.

- 1 MT of food waste generates about 80-100 meter cube of biogas.

Source: World Economic Forum - https://www.weforum.org/agenda/2014/08/india-perishable-food-waste-population-growth/

SOLID WASTE MANAGEMENT



- **NIT – Trichy – Biogas Plant using Hostel Food Waste**

The project is touted to deal with food waste by using the excess food from the institute's hostel messes as feed for the biogas plant. The biogas produced here will be supplied to hostels for cooking.



- **Hiranadani Estate, Thane**

90 percent residents in 72 buildings to segregate household garbage, collecting 3,000kg of kitchen waste per day. The Waste is being sent to the biogas plant at the estate which generates around 160 units of electricity per day.

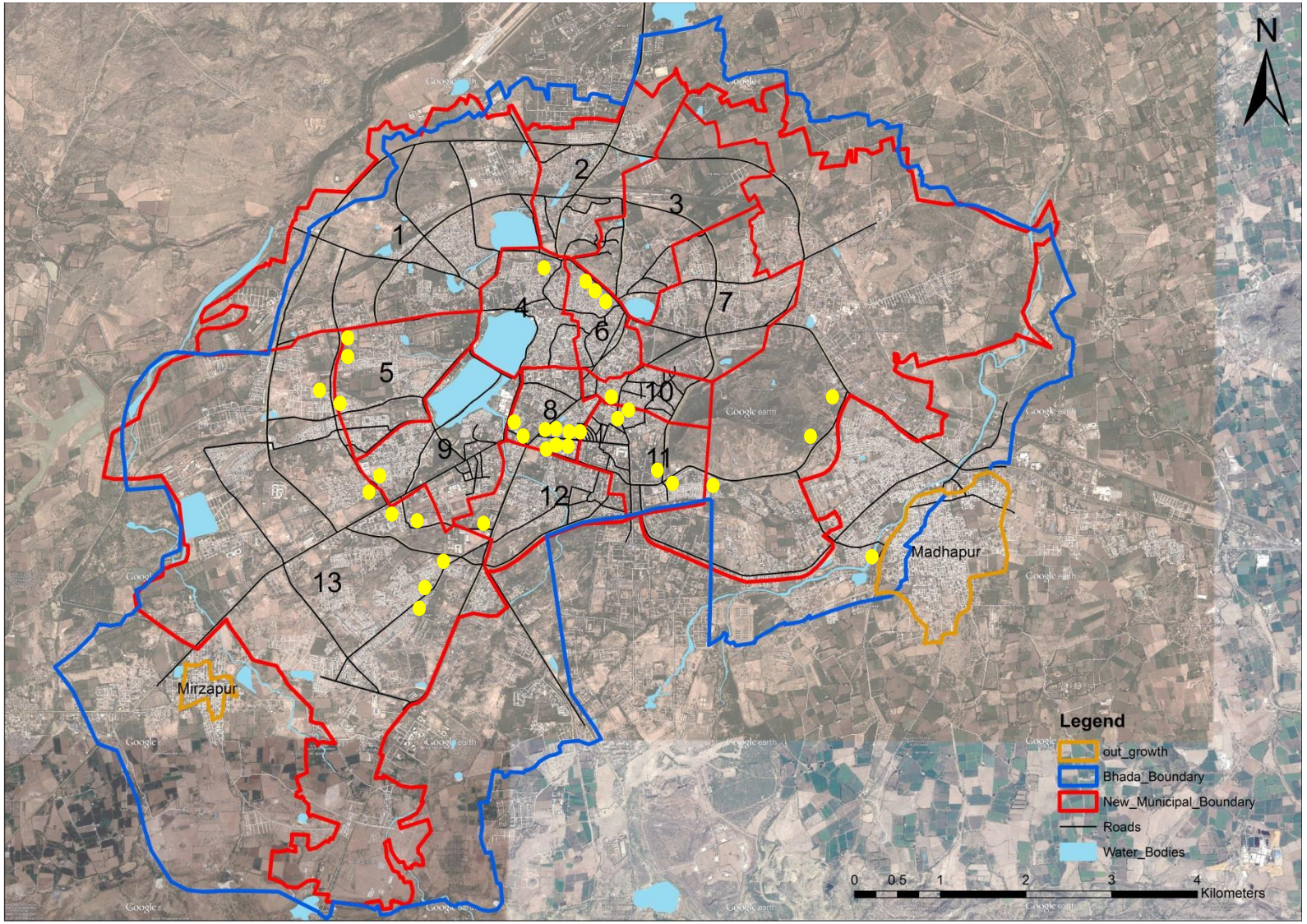



- **Delhi Secretariat**

Up to half a tonne of kitchen and horticulture waste per day is fed into the plant, producing some 40 cubic meters of the gas per day - equivalent to 2 commercial and 3 domestic LPG cylinders.

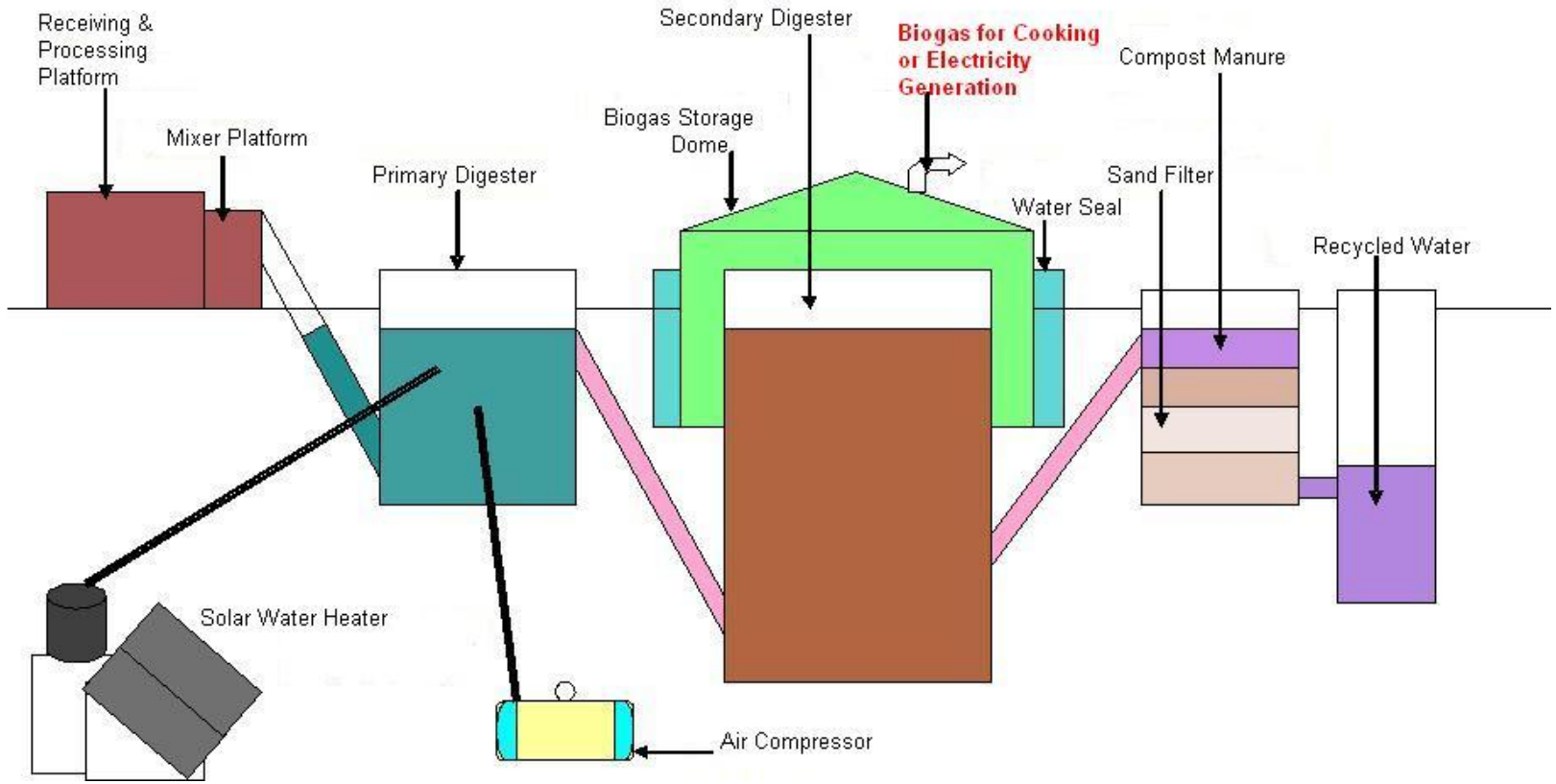
Source: http://icrier.org/Urbanisation/events/26-27-August-Kerala/Dr%20Kale's%20presentation.pdf

SOLID WASTE MANAGEMENT



- Bhuj Generates about 60 MT of Wet waste.
- About 12 MT of that waste is wastes from hotels and restaurants and bulk wastes.
- Converting this quantum of waste to energy can generate about 75 Kw of Energy or about 30 LPG Cylinders per day.
- 60% of the energy is lost in converting the biogas formed into energy as heat losses and machine loses.

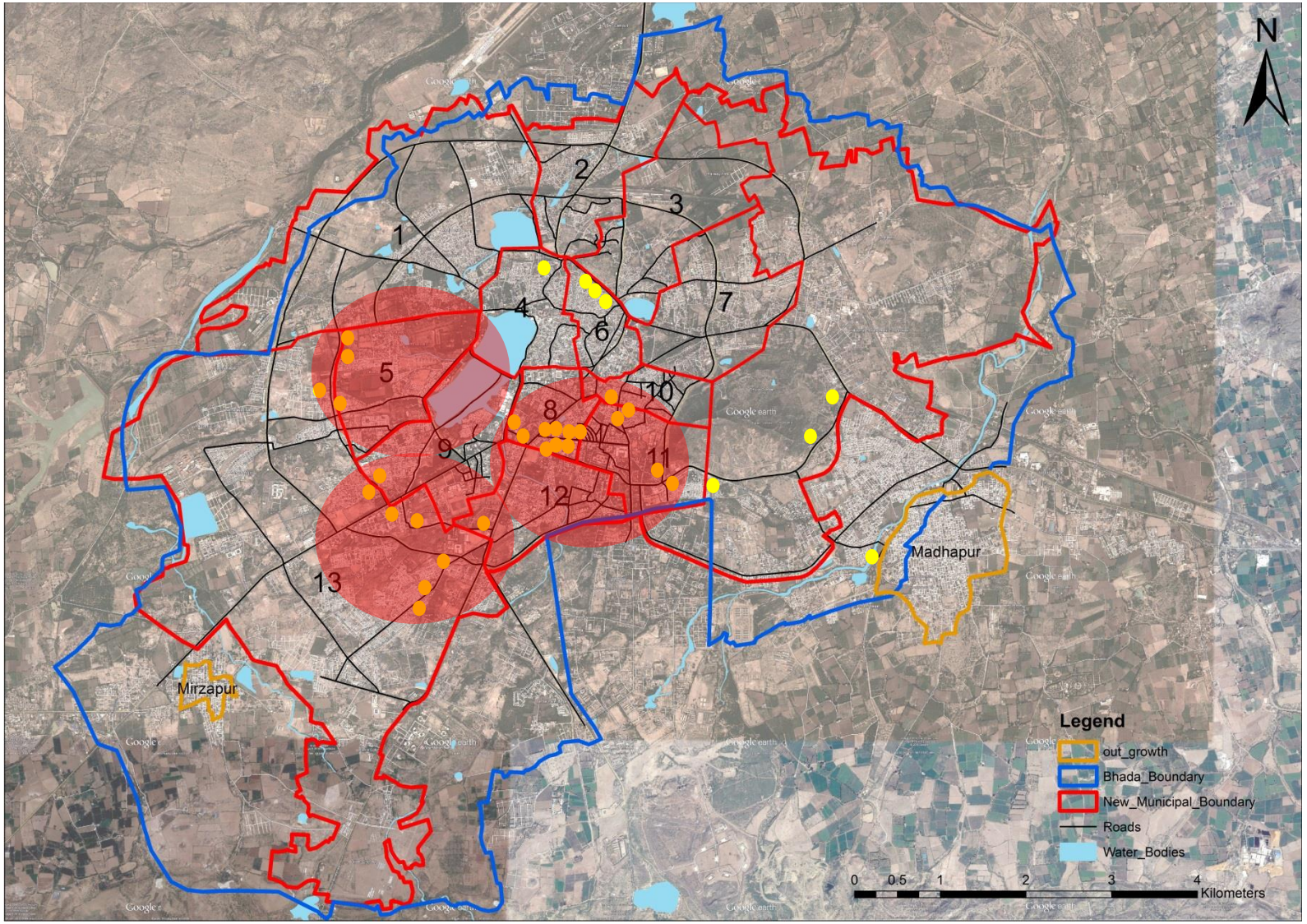
Source: http://timesofindia.indiatimes.com/life-style/food/food-reviews/What-do-restaurants-do-with-leftover-food/articleshow/39099560.cms



- Technology inspired by BARC's "NISARGUNA" technology .
- BARC's NISARG-RUNA plant for solid waste management offers a Zero garbage, Zero effluent method for waste management. Two such plants have been installed at BARC and the residential complex, Anushaktinagar, for environmental friendly disposal of the waste generated in kitchens of various canteens in the premises.
- A substantial portion of our biodegradable waste is food waste (38-40%) which is used to generate methane. This methane gas can be used as fuel for domestic purposes or in vehicles. The vegetable waste and paper waste yield manure.

Source: http://www.pluginindia.com/nisargrunabiogasplant.html

SOLID WASTE MANAGEMENT



- G.K. General Hospital

- Government Polytechnic College

- Government Engineering College

PROJECT

IMPLEMENTATION

Project should be driven by the Nagarpalika and executed through a PPP mode under which the Technology Provider can have his share through BOT or BOOT mode.

Advantages of BOOT mode would be:

- Technology provider takes care of maintenance.
- Market of Product can be handled by the technology provider.

Since a new project the authority can take the contract years to develop and capacity build the staff for future.

COSTING

Solid and Liquid Waste Management Plant – 40 Lacs

O&M Plant – 2 Lac/Annum

Space Required – About 500 sqmt.

Per household

Cost for all three Plants

Total Cost – 2 Crores

Total O&M – 6 Lacs/Annum

One Gas Stove – 10 Lacs (Approx.)

- Upto 50% of Cost of Stove, Ceiling of Rs. 5000 for all three plants.

Cost of LPG Per Kg – About 50 Rupees

LPG Produced per Day – 424 Kg

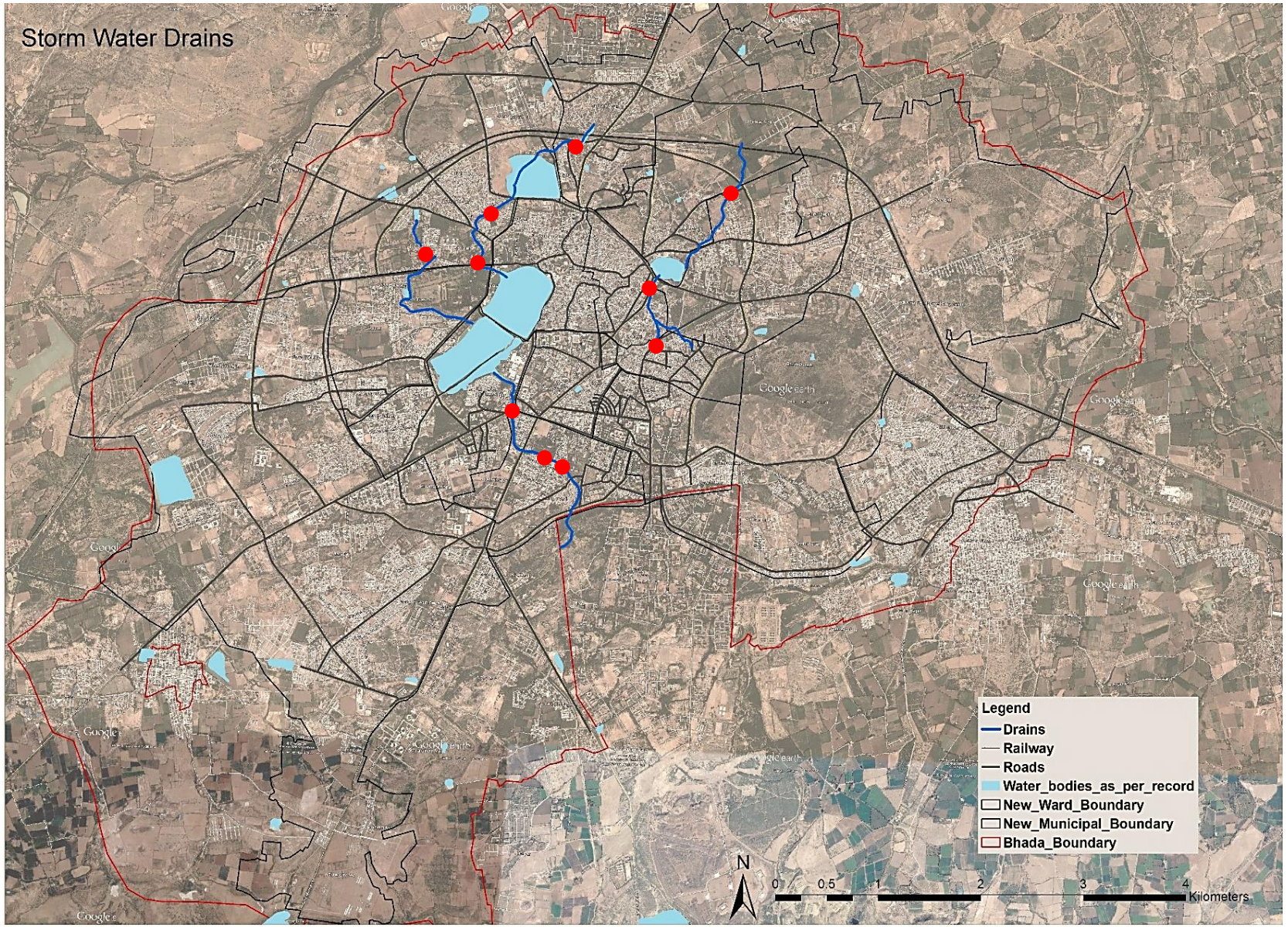
Value of Gas Produced – 21300 Rs.

Annual Revenue – 40 Lacs

Source: http://www.pluginindia.com/nisargrunabiogasplant.html

DRAIN CLEANING AND C&D WASTE

SOLID WASTE MANAGEMENT



Hamirsar

Bhaveshwar nagar

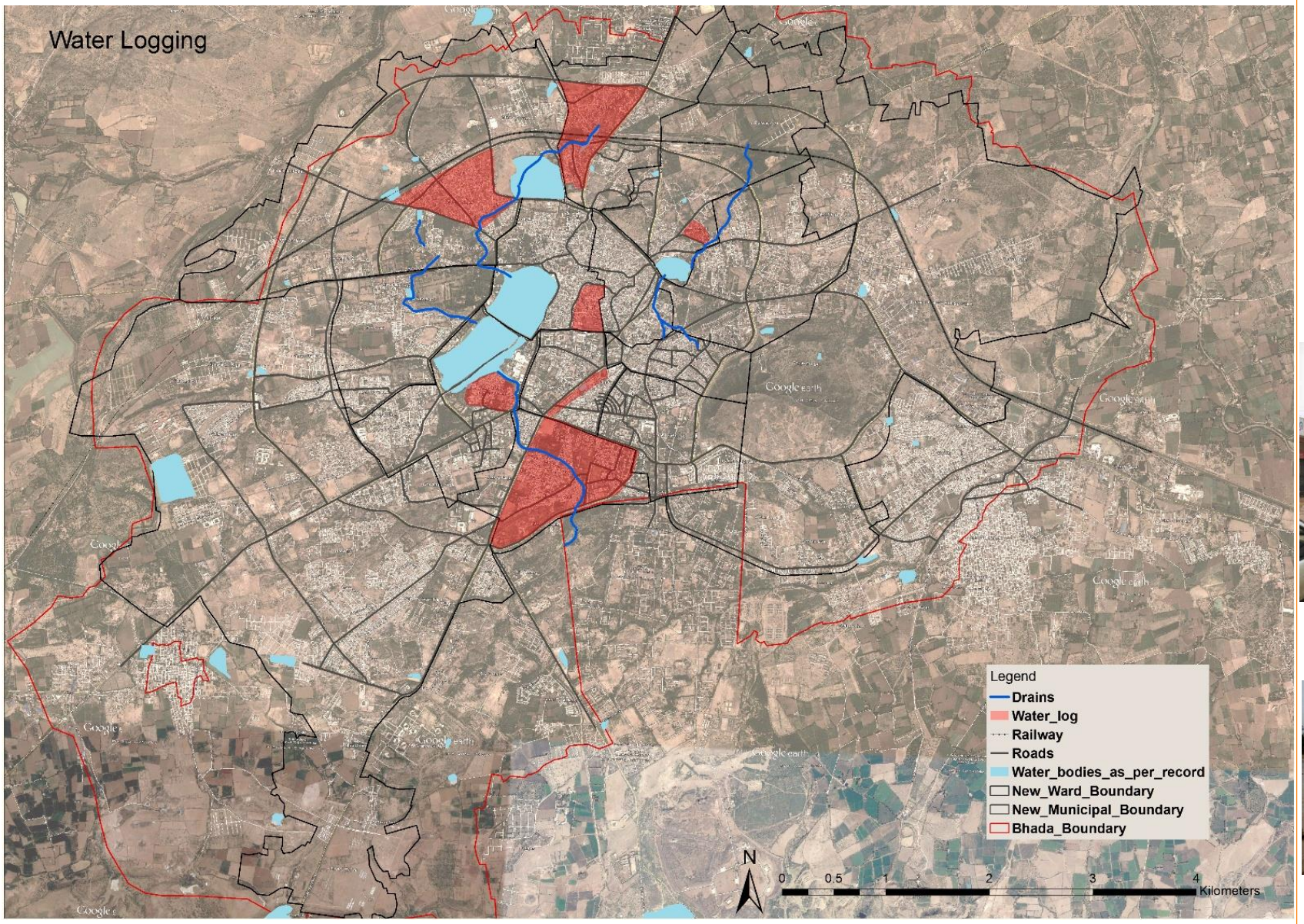
Ravcinema

Desalsar lake

Pragsar lake

Source: Primary Survey, Google Earth

ISSUES



Flooding in the year 2011 September, Center of the city is majorly affected

Source: Google Earth, Primary Survey

Involving Street Sweepers To Carry Out Regular Storm Waster Drain Cleaning and Nallas

Regular cleaning

- **Avoid accumulation of solid waste, mosquitoes breeding, blockage of drains, etc.**
- **Involving regular street sweepers In cleaning SWD/Nallahs**
- **Prevent dumping street swept waste in to drains.**
- **Cleaning should be done twice in a month**

According to the proposed contract:

- **592 sweepers** daily sweeping of the roads

For **Storm water drain cleaning**:

- **28 sweepers** needed for **13.93 Km length**

4 lakhs per annum

Source: Solid waste management- Ahmedabad

Yearly cleaning

- Removal of silt, debris from SWD/ Nallah
- Cleaning works will be given out for private contractors
- Cleaning will be done once in a year, before monsoon

PRESENT

4 lakhs per annum

For 1 km length of storm water drain

PROPOSED

14.2 lakhs per annum

For 14 km drain length with average width of drain 1.2 Mt

Source: Schedule of Rates-Bhuj

- **Annual tender** is floated for desilting of SWD/Nallahs in **ward number 1,2,3,4,5** with in the city boundary.

- **Scope of work:** Removal of silt, debris, sand, grit, pebbles, stones, boulders, grass, animal dung, rank vegetation, branches of trees and any or all such objects from SWD/Nallahs.

- Waste collected from the cleaning processes should be segregated and the same are to be disposed off to the designated C&D Waste centers.

- **Qualification Criteria:** Previous experience in cleaning works
-
- **Equipment Criteria**: **Proclain machine – 2** numbe
  Tractors/Dumpers- 15 numbers

Sr no.	Name of the work	Estimated cost	Amount of EMD	Working Period
1	Desilting of SWD/Nallah in the city area	**14.2lakh**	**14,200/-**	**1month**

CONSTRUCTION AND DEMOLITION WASTE

Why C&D waste management is must?

Generators

- Small scale waste
- Renovation

- Large scale waste
- Construction waste
- Demolition waste
- Excavation

- Waste generated by BNP
- Civil works
- Construction waste
- Excavation

Lake bed, Empty fields, Natural drains ,Streets

Environmental Impact

Health Impact

Economic Impact

Waste control

C&D waste management

Source: Primary Survey

C&D waste generated so far?

2001 Earth quake

Category	Total no of Buildings	Average Waste/Building(MT)	Total waste(Lakh)
Demolition	6402	283MT	18.2
Renovation	6933	24MT	1.68
Construction	25550	34MT	8.69
Total			**28.57**

Present generation

Waste generated in last 5 years	
C&D waste from 2010-2015	56900MT
per year generation	9483MT
Per day generation	25.98MT
But generally 10%-15% of total SW in the city	15MT

Waste control

C&D waste management

Source: CPHEEO Manual-2016

Role of generators

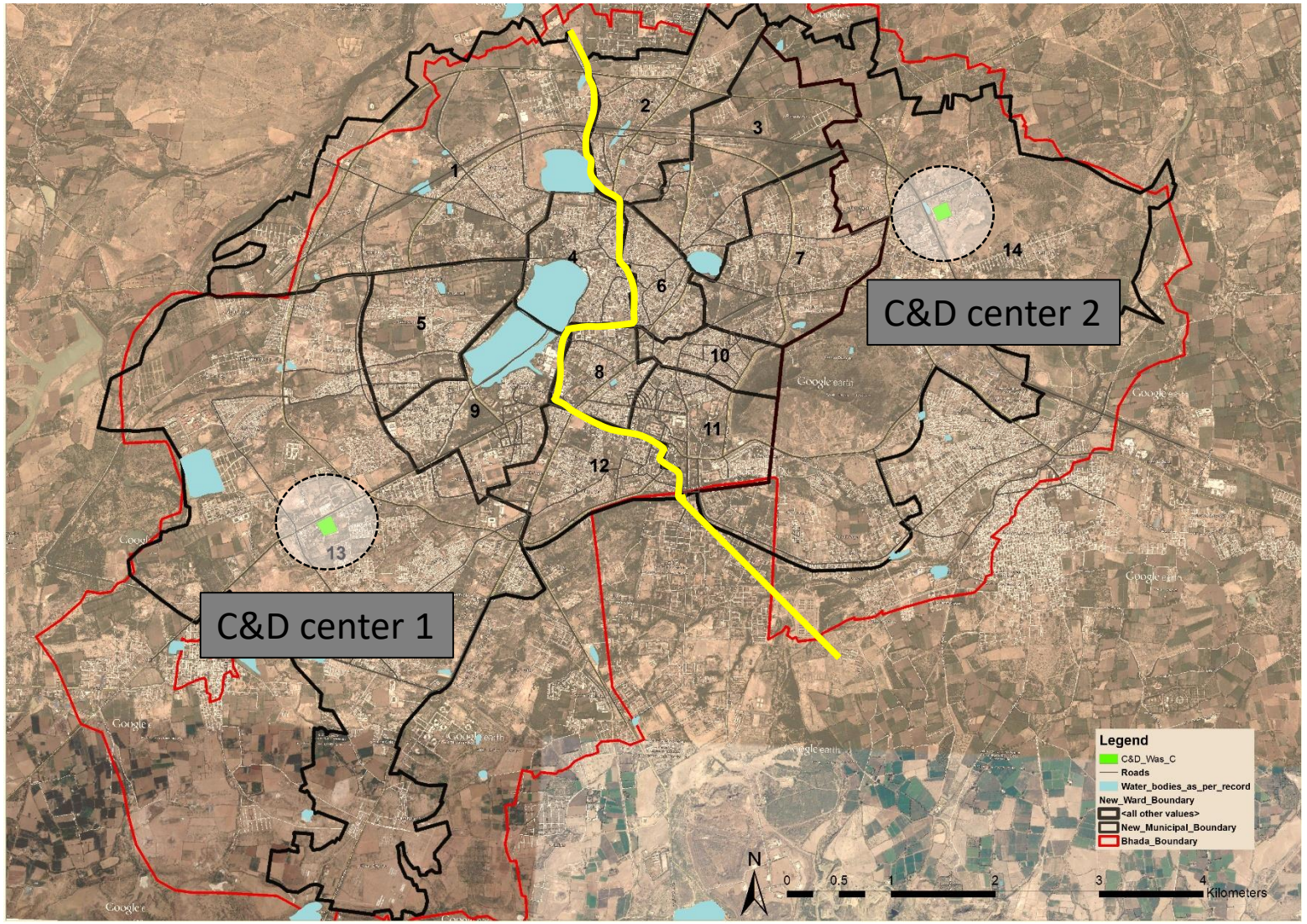
- Preparation of C&D waste management plan
  *Quantity of waste generated
  *Layout plan for storage
- Every waste generator shall keep the construction and demolition waste within the premise until it is collected.
- The generator shall ensure that other waste (such as solid waste)does not get mixed with this waste and is stored and disposed separately.
- Every waste generator shall pay relevant charges for collection, transportation, processing of waste.

Role of BNP

- BNP shall examine and sanction the waste management plan of the generators before approval of building plan.
- shall keep track of the generation of construction and demolition waste within its jurisdiction.
- shall get the collected waste transported to appropriate sites for processing and disposal.
- BNP shall give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ.

Waste control

C&D waste management



Waste control

C&D waste management

C&D waste recycling plant

- Plant are generally for processing of waste greater than 100MT/day
- High capital cost
- High O & M cost.
- Land requirement is more.
- Not viable for class 2 city like Bhuj which only generates 10MT-15MT of C&D waste a day.

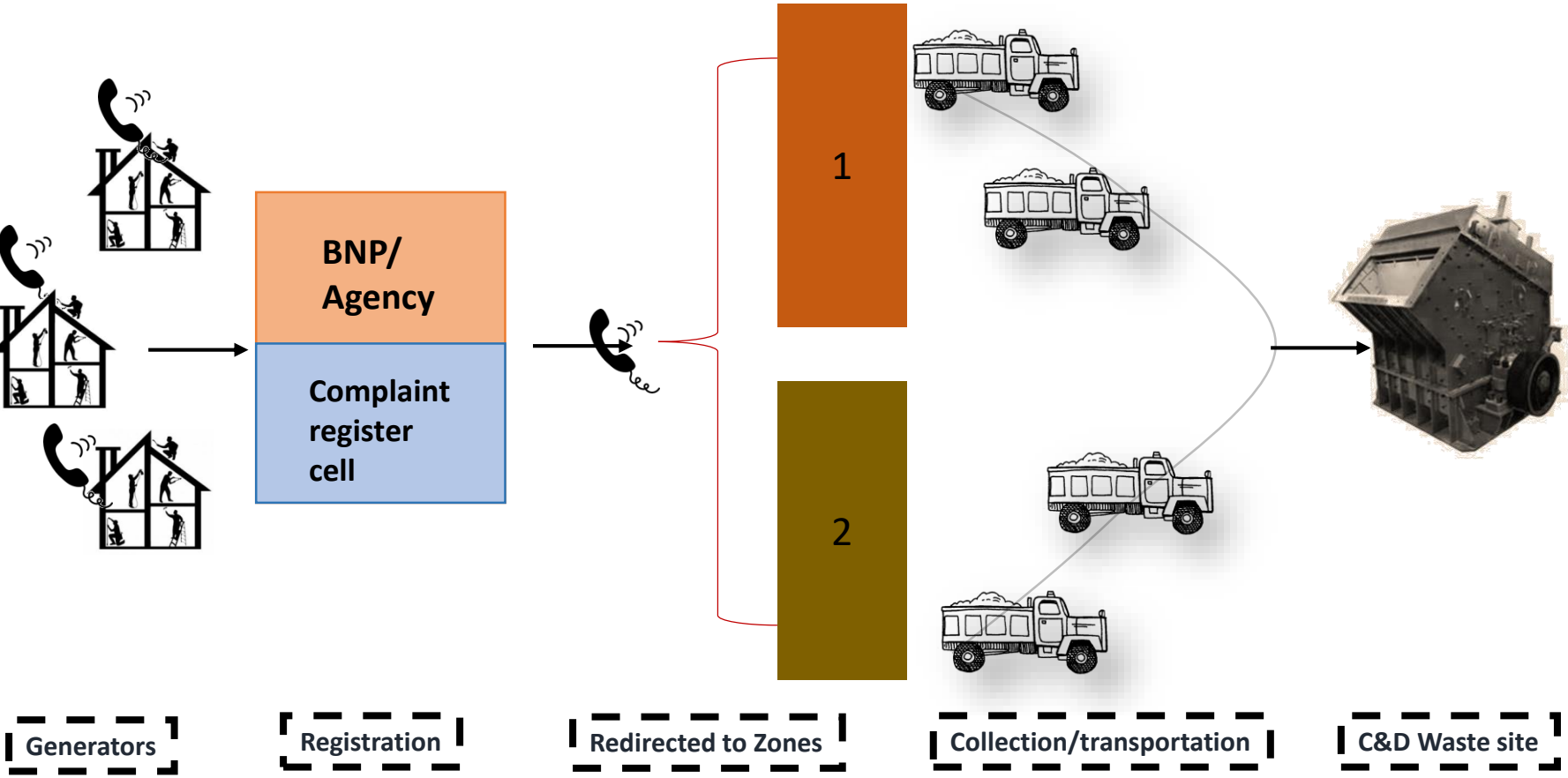
Mobile crushing unit

- Unit could be transferred to required place without efforts.
- Suitable for small cities which generated less C&D waste.
- Land required is very less.
- Less capital, O&M cost and easy to operate.
- Gives semi finished material which could be further transported to bigger processing plant or could be used as land filling material.

Waste control

C&D waste management

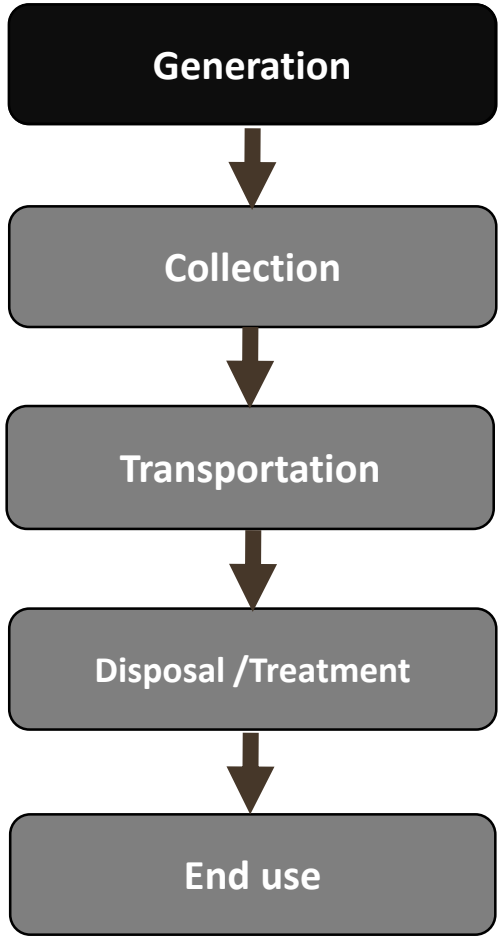
Source: www.dir.indiamart.com



Waste control

C&D waste management

Frame work for C&D waste for Bhuj



1. Generated from new construction, Demolition or renovation activities.

2. Contributors can be Builders, Developers, Contractors or General public.

3. Contributors become a part of the process and are liable to bear the cost as well.

Frame work for C&D waste for Bhuj

- Generation
- Collection
- Transportation
- Disposal /Treatment
- End use

1. MSW rules stipulate C & D waste to be collected and dumped separately.

2. Cost implication will be for collection and processing of waste.

Waste control

C&D waste management

Frame work for C&D waste for Bhuj

- Generation
- Collection
- Transportation
- Disposal /Treatment
- End use

1. Transportation of C & D waste will be different from the general SWM.

2.Transportation agency/BNP to have Daily Target reports and Daily progress reports.

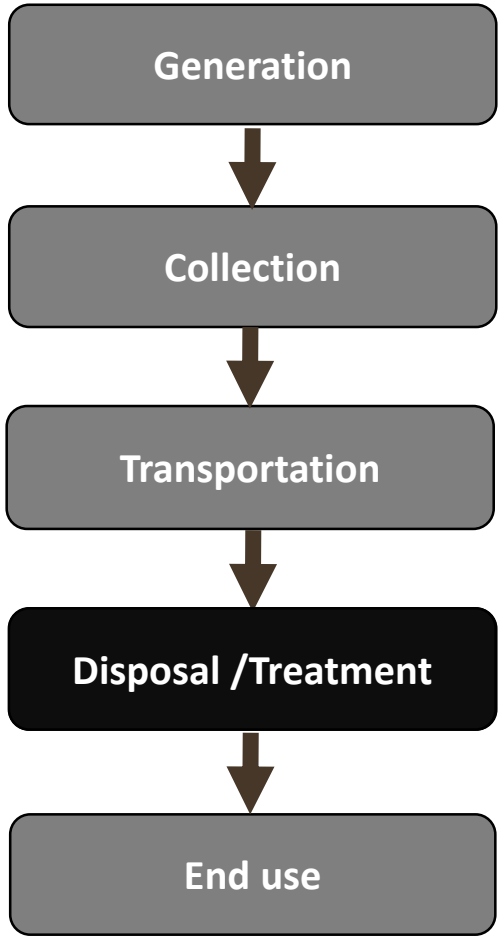
3.Transportation of C&D waste will either be done by BNP or the contracted agency.

4. Waste should be collected from the source (BNP/Agency) and conveyed it to the nearest C&D waste processing unit.

Waste control

C&D waste management

Frame work for C&D waste for Bhuj



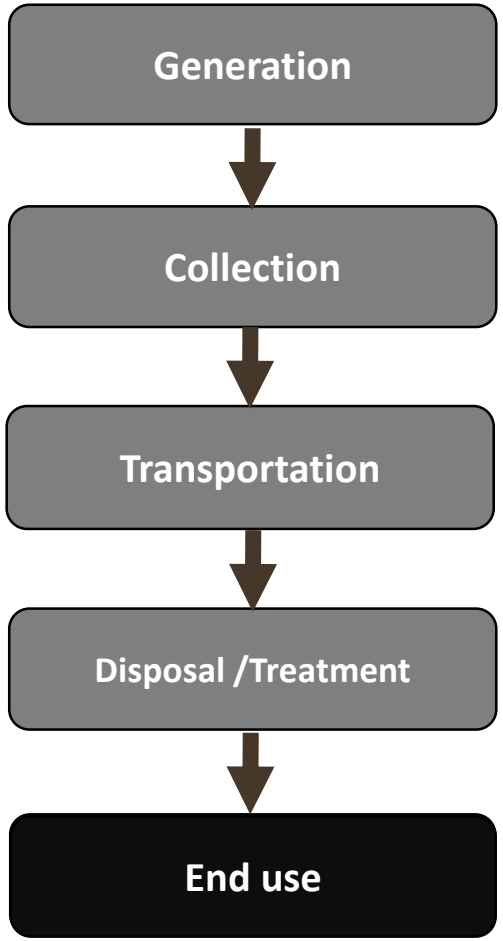
1.The location and Management of C&D waste to be as per CPHEEO Guidelines.

2. Waste should be disposed and processed in designated location which will be identified.

3. Treatment adopted would be in accordance with the technology, suitable; with respect to the quantum of waste.

4. Processing will be done either by BNP/Agency.

Frame work for C&D waste for Bhuj



1.The market for the processed unfinished materials in Bhuj, is still untouched and unexplored.

2.The policy structure should define the end use of the material so collected, this will help in restructuring the costing of the whole management process

3.The end use of the waste collected will be totally dependent of the potential of the market to use this material.

150 lakhs

33.5 lakhs/ Annum

93 lakhs/ Annum

SOLID WASTE MANAGEMENT

PPP model 1

- Capital: BNP-30% / Agency-70%
- O&M: BNP-0% / Agency-100%
- Revenue: BNP-30% / Agency-70%

Operation & maintenance

Complaint registration cell management	Agency
Collection & transportation of waste	Agency
Processing/ Treatment of waste	Agency
Marketing of semi finished material	Agency

only BNP

- Capital: BNP-100% / Agency-0%
- O&M: BNP-100% / Agency-0%
- Revenue: BNP-100% / Agency-0%

Operation & maintenance

Complaint registration cell management	BNP
Collection & transportation of waste	BNP
Processing/ Treatment of waste	BNP
Marketing of semi finished material	BNP

PPP model 2

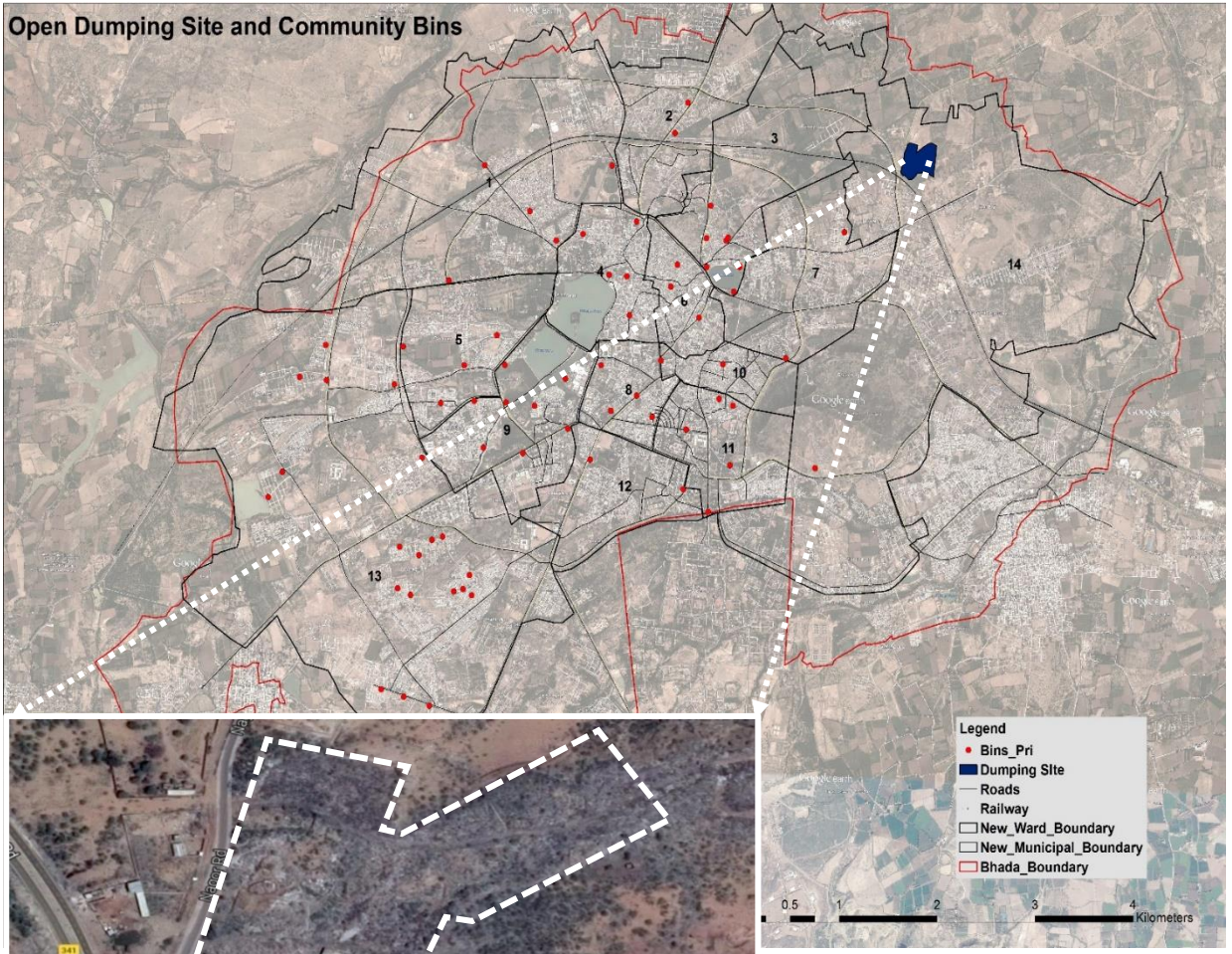
- Capital: BNP-0% / Agency-100%
- O&M: BNP-0% / Agency-100%
- Revenue: BNP-20% / Agency-80%

Operation & maintenance

Complaint registration cell management	Agency
Collection & transportation of waste	Agency
Processing/ Treatment of waste	Agency
Marketing of semi finished material	Agency

MUNICIPAL SOLID WASTE TREATMENT AND DISPOSAL

What we see today

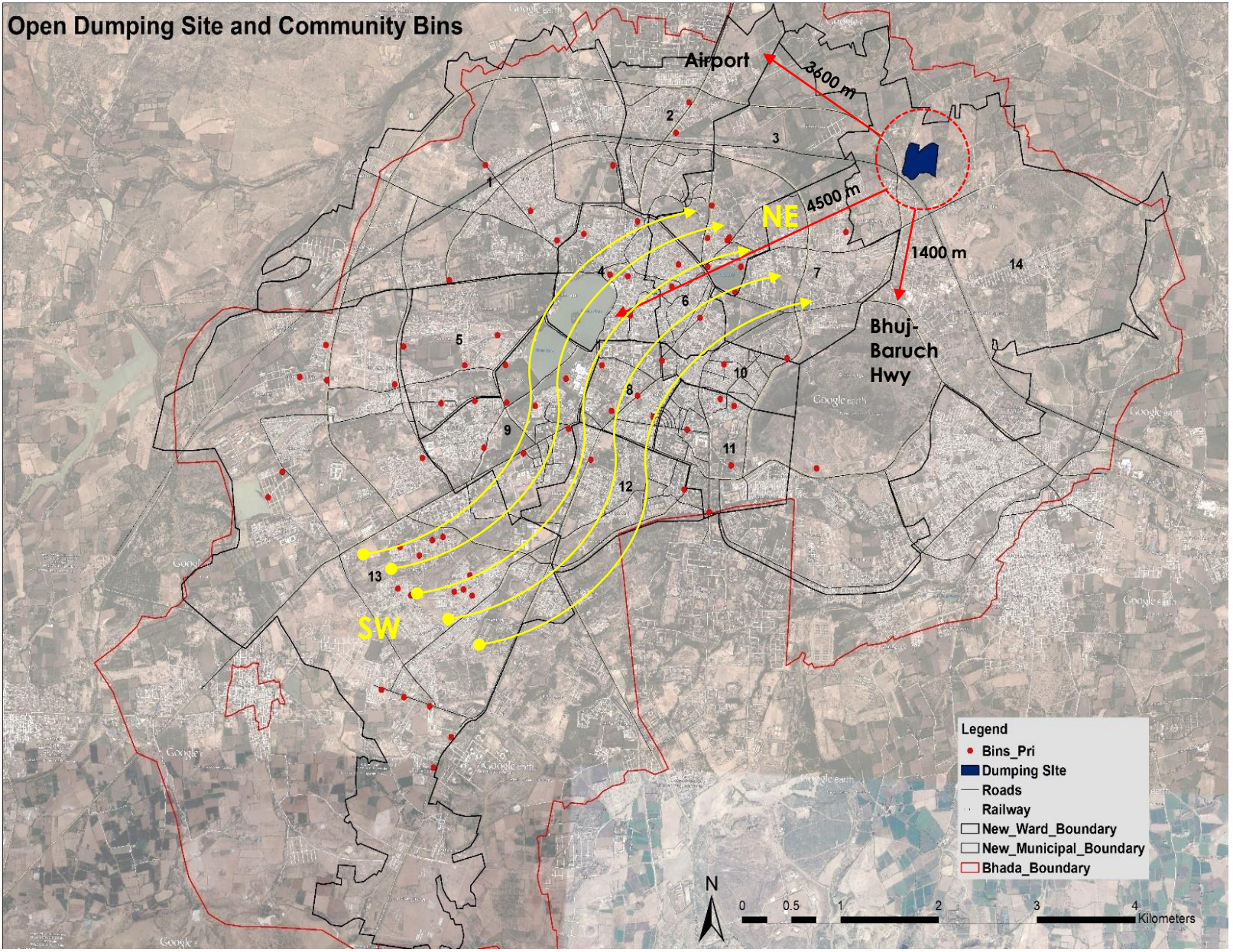


ISSUES OBSERVED

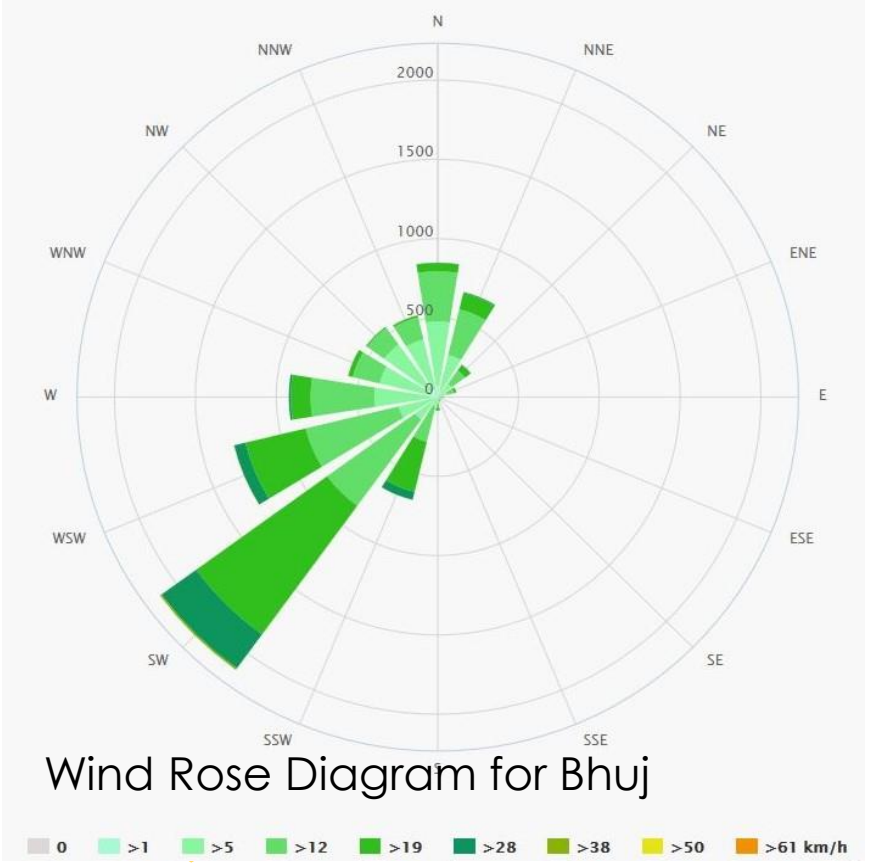
- Littering, odour and dust
- Surface and Underground Water contamination
- Health issues and unhygienic conditions
- Stray animals and birds
- Burning of waste!
- Slope failure and flow of contaminated water during monsoon

Source: Primary Survey, Google Images and PC: Laila Khan

How does it really matter ?



- Dumpsite area – 9.6 hectare (medium category)
- 50-60 tractors a day – 60 to 65 tons per day disposed



Wind Rose Diagram for Bhuj

Source: Wind Rose - https://www.meteoblue.com/en/weather/forecast/modelclimate/bhuj_india_1275812, Primary Survey

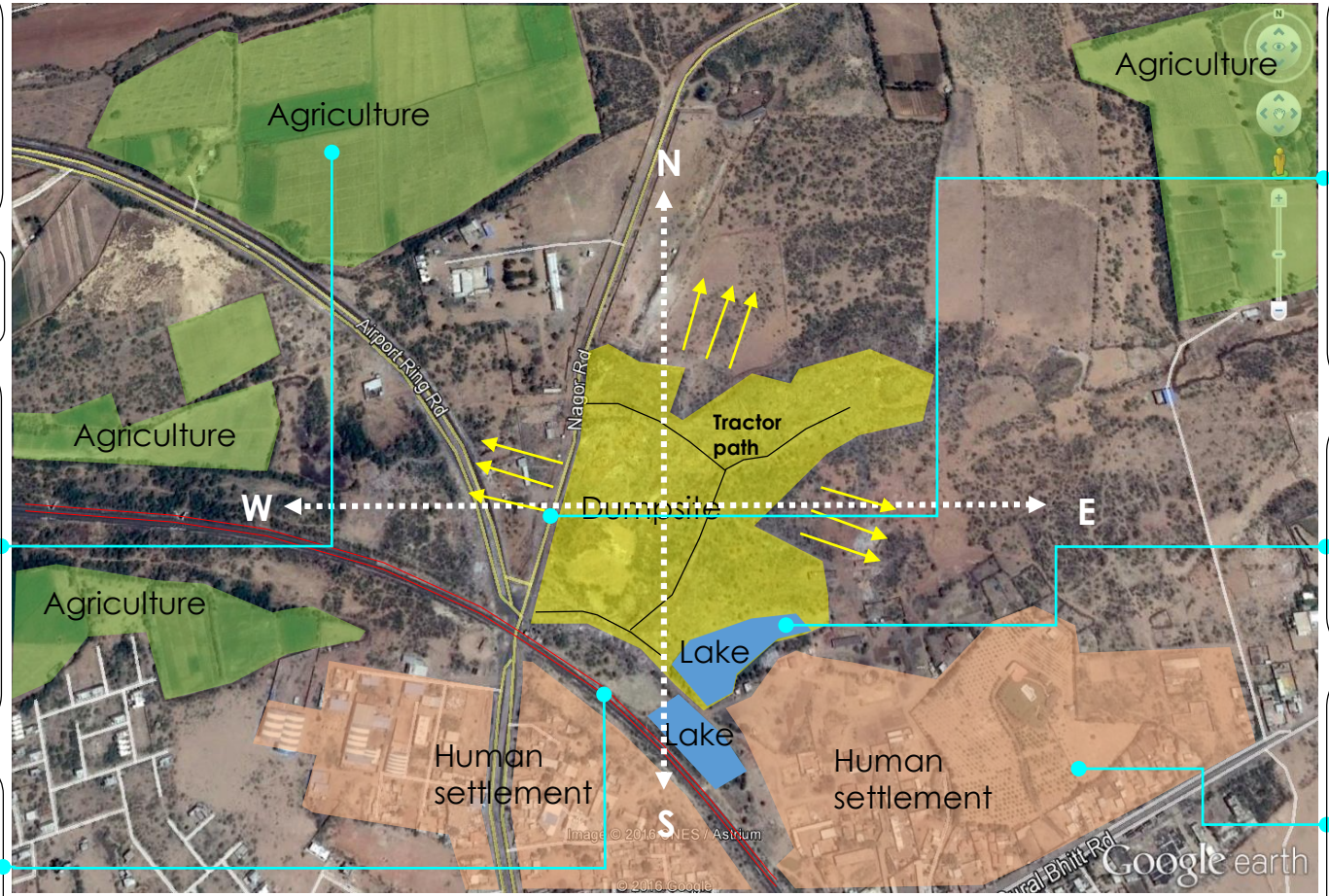
Well, it does matter

- Airport at a distance 3600 m
- Birds flying within airstrip vicinity

- River at distance 4100m

- Agriculture fields within 750m
- Single crops – oil (Erranda)
- Contaminated UGW
- Yield of crops reduced

- Railway line – barrier btw dump site and southern settlement

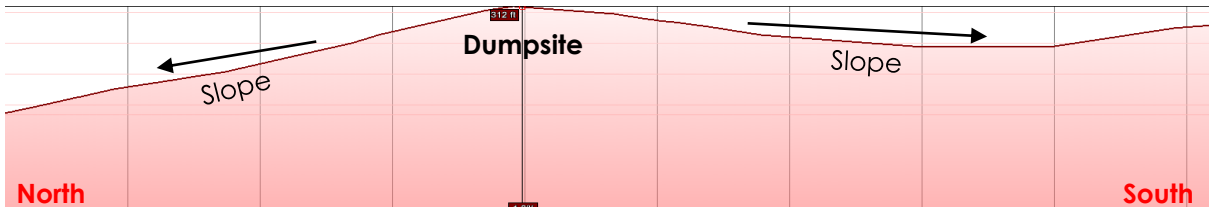


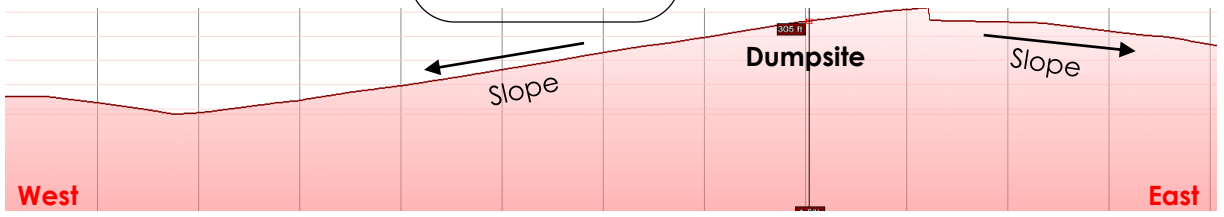
- Access from Nagor Rd
- 2 entry pnt
- Leachate flow onto roads during monsoon
- Nearest Hwy – 1400m

- Surface water contamination
- At a distance of <100m

- At a distance of <250m
- GW contamination
- Health issues

Description	Not at a distance	Actual
Lake/ pond	< 200m	< 100m
River	< 100m	4100 m
Flood plain	100 years	No
Highway	< 200m	1400m
Habitation	< 500m	< 250m
Parks	< 300m	> 4000 m
Critical habitat	Not within	Not within
Wetlands	Not within	Not within
GWT	< 2m below GL	15 m
Airport	< 10000m	3600 m
Well	< 500m	> 750m
CRZ	Not within	Not within





Source: Primary Survey, Google Earth, CPHEEO Manual 2016

What are the possible options for improvement ?

HOW ABOUT

Utilizing the existing space to construct a new scientific landfill and mining/ capping the old dumpsite !

Need for Scientific landfill to manage and dispose inert waste!

Project Highlights

- *Mining, Shifting and Capping (green) of existing dumpsite*
- *Safe buffer (no-dump zone) near the lake adjacent to refurbished dumpsite*
- *New Scientific landfill adjacent to the refurbished dumpsite*
- *Marigold farming/ Solar plant over refurbished dumpsite as a revenue model*

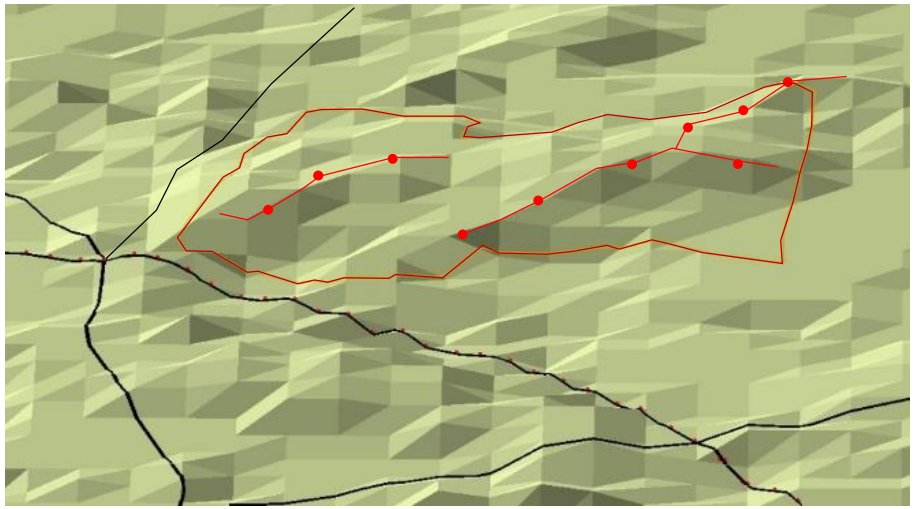
Feasibility

Alternatives	Actual
Environmental Impact	Reduced impact due to implementation of scientific approach
Social Acceptance	Reduced impact due to implementation of scientific approach
Land availability	Utilization of existing land
Transportation cost	Less as waste to landfill considerable reduced (15%)
Landfill cost	Small sized landfill

Source: Primary Survey

Let's see what one can do

Dumpsite showing the level differences between the waste mound and the nearby water body



Contour 3D profile of the existing dumpsite (Avg. height of the elevated region is 6m above Surface water level)

Present scenario

Waste dumped since	2001 (post earthquake)
Daily quantum of waste reaching the dumpsite	55 – 60 TPD
Avg. Height of elevated patches considered	6 m
Estimated Volume of waste (approx.)	1,22,000 cu.m
Area covered by the dumpsite	96,000 sq.m
Open dump suggests that large quantum of waste is recoverable	50 – 90% recoverable (studies)
Capping of dumpsite itself is not 100% effective	Life is 50-100 y < waste neutralization period

Why Landfill Mining?

- One of the best options practiced for dumpsite refurbishment
- Requirement of reduced area/ conservation of space
- Enables recovery of 50 – 90% of the total volume of waste
- Soil fraction in the recovered waste would range from 50 – 60%
- Options: Plastic/ rubber/ metal for recycling and soil – new landfill/ fertilizer
- Reduces the waste management cost considerably/ alternate revenue source

Source: Primary Survey, Bhuvan. Org, CPHEEO Manual 2016

How have projects worked in the past ?

Mining

China – *Sai Lin*

- Extremely fertile soil and incombustible waste was encountered
- Emptied cells were relined
- Residual waste was dumped back
- Recovered soil + virgin silt for a fertile mix
- Upgraded cells with help of bio reaction and leachate recirculation
- Greenhouse cultivation above the upgraded cells/ excess heat would keep the GH warm
- Methane flaring

Mining

India – Deonar

- Mining carried out in Deonar dumpsite in Maharashtra
- Excavation and mining carried out in those portions that were 4 – 12 years old
- Recovery of soil was the primary purpose
- Other wastes (plastic/ rubber/ metal etc.) were left untouched
- A mixture of Soil + cow dung + dolerite + gypsum + neem cake used as fertilizer
- Fertilizer used in agriculture

Capping

India – Gorai

- Capped the waste using geosynthetic lining system - prevent rain water ingress
- Sheet piles @ 15m depth all around to prevent leachate flow to the creek
- Landfill gas – electricity production and flaring
- Reduction in GHGs – carbon credits (or Certified Emissions Reductions) – source of supplementary financing

Take outs for Bhuj

- Recovery of recyclable material + usable soil
- Soil could be utilized for landfill lining & manure for farming
- Relocation site for residual waste can be lined
- Leachate recirculation
- Farming/ Solar plant above refurb site: Revenue model

Source: Report on Dumpsite Rehabilitation and Mining – ARRPET, Asian Institute of Technology, KK Enviro Tech – Case study

This could work

Other infrastructure facility

Entry gate to the facility

Approach road (Nagor Road) to the facility

Internal road

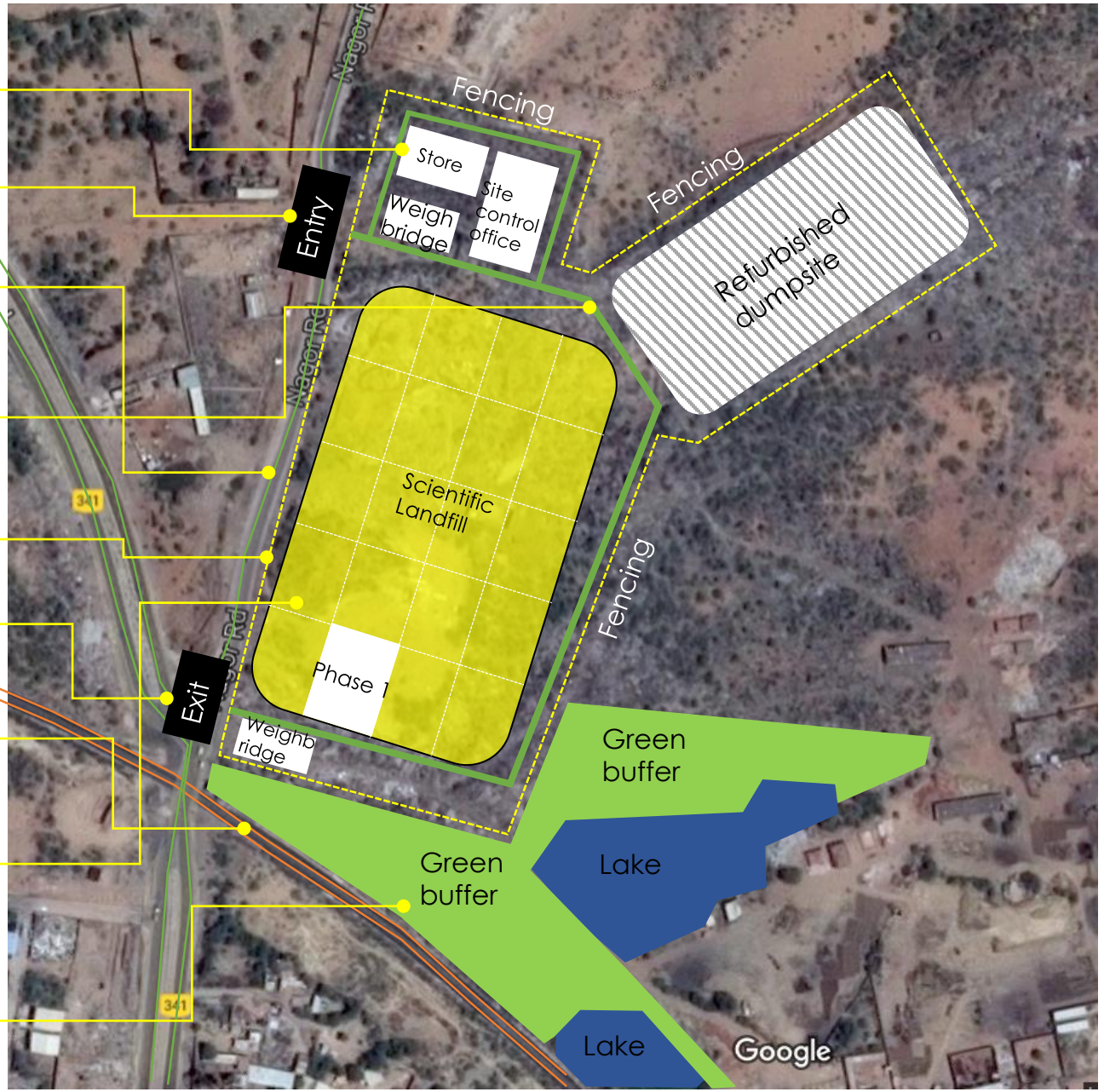
Fencing around the facility

Exit gate

Railway track

Scientific landfill with year-wise phasing (Trench)

Green buffer (no littering zone) around the lakes



Design Considerations

Population	160385
% waste to Landfill	15%
Active life	20 years
Landfill capacity	250980 cu.m
Facility area	28200 sq.m (240x120)
Landfill area	25300 sq.m (230x110)
Height	8 m (3 AG+5 BG)
Phase area	1200 sq.m (40x30)
Cell area	18 sq.m (6x3)
Additional infrastructure	3000 sq.m
Internal road	3.5 m wide
Weighbridge	2 x 5 MT
Old dumpsite	14,400 sq.m (180x80)
No littering zone	Around nearby surface water bodies
Fencing	Around the facility

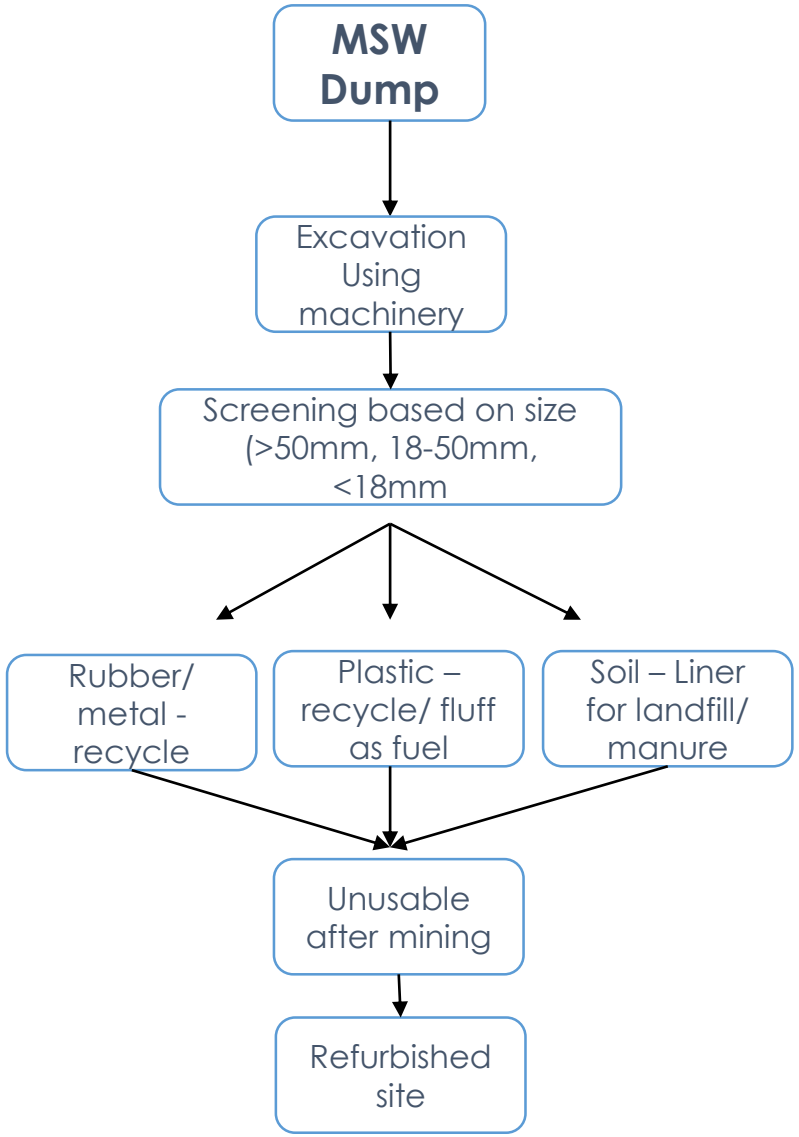
Source: Primary Survey, CPHEEO Manual 2016

This could work

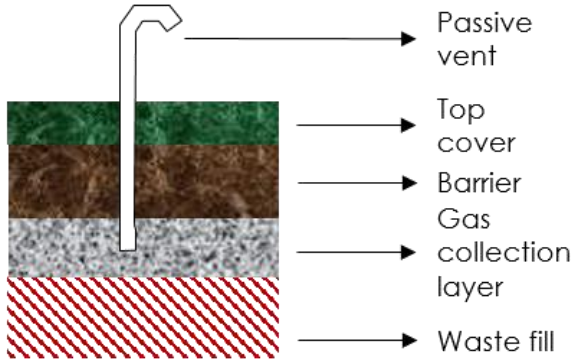
Project Specifics

Daily quantum of waste reaching the dumpsite	55 – 60 TPD
Avg. Height of elevated patches considered	6 m
Estimated Volume of waste (approx.)	1,22,000 cu.m
Area required for shifted dumpsite	14,400 sq.m (180x80)
Design depth (after compaction)	6m BG
Recovery of material expected after mining	50% of the total volume
Revised depth for refurb dumpsite	3m BG
Single liner system to be provided after trenching/ mining	
Leachate recirculation for faster decomposition of remaining waste	

Mining Process Flowchart



Layout showing the new location of the refurbished dumpsite



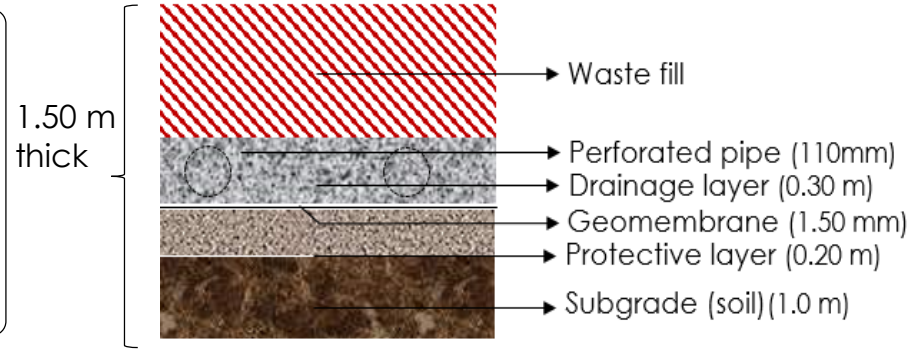
Landscaped Top cover

Source: Primary Survey, CPHEEO Manual 2016

Project – New Landfill facility

This could work

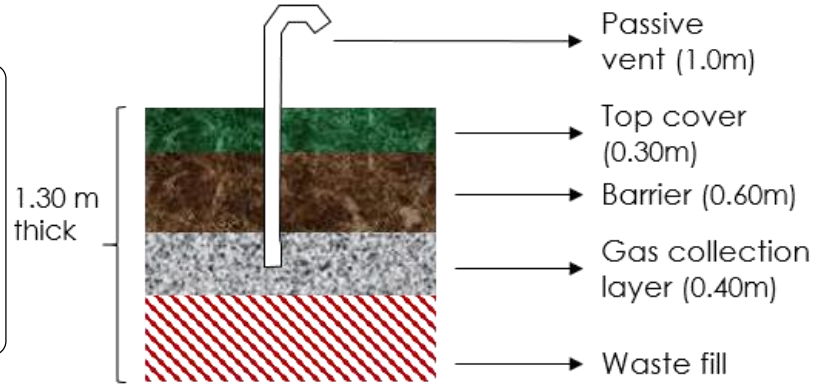
Liner System



Leachate Management

Dia of perforated HDPE pipe	110 mm
Spacing of pipes	30 m
Leachate holding tank (max capacity of 5 days)	8x5x3 m (110 cu.m)

Cover System



Staff Requirement

Weighbridge operator	1
Machine driver	1
Watchman (2 shifts)	2

Machinery Requirement

Landfill compactor	1 no
Backhoes and frontend loaders (JCB)	1 no
Tractor trailers	2 no
Water tank (10,000L)	1 no

Total Project Cost

LANDFILL

- Capex - **₹ 522.43** Lakhs
- Opex - **₹ 10.92** Lakhs/ annum
- BNP will have to spend **₹ 200/ DAY/ TON** of waste disposed

- Period of operation – **20 years**

Landfill Activities (Excavation/ Lining/ Capping) would span over **20 years**

- Other construction activities – 1.5 to **2 years**

DUMPSITE REFURBISHMENT

- Capex - **₹ 278.51** Lakhs

- Time reqd. for clearing the land at a rate of 150MT/day for excavation & mining – **9.15 months**
- Benefit/ Cost ratio: **1.02**

Source: Primary Survey, CPHEEO Manual 2016

The project ought to sustain

Marigold Farming

Possibility of growing Marigold over the refurbished site | Increased aesthetics | Generation of revenue for facility operation

Why?
Commonly grown for garden decoration, making garlands for religious and social functions, short harvesting duration, high yield and promising returns to investment

Land available for farming
1.45 Hectare | refurbished land

Estimated cost
₹ 9.80 Lakhs per annum

Estimated returns
₹ 13.05 Lakhs per annum by selling flowers @ ₹ **50**/ KG

Benefit to Cost Ratio
1.33

Possible replication to scientific landfill site after closure period

Solar plant

Possibility of installing solar plant over the refurbished site | Energy generation | Revenue for facility operation | Scheme facilitated

Why?
India's National Solar Mission focusses on generating 100GW (by 2022) power entirely by solar energy. Subsidies up to ₹ 40,000 per KW of energy produced.

Land available for installation
1.45 Hectare | refurbished land

Estimated cost (Capex)
₹ 120 Lakhs

Estimated returns
₹ 109.50 Lakhs per annum
By selling energy to PGVCL @ ₹ 5/KW

Total capex can be covered in a span of 1 year and 2 months

Possible replication to scientific landfill site after closure period

Source: https://www.indiaagronet.com/indiaagronet/crop%20info/Marigold.htm, http://www.agrifarming.in/marigold-farming/

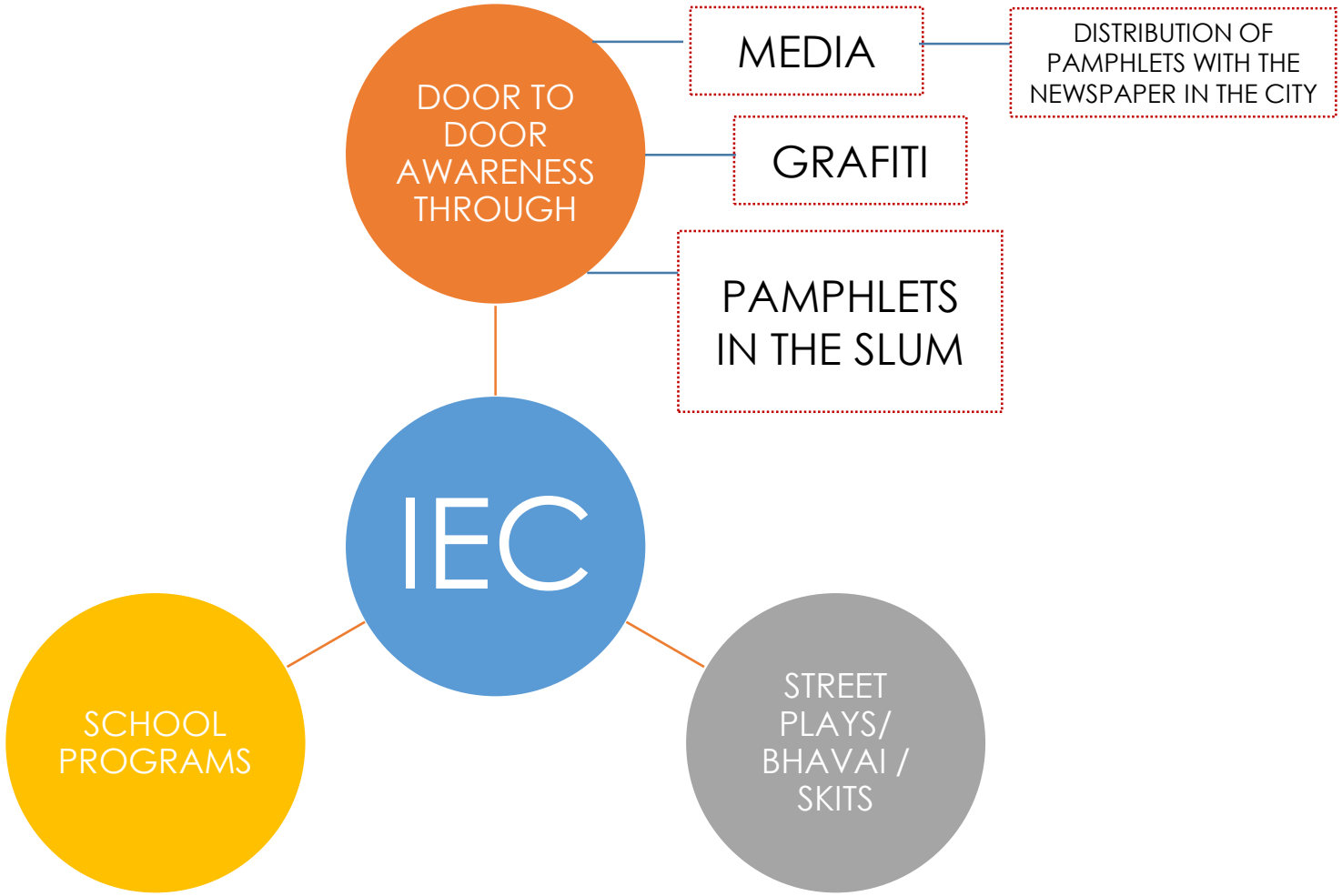
INVESTMENT	CAPEX			OPEX		RISK	IRR
SCENARIO	LAND	CAPITAL					
	FACILITATOR	FACILITATOR	TYPE	FACILITATOR	REVENUE MODE		
1	BNP	BNP	FUNDING BY GRANTS	PVT. AGENCY	TIPPING CHARGE @ **RS 200/MT**	LOW	13%
2	BNP	PVT.AGENCY	BOT (INVESTMENT)	PVT. AGENCY	TIPPING CHARGE @ **RS 1200/ MT**	HIGH	12%
3A	BNP	PVT.AGENCY	BOT (INVESTMENT)	PVT. AGENCY	TIPPING CHARGE @ **RS 1100/ MT** MARIGOLD FARMING	HIGH	11%
3B	BNP	PVT.AGENCY	BOT (INVESTMENT)	PVT. AGENCY	TIPPING CHARGE @ **RS 200/ MT** SOLAR POWER PLANT	HIGH	19%

Most Likely scenario – 1 – Minimum risk – Low Tipping Charges

2nd most Likely scenario – 3B – High risk – No/ Low Tipping Charges – High returns on investment

INFORMATION EDUCATION AND COMUNICATION (IEC)

IEC



According to CPHEEO guidelines, the following are the mediums that can be taken up for IEC. They are as:

1. Providing hot line
2. Public education

-Group education
-Mass education

- Use of print media
- Use of tv/cable/radio/website
- Use of cinema halls
- Street plays/ puppet shows etc
- Posters
- Pamphlets
- Hoarding
- Public transport system
- Children
- NCC
- Medical practioners
- Women association
- Resident association
- NGO
- Primary curriculum

Source: CPHEEO

IEC

IEC

DOOR TO DOOR AWARENESS

- PAMPHLETS
- GRAFITI

Door-to-door legal awareness campaign in Bidar on Nov. 2 and 3

SPECIAL CORRESPONDENT

District Legal Services Authority will organise a door-to-door awareness campaign across the district on November 2 and 3.

TOPICS
India
Karnataka

DLSA members and activists will tour at least 200 villages and speak to residents about the various services offered by the authority. Programmes will be held to create awareness about various laws, especially those that can help consumers, victims of crimes, women, children and members of deprived classes. Pamphlets will be distributed among villagers. Awareness will be created against open defecation and other unhygienic practices.

Hanchate Sanjiv Kumar, principal district and sessions judge and other members will be present.

A national Lok Adalat will be organised in the district court premises on November 12. People of the district can use the opportunity to settle pre-litigation cases and pending cases dealing with family disputes, civil cases, land acquisition, property distribution, payment of public utility bills, banking-related issues, pending MNREGA wage and other issues, according to a release.

Source: TEDx Bangalore, www.thehindu.com

IEC

DOOR TO DOOR AWARENESS

- PAMPHLETS
- GRAFITI

BHUJ BOLE CHE
+
SAHJEEVAN
+
NEWSPAPER SELLER

DOOR TO DOOR AWARENESS CAMPAIGNS (DISTRIBUTION OF PAMPHLETS IN GUJRATI, HINDI AND ENGLISH

COST : Rs 58, 516

IEC

IEC

DOOR TO DOOR AWARENESS

- PAMPHLETS
- GRAFITI

SAHJEEVAN

Awareness campaigns can through wall paintings/ Graffiti / a cartoon on walls with maximum littering followed by a catchy Gujrati slogan.

COST 14, 800 Rs

The anti-waste organization (EcoPro) from Auroville has been promoting responsible waste management for two years in Periyamudaliarchavadi (PMC),

Displays the causes and effects of pollution through pictures and posters.

EcoPro also tries to increase awareness by painting walls with anti-litter messages.

Source: http://www.aurovilleradio.org/ecopros-awareness-campaign/

IEC

IEC — STREET PLAYS/ BHAVAI

SAHJEEVAN

ENGAGE YOUTH CLUB OF BHUJ IN BHAVAI , STREET PLAYS

COST = Rs 2,00,000

The youth/students of Faculty of Performing Arts, Maharaja Sayajiao University (MSU), conducted Bhavai for awareness, near Gandhinagar Sabha Grah, City area, on the theme of **'Role of Youth in eradication of corruption and promotion of good governance',** which was very much appreciated by the passer by, in the busy market area.

Source: http://www.ongcindia.com/wps/wcm/connect/ongcindia/home/media/press_release/ongc-ignites-generation-vigilanceawareness-week

IEC

IEC — SCHOOL PROGRAMS

SAHJEEVAN

↓

ANGANWADI'S

↓

AWARE STUDENTS ON THE IMPORTANCE OF SOLID WASTE MAANGEMENT THOUGH VARIOUS POSTER AND ESSAY COMPETITION AND PRIZE DISTRIBUTION

↓

COST = Rs 35, 772

KANNUR: GREEN, CLEAN SCHOOLS
An essay competition is held in a school as part of an SWM eco-city initiative.

The Centre for Environment Education (CEE) is working on a project focused on waste management in eight schools. Eco-clubs are formed, and the students conduct surveys of the waste generated in their schools, houses, and towns. The students also engage in green games, activities with strong environmental messages, community walks, cleanup drives, street plays, and nature walks.

Source: Improving Solid Waste Management In India , The World Bank

VARIOUS ACTIVITIES FOR IEC CAPAIGN	RATE (INR)	UNIT	FREQUENCY	AMOUNT
PAMPLETS FOR CITIES (Except Slums)	0.5	12, 230	5	28575
PAMPHLETS FOR SLUMS	0.5	15, 946	5	29941
GRAFITI	100 (1 SQ MT)	74	2	14, 800
BHAVAI/ STREET PLAYS	2000	20	5	2, 00, 000
SCHOOL PROGRAMS				
POSTER COMPETITION	469	500	2	19, 000
ESSAY COMPETITION	386	11	2	772
PRIZES	2250	12	2	16, 000
TOTAL SCHOOL COST				35, 772
TOTAL COST				**3.09 lakhs**
GRANT FROM SBM FOR IEC				25% STATE AND 75% CENTRAL

Source: IEC AHMEDABAD, AMC

PART C: Component-wise action plan for Swachh Bharat Mission (SBM) – Urban

Physical Targets

1		Targets	*Baseline 2014*	*Cumulative Estimated Projection upto2019*	*Reasons/Justification based on 2001-2011 data and other factors*	*Target 2014-15*	*Target 2015-16*	*Target 2016-17*	*Target 2017-18*	*Target 2018-19 (up to Oct, 2019)*	*Cumulative Target (2014-19)*
A*	a	Construction of new individual household latrines (IHL)	*[80% of Part A, 2.4]*								*[100% of 2014 baseline]*
	b	Conversion of pit latrines into sanitary latrines	*[Part A, 2.2.4]*								*[60% of 2014 baseline]*
	c	Conversion of insanitary latrines into sanitary latrines	*[Part A, 2.2.5]*								*[100% of 2014 baseline]*
B*		Construction of Community toilets [NORM: 1 seat / 25 women and 1 seat / 35 men]	*[20% of Part A, 2.4]*								*[100% of 2014 baseline]*
C*		Construction of Public Toilets [NORM: 1 seat / 50 women and 1 seat / 100 men up to specified numbers**]	*[Part A, 1.2]*								*[5% of 2014 baseline]*
D		Solid waste Management	*[No. of cities proposed to be covered]*								*[100% excluding the on-going project]*
E		Capacity Building	*[Part A, 1.3]*								*[100% of cities]*
F		Public Awareness & IEC	*[Part A, 1.3]*								*[100% of cities]*

*Efforts shall be made to construct the toilets within two years i.e. upto 2016-17.
**Please also refer Manual on Sewerage & Sewerage Systems, Part A for more details (page No. 8-16)

Source: SBM Manual

IEC

SOLID WASTE MANAGEMENT

Rotary Club of Bhuj wall city along with S.M.I.T Rotaract Club and Lion's club are organising such public health care initiatives. Similar attempts can be taken by Rotary Club for solid waste which also is a part of the Public Health.

HDFC Bank holds Painting Competition

Posted on 7/09/2015 by Dailyexcelsior

Excelsior Sports Correspondent

Winnerrs of Painting Competition organized by HDFC Bank posing for a photograph at Harsh Niketan Hr Sec School in Sunderbani.

SUNDERBANI, Sept 6: In order to mark the Teacher's Day, which synchronized with the birth anniversary of India's former president Dr. S. Radhakrishnan, a Painting Competition was organized at Harsh Niketan Hr. Sec. School, Sunderbani today.

The Competition was sponsored by HDFC Bank Branch of Sunderbani.

In all, 30 students participated in the Competition. The paintings prepared by Vanshika Sharma and Isha Sharma were adjudged 1st and 2nd respectively, whereas the 3rd position was claimed by Rupakshi.

The winners were awarded the trophies and citations for their best performances.

DOON INTERNATIONAL SCHOOL SRINAGAR

ABOUT US | SCHOOL | NEWS | EVENTS | DOWNLOADS | GALLERY | CONTACT

Painting Competition Organised By HDFC BANK at DIS Srinagar

Source: SBM Manual, ttps://map.rotary.org/en/project/pages/project_detail.aspx?guid=F090FBF1-EB7E-49BA-9575-4FBAD6E0ED5B, http://www.dailyexcelsior.com/hdfc-bank-holds-painting-competition/, http://www.doonsrinagar.com/events/painting-competition-organised-by-hdfc-bank-at-dis-srinagar

VARIOUS ACTIVITIES FOR IEC CAPAIGN	AMOUNT	FUNDING AFTER 2019
PAMPLETS FOR CITIES (Except Slums)	28575	RELIANCE
PAMPHLETS FOR SLUMS	29941	RELIANCE
GRAFITI	14, 800	BNP
BHAVAI/ STREET PLAYS	2, 00, 000	ROTARY CLUB OF BHUJ WALL CITY, S.M.I.T ROTARACT CLUB OF BUJ AND LION'S CLUB
POSTER COMPETITION	19, 000	
ESSAY COMPETITION	772	
PRIZES	16, 000	
TOTAL SCHOOL COST	35, 772	HDFC
TOTAL COST	**3,09,088**	
GRANT FROM SBM FOR IEC	25% STATE AND 75% CENTRAL	

Source: SBM Maual

SUMMARY

SUMMARY

PROJECTS	IMPLEMENTING AGENCIES	CAPEX (in lakhs)		OPEX (in lakhs)		REVENUE (in lakhs)		ULB SHARE
		PUBLIC	PRIVATE	PUBLIC	PRIVATE	PUBLIC	PRIVATE	
Service Improvement	BNP Pvt. Contractor	175 (12%)	-	-	708 (78%)	707 (65%)	-	-
Efficient Utilization of Waste	BNP NGO	176 (12%)	-	127 (14%)	-	144 (13%)	-	-
Waste to Energy	BNP	-	120 (8%)	-	16 (2%)	40 (4%)	-	-
C&D Waste	Pvt. Contractor	-	150 (11%)	-	34 (4%)	18.6 (2%)	74.4 (7%)	-
MSW Disposal And Treatment	BNP Pvt. Contractor	-	800 (56%)	-	11 (1%)	6.2 (1%)	55.8 (5%)	-
IEC	BNP NGO CSR	3 (0%)	-	-	-	-	-	-

Total Project cost 1425 Lakhs

PHASING

Project	Phase I					Phase II					Phase III					Phase IV				
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Service Management																				
Efficient Utilization of Waste																				
Waste To energy																				
C&D Waste																				
Open Dumping																				
LandFill Site																				

COMPLAINT REDRESSAL

Complaint Redressal Department

Street light | Water Supply | Drainage | Solid waste | Tree cutting

Sanitation Department

Faecal Sludge Management

Telephonic

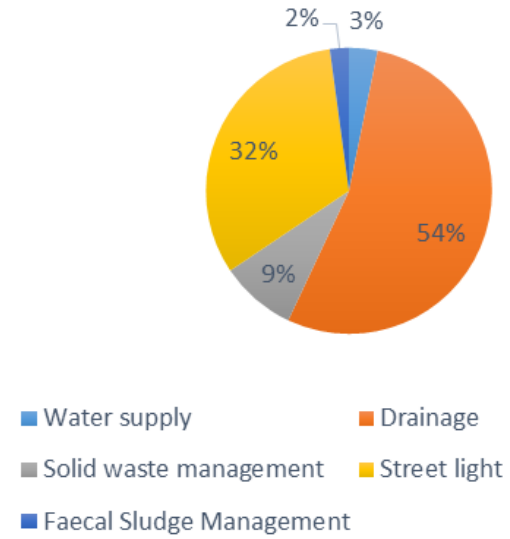
30-40 (Nos)

Desk registration

40-50 (Nos)

- Line leakage
- No supply
- Choke up of sewer lines (20-25)
- Silting of sewer lines (30)
- Littered area
- Dead animal
- Open dump area

Departmentwise complaints



COMPLAINT REDRESSAL

Existing system

User

Complaint registration Department

Desk

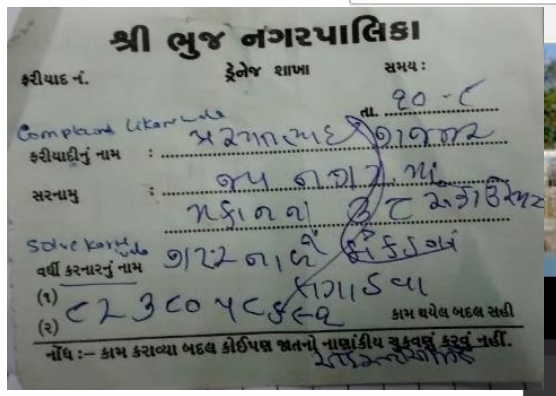
Telephonic

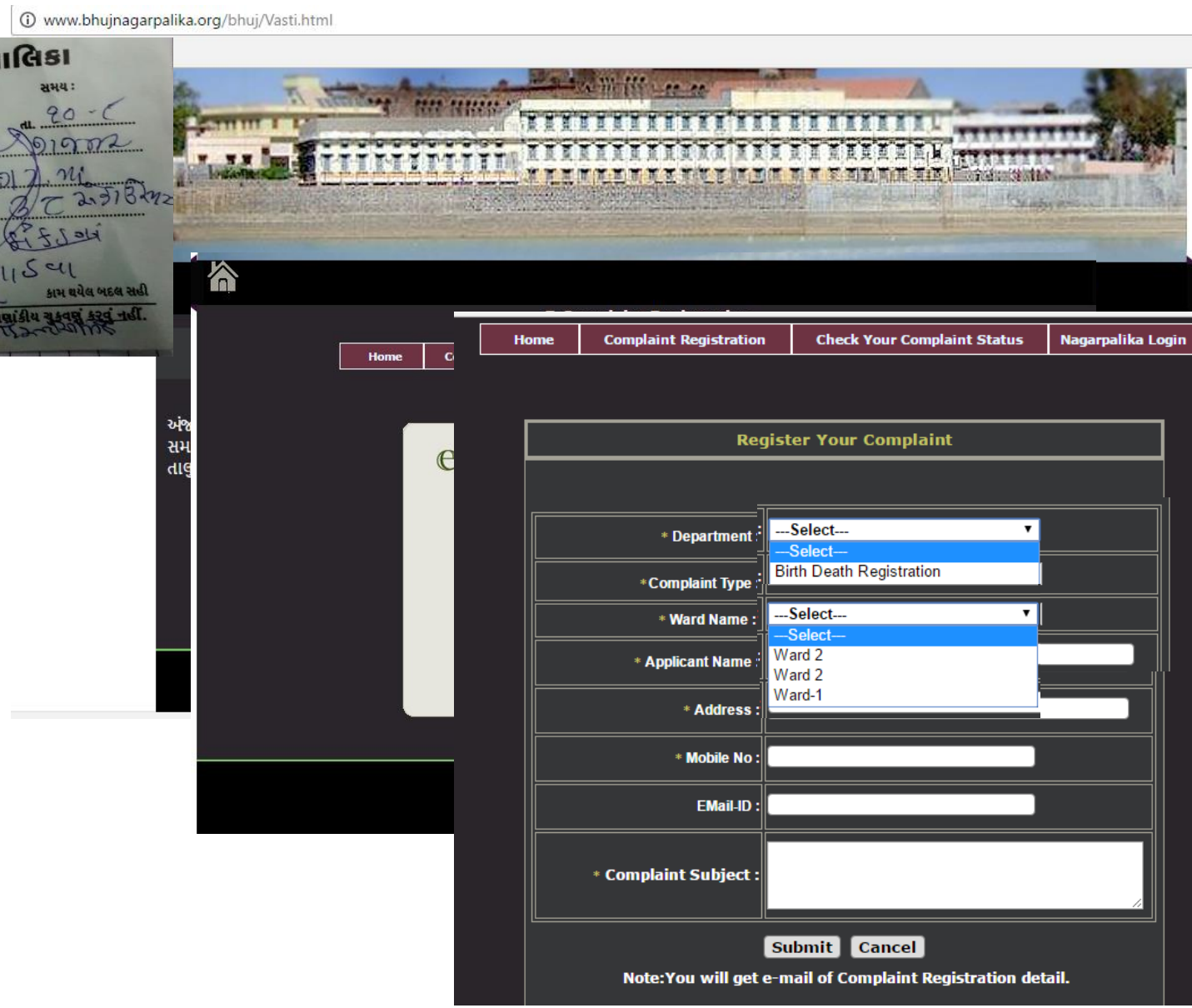
Website

Software entry

complaints are submitted to respective department

No further monitoring of complaints





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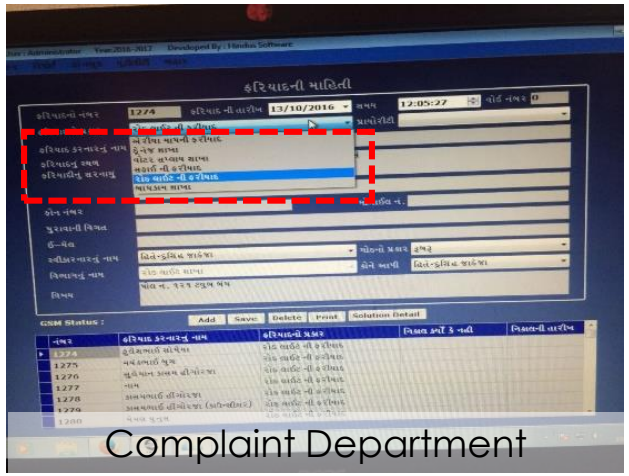
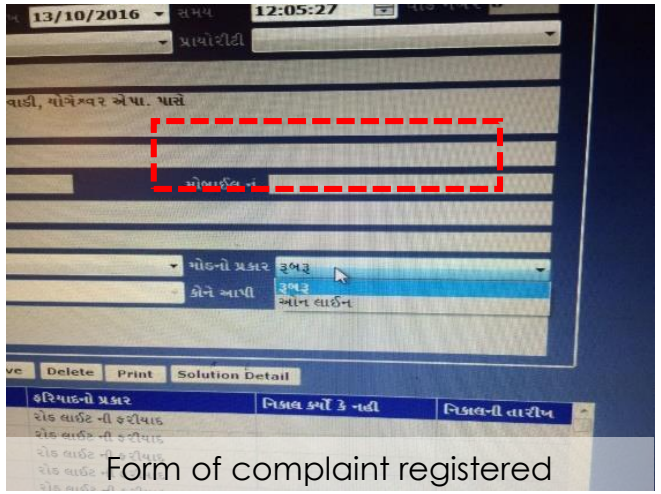
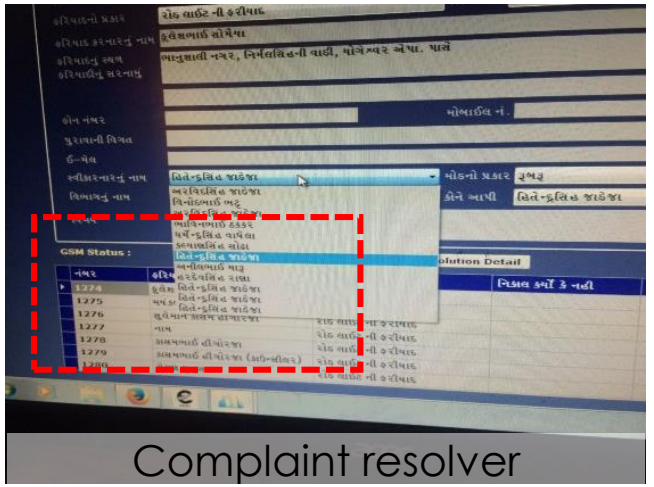


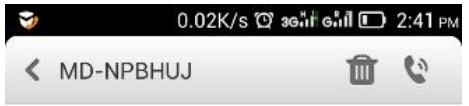
Complaint Department

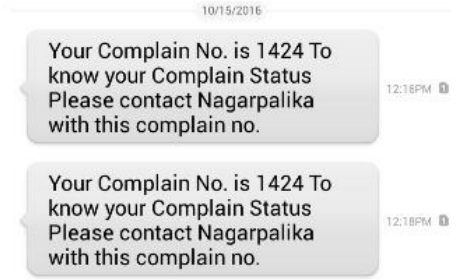


Form of complaint registered



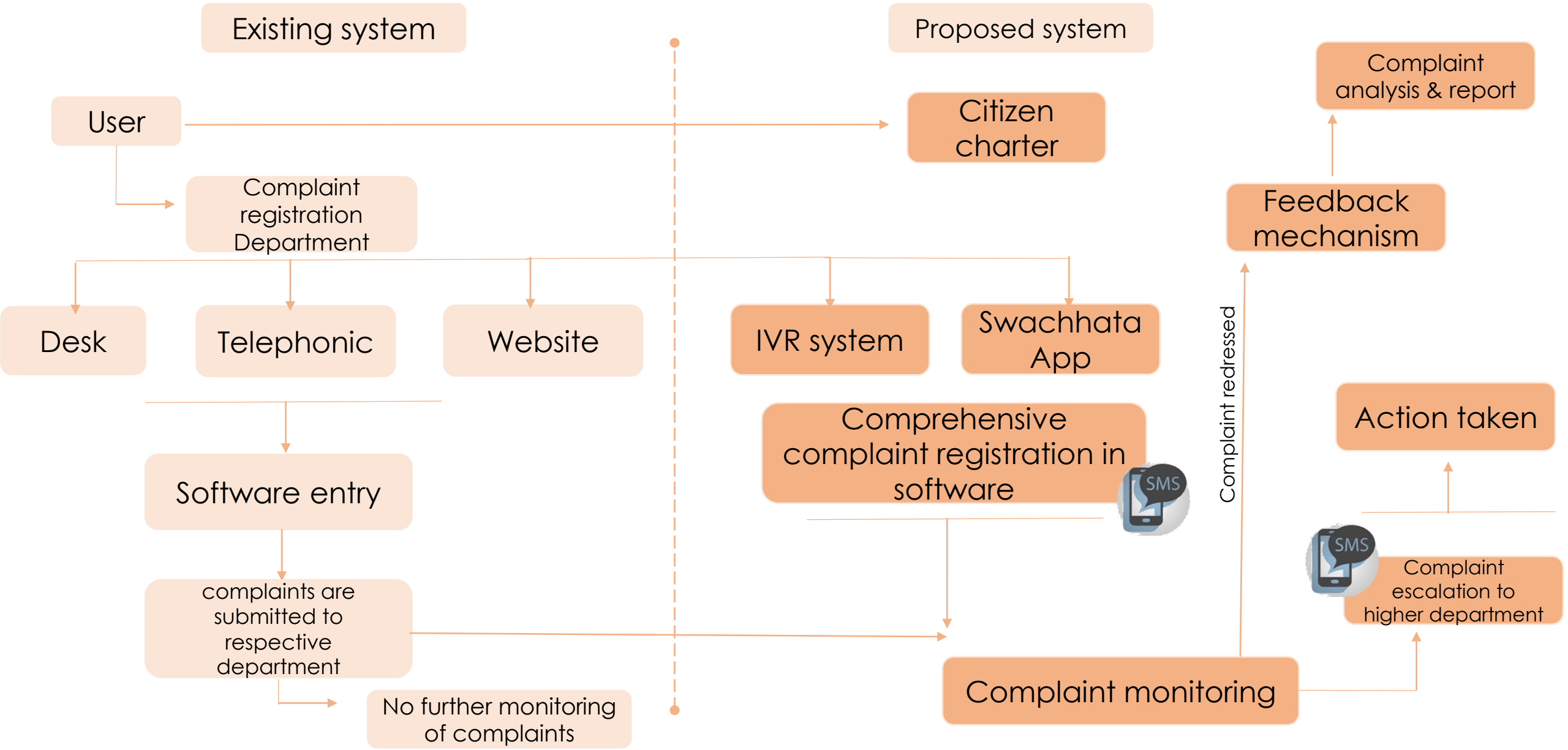
Complaint resolver





Source:**Bhuj nagarpalika**

COMPLAINT REDRESSAL



Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

COMPLAINT REDRESSAL

- Citizen Charter
- Complaint registration & compilation
- Complaint resolve timing
- Complaint monitoring
- Complaint escalation
- Feedback mechanism and Other

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

Citizen Charter

No provision of Citizen charter

- Comprehensive Citizen charter

Efficiency in redressal of customer complaints – 80% (24 hours)

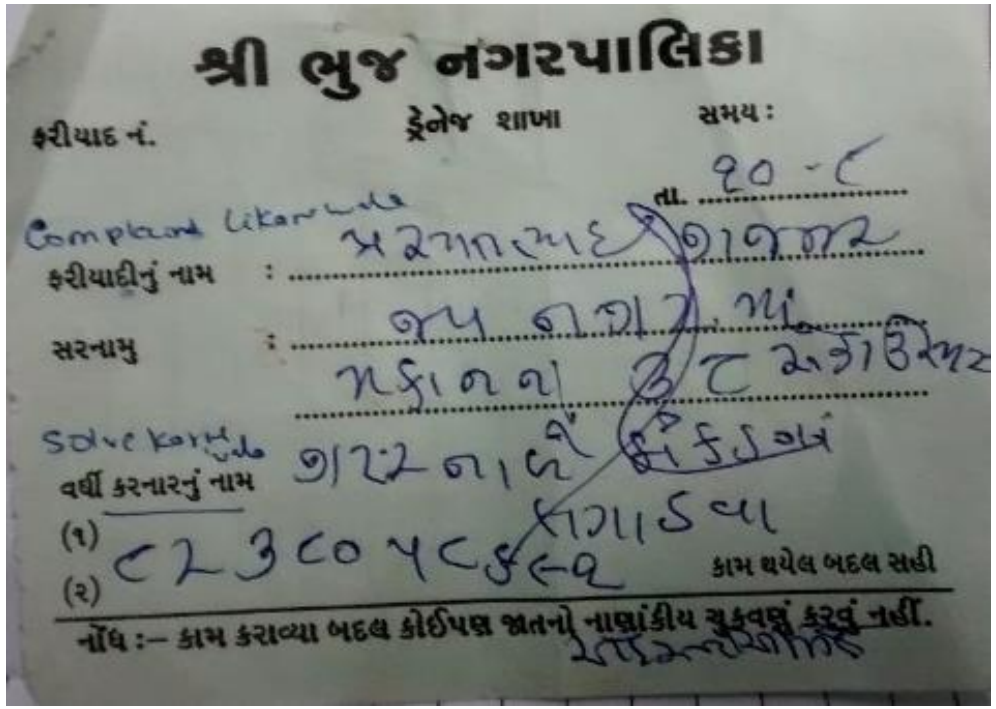
ભુજ નગરપાલિકા

નાગરિક અધિકાર પત્ર

ફરિયાદ ની વિગત	નિકાલ માટેના દિવસો	અધિકારી
લીકેજ અંગેની ફરિયાદ	1	ભાવિનભાઇ
નળમાં દુષિત પાણીની ફરિયાદ	1	ભાવિનભાઇ
પાણીની પાઇપ તૂરી ગયેલની ફરિયાદ	2	ભાવિનભાઇ
પાણી પૂરતા પ્રેસરમાં ન મળવા માટેની ફરિયાદ	5	ભાવિનભાઇ
ગટર ચોકની ફરિયાદ	5	ધર્મેન્દ્રસિંહભાઇ
મેન હોલ ચોકની ફરિયાદ	5	ધર્મેન્દ્રસિંહભાઇ
ગટર ઉભરાય ની ફરિયાદ	5	ધર્મેન્દ્રસિંહભાઇ
ડોર ટૂ ડોર કલેકશનની ફરિયાદ	1	કલ્યાણસિંહભાઇ
સફાઈ ન થતીં હોય તેની ફરિયાદ	1	કલ્યાણસિંહભાઇ
મૃત પશુઓનો નિકાલ અંગેની ફરિયાદ	1	કલ્યાણસિંહભાઇ
સ્ટ્રિટલાઈટ રિપેરિંગ	1	કલ્યાણસિંહભાઇ
રોડ ડેમેજ	10	કલ્યાણસિંહભાઇ

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

Citizen Charter	No provision of Citizen charter	• Comprehensive Citizen charter
Complaint registration & compilation	• Registration through telephonic & desk • Compilation of complaints respective of their departments in the software except drainage	• Certain changes are needed in the complaint registration like add ward no/zone no.



ભુજ નગરપાલિકા

ફરિયાદી નંબર: તા:__/__/____

વોર્ડ નંબર: સમય:

ફરિયાદી નામ: _____

સરનામું:

ફરિયાદ નો પ્રકાર: _____

વિભાગ: _____

જવાબદાર અધિકારી: _____

મોબાઇલ નં: _____

કામ કરેલ ની સહી

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

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To register complaint through IVR (Interactive Voice Response):

Step – 1 : Select language – Press 1 for Gujarati, 2 for Hindi or 3 for English

Step – 2 : Press 1 to call back or press 2 to continue with IVR

Step – 4 : For Water press 1
For Drainage press 2
For Solid waste management press 3
For Sanitation press 4

Step – 3 : Enter Name & press #

Step – 4 : Enter Address & press #

Step – 5 : Enter Problem to resolve & press #

Step – 6 : Enter Location address where the problem is & press #

The call center operator will listen to the IVR recorded complaint and register the same in the system.

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

COMPLAINT REDRESSAL

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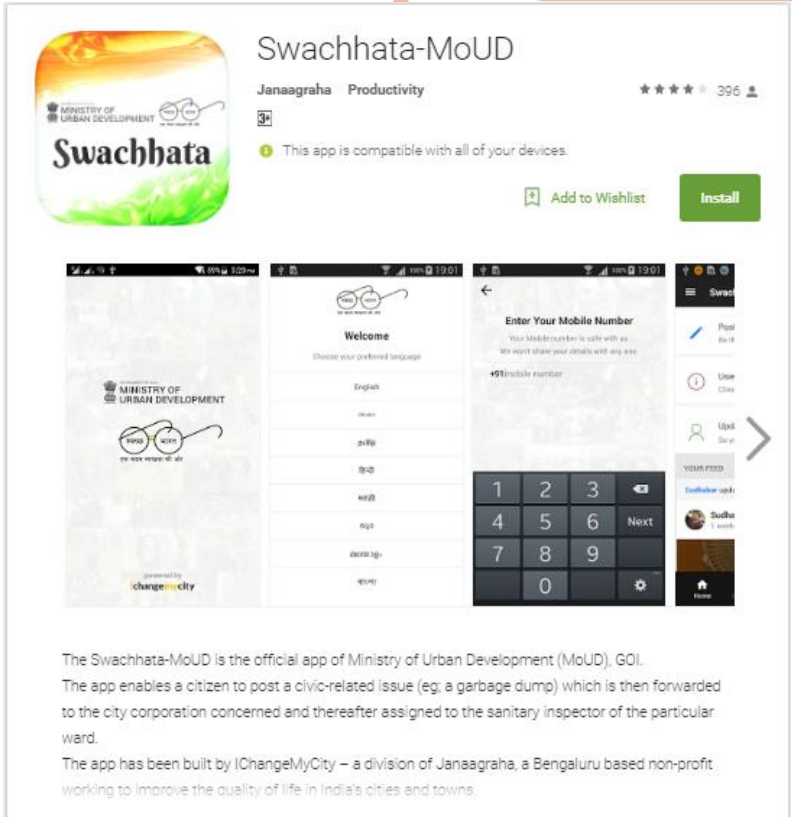

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

COMPLAINT REDRESSAL

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Complaint resolve timing	• List of complaints submitted to concern department head • No fixed timing for resolving complaint	• There should be fixed timings for redressal which can be handled by Head of Department. • Complaint tracking through SMS

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

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Complaint monitoring	• No monitoring of complaint • No analysis of complaint and no segregation of complaints based on ward/zone	• Complaint monitoring tool

- Complaint no
- Date of complaint
- Time
- Ward no :
- Type of complaint (Department)
- Name of the occupier
- Address of occupier

- Location of fault
- Phn no
- Mob no
- E mail
- Name of responsible person
- Mode of complaint
- Department name
- Detail of complaint

Comparison of details of existing software with the monitoring tool

- **Area: Slum/Non-slum**
- **Ward no**

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

COMPLAINT REDRESSAL

Citizen Charter	There is no provision of Citizen charter	• Comprehensive Citizen charter
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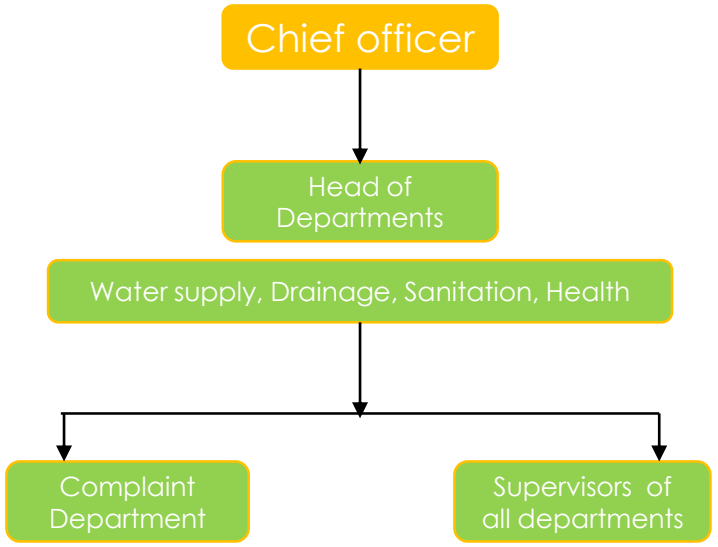
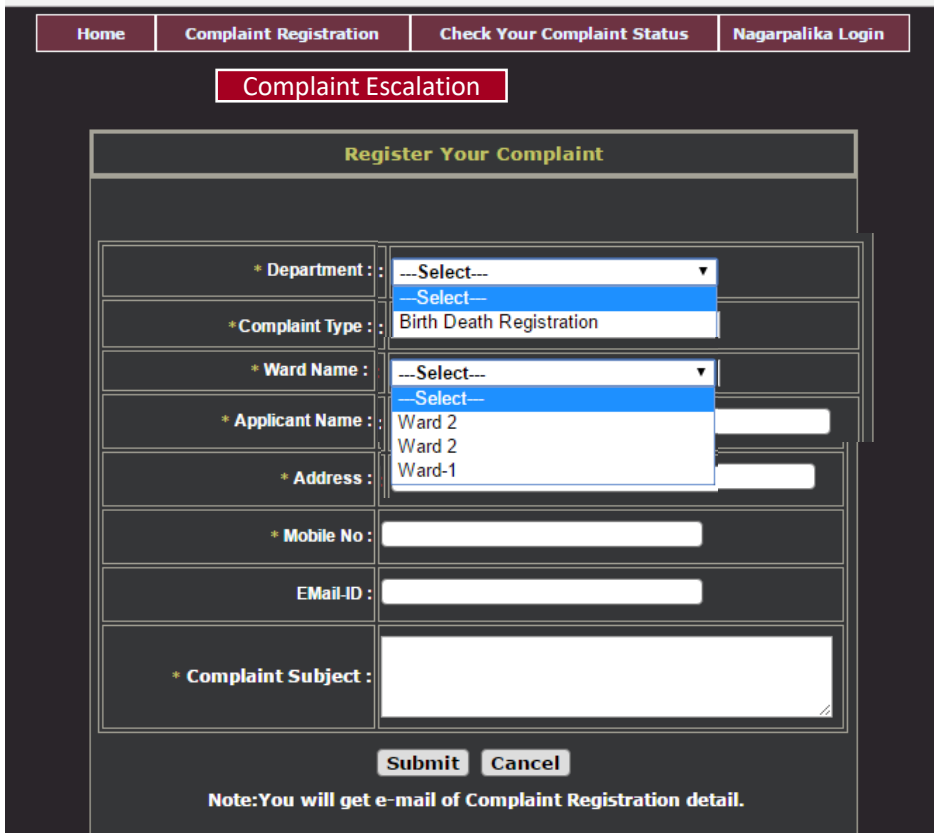
Complaint monitoring	• No monitoring of complaint • No analysis of complaint and no segregation of complaints based on ward/zone	• Complaint monitoring tool
Complaint escalation	• There is no system of escalation present for further updates of complaint	• If the complaints are not being redressed in the given period of time, then the complaint should directly escalated to the chief officer.

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

Institutional framework





- 1st escalation within 24 hours after the time limit is over
- 2nd escalation after 6 working days of 1st escalation
- 3rd escalation after 12 working days of 1st escalation

COMPLAINT REDRESSAL

Citizen Charter	No provision of Citizen charter	• Comprehensive Citizen charter
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Complaint resolve timing	• List of complaints submitted to concern department head • No fixed timing for resolving complaint	• There should be fixed timings for redressal which can be handled by Head of Department. • Complaint tracking through SMS
Complaint monitoring	• There is no monitoring of complaint so as to if complainant want to know his/her complaint status, it is not possible • These receipts have limited shelf life because storage issue. So there is no analysis of complaint • There is no segregation of complaints based on ward/zone	• Complaint monitoring tool
Complaint escalation	• There is no system of escalation present for further updates of complaint	• If the complaints are not being redressed in the given period of time, then the complaint should directly escalated to the chief officer.
Feedback mechanism and Other	• No feedback mechanism where citizen can express about this system	• Making of feedback form • Capacity building programme for the use of monitoring tool • Awareness creation in the ULB staff as well as citizens

Source: Adapted from improvement in Public grievance redressal systems of ULB in Gujarat, PAS and Department of Administrative reforms & public grievances

પ્રતિસાદ ફોર્મ

ફરિયાદ નંબર: તા:__/__/ ____

વોર્ડ નંબર: સમય:

ફરિયાદી નામ: _____

ફરિયાદ નો પ્રકાર: _____

ફરિયાદ નિકાલ માટે લાગેલ સમય: _____

ફરિયાદ નિકાલ માટેની ગુણવત્તા : _____

સ્ટાફ વર્તન:

ટિપ્પણીઓ:

ભુજ નગરપાલિકા

ફરિયાદી નંબર: તા:__/__/ ____

વોર્ડ નંબર: સમય:

ફરિયાદી નામ: _____

સરનામું:

ફરિયાદ નો પ્રકાર: _____

વિભાગ: _____

જવાબદાર અધિકારી: _____

મોબાઈલ નં: _____

કામ કરેલ ની સહી

ફરિયાદ નિકાલ માટે લાગેલ સમય: _____

ફરિયાદ નિકાલ માટેની ગુણવત્તા : _____

સ્ટાફ વર્તન:

ટિપ્પણીઓ:

COMPLAINT REDRESSAL

The Citizen Application

A mobile application on Android and iOS for citizens to upload Swachh Bharat complaints.

The Engineer Application

A mobile application in Android for the ULBs to see the complaints uploaded by the citizen and take action.

Municipal Administrator Website

A website for Municipal Commissioners and their digital teams to monitor the complaints received in their cities and towns.

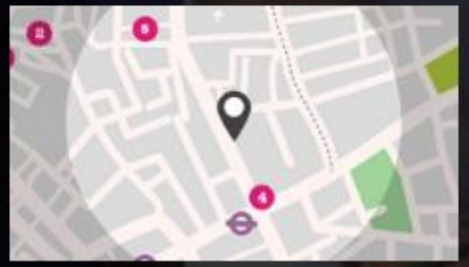
Ranking & Rating Website

This is a website open to all citizens, it will provide the ratings and rankings for all the cities on the Swachhata platform based on the resolution rate of each ward in the city.

SIMPLICITY AND EASE OF REPORTING

Citizens only need to take a picture of the civic-related complaint and post it through their Swachhata app.

LOCATING THE COMPLAINT WITH E...



The app can pinpoint the location of the complaint with accuracy using the geo-location of the picture, which will lead to faster resolution of the complaint.

REGULAR COMPLAINT STATUS UPD...

Citizens will get regular updates on the status of the complaint in the form of a push notification.

PUSH NOTIFICATION WHEN RESOLV...

Citizens will get a push notification with the 'Resolved' image uploaded by the sanitary inspector or engineer when they change the status to Resolved.

REOPEN UNRESOLVED COMPLAINTS

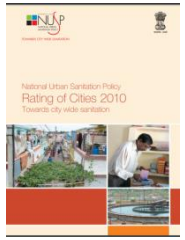
Citizens can reopen the complaint if they are not satisfied with the resolution.

PROVIDE FEEDBACK ON COMPLAIN...

As complaints get resolved, citizens can provide feedback on the quality of the resolution.

Source: http://swachh.city/

RANKING OF THE CITIES



NUSP-2010

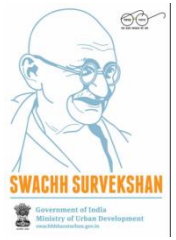
Total Marks = 100

Focused on: Septage Management, OD, Wastewater reuse, Solid Waste Collection and treatment.

Evaluation :

Cities have to **assess themselves** based on following Indicators.

1. **Output Related Indicators** : 50 **(50%)**
2. **Process Related Indicators** : 30 **(30%)**
3. **Outcome Related Indicators** : 20 **(20%)**



Survekshan-2016

Total Marks = 2000

Focused on: ODF, Public/Community Toilet, Solid Waste Management Chain, IEBC,

Evaluation :

In three level,

1. **Service level Status Data : 50 %**

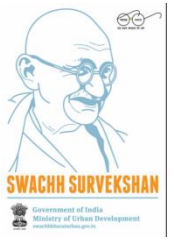
ULB, themselves ranking them

2. **Independent Observation Data : 25%**

Based on Survey, Photographs, Observations and records

3. **Citizen Feedback : 25%**

Sample Size of 0.1% of total population is surveyed through



Survekshan-2017

Total Marks = 2000

Focused on: ODF, Public/Community Toilet, Solid Waste Management Chain, IEBC, **Capacity Building- E courses**

Evaluation :

In three level,

1. **Service level Status Data : 45 %**

ULB, themselves ranking them

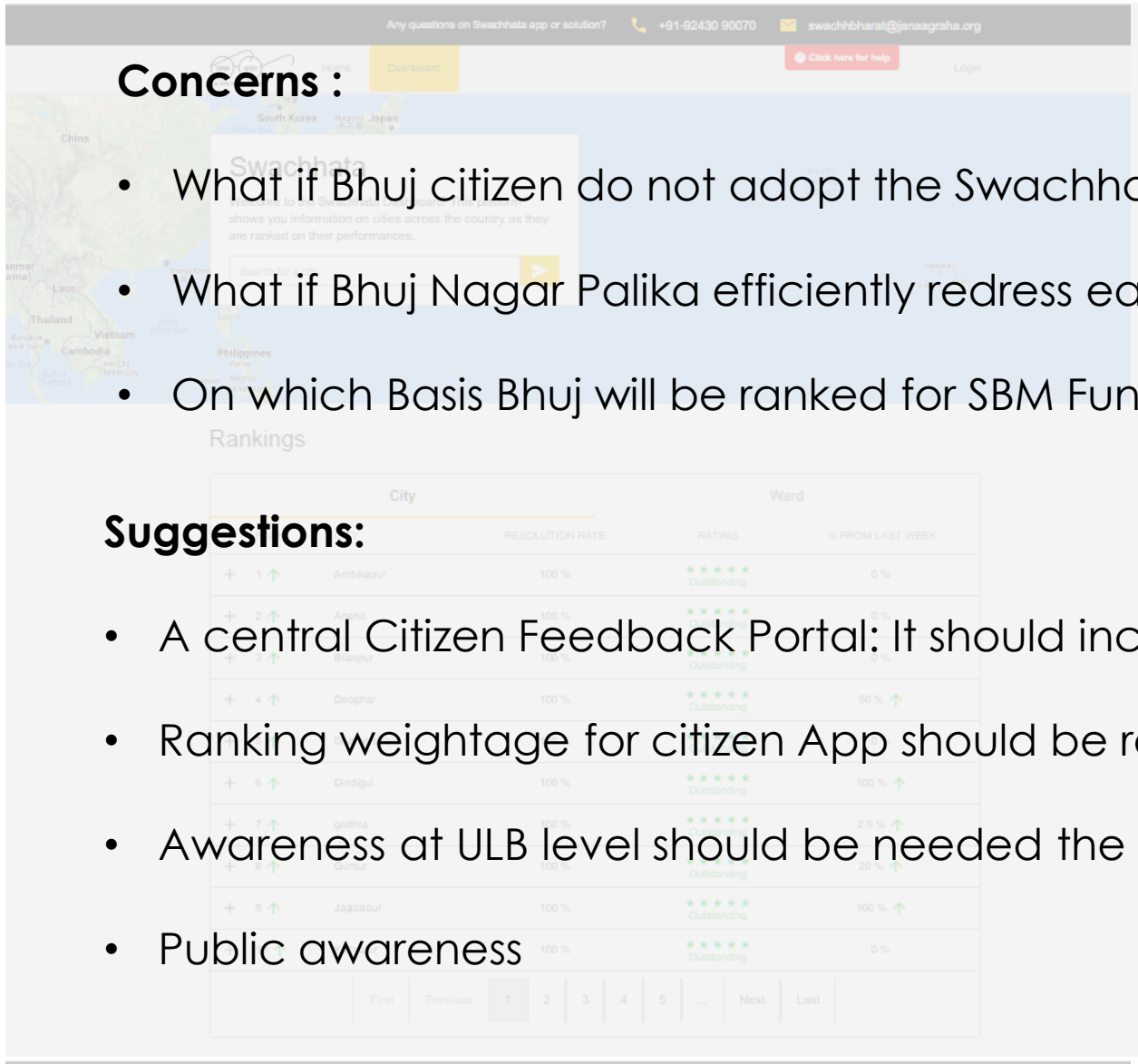
2. **Independent Observation Data : 25%**

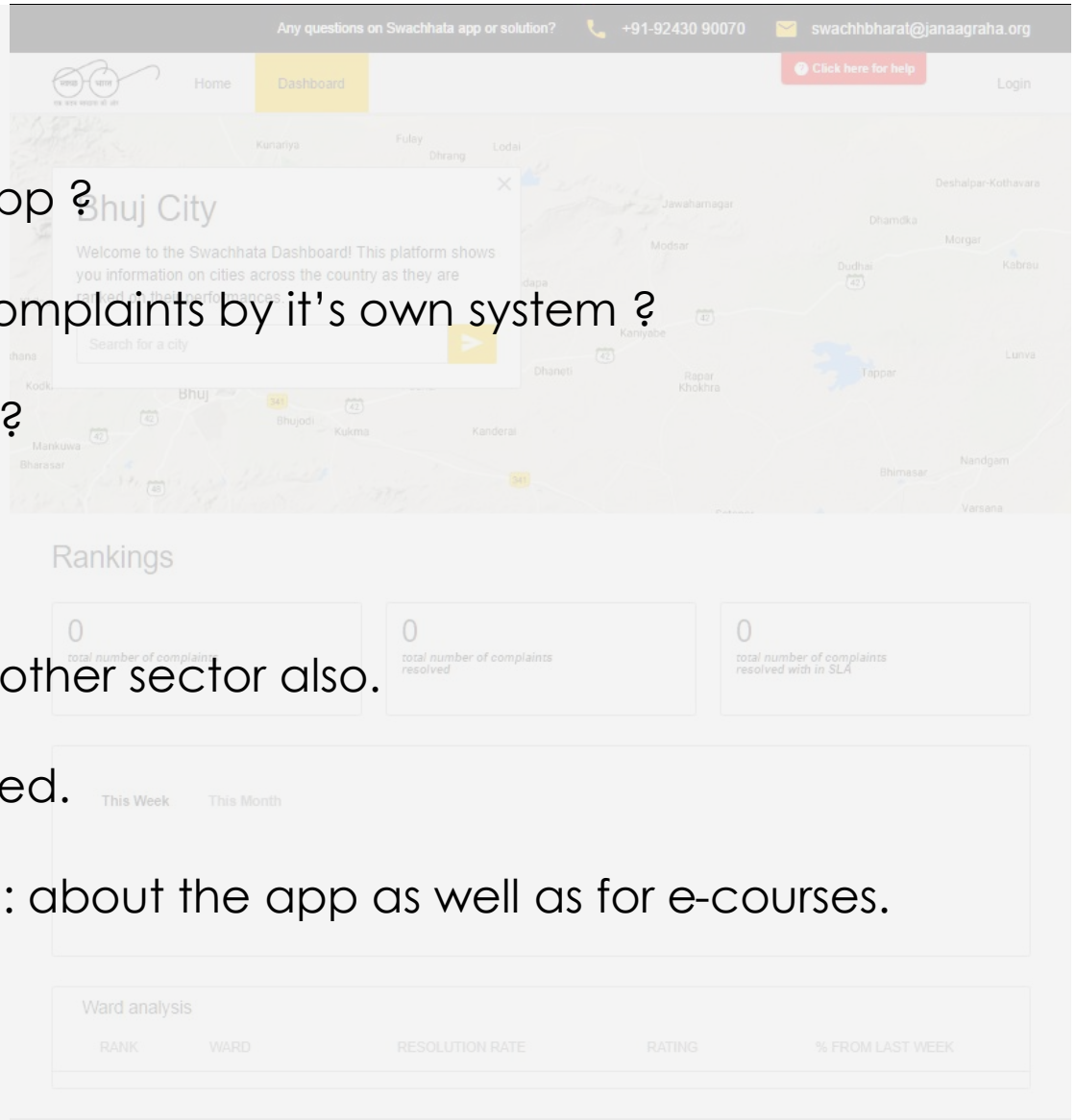
Updating the questionnaire

3. **Citizen Feedback : 30%**

Citizen App- Complaint Redressal System

Source: http://swachh.city/





Concerns :

- What if Bhuj citizen do not adopt the Swachhata App ?
- What if Bhuj Nagar Palika efficiently redress each complaints by it's own system ?
- On which Basis Bhuj will be ranked for SBM Funding ?

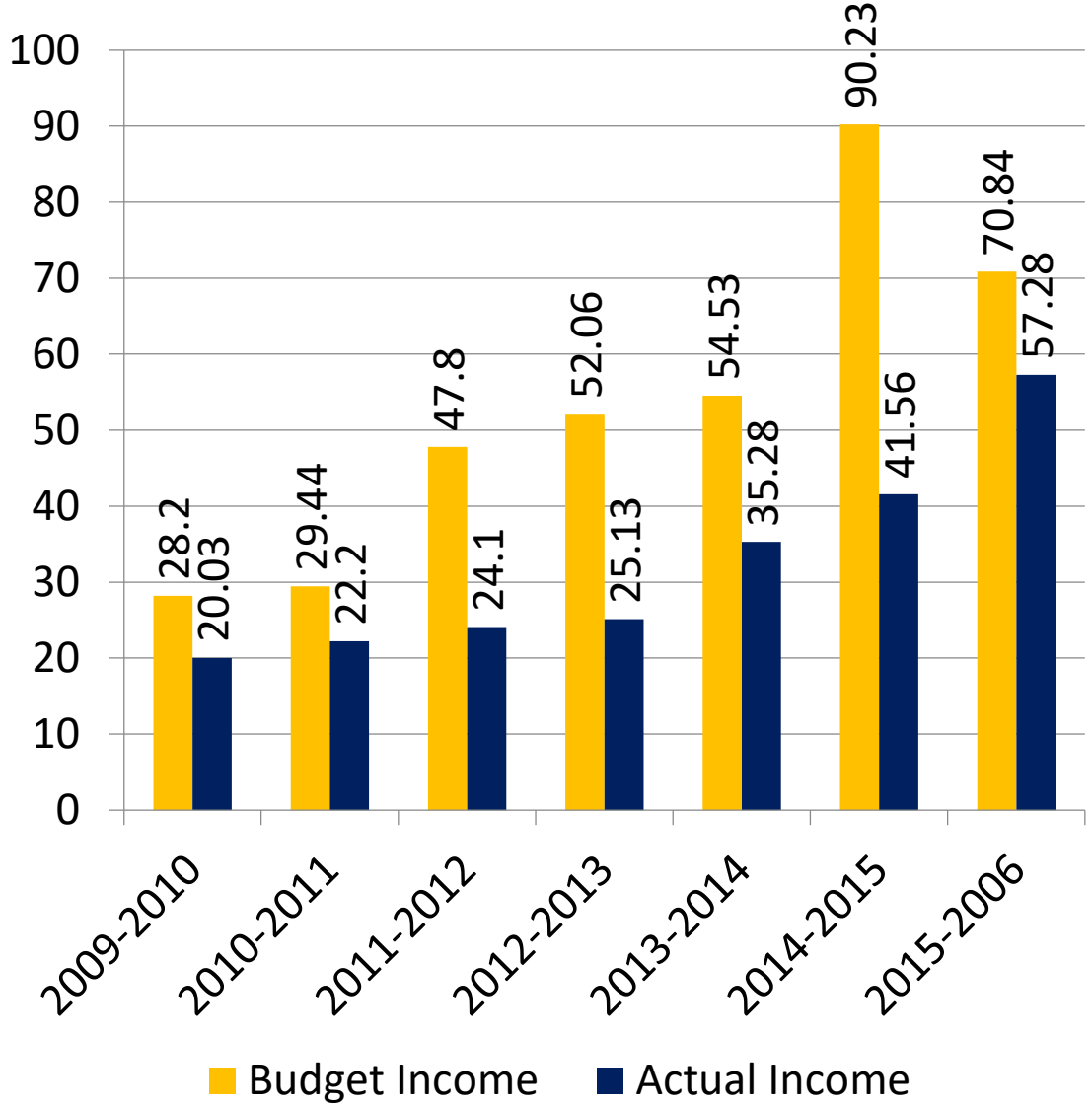
Suggestions:

- A central Citizen Feedback Portal: It should include other sector also.
- Ranking weightage for citizen App should be reduced.
- Awareness at ULB level should be needed the most : about the app as well as for e-courses.
- Public awareness

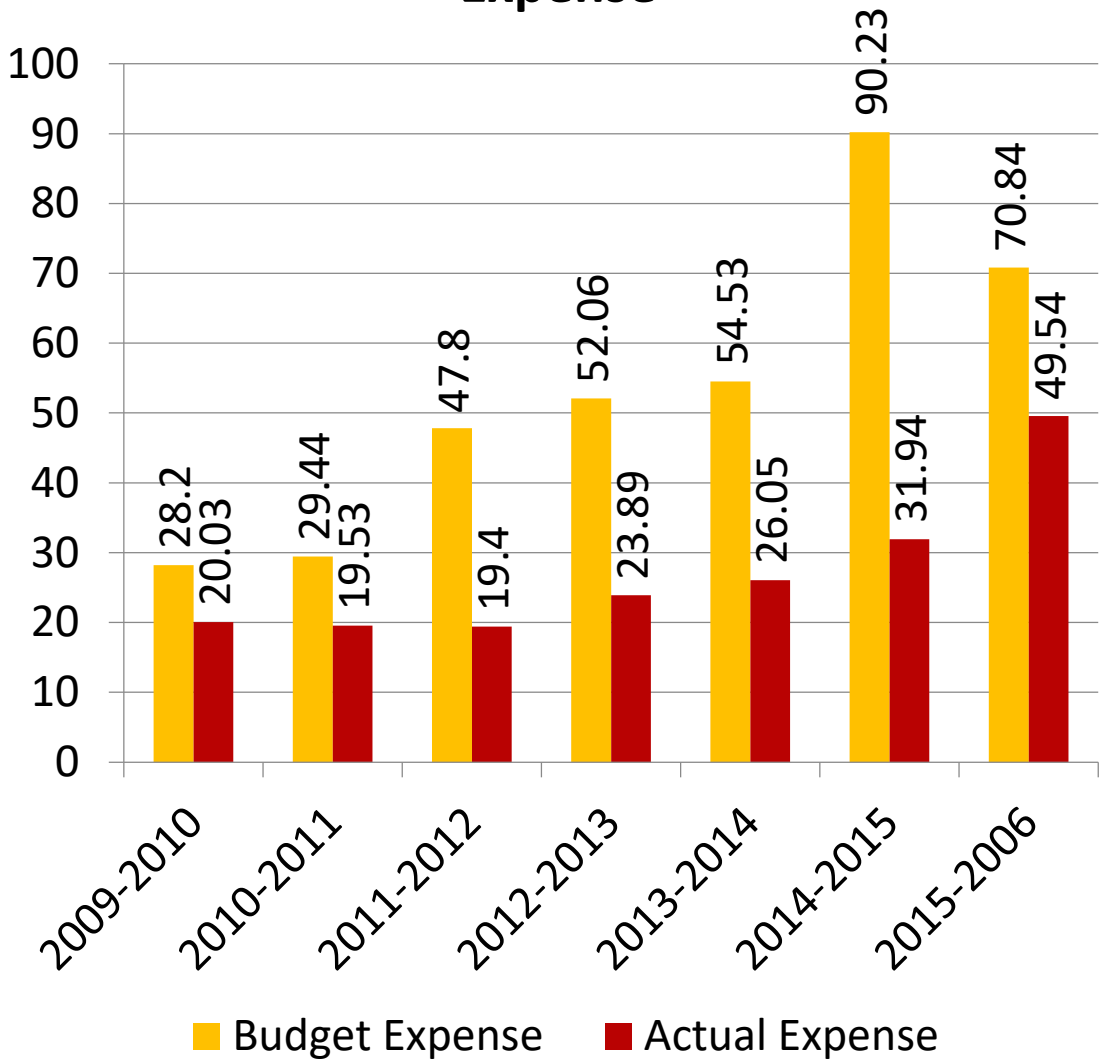
Source: http://swachh.city/

FINANCE, INVESTMENT & PHASING

Budgeted Income v/s Actual Income

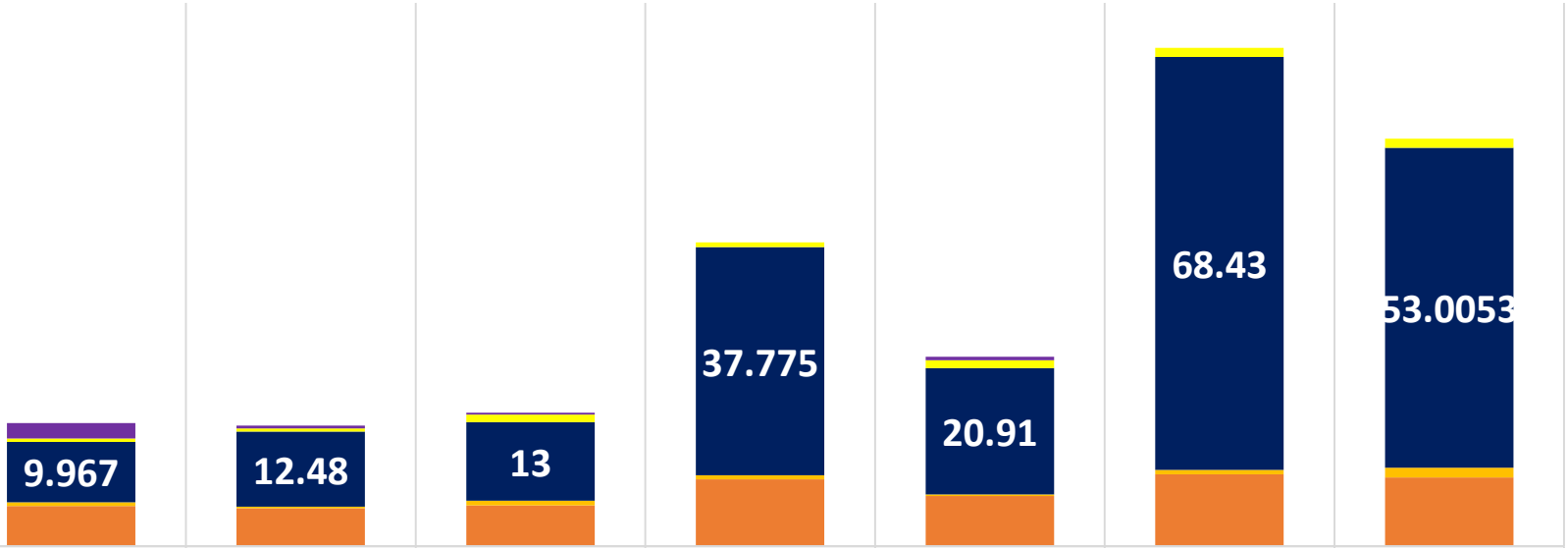


Budgeted Expense v/s Actual Expense



- Municipal Budget

INCOME



	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Extraordinary	2.55	0.5	0.34	0	0.57	0	0
Others	0.607	0.49	1.22	0.8	1.33	1.479	1.509
Grant	9.967	12.48	13	37.775	20.91	68.43	53.0053
Non-tax	0.622	0.24	0.81	0.649	0.255	0.683	1.58
Tax	6.67	6.29	6.75	11.1	8.34	11.94	11.42

Invest

FINANCE

Sector	Project	Category	Total Project Cost	Capital		O & M		Revenue	
				ULB	Private	ULB	Private	ULB	Private
	Daily water supply	Remedial	780	825	0	387	0	0	0
	Improve Quality of water								
	Increase collection Efficiency	Transformative	45	45	0	196	0	45	0
	Water quality Testing	Anticipatory	135	135	0	3.1	0	0	0
	Ground water Monitoring and Recharge								
	Upgradation of Single pit System	Remedial	532	401.65	0	31.31	0	14.54	0
	Emptying of Septic tanks								
	Treatment of Septage								
	Slum sanitation								
	Waste Water Reuse in Parks	Transformative	380	111	0.2	15.7	18.42	16.04	14.9
	Waste Water Reuse in institutions								
	Decentralized								
	Service Management	Remedial	326	326	0	741.5	0	800	
	C&D waste management								
	Scientific landfill facility	Transformative	574	975.94	0	137.92	0	144	
	Establishing decentralized waste centres & treatment options								
	Dumpsite refurbishment								
	IEC	Awareness	3.1	3.09	0	0	0	0	0
	Waste to Energy	Anticipatory	120	120	0	6	0	0	0
	PGR								
	Waste and storm water drain management	Remedial	1850	1610	0	19.011	35	200	20
	Storm water management through WSUD								
	Flood control in slums								
	Dosrai lake	Transformative	1325	939	385.6	113.3	0	130.5	0
	Desalsar lake								
	Hamirsar lake								
	Pragsar lake								
			6484	5491.7	385.8	1650.8	53.42	1350.1	34.9

Sectorial Investment

Sector	Share of Capital(Lakh)				Total capital cost
	ULB	Central	State	Private	
	83	413	330	--	960 (8.7%)
	17	336	160	0.2	642 (2.7%)
	120	496	126	800	1703 (7.05%)
	283	1213	386	386	3175 (8.91%)

- Project finance, Infrastructure Lab,2016

GoI Contribution
+
State Government
+
Loca Body

AMRUT FUNDS : 50,000 CR (2015-2021)

For Gujarat : 5.33% share has been allocated (2665 Cr.) for 5 years.

For Bhuj: 184 Cr. For the 5 years (36 Cr. Aggregate for every year)(Centre+ State+ ULB)

Funding Ratio : 50:40:10

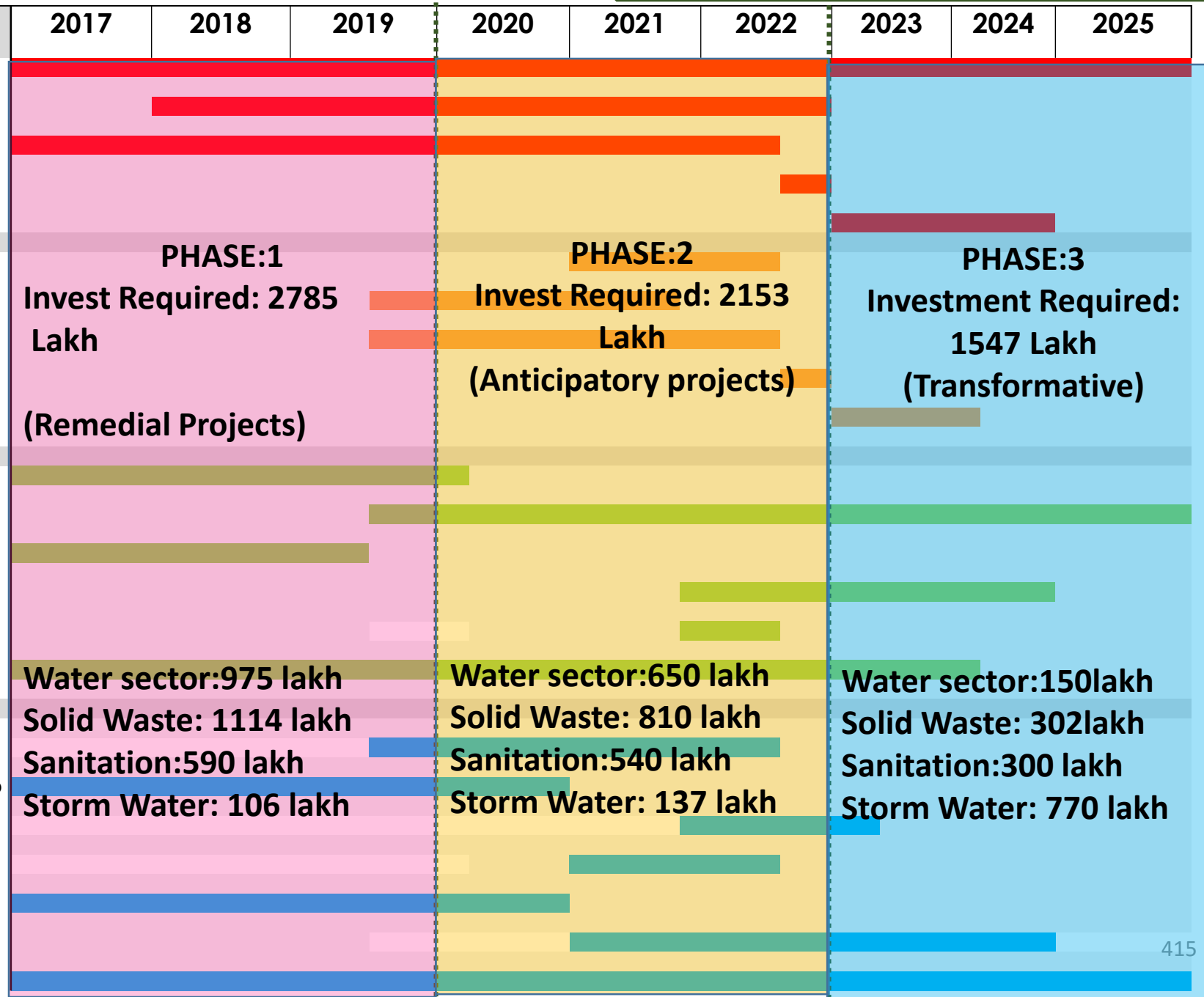
Current Budget of the city: 94 Cr.

Project Cost: 54 Cr for 10 years of implementation.

PHASING

FINANCE

Sector	Project name/component
Water	Daily water supply
	Improvement of cost recovery
	Improve Quality of water
	Water quality Testing
	Ground water Monitoring and Recharge
Sanitation	Decentralized WWT
	On site sanitation
	Onsite sanitation in slum
	Waste Water Reuse in Parks
	Waste Water Reuse in institutions
SWM	Service Management
	Scientific landfill facility
	Dumpsite refurbishment
	Waste to Energy
	C&D waste management
	Efficient utilization of waste
Lakes and storm water	Linking of stream lines
	Storm water management through WSUD
	Dosrai lake
	Desalsar lake
	Hamirsar lake
	Pragsar lake
	Flood control in slums



THANK YOU