



WATER – SANITATION LAB
DWARKA : GUJARAT

PURPOSE OF THE LAB

To understand Water and Sanitation sector in a holistic manner
with a Case example.

PRESENTATION OUTLINE

SECTOR OVERVIEW

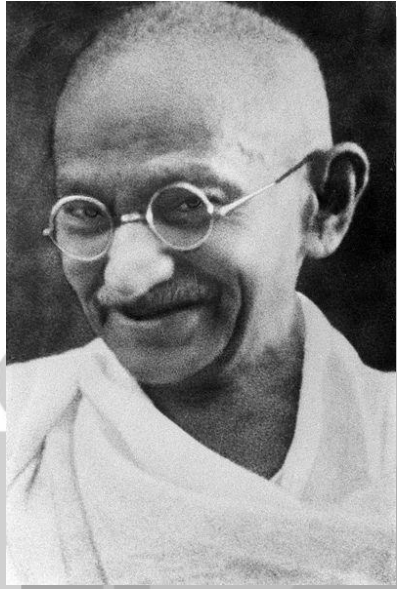
1. **Global** Scenario
2. **Indian** Scenario
3. **Gujarat** Scenario

DWARKA

CITY PROFILE

CITY DIAGNOSIS & PROPOSALS

1. **Sectors**
 - ✓ Water Supply
 - ✓ Sanitation
 - ✓ Solid Waste

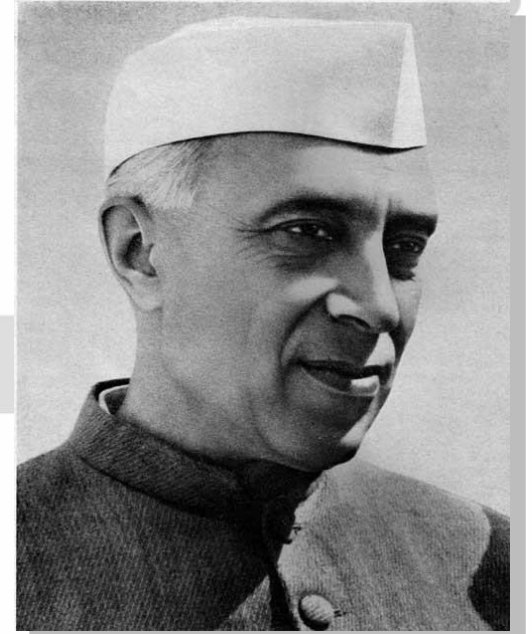


“Sanitation is more important than independence”

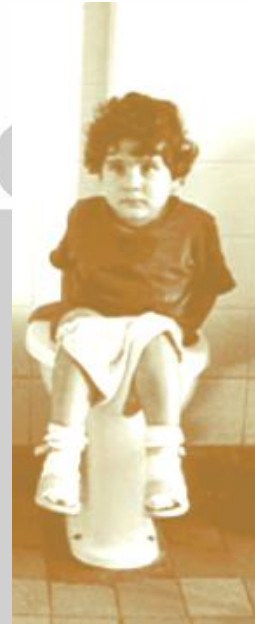
Mahatma Gandhi

“ The day everyone of us gets a toilet to use, I shall know that our country reached the pinnacle of progress ”

Jawaharlal Nehru



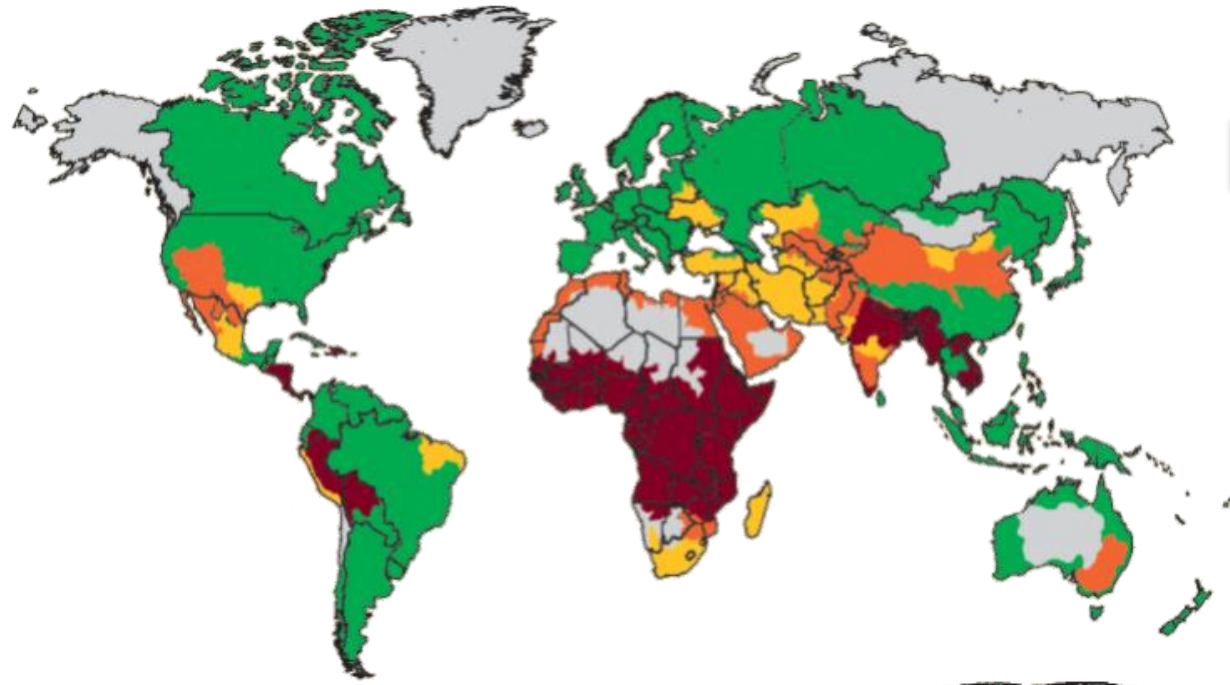
Water and sanitation are key to achieving broader goals of **economic growth** and **poverty alleviation**.



Under MDGs (Goal 7, target 10)

Halving 'by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation'.

Global Scenario - WATER

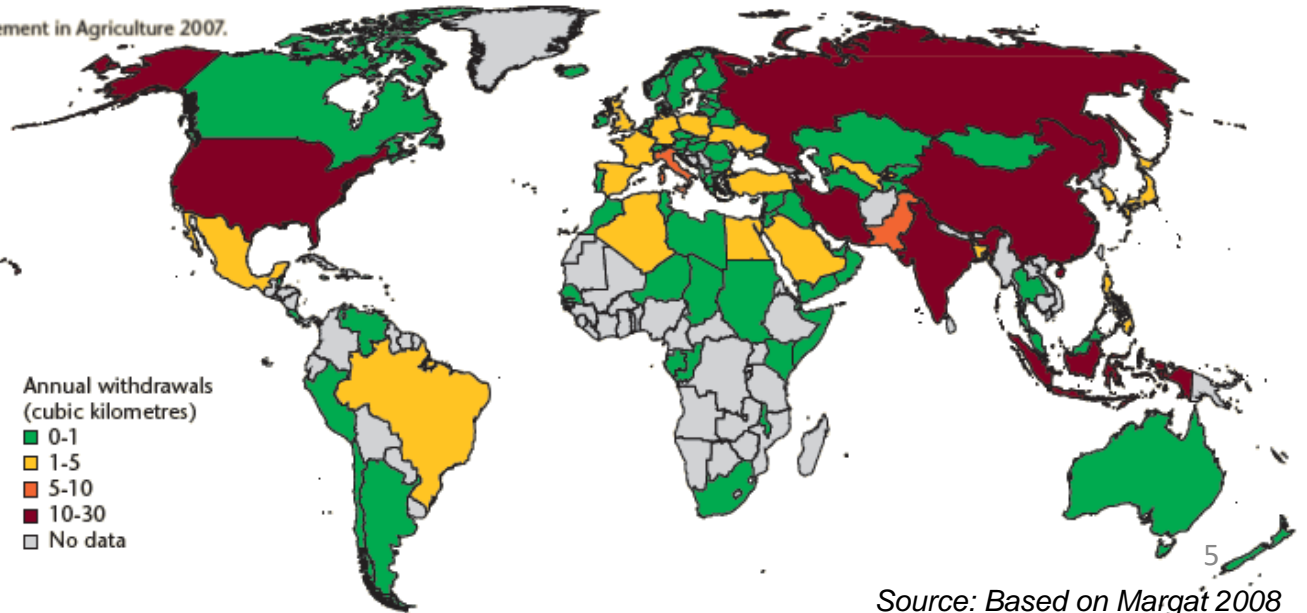


Increasing water scarcity

- Little or no water scarcity
- Approaching physical water scarcity
- Physical water scarcity
- Economic water scarcity
- Not estimated

Source: Based on Comprehensive Assessment of Water Management in Agriculture 2007.

Ground water use for drinking water



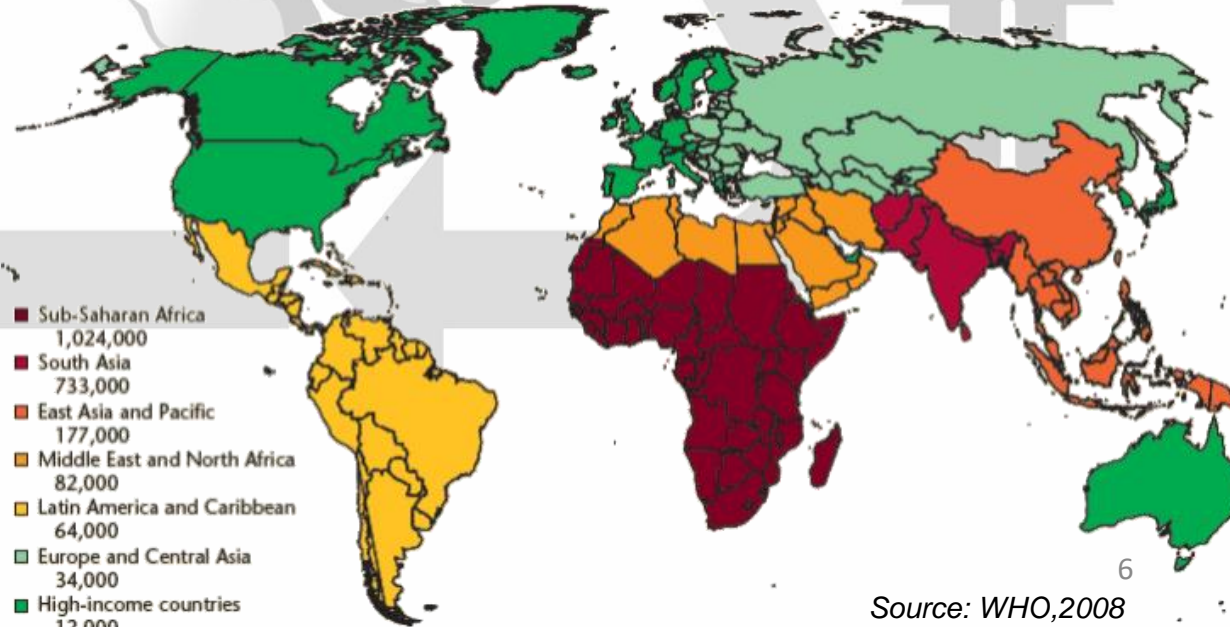
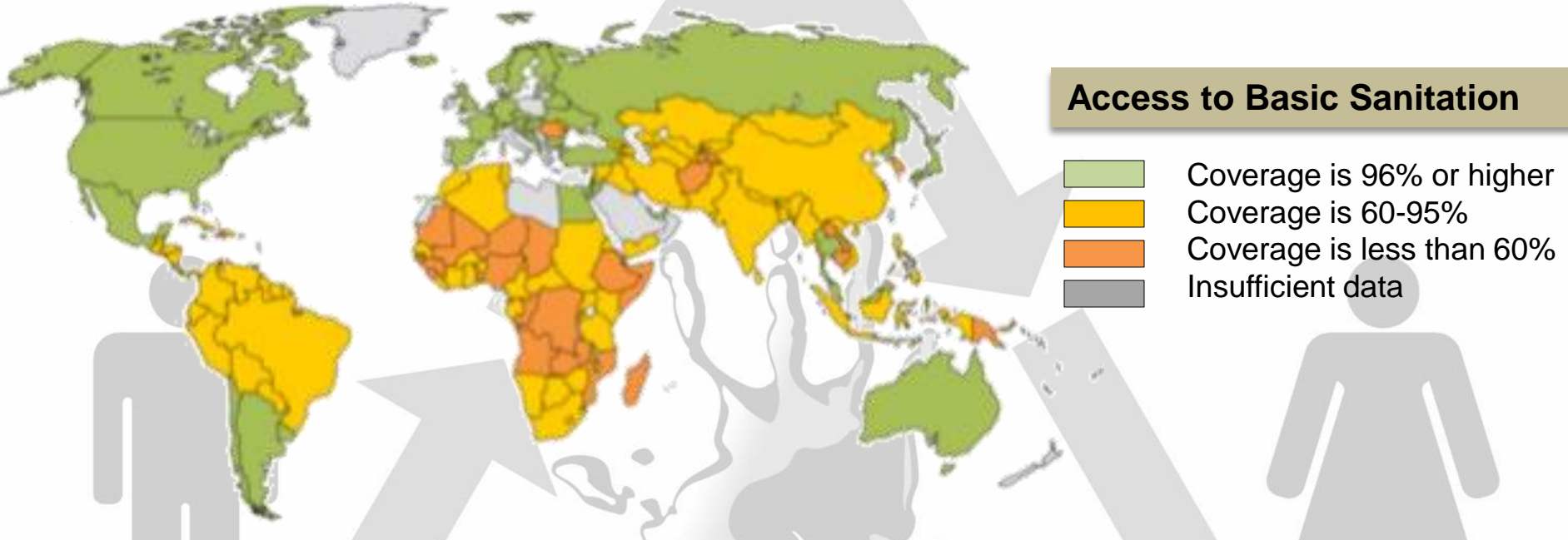
- Annual withdrawals (cubic kilometres)
- 0-1
 - 1-5
 - 5-10
 - 10-30
 - No data

Source: Based on Margat 2008

Global Scenario - SANITATION

Access to Basic Sanitation

- Coverage is 96% or higher
- Coverage is 60-95%
- Coverage is less than 60%
- Insufficient data



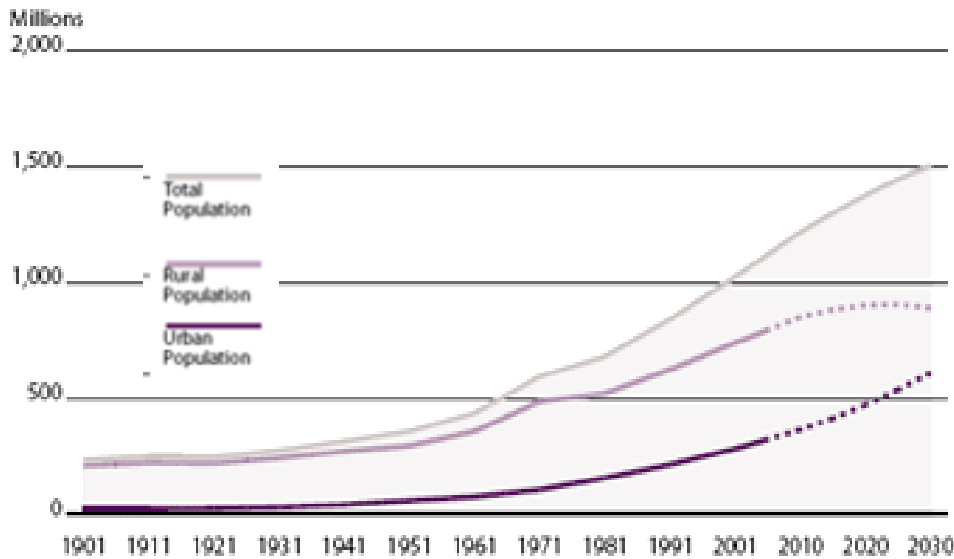
- Sub-Saharan Africa
1,024,000
- South Asia
733,000
- East Asia and Pacific
177,000
- Middle East and North Africa
82,000
- Latin America and Caribbean
64,000
- Europe and Central Asia
34,000
- High-income countries
12,000

Deaths due to Diarrhoea

India URBANISING

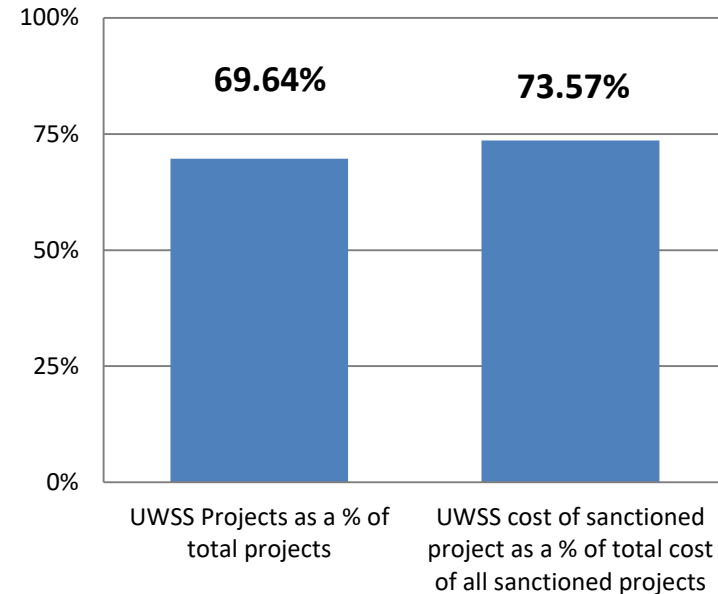
Increasing demands, increasing pressure on services.

POPULATION GROWTH



JNNURM

Sector wise release of funds under submission for Urban Infrastructure and Governance



Estimated Urban Population in 2031 : **600 million.**

Increase in no. of **million plus cities** from **50 (2011)** to **87 (2031).**

Sanctioned Projects

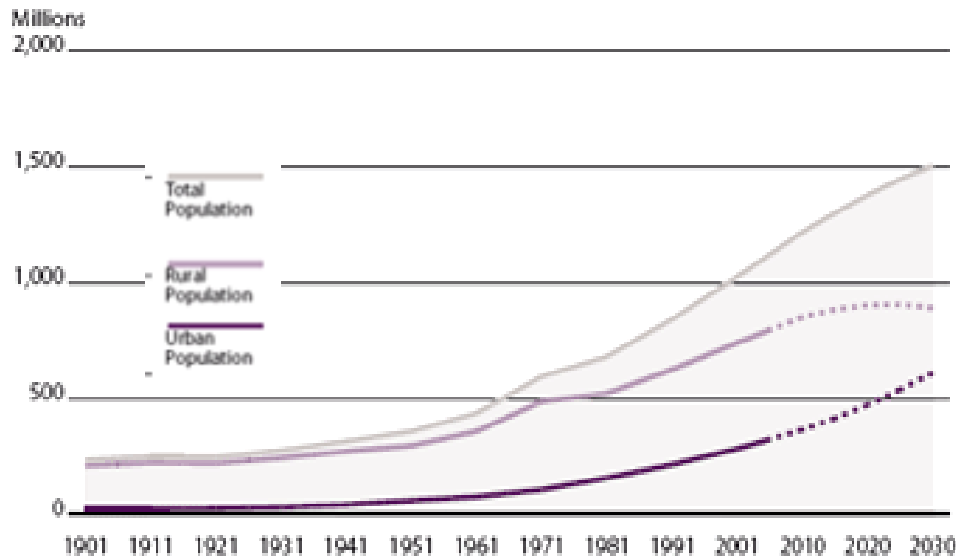
367 UWSS projects : Rs. 44,129 crores

Total cost of all projects: Rs. 59,981 crores

India URBANISING

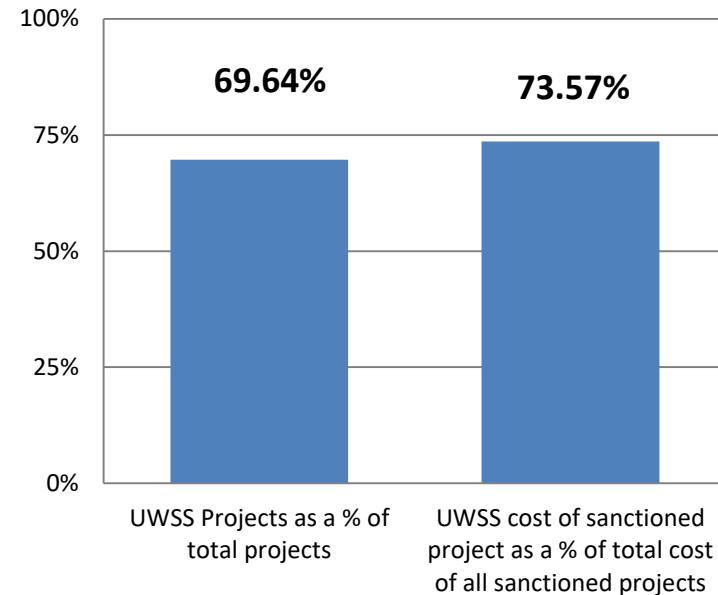
Increasing demands, increasing pressure on services.

POPULATION GROWTH



JNNURM

Sector wise release of funds under submission for Urban Infrastructure and Governance



ESTIMATED INVESTMENT REQUIREMENTS

Increasing investment in urban infrastructure from **0.7 per cent of GDP (2011-12) to 1.1 per cent (2031-32).**

W & S Sector : Investment worth **Rs 8 lakh crore (or 20%)** of total requirement for capital works in 20 years.

Investment worth **Rs.10.6 lakh crores (53%)** of total requirement for O& M of old & new assets.

Source : Report on Indian Urban Infrastructure and Services (2011), By- High Powered Expert Committee

Source : <http://jnnurm.nic.in/wp-content/uploads/2011/01/sectowise-approved-projects.pdf>

INDIAN Scenario

Water as

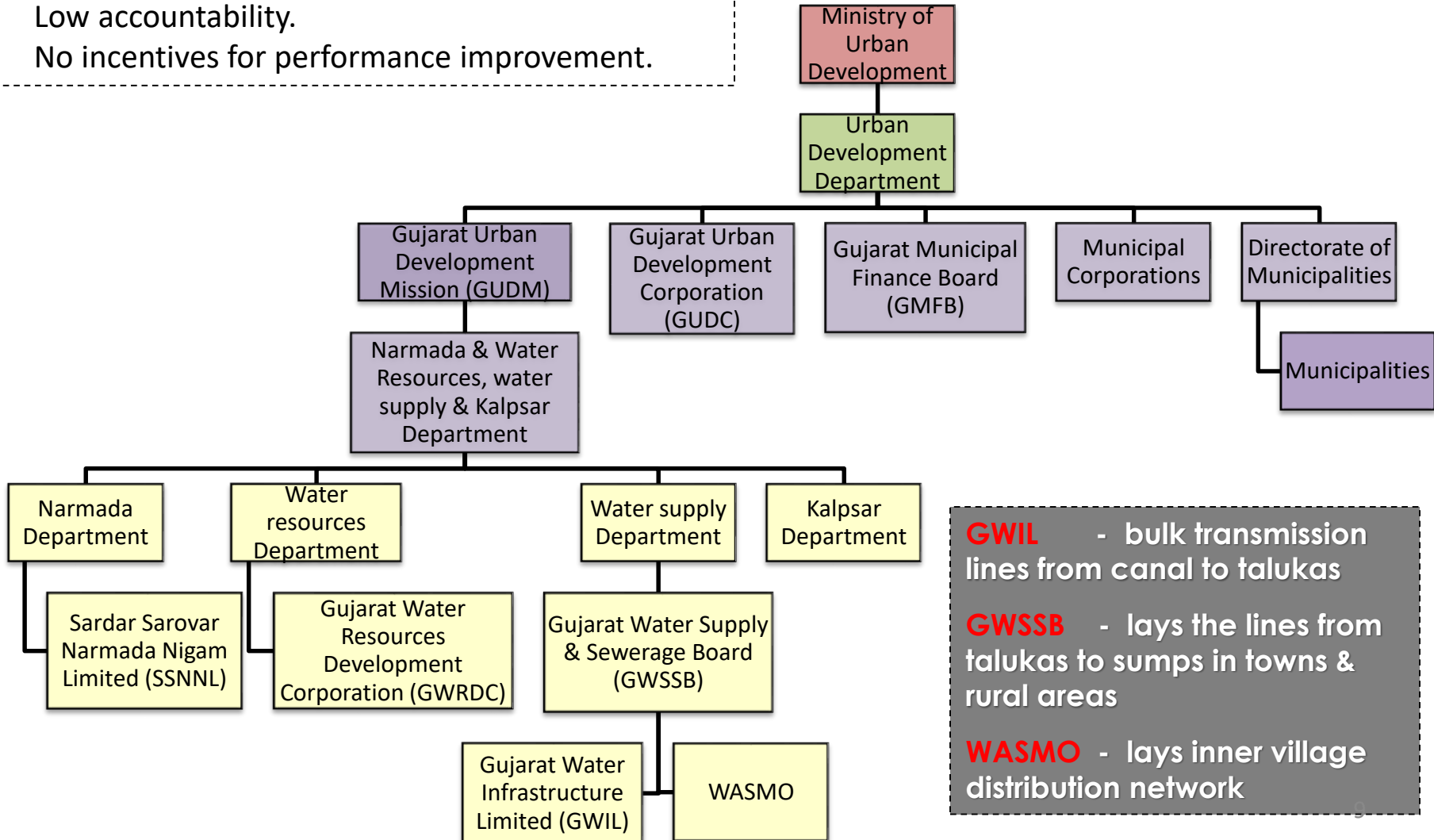
RESOURCE

SERVICE

✓ **Institutional Framework**

Low accountability.

No incentives for performance improvement.



GWIL - bulk transmission lines from canal to talukas

GWSSB - lays the lines from talukas to sumps in towns & rural areas

WASMO - lays inner village distribution network

Water as RESOURCE

✓ **Availability**

Decrease in per capita availability of water.

✓ **Depletion of Ground Water Sources**

(Quantity as well as Quality)

- **India - 16 % of the world's population & 4 % of its fresh water resources.**
- **Surface & Ground water availability -1,869 billion cubic metres (BCM).**
Of this, 40 % is not available for use due to geological and topographical reasons.
- **INDIA**
'Water stressed ' by 2020 with per capita availability of water to be **1,600 cu.m/person/year.**
' Water Scarce ' by 2050 with per capita availability of water to be below **1000 cu.m/person/year.**

Source : *Drinking water quality in rural India: Issues and Approaches* (WaterAid - www.wateraid.org)

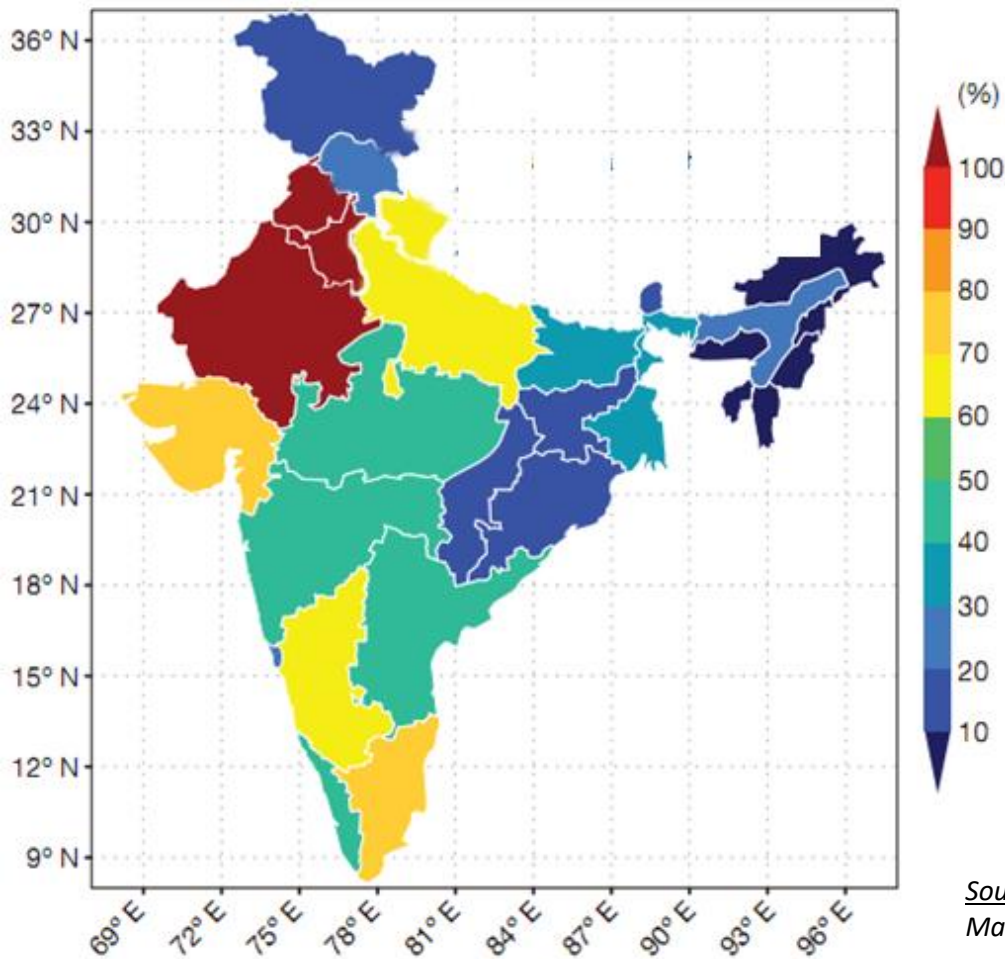
Water for India in 2050: first-order assessment of available options (S. K. Gupta and R. D. Deshpande, 2004)

INDIAN Scenario

Water as RESOURCE

Groundwater withdrawals as a percentage of recharge.

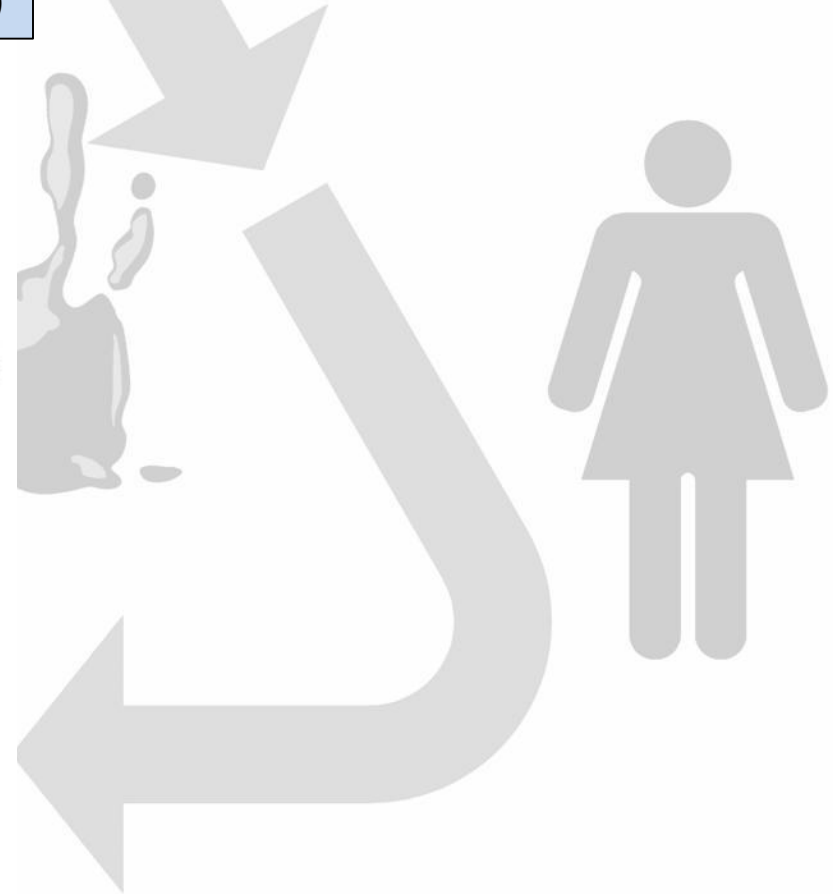
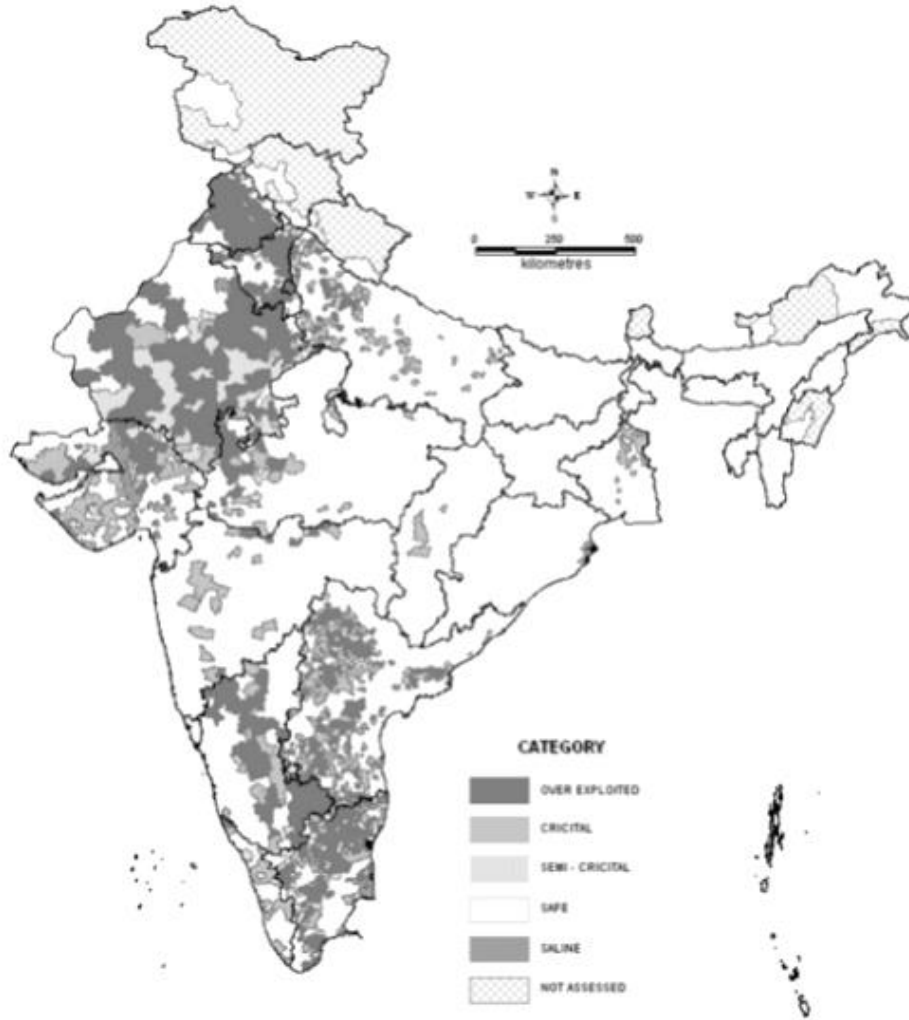
The map is based on state level estimates of annual withdrawals and recharge reported by the Indian ministry of Water Resources.



Source: Satellite-based estimates of groundwater depletion in India (2009)
Matthew Rodell, Isabella Velicogna^{2,3,4} & James S. Famiglietti

Water as RESOURCE

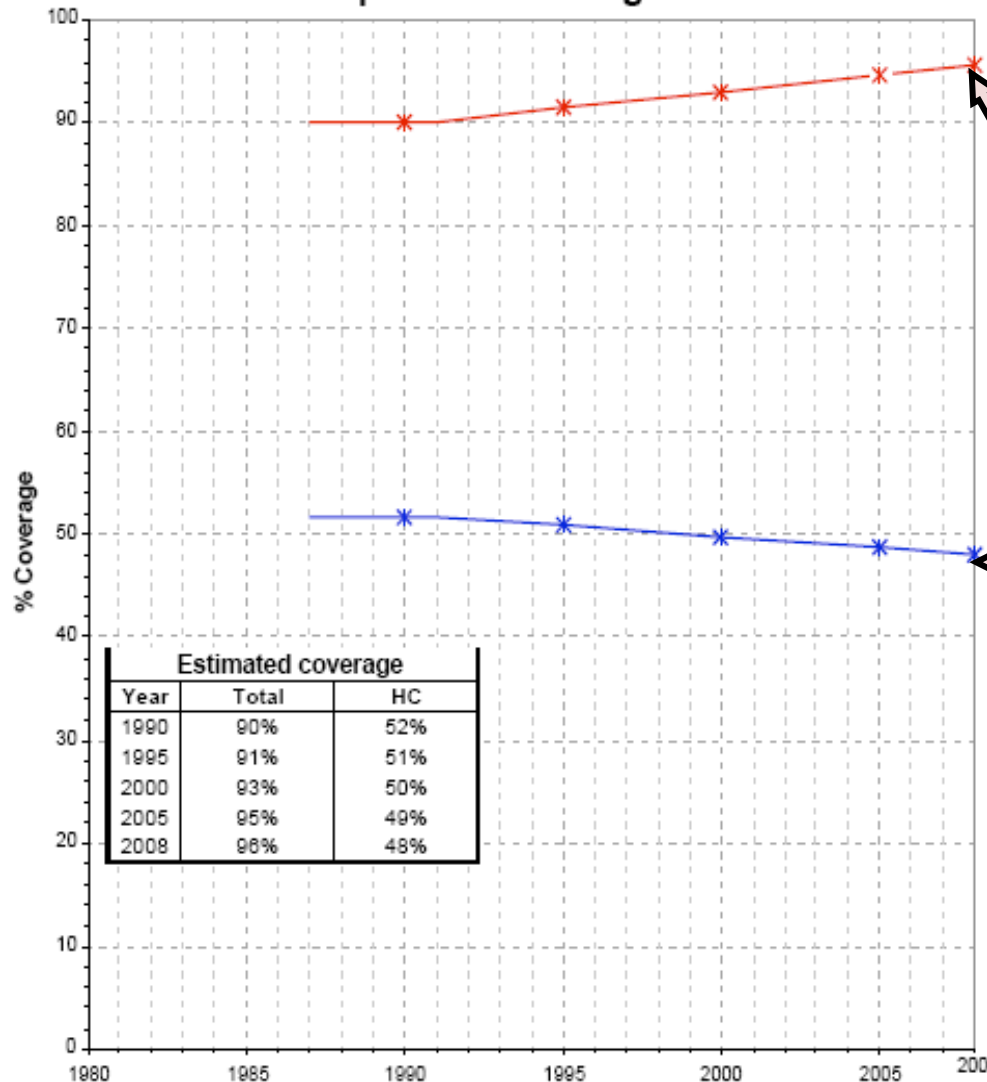
Ground Water Exploitation Status (as on 2004 from CGWB)



Source: Estimation of replenishable groundwater resources of India & their status of utilization (2009), Rana Chatterjee & Raja Ram Purohit 12

SERVICE

Use of improved drinking water sources



✓ Service Delivery

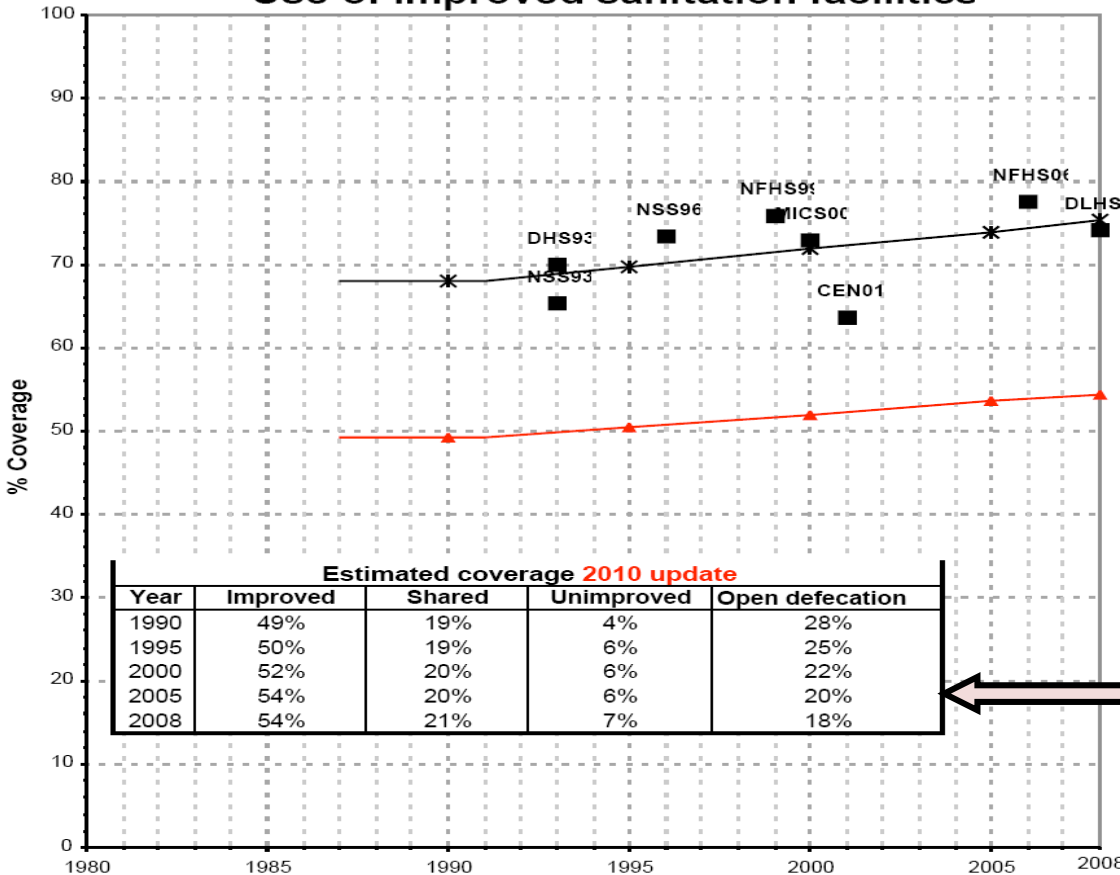
1. **Accessibility** - Improved basic access but decrease in household connections.

Basic access in urban India has reached nearly 96% by 2008

% Household level connections in urban India has declined from 54% in 1990 to 48% by 2008

SERVICE

Use of improved sanitation facilities



Estimated coverage 2010 update

Year	Improved	Shared	Unimproved	Open defecation
1990	49%	19%	4%	28%
1995	50%	19%	6%	25%
2000	52%	20%	6%	22%
2005	54%	20%	6%	20%
2008	54%	21%	7%	18%

18% of population continue to defecate in open and 21% rely on shared facilities

■ Used for the estimates * Estimates —●— JMP 2010 estimate

SERVICE

✓ Service Delivery

- 1. Accessibility** - Improved basic access but decrease in household connections.
- 2. Large Demand Supply gap** in terms of infrastructure as well as services.
- 3. Equity issues** –
Urban Households – 135lpcd
Slums – 40 lpcd
- 4. Poor Services** (Quality as well as Quantity).

INDIAN Scenario

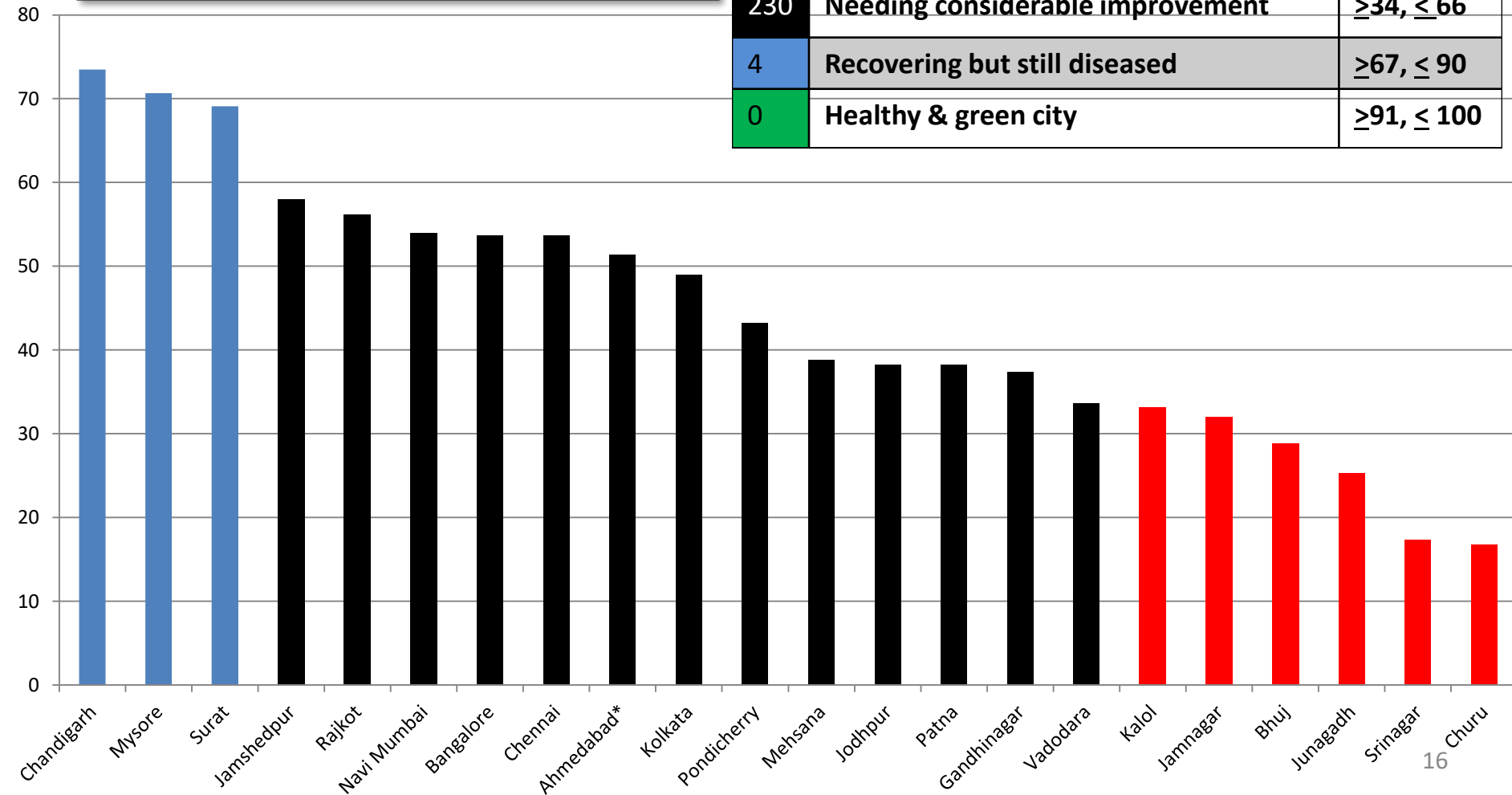
SERVICE

National Rating of 423 cities

(Cities with Population > 100,000)

LEGEND : City Rating for Sanitation levels

189	Require immediate remedial measures	< 33
230	Needing considerable improvement	≥34, ≤ 66
4	Recovering but still diseased	≥67, ≤ 90
0	Healthy & green city	≥91, ≤ 100





Poor infrastructure condition is a major problem



Illegal connections



Thousands of small leaks go undetected

SERVICE

✓ Service Delivery

- 1. Accessibility** - Improved basic access but decrease in household connections.
- 2. Large Demand Supply gap** in terms of infrastructure as well as services.
- 3. Equity issues** –
Urban Households – 135lpcd
Slums – 40 lpcd
- 4. Poor Services** (Quality as well as Quantity).
- 5. Low cost recovery**
High NRW (more than 50% in Indian cities)

RESOURCE

SERVICE

✓ Institutional Framework

Overlapping roles & responsibilities leads to low accountability.

✓ Availability

Decrease in per capita availability of water.

✓ Depletion of Ground Water

Sources

(Quantity as well as Quality)

✓ Service Delivery

1. Accessibility

2. **Large Demand Supply gap** in terms of infrastructure as well as services.

3. **Equity issues** - (Households and Slums).

4. **Poor Services** (Quality as well as Quantity).

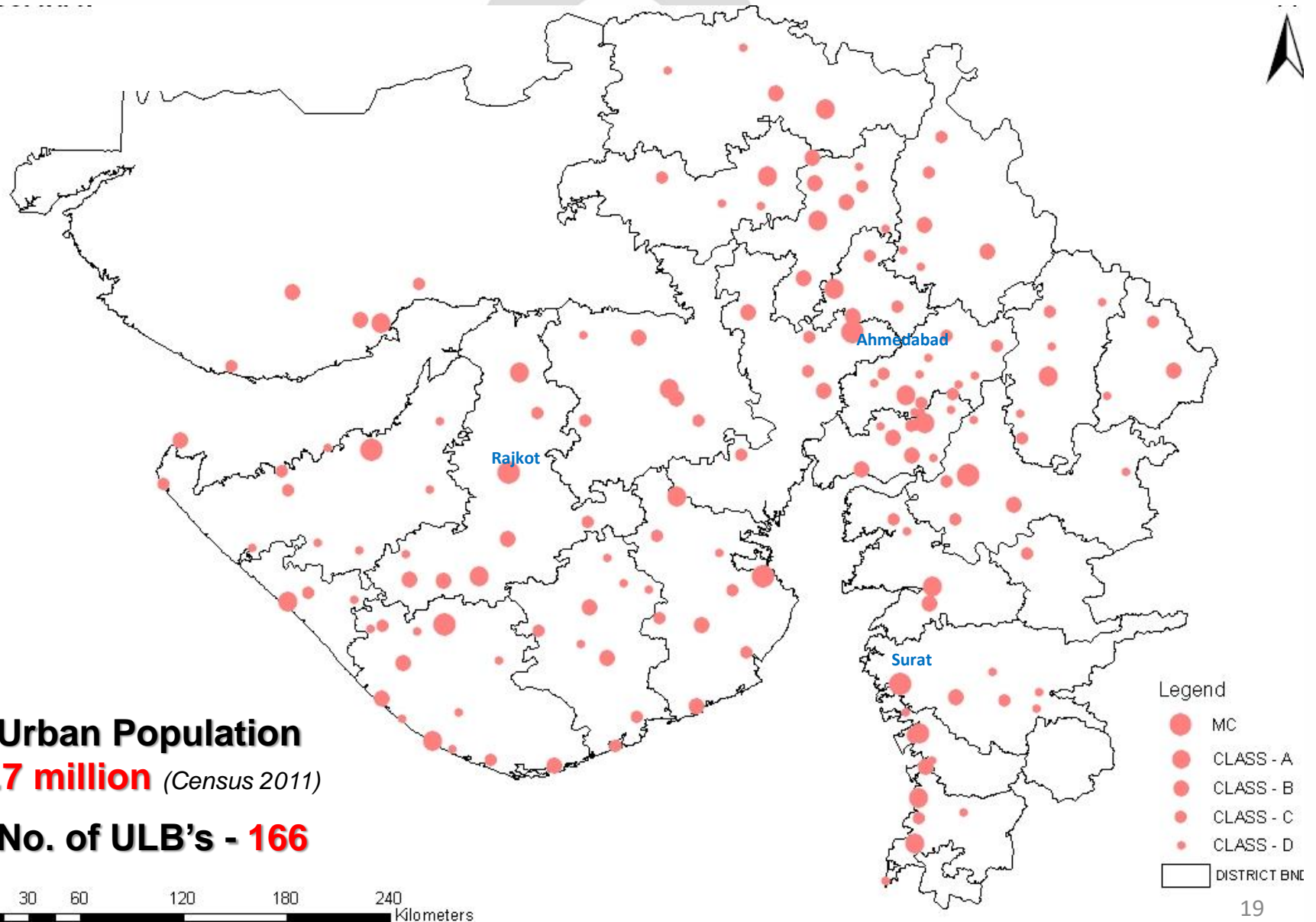
5. **Low cost recovery** – High NRW.

HEALTH IMPLICATIONS

- ✓ **Around 37.7 million** Indians are affected by **waterborne diseases** annually.
- ✓ **1.5 million children** are estimated to die of **diarrhoea** alone and
- ✓ **73 million working days** are lost due to waterborne disease each year.

Source: Drinking Water Quality in rural India – Issues And approaches (Water Aid)

GUJARAT Scenario



WATER

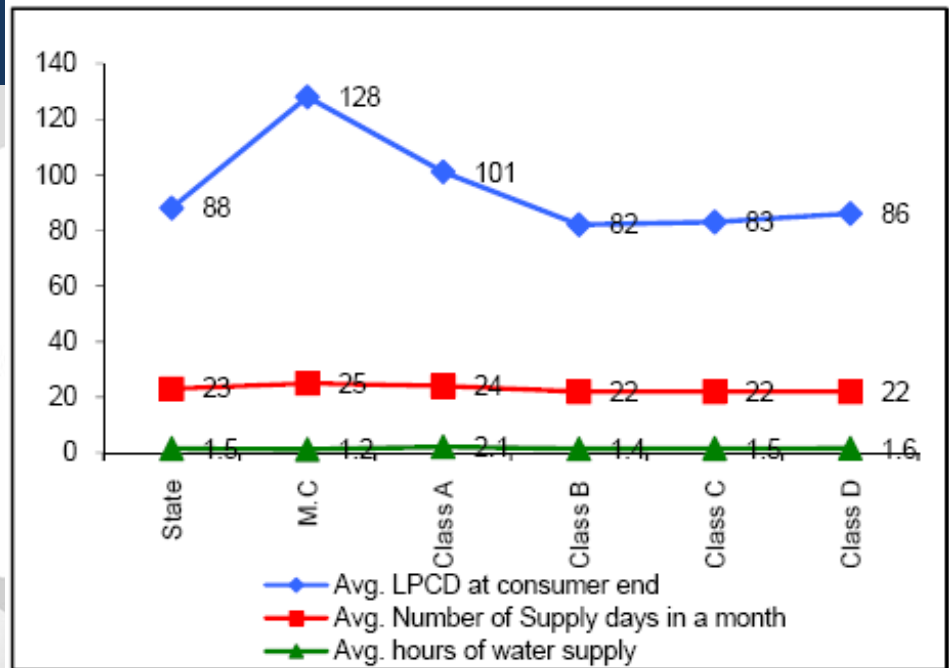
Coverage of water supply –
 Non slums – 68%, Slums – 53%

Per capita supply of water – 88 lpcd

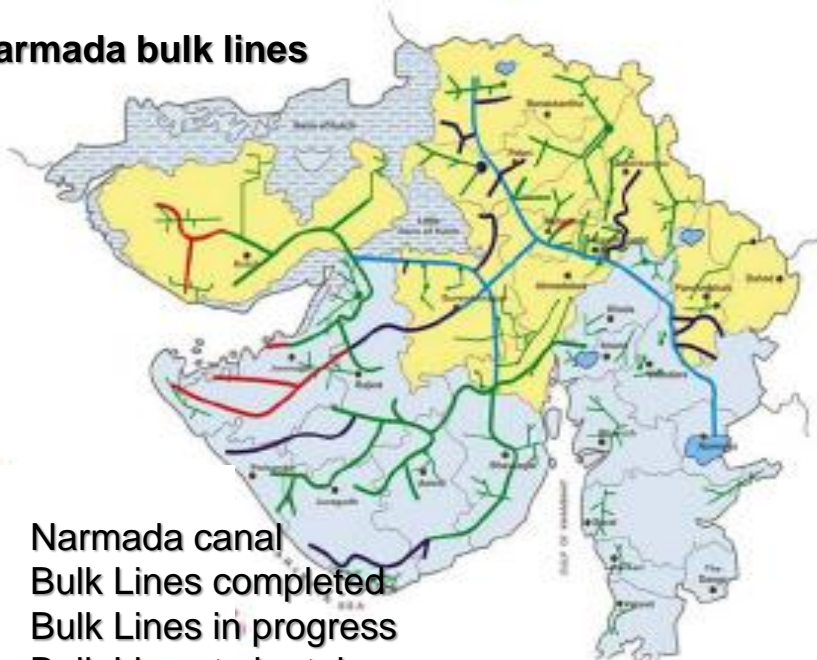
Continuity of water supply – 1.5 hours

Extent of Non-revenue water – 30 %

Cost Recovery – 60 %

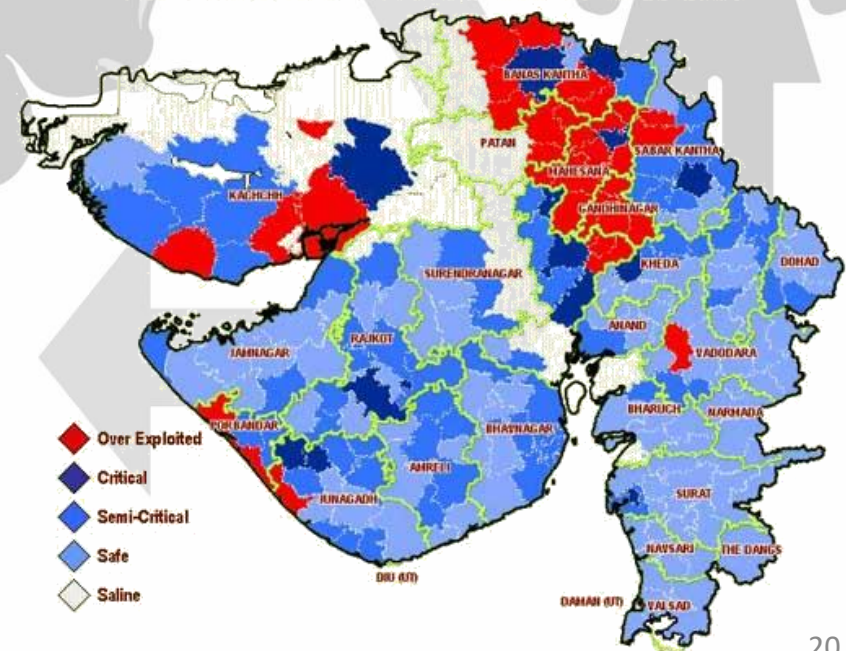


Narmada bulk lines



- Narmada canal
- Bulk Lines completed
- Bulk Lines in progress
- Bulk Lines to be taken up

CATEGORIZATION- GROUNDWATER DEVELOPMENT



SANITATION

Coverage of toilets – Non-slums - 81%, Slums – 57%

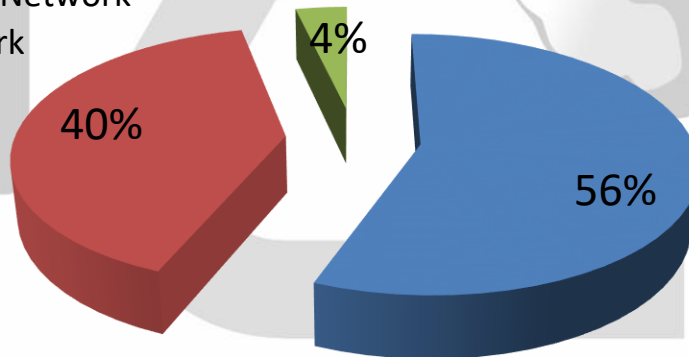
Collection efficiency of waste water network – 77%
(6 ULBs)

Cost Recovery – 51 %

99 ULB's – No sewerage network

Sewerage Network

- No Sewer Network
- Partial Sewer Network
- Sewer Network



Nirmal Gujarat Program

Technical & financial support for construction of toilets for urban poor

SWM

Door to door collection – 78%

Service delivery – slums -57%

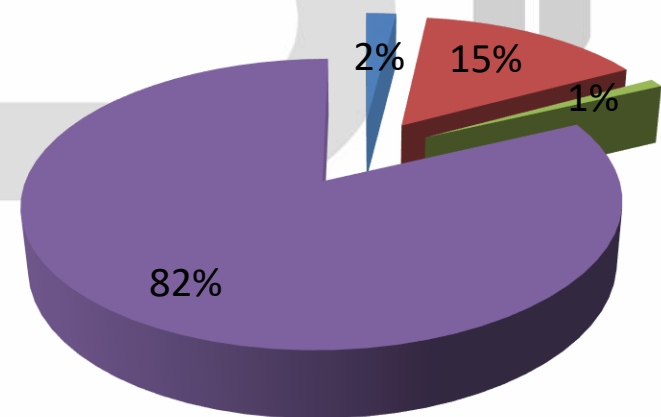
Cost Recovery – 23%

Tax – Safai Vero

Recently introduced in most ULB's in 2008-09

Percentage of HH level coverage of SWM services

- No Data
- No Coverage
- Full Coverage
- Partial Coverage



CITY SELECTION

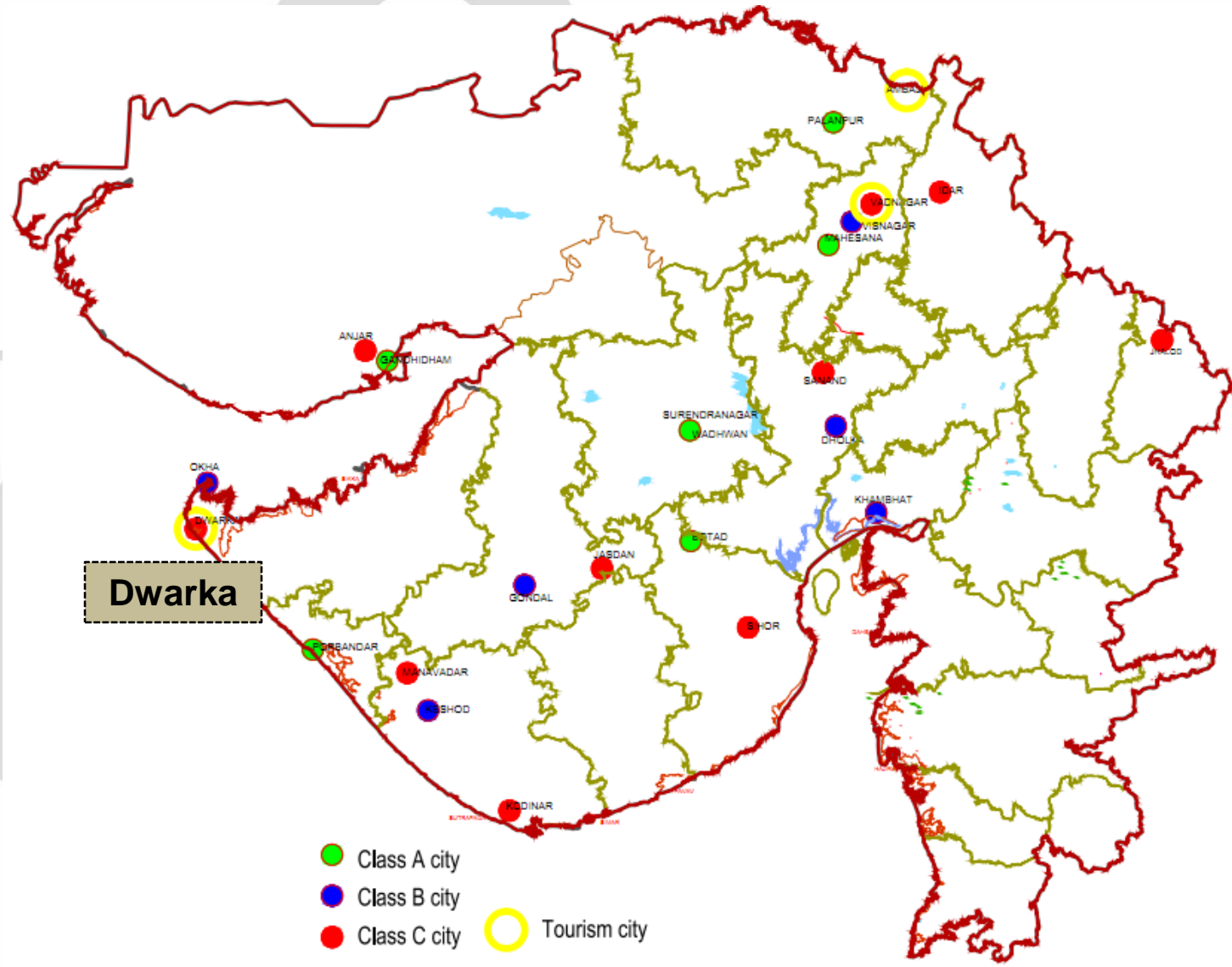
WS Scenario
SLB Indicators

Map Overlay
(Ground Water extraction)

Size of the city

Slum Population

Tourism



36

22

BACKGROUND

CITY DIAGNOSIS

PROPOSALS

4 Weeks

8 Weeks

4 Weeks

Understanding Water & Sanitation Sector

Aim & Objectives

City Selection

Diagnostic Framework

City Situation Analysis

City Profile

Water & Sanitation Profile

Identification of Issues/Gaps

Proposals

- Literature Review**
- ✓ Global Scenario
 - ✓ Indian Scenario
 - ✓ Gujarat State Level Assessment
 - ✓ Institutional Structure
 - ✓ Programs, Acts, Policies or other initiatives
 - ✓ Service Level Benchmarks
 - ✓ Best practices

- ✓ Location
- ✓ Demographics
- ✓ Land Use
- ✓ Topography
- ✓ Tourism

- ✓ HH surveys
- ✓ Water Quality Sampling
- ✓ Focused Group discussions
- ✓ Visual Observations
- ✓ Interaction with ULB & State level agencies
- ✓ Discussions with Sector Experts

- ✓ Institutional
- ✓ Financial
- ✓ Technical
- ✓ Promotion

AIM

Quality Water and Sanitation services to 'ALL'

OBJECTIVES

- ✓ *To provide **spatial and socio-economic equity** in the provision of **W&S services**.*
- ✓ *To provide alternatives in order to **cater to the peak tourism demands** of the city.*
- ✓ *To ensure a service delivery mechanism which is **sustainable** in the long run.*

Data/Information to be Collected

CITY PROFILE

- ✓ Demographics (Ward wise details)
- ✓ Topography & Rainfall
- ✓ Tourism
- ✓ Land Use
- ✓ Socio Cultural Aspects

WATER

- ✓ Sources & Alternatives
- ✓ Existing Network
- ✓ Tourist facilities [Peak/Off-peak]
- ✓ Service Operations
- ✓ Storage & Treatment
- ✓ Institutional Setup
- ✓ Finance

WASTE WATER (FSM)

- ✓ Toilet availability [Residential & Non Residential]
- ✓ On-site sanitation
- ✓ De-sludging mechanism
- ✓ Tourist Facilities [Peak/Off-Peak period]
- ✓ Treatment & Disposal
- ✓ Institutional Setup
- ✓ Finance

SOLID WASTE MANAGEMENT

- ✓ Waste Collection mechanism [Peak/Off-Peak]
- ✓ Containers
- ✓ Transportation
- ✓ Tools/Equipments
- ✓ Treatment
- ✓ Disposal Areas
- ✓ Institutional Setup
- ✓ Finance

HH surveys
Interaction: ULB
Water Quality tests
State Level Agencies
FGDs
Sector Experts

Objectives

Aim

Provide **spatial and socio economic equity** in the provision of services.

Alternatives to **cater to the high tourism demand**

Deliver a more **'Sustainable service delivery'** mechanism.

Quality W&S Services to 'ALL'

DIAGNOSTIC FRAMEWORK

BACKGROUND

Understanding Water & Sanitation Sector

Aim & Objectives

City Selection

Diagnostic Framework

City Situation Analysis

City Profile

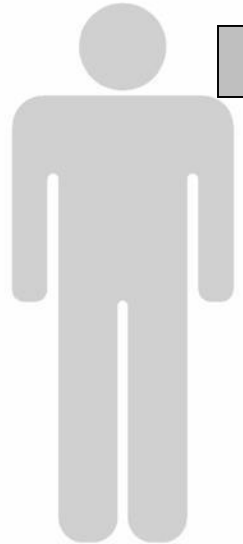
Sector Profile

Identification of Issues/Gaps

Proposals

CITY DIAGNOSIS

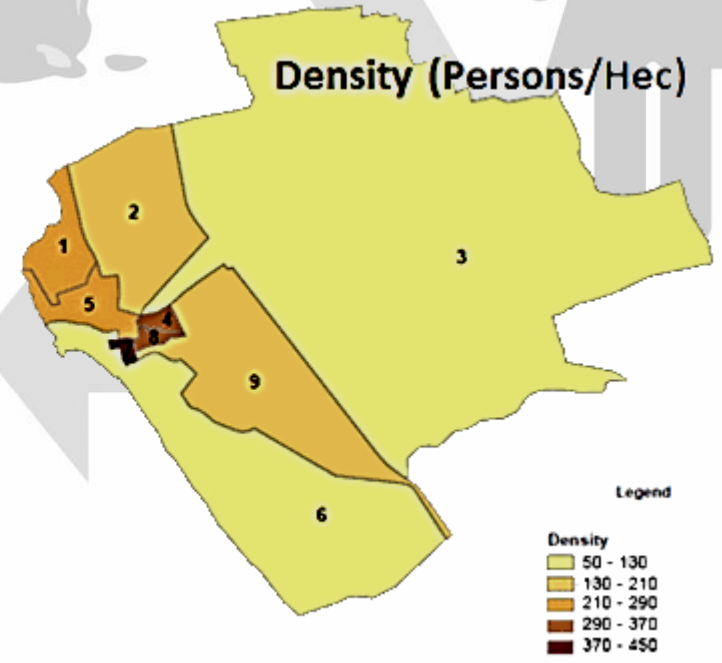
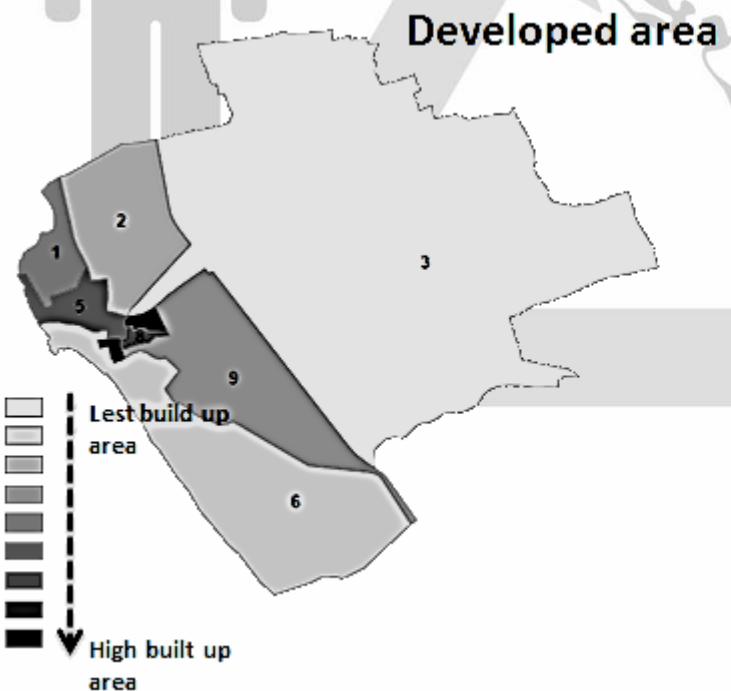
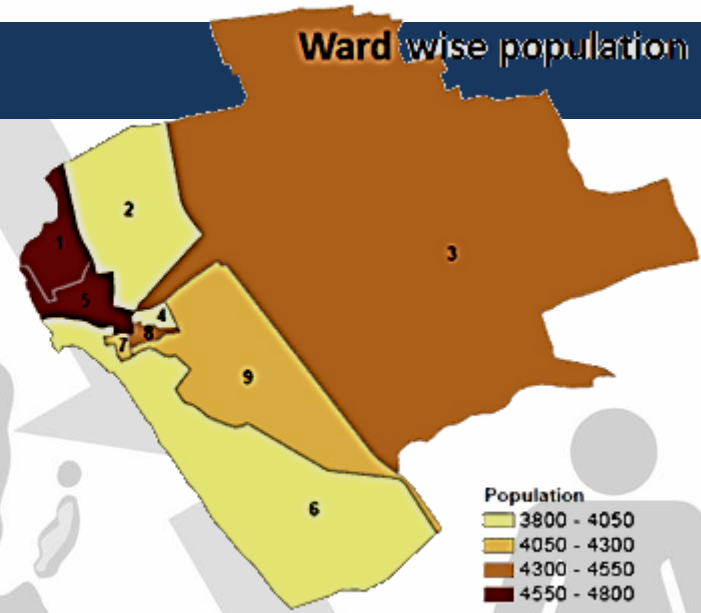
PROPOSALS



DEMOGRAPHIC PROFILE

Class 'C' Municipality

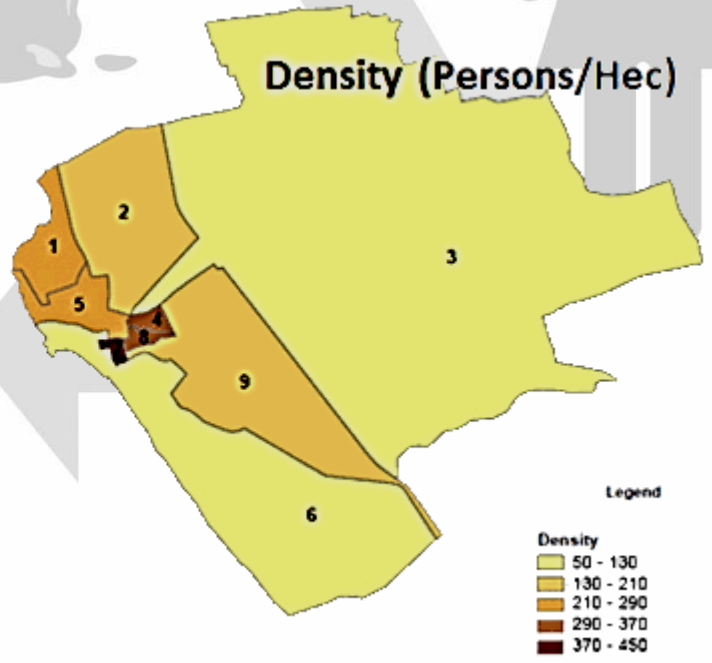
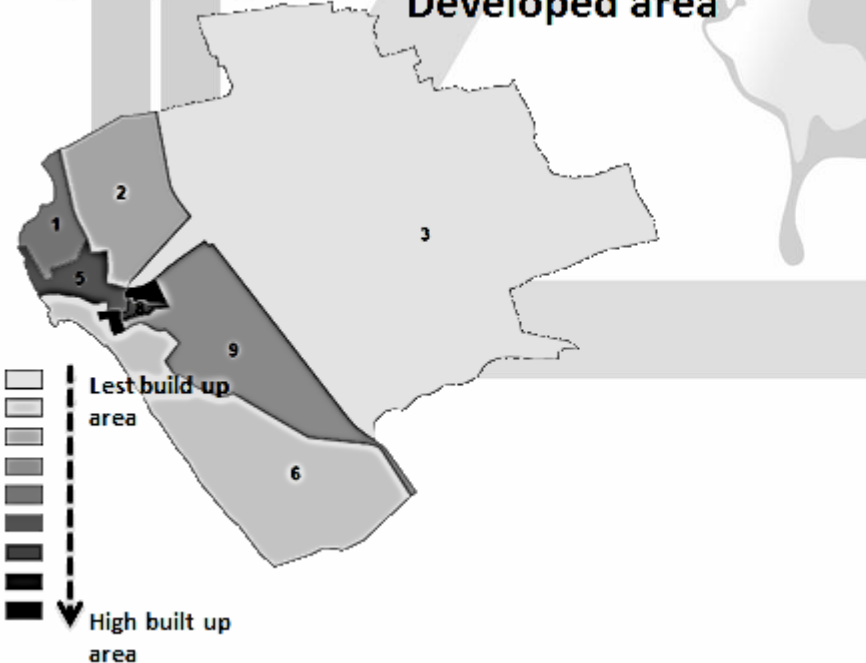
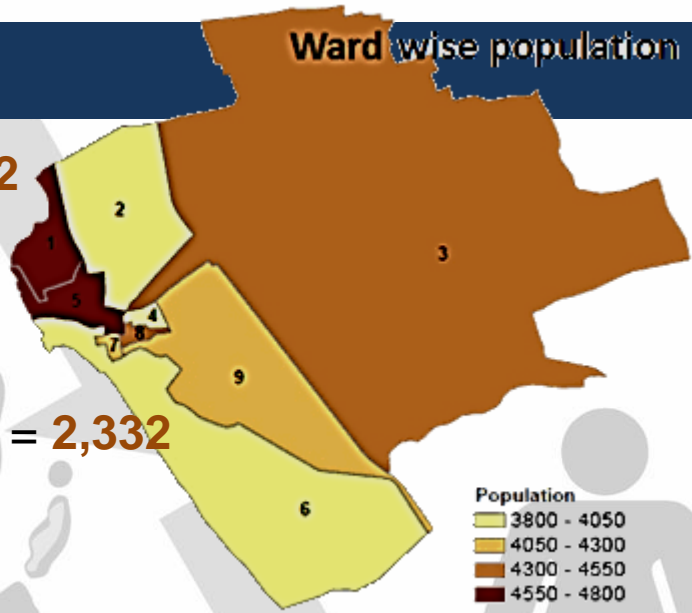
- Municipal area = 42.7 Sq.Km
- Inhabitant area = 5.2 Sq.Km (Approx)
- Number of elective wards = 9



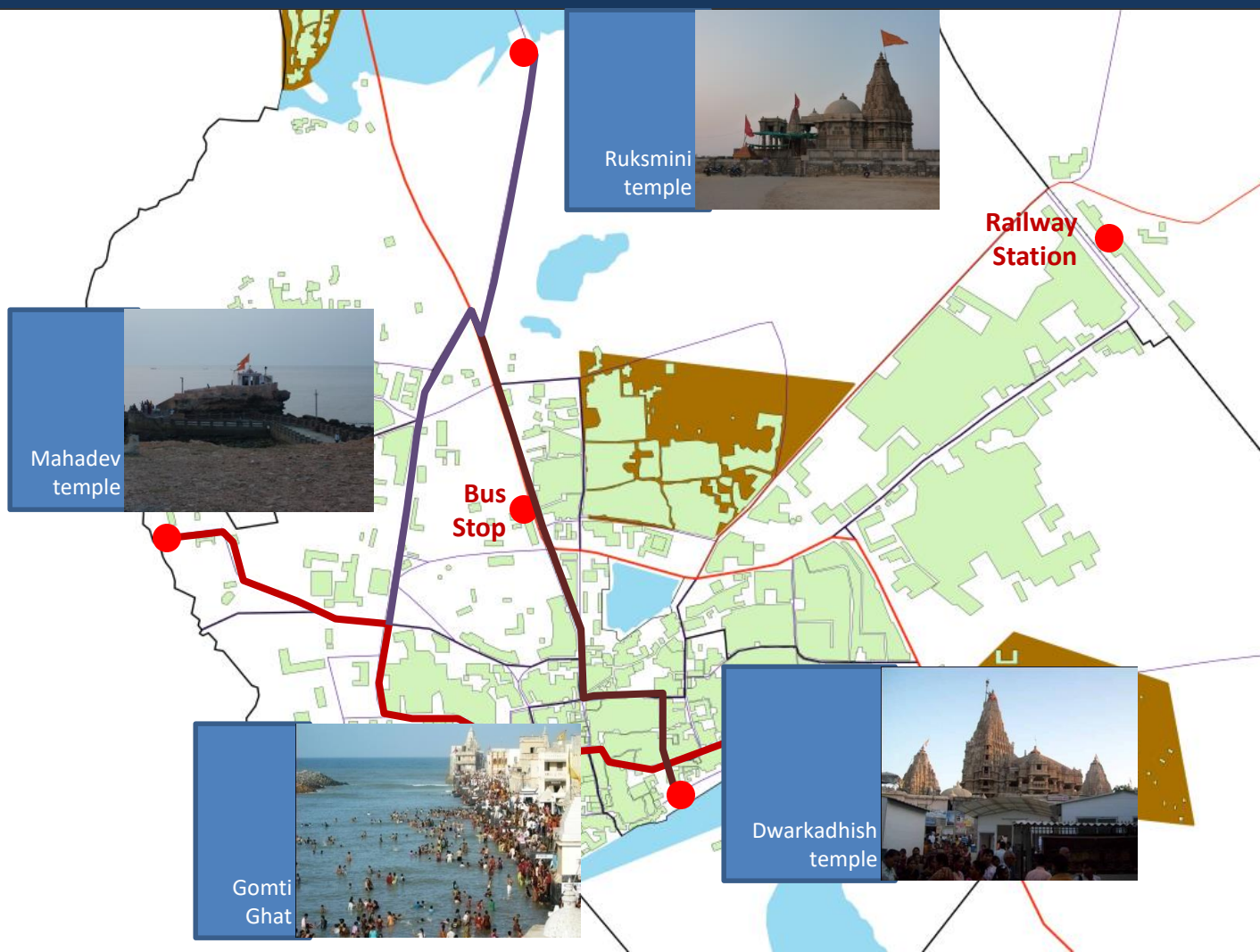
DEMOGRAPHIC PROFILE

- Total Population as per **2011** census = **38562**
- Number of properties = **13,319**
- Number of HH = **7712***
- No. of commercial and other establishments = **2,332**
- Number of slums = **3**
- Slum Population = **4684**
- Slum HH = **780***

Developed area



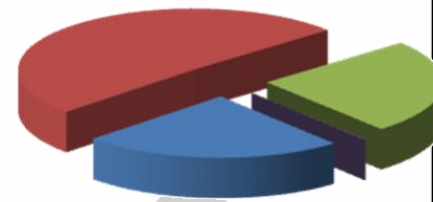
TOURISM INFLOW AT DWARKA



Dwarka has 27.49 lakh tourists constituting 14.66% of the states total tourist inflow

Source- GITCO Annual Report 2009-10

TOURIST ORIGINS



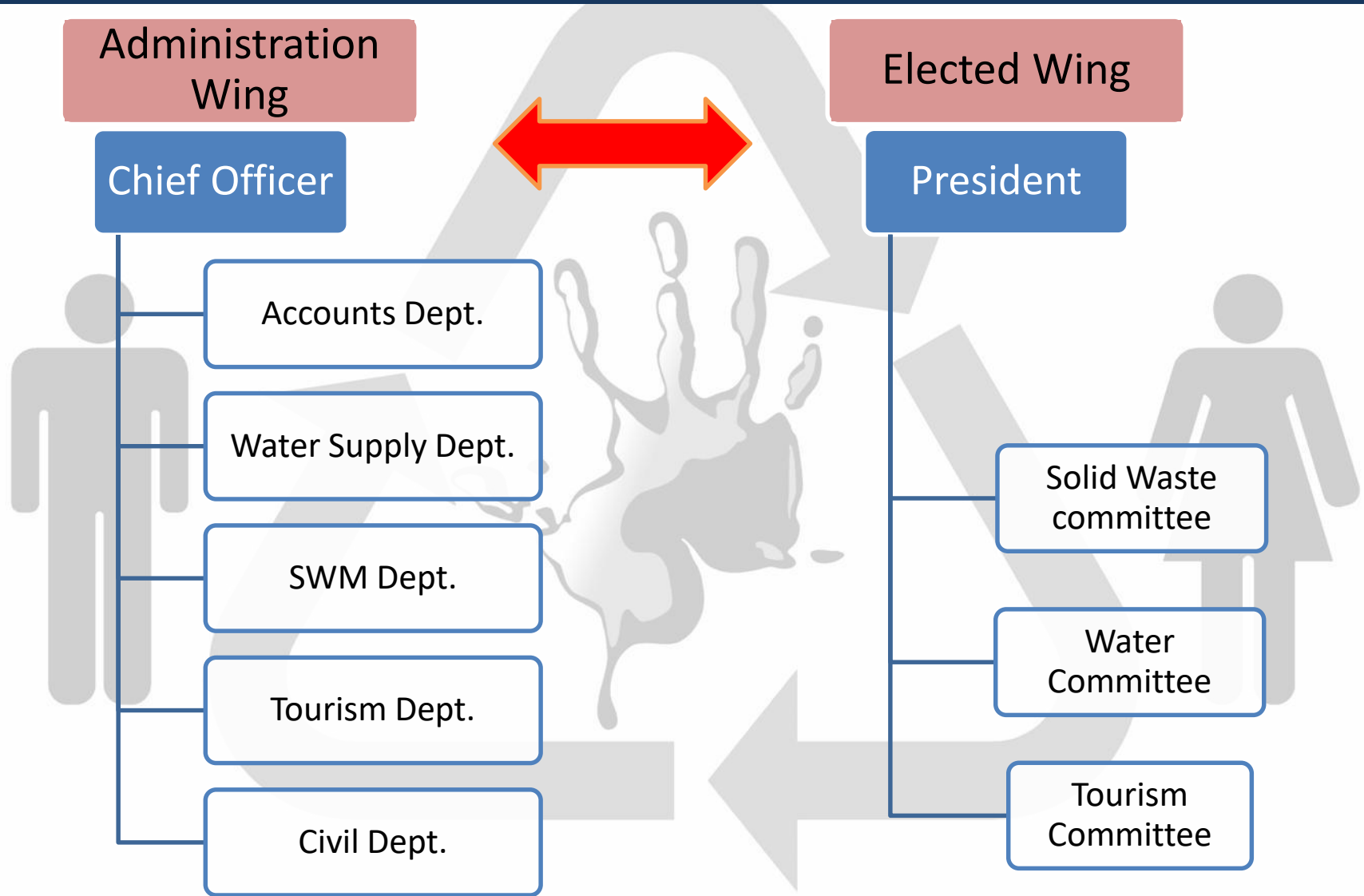
- Local (24%)
- Gujarat (50.9%)
- India (25%)
- Foreigners (0.1%)

ANNUAL BREAK-UP FOR TOURIST FLOW AT DWARKA

Particulars	High Season	Low Season	Fairs and festivals	Total
Days/year (%)	218 (59.73%)	139 (38.08%)	8 (2.19%)	365 (100%)
Tourist flow (lakhs)	20.12	3.49	3.87	27.49
Tourist flow (%)	73.2%	12.7%	14.1%	100%
Avg visitors/day	9322	2502	48375	



INSTITUTIONAL SETUP



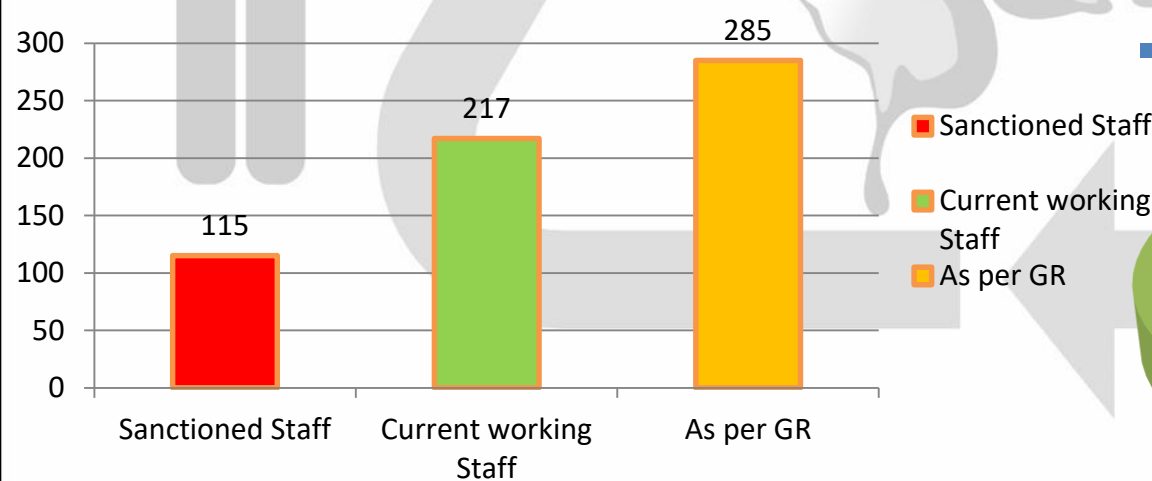
There are 27 Elected Members in Council.

Waste water Dept is not there and any work related to waste water is carried out by SWM Dept.

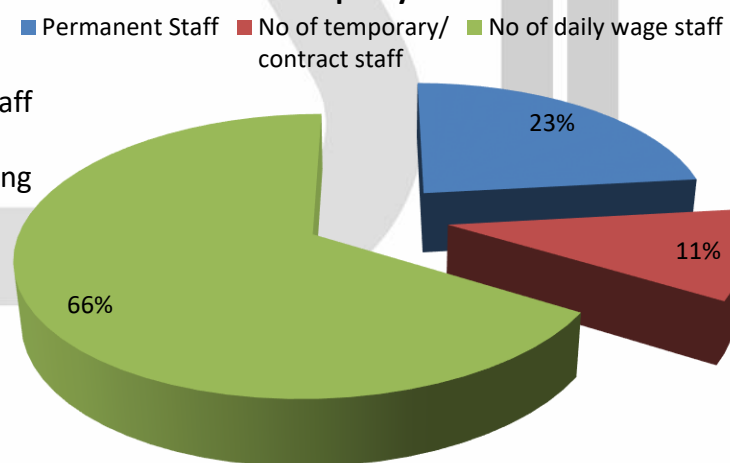
ADMINISTRATIVE DETAILS

Department	Permanent Staff		No of temporary/ contract staff	No of daily wage staff	Total staff	As per GR & CPHEEO
	Sanctioned	Filled				
Total municipal staff	115	49	22	140	213	285
Administration	46	22	3	29	54	14
Finance/Accounts	1	0	0	6	7	7
Water supply	7	4	2	16	22	16
Waste water & SWD	0	0	0	0	0	0
SWM	61	23	17	90	130	248

Scenario For Administrative Staff



% of total working staff for Dwarka Municipality

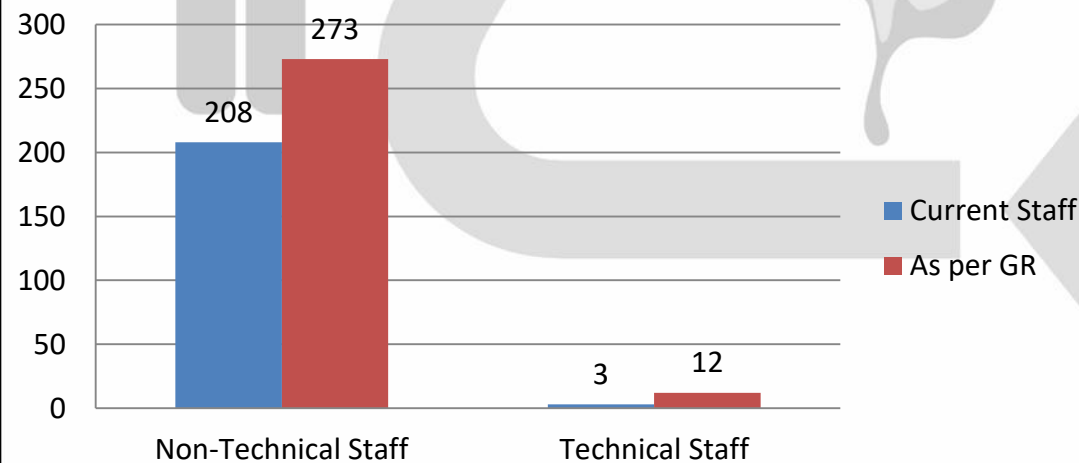


Technical staff is less compared to technical staff mentioned by GR(2006).

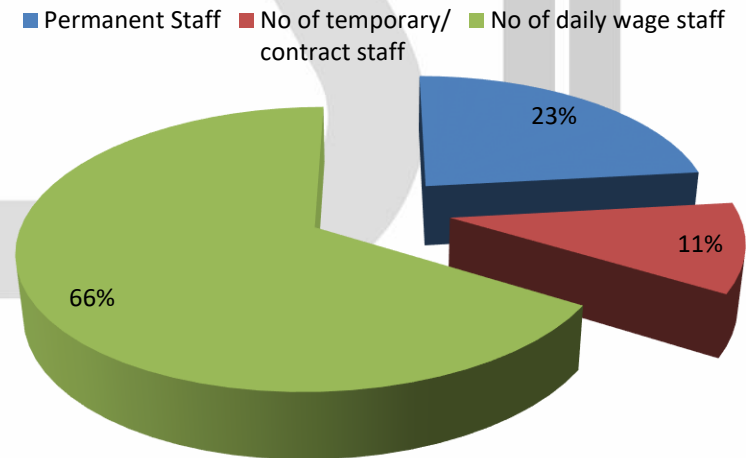
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Scenario for Technical Staff



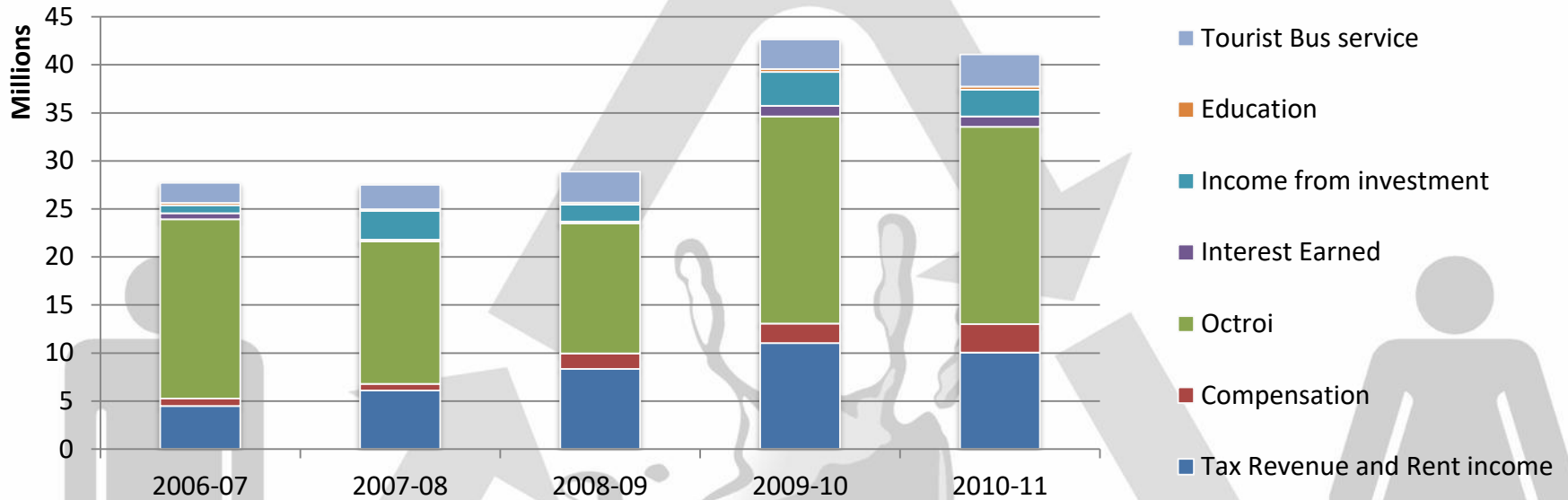
% of total working staff for Dwarka Municipality



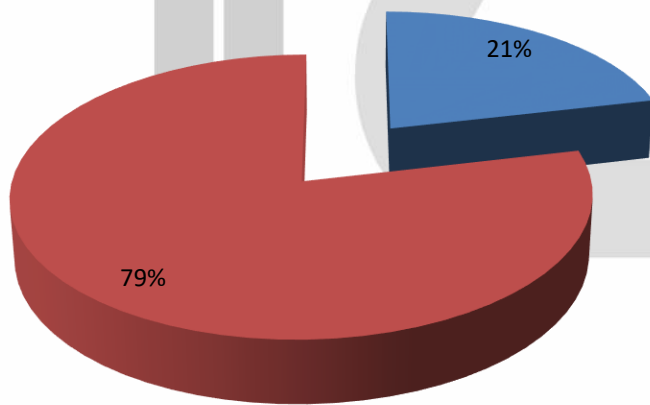
Technical staffs less Compared to technical staff mentioned by GR(2006).

FINANCE- Dwarka Municipality

Revenue Income

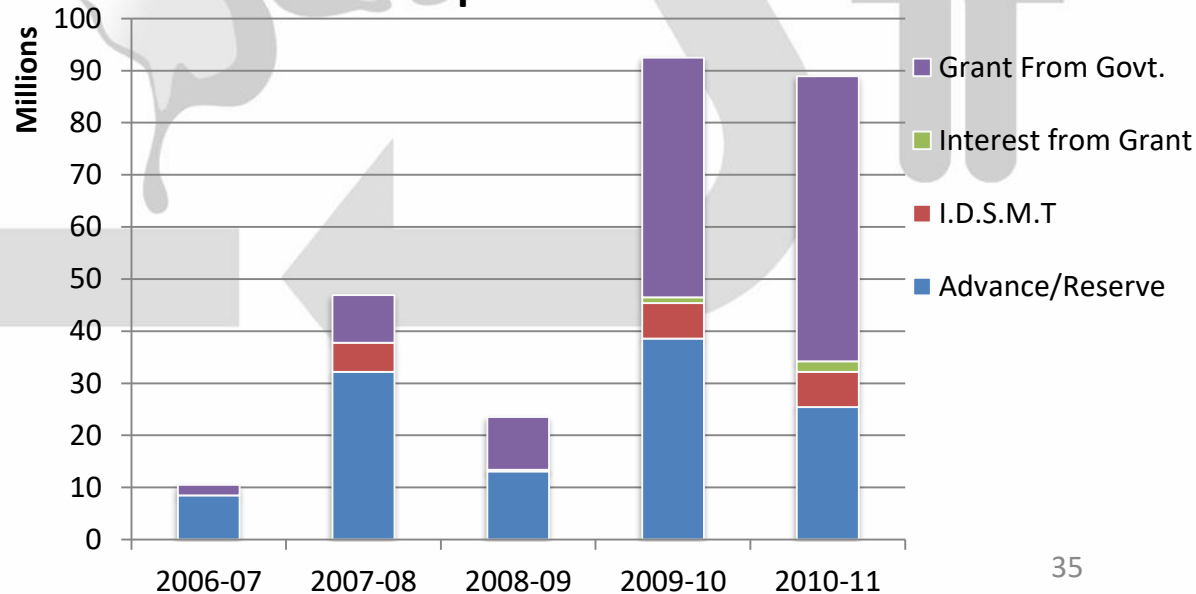


Own Source V/s Grants



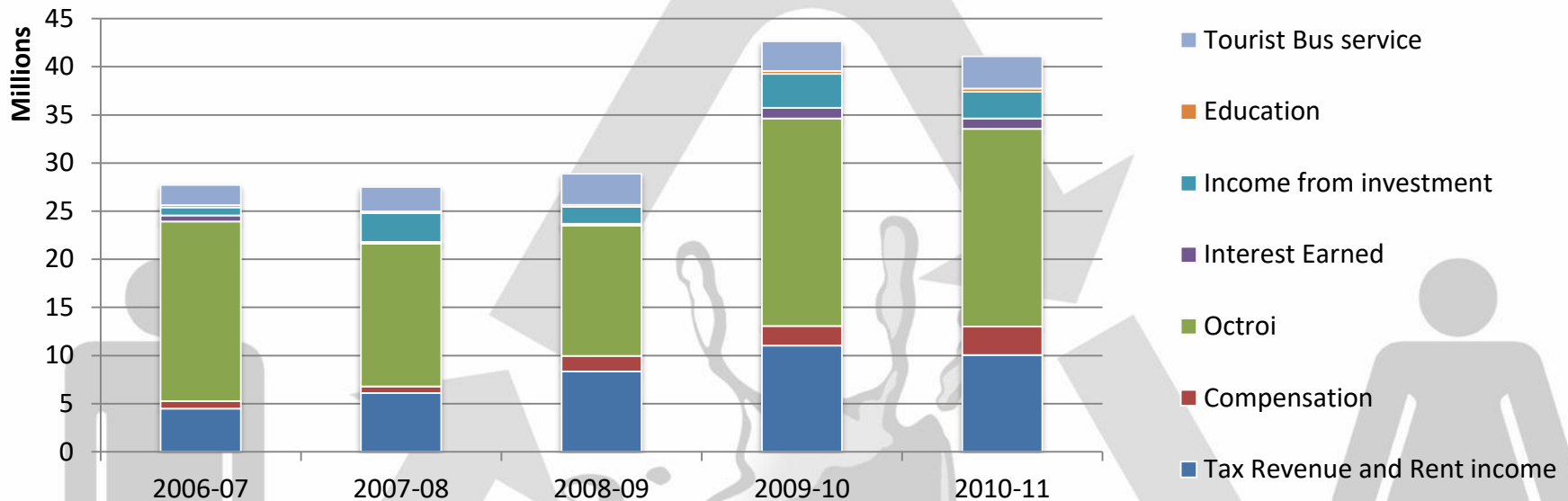
Own Source Grants

Capital Income

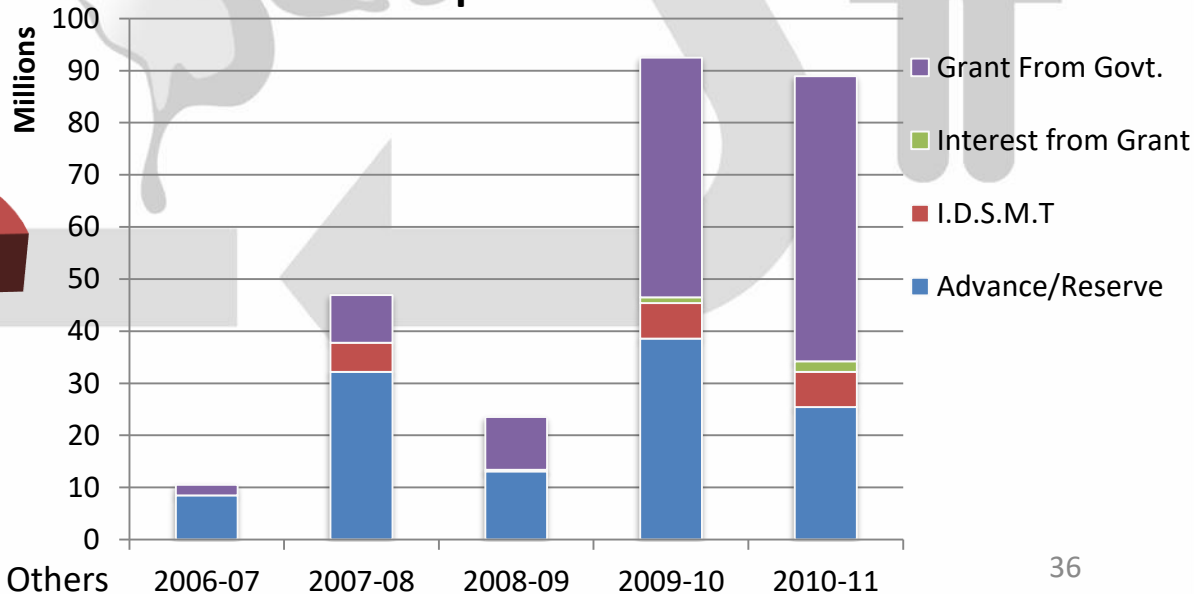


FINANCE- Dwarka Municipality

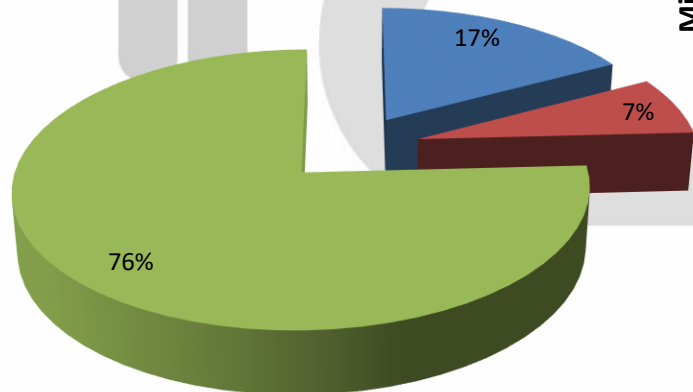
Revenue Income



Capital Income



Revenue break up

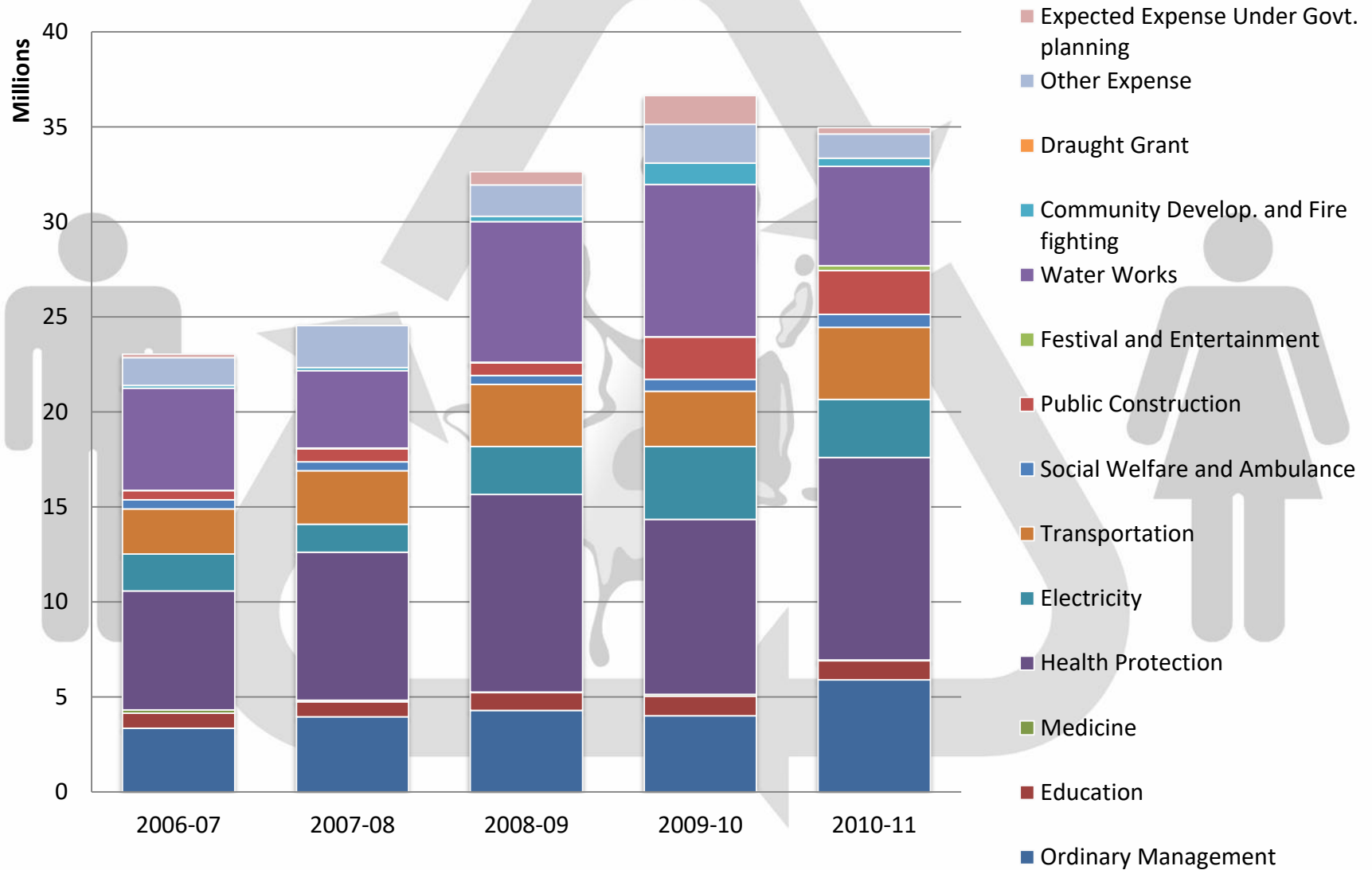


Water Teriff in % SWM Charge in % Others

Source: Annual Actual Budgets, Dwarka Finance

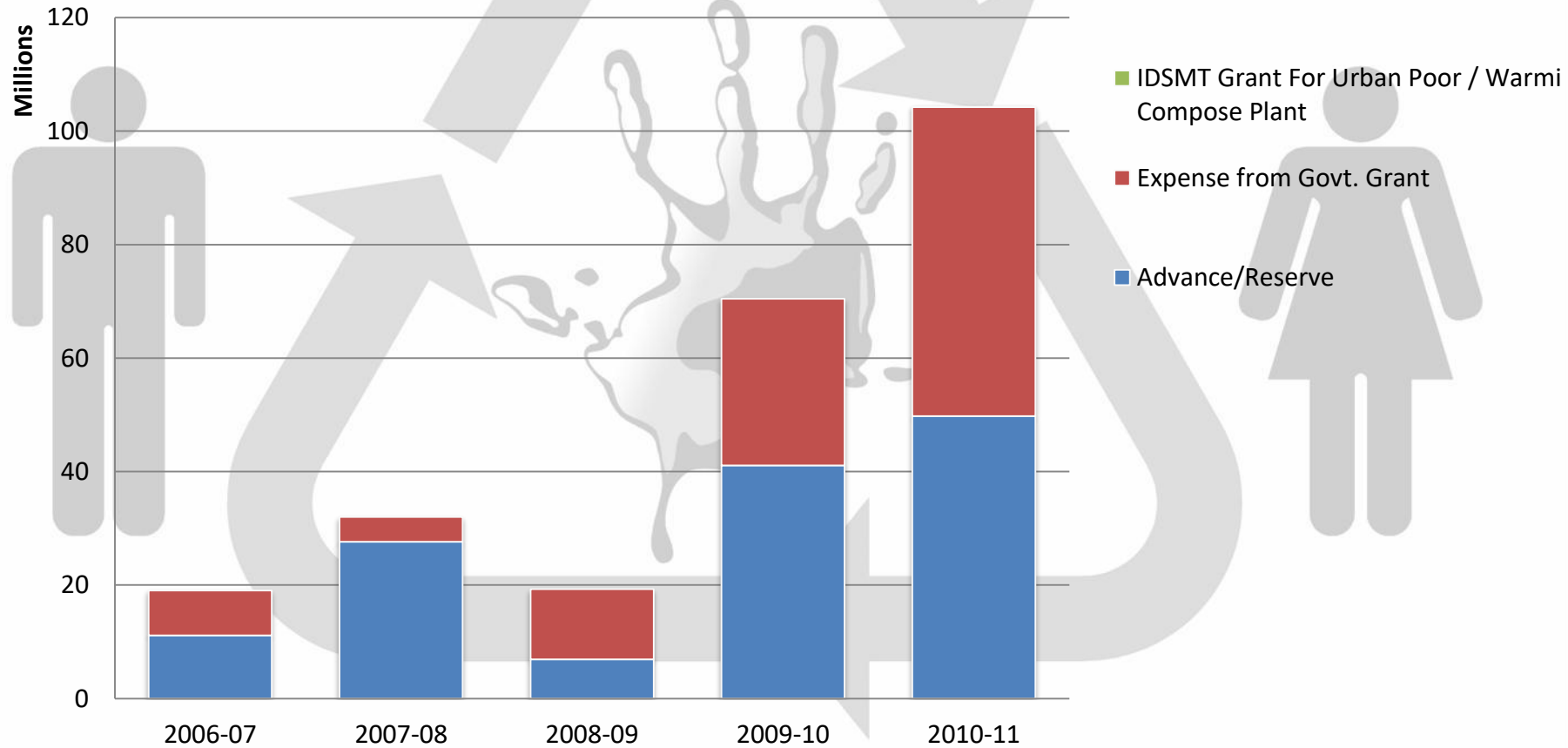
FINANCE- Dwarka Municipality

Revenue Expenditure



FINANCE- Dwarka Municipality

Capital Expenditure



BACKGROUND

Understanding Water & Sanitation Sector

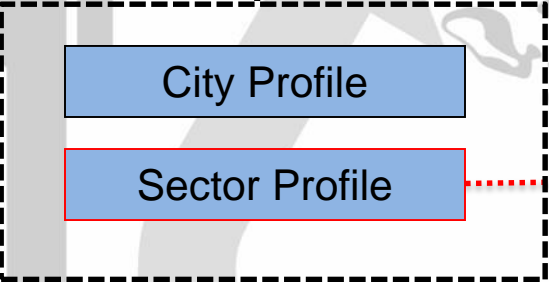
Aim & Objectives

City Selection

Diagnostic Framework

CITY DIAGNOSIS

City Situation Analysis



Water

Sanitation

Solid Waste

Identification of Issues/Gaps

PROPOSALS

Proposals

SANI DAM

Daily Purchase – 1.74 MLD

6 hrs

WDS 1 (TOWN ZONE)
 Storage Capacity – 2.48 MLD
 Population – 27,565
 Water stored – 59%

WDS 2 (Station ZONE)
 Storage Capacity – 2.10 MLD
 Population – 10,997
 Water stored – 59%

Dead storage – 1 MLD

65% 1.19 MLD

Dead storage – 1 MLD

35% 0.55 MLD

Ward – 5,2,1,3
 Population – 19,075

Ward – 6,4
 Population – 8,490

Ward – 7,8,9
 Population – 10,997

Hr of Discharge from WDS- 6 Hr

Hr of Discharge from WDS- 3 Hr

Hr of Discharge from WDS- 6 Hr

0.55 MLD

0.32 MLD

0.55 MLD

16% Technical Losses & 24% NRW

0.46 MLD

0.26 MLD

0.46 MLD

Assuming : 1 HH = 1 connection and 60% coverage network.

20 lpcd

23 lpcd

35 lpcd

SANI DAM

Daily Purchase – 1.74 MLD

Key Highlights (To be consider in Proposal):

Storage (% water to be stored)

WDS-1	59%
-------	-----

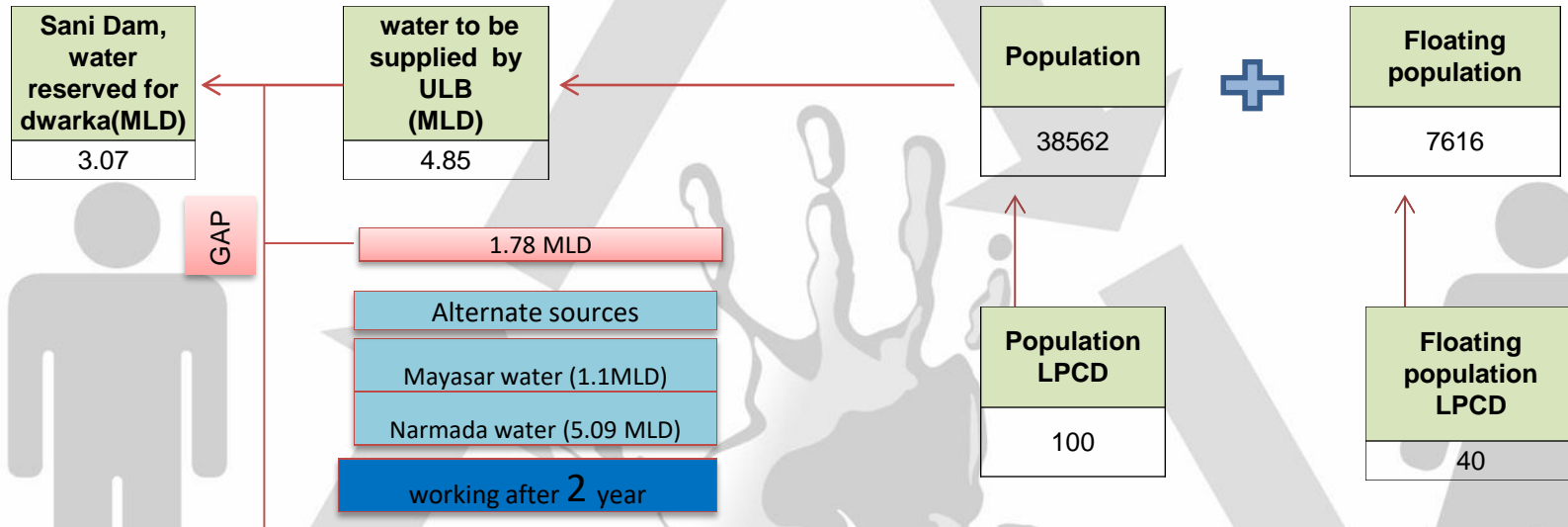
WDS-2	58.50%
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Supply	Alternate day
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Flow rate	Constant velocity
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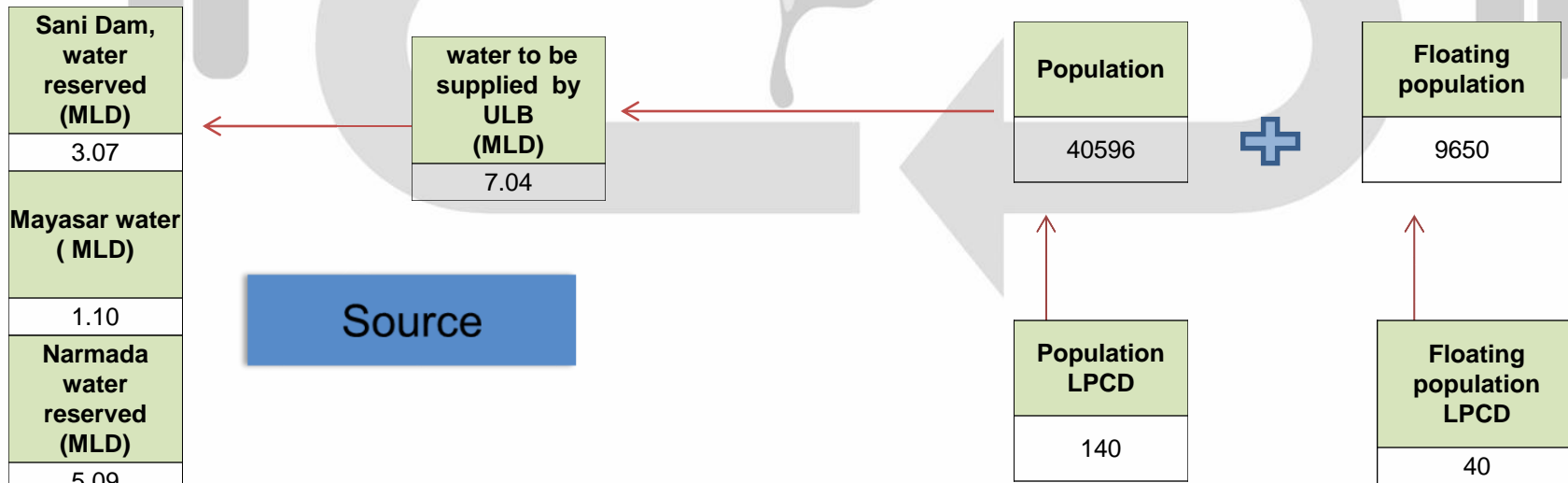
DWARKA_WATER PROFILE

Taking 100 LPCD for Existing population and 40 LPCD for Floating population



SCENARIO- 2014 (considering Sewerage System)

Taking 140 LPCD for Residential population and 40 LPCD for Floating population.



DWARKA_ WATER PROFILE

Summary: Proposals for source

SOURCE	YEAR	Ongoing Projects	Cost
Sani Dam	Existing	Pumping station & transmission main(Express line, 21 Km, 400 dia) from Gorinja to Dwarka	13.5 crore
Mayasar Talav (for 6 months)	2 years (2013)	Intake structure, sump and pumping station	41.5 lakh
Narmada water (If shortage of water from local sources)	2 years (2013)	Pipe line from surendranagar (shorter path) to kalyanpur	

OPTION'S – For Increasing Water Supply

OPTION - 1

A
(2011)

Utilizing full 3.07 Allocation

scenario- 1

- ✓ Taking Same % of storage
- ✓ Alternate day supply

B
(2013 onwards)

Providing 100 lpcd water

Scenario- 2

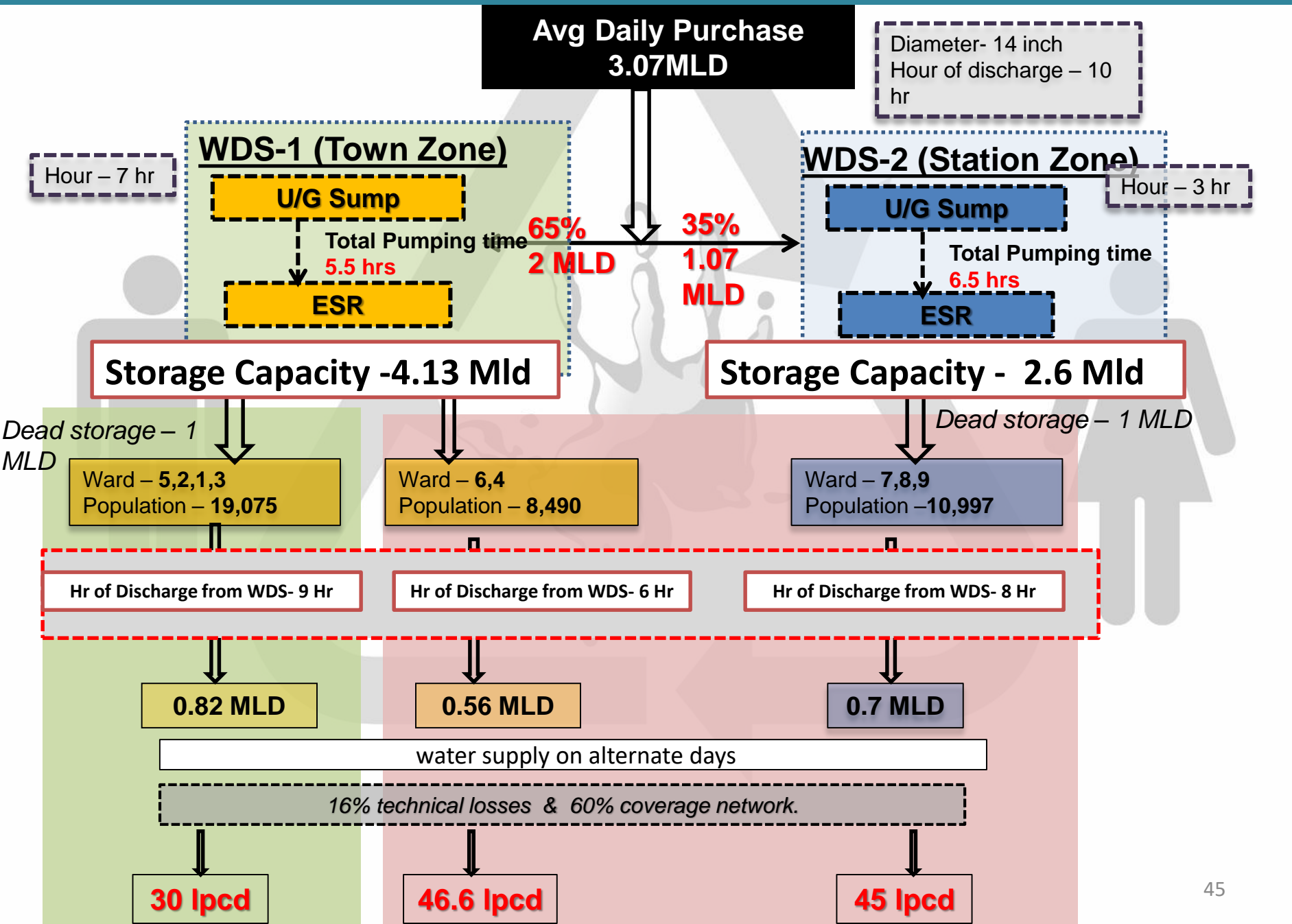
- ✓ Reducing % of storage
- ✓ Daily supply

Do Minimum

OPTION - 2 (After 2014)
(considering 140 lpcd)

Modification & Addition of
Distribution Network

Utilization of 3.07 Mld (Taking Same % of storage & alternate day supply)



Utilization of 3.07 Mld (Reducing % of storage & daily supply)

**Avg Daily Purchase
3.07MLD**

Diameter- 14
inch
Hour = 10 hr

WDS-1 (Town Zone)

WDS-2 (Station Zone)

Hour - 7 hr

U/G Sump

U/G Sump

Hour - 3 hr

**65%
2 MLD** **35%
1.07
MLD**

Total Pumping time
12 hrs

Total Pumping time
6 hrs

ESR

ESR

Storage (30%) - 0.6 MLD out of
2.48MLD

Storage (30%) - 0.3 MLD out
of 2.1 MLD

Ward - 1,2,3,4,5,6
Population - 27565

Ward - 7,8,9
Population - 10,997

Hr of Discharge from WDS- 15 Hr

Hr of Discharge from WDS- 8 Hr

1.4 MLD

**0.75
MLD**

water supply on Daily days

16% technical losses & 60% coverage network.

71 lpcd

95.5 lpcd

Providing 100 lpcd water

**Avg Daily Purchase
4.73 MLD**

Diameter- 14 inch
Hour – 16 hr

WDS-1 (Town Zone)

U/G Sump

Total Pumping time
18 hrs

ESR

Storage Capacity -2.53 Mld

Ward – 1,2,3,4,5,6
Population – 28534
Floating Pop - 4298

Hr of Discharge from WDS- 23 Hr

**2.15
MLD**

water supply on Daily days

16% technical losses & 60% coverage network.

100 lpcd

WDS-2 (Station Zone)

U/G Sump

Total Pumping time
10 hrs

ESR

Storage Capacity -1.5 Mld

Ward – 7,8,9
Population – 11384
Floating Pop - 4298

Hr of Discharge from WDS- 13 Hr

**1.15
MLD**

100 lpcd

Hour – 10
hr

Hour – 6 hr

65%
3.1 MLD

35%
1.65 MLD

SUMMARY: Do Minimum Option

OPTION-1			Year	Lpcd	Advantages	Disadvantages	Capital Cost	O&M cost
A	Utilization of 3.07 MLD of sani water	Same % storage Alternate Supply	2011	40	<ul style="list-style-type: none"> ✓ Increase in lpcd ✓ Sufficient water in case of failure 	<ul style="list-style-type: none"> ✓ More storage capacity required (Need of sump of 1.65ML at WDS-1 & 0.5 ML at WDS-2) ✓ Water still supplied on alternate days 	31 lacs	52 lacs
		Decrease in % storage Daily supply	2011	84	<ul style="list-style-type: none"> ✓ Increase in lpcd ✓ No extra storage required 	<ul style="list-style-type: none"> ✓ More hour of pumping will increase O& M cost 	-	53.5 lacs
B	Providing 100 Lpcd water		2013	100	<ul style="list-style-type: none"> ✓ Provision of 100 lpcd water . ✓ Supplying daily. ✓ Equitable distribution 	<ul style="list-style-type: none"> ✓ More storage capacity required ✓ More time to discharge water (Need of New ESR of 36 mt at WDS-1) ✓ More hours of pumping. (Need of more pumping machinery 30hp) 	42 lacs	74 lacs

OPTION - 2 (After 2014) (considering 140 lpcd)

Modification & Addition of Distribution Network

- ✓ Additional Intake flow through 16inch pipe from Gorinja and 14 inch pipe from Mayasar talav
- ✓ Replacement of old pipe in distribution network.
- ✓ Using 30 HP of 2 pump with 1 stand by at both WDS.
- ✓ Increasing pressure by proposing ESR of height 36 mtr. at WDS-1

OPTION-2 Modification & Addition of Distribution Network (140lpcd)

Existing Network

Existing:

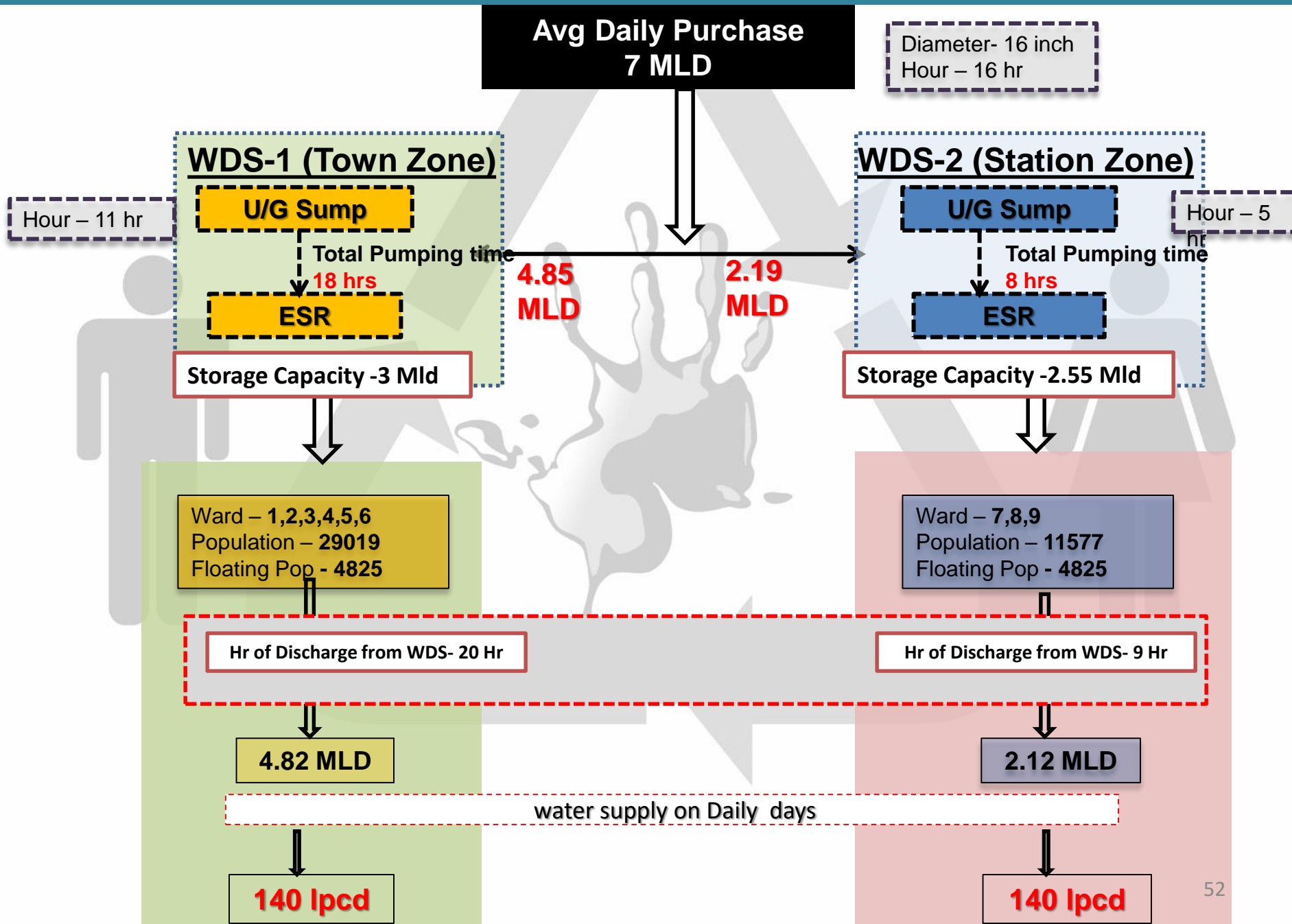
- ✓ Spatial coverage of water supply network – 90% of inhabitant area.
- ✓ Rupen bandar & Awarpado still not spatially covered with water line.
- ✓ Hence, to achieve 100% coverage addition of pipe network is required.
- ✓ Some of Existing line are also more than 30 years old, continues chlorination increases corrosion in pipes causing damage & concentration of cholrine leads to reduction in volume .
- ✓ Hence replacement of some pipe networks are necessary.

OPTION-2 Modification & Addition of Distribution Network (140 Ipcd)



Type of pipeline	Diameter (inch)	Cost (lacs)
Transmission line	16	1365.5
	14	57.0
Feeder line	12	10.3
	10	7.2
	9	6.4
Distribution line	6	12.6
	4	35.2
Total		14.93 crore

OPTION-2 Modification & Addition of Distribution Network (140lpcd)



SUMMARY: OPTION -2

OPTION-2	Year	Lpcd	Advantages	Disadvantages	Capital Projects	Capital Cost	O&M cost
Modification & addition of Distribution Network Providing 140 Lpcd	2014	140	<ul style="list-style-type: none"> ✓ Providing Sufficient water supply for conventional sewerage system to work. ✓ Saving Energy cost by using more efficient pumps. ✓ Diverting people from other coping mechanisms of bore well to better quality water supply by ULB . ✓ Catering to Tourism demand. 	<ul style="list-style-type: none"> ✓ Need to replace old pipe line incurring large capital cost. ✓ Operation cost will increase 	<ul style="list-style-type: none"> ✓ 16 inch pipe from gorinja to dwarka (already under proposal – express line) ✓ 2 sets of 30 hp pump at both WDS ✓ Storage capacity of 0.97 Mld ✓ Modification & addition of distribution network (under proposal, Saheri vikash varsh, 2005) 	<p>1365 lacs</p> <p>12 lacs</p> <p>16.5 lacs</p> <p>128.87 lacs</p> <p>Total - 15.22 crores</p>	133 lacs

SERVICE ASSESSMENT FOR WATER SUPPLY _ INDICATORS

COVERAGE

Coverage of water supply connections (%)

Existing

60%

Proposed

100%

Spatial coverage of water supply network (%)

90%

100%

QUANTITY

Per capita supply of water (Lpcd)

26 lpcd

100 lpcd & 140 lpcd

Spatial variations in per capita supply of water (Ratio)

0.25

0

Continuity of water supply (hrs)

0.75 hrs

1.5 hrs

Continuity of water supply (Days)

Alternate

Daily

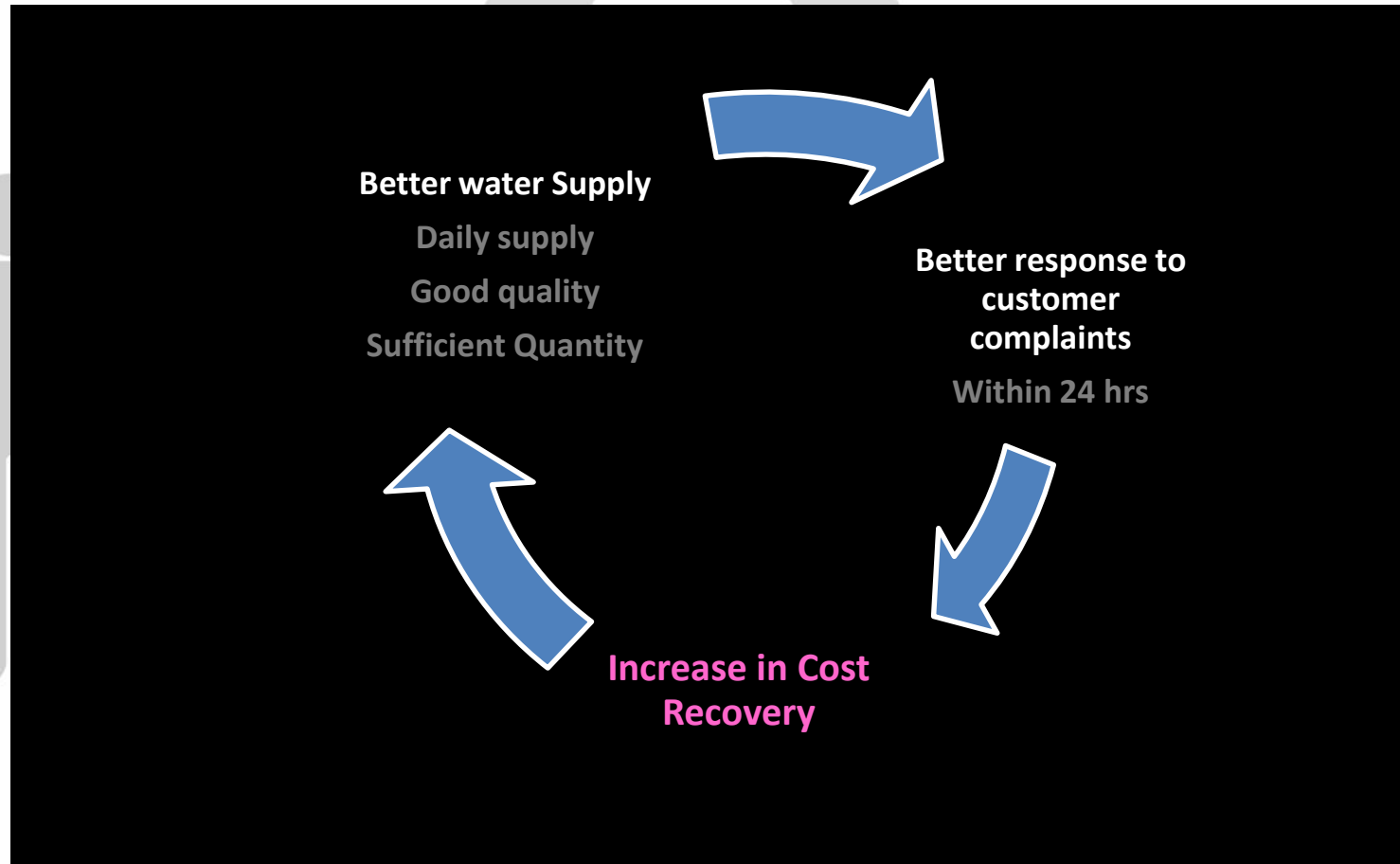
QUALITY

Quality of water supplied (ULB)

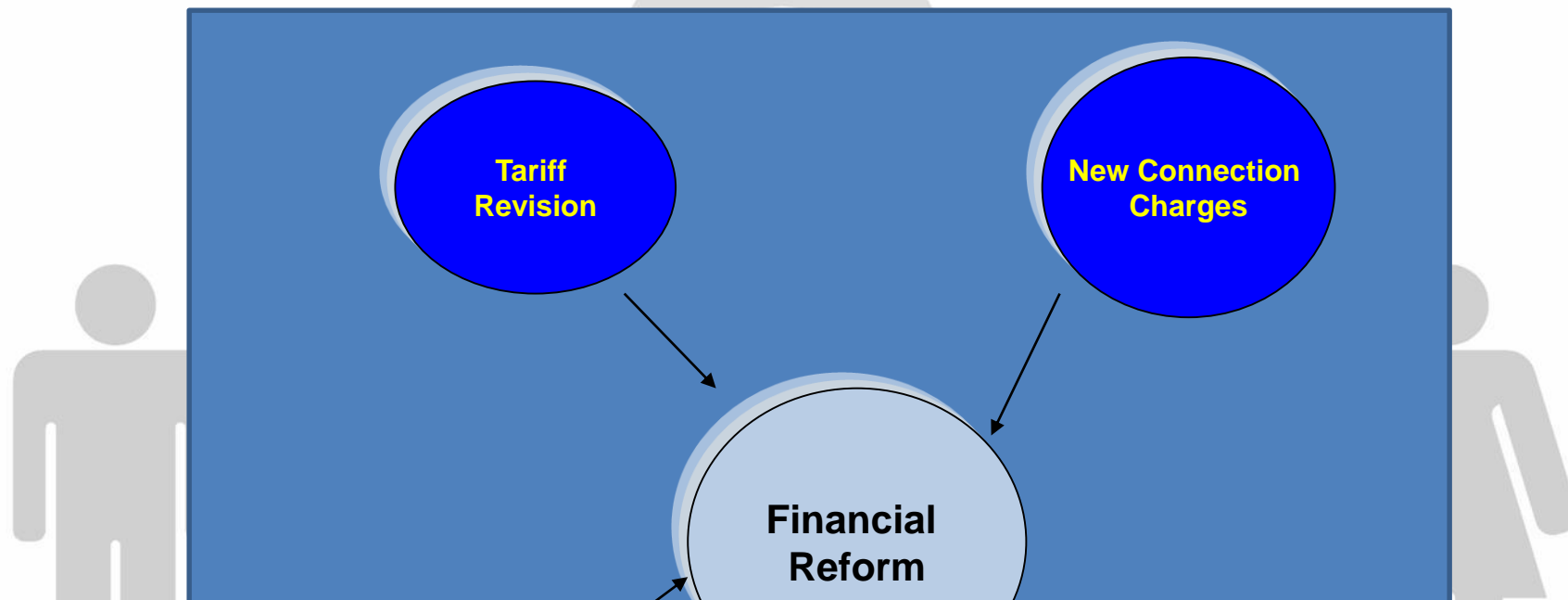
100%

100%

Journey towards better water supply & Self-sustainability



FINANCIAL REFORMS:



Description		Existing	Revised	
			100 lpcd (2013)	140 lpcd (2014)
1. Tariff Revision	Residential	360 Rs/year	720 Rs/year	720 Rs/year
	Commercial	960 Rs/year	3840 Rs/year	3840 Rs/year
2. Introducing water Tax	Each property	-	200 Rs/year	200 Rs/year
3. New Connection Charges	Residential	500 Rs	500 Rs	500 Rs
	Commercial	2000 Rs	3500 Rs	3500 Rs
4. Energy Cost Saving	% cost saving	Efficiency- 60%	11% (Efficiency- 80%)	11 % (Efficiency- 80%)
Cost Recovery		28%	100%	56%

FINANCIAL REFORMS:

Description		Existing	Revised	
			100 lpcd (2013)	140 lpcd (2014)
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4. Energy Cost Saving	% cost saving	Efficiency- 60%	11% (Efficiency- 80%)	11 % (Efficiency- 80%)
Cost Recovery		28%	100%	56%

Customer Redressal:

Meaning: Redressal of grievances pertaining to water and underground drainage, billing dispute etc., are heard and redressed

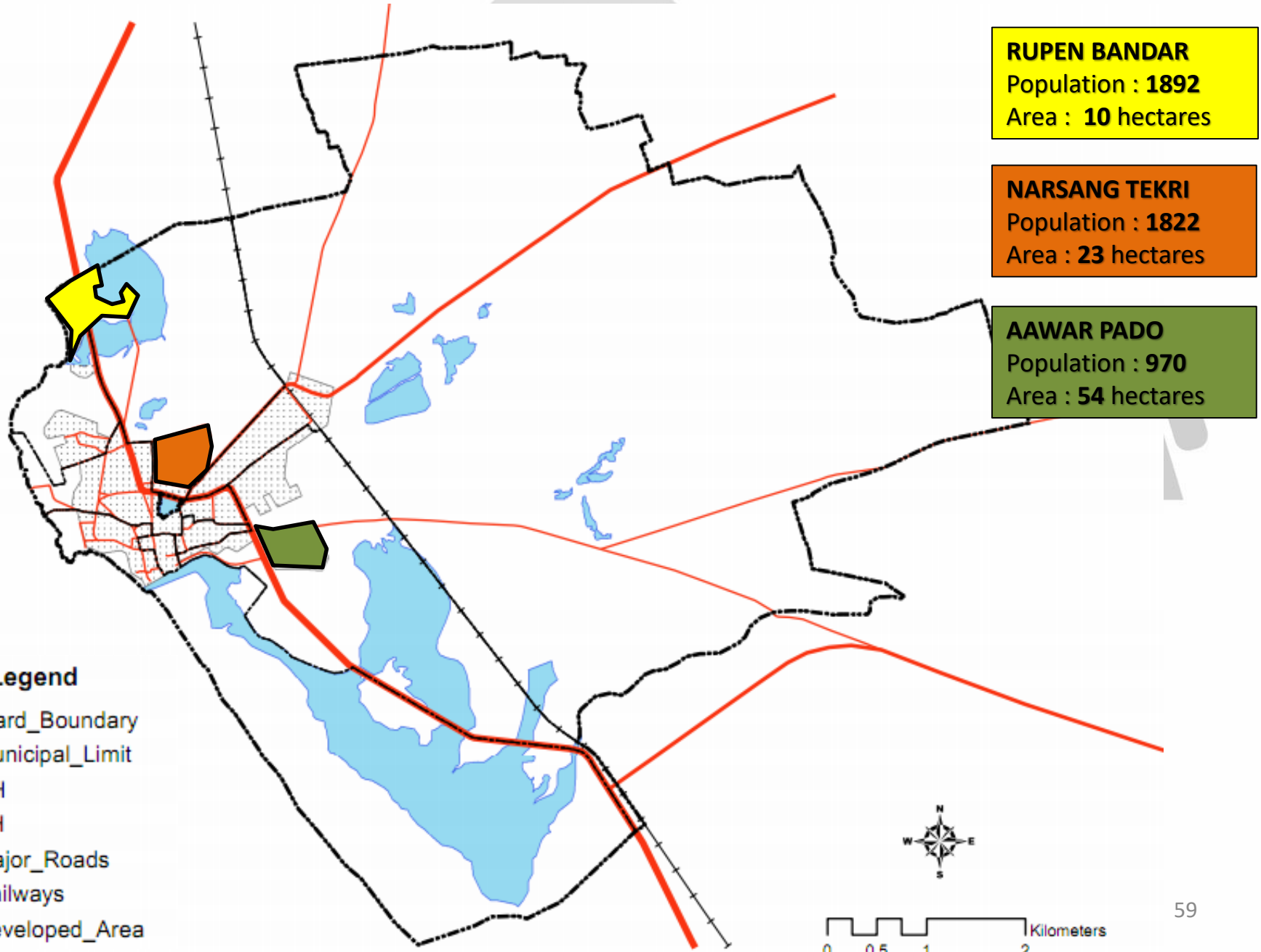
Options:

- **Customer care centre** can be opened especially to register & redressed customer complaints.
 - Any information sought by the general public is furnished in accordance with the Right to Information Act;
- Complaints can be registered through **Phone, SMS also.**
- **Citizens Charter-** It elucidates all information including procedure that the customer requires and details the maximum response time .
- **All complaints to be redressed within 24 hrs**

Customer Care Centre



SLUMS _ Location



COMPARISON

WATER PROFILE

	NARSANG TEKRI	AAWAR PADO	RUPEN BANDAR
Drinking Water Sources	Standposts	Water Tanks + Buy	Water tanks + Buy
Washing/ Cleaning Sources	Bores/Wells + Talav	Tanks / Buy	Talav
LPCD supply (drinking only)	2.3 litres	1.4 litres	2.26 litres
Per capita water requirement /day	40 lpcd (ULB water+ Bore water+ Purchase + Rain)		
No. of Standposts/Tanks	Standposts 36 (45)	3 Tanks (3000L, 3000L, 5000L)	2 Tanks (10000L, 20,000L)
Avg. money spent on water/HH/day	Water from Bore Wells – Rs 0.5 Water Purchase– Rs 12		

SANITATION PROFILE

	NARSANG TEKRI	AAWAR PADO	RUPEN BANDAR
Public toilets	2 blocks (1 men – 6 urinals) (1 women – 6 seats)	1 (Pay and Use) CLOSED	2 Blocks (Pay & Use) (1 Bathing – 4 + 4) (1 Toilet – 4 + 4 + 4U)
No. of Individual Toilets (%)	50 %	25 %	15%
Open defecation dependency	50 %	75 %	85%
Avg. distance travelled for OD	0.5 km	0.5 km	250 m

RUPEN BANDAR

Average Family income : Rs. 2500/month

Average money spent on water : Rs. 360/month



AREA – 10 hectares

WARD NO. - 1

POPULATION - 1892

(Source : ULB 2011)

No. of HH - 380

(HH Size - 6)

DENSITY - 189.2 p/hect.

OCCUPATIONS– Fishing,
Daily wages labor
(construction/civil works
etc.), etc.

Water Sources



Sanitation



Options for Proposal

WATER

1. Increase no. of trips

Increase no. of trips per week with current infrastructure

No. of trips per week	Total Supply	Per capita supply
2	30,000	4.5
3	Litres	6.8

Current cost per month: Rs. 6000/month

(Taking Rs. 300/trip)

Estimated Increase in Cost : Rs. 18000/month

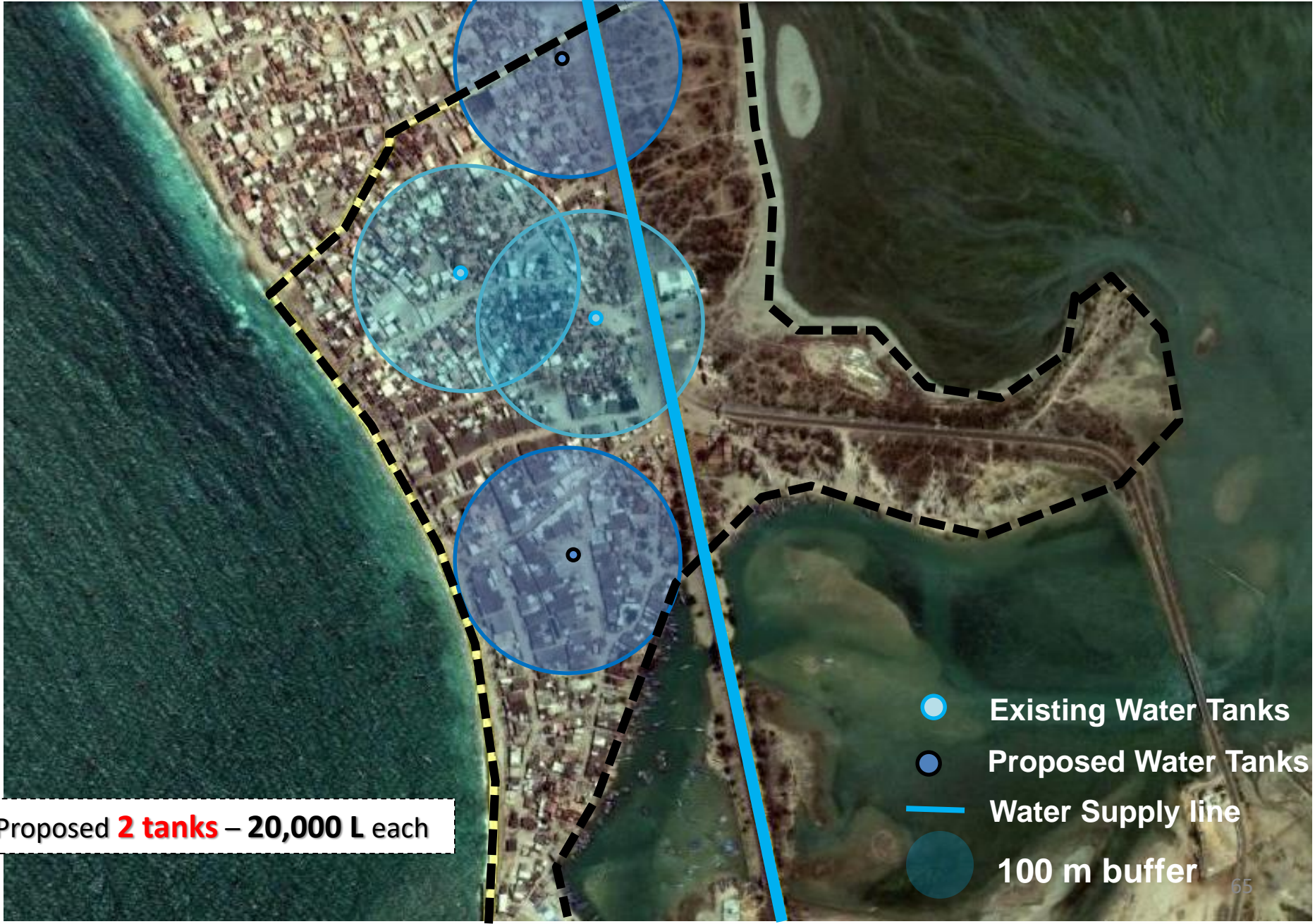
2. Two water tanks of 40,000 ltr & 3 trips

Add 2 tanks (20000 L each) + Increase no. of trips per week

Added Capacity	(Litres)	40000
Total Water Tank Capacity	(Litres)	70,000
No. of days	(Days)	7
Per Capita Supply	(lpcd)	5.3
No. of trips per week	Time taken to refill (days)	Per capita supply
3	2.3	15.9

Construction Cost of Tanks : Rs. 2, 00,000

Estimated Trip Cost : Rs. 43,200 /month



3. Standposts (extension of line upto Rupen Bandar)

No. of HH per tap	3							
No. of taps per Standpost	4	6	8	(Alternate days)	Mins	Total Liters	No. of people/tap	LPCD
No. of standposts required	26	18	13		45	112.5	18	6.3
					90	225	18	12.5
				Daily	45	112.5	18	12.5
					90	225	18	25.0

Estimated Capital Cost : Rs. 6,50,000

4. Individual Connections

	Mins	Total Liters	LPCD
Alternate days	45	112.5	9.3
	90	225	18.75
Daily	45	112.5	18.75
	90	225	37.5
Total ltrs to be supplied/day		70,950	

Cost for extending TRUNK LINE till Rupen Bandar (2 km stretch) : Rs. 8,00,000

Cost /connection (including internal supply network) : Rs. 47,30,000

Total estimated Capital Cost : Rs. 55,30,000

Proposed Toilet blocks

- Community Toilets
- 50 m buffer



Persons per seat (WC)	20		
No. of seats required	95		
No. of Toilet Blocks required	16	12	96 seats
Seats per toilet block	6	8	
Toilet block size	8 x 4 m		

Cost/Block : Rs. 1,50,000 (Rs. 25000/seat)
Total Capital Cost : Rs. 18,00,000
Total O&M Cost : Rs. 10,80,000 / yr

Average household size : 5.6
Average Family income : Rs. 3000/month
Average money spent on water : Nil

KHARA TALAV

RAWRA
TALAV

NH8E

NARSANG TEKRI



WARD NO. - 2

AREA - 23 hec.

POPULATION - 1822 (2011)

No. of HH - 304

Gross DENSITY -

79.2 p/hec.

OCCUPATION -

Daily wages labor
(construction/civil works, street
salesmen), fishermen, beggars,
etc.)

Existing Facilities



No. of taps/standpost	2.57	Average matkas per HH	3	
No. of HH /Standpost	16	1 matka	10	litres
No. of HH /tap	6.23	Total matkas filled per standpost	48	
Total Households	325	Total litres per standpost	480	litres
Covered HH	224	Total water per tap	186.8	litres
Left/Uncovered HH	101	Total water per HH	30	litres

Options for Proposal

WATER

Individual Connections

Population	1822		
No. Of HH's	303		
	Mins	Total Liters	LPCD
Alternate days	45	112.5	9.3
	90	225	18.75
Daily	45	112.5	18.75
	90	225	37.5
Total Ltrs to be supplied/day	68,325		

Cost /connection (including internal supply network) : Rs. 45,50,000

Total estimated Capital Cost : Rs. 45,50,000

AAWAR PADO

Average household size : **6.25**

Average Family income : **Rs. 2500/month**

Average money spent on water : **Rs. 340/month**

Average money spent on Electricity : **Rs. 500/month**



AREA – **54 hec**

WARD NO. - **9**

POPULATION - **970**

(Source :ULB)

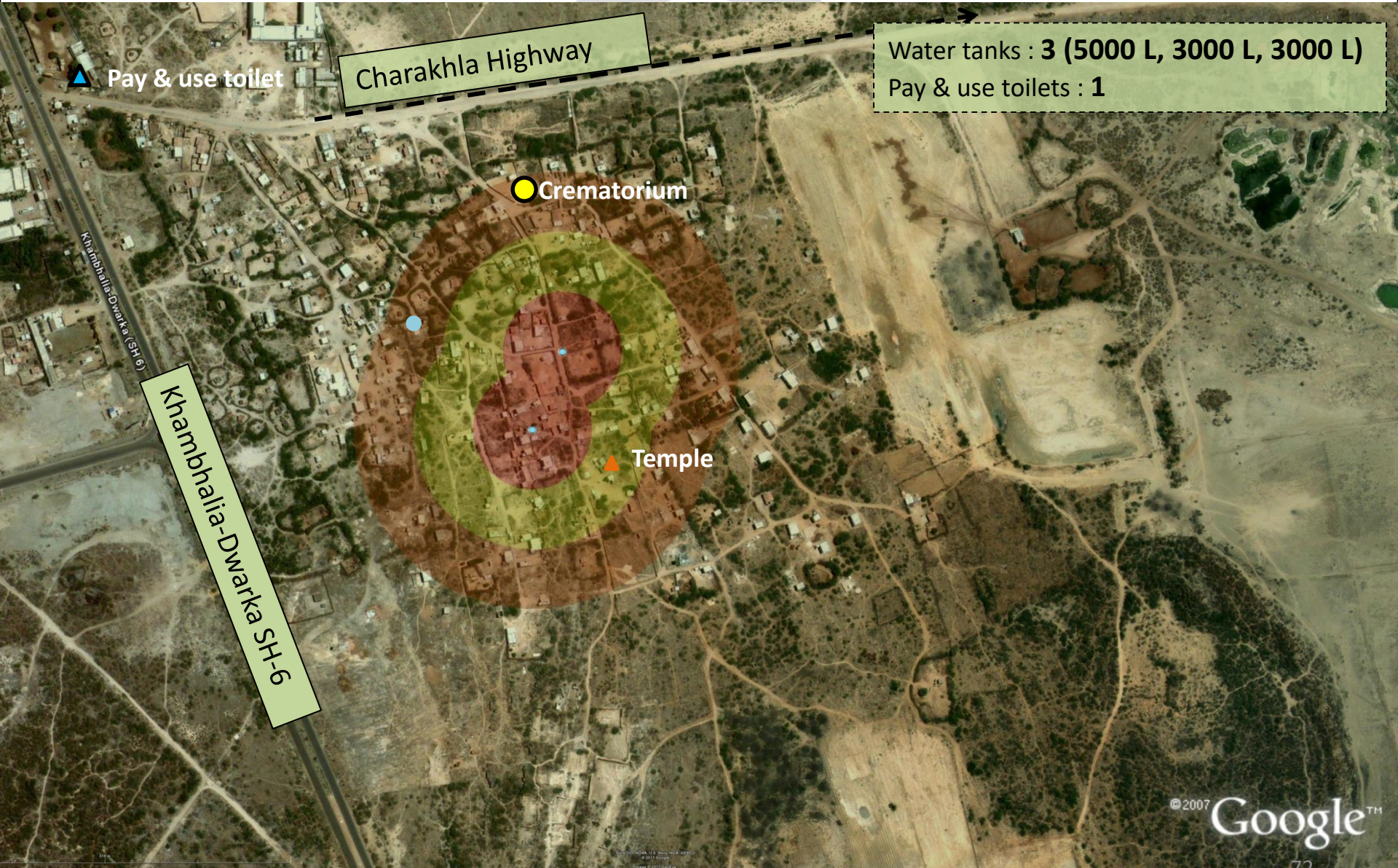
No. of HHs - **162**

DENSITY - **17.96 p/hec.**

OCCUPATIONS–

Daily wages labor
(construction/civil works
etc.), drivers etc.

Existing Facilities



 Pay & use toilet

 Water Tank

Options for Proposal

WATER

1. Increase no. of trips

Increase no. of trips per week with current infrastructure

No. of trips per week	Per capita supply
2	3.24
3	4.86

Total trip Cost
: **Rs. 7,200/mnth**

2. Two water tanks of 40,000 ltr & 3 trips

Add 3 tanks (20000 L each) + Increase no. of trips per week

Added Capacity (Litres)	40,000
Total Water Tank Capacity (Litres)	51,000
No. of days (Days)	7
Per Capita Supply (lpcd)	7.5
No. of trips per week	Per capita supply
3	22.5 lpcd

Total Tank Cost
: **Rs. 2,00,000**
Total trip Cost
: **Rs. 7,200/mnth**

SANITATION

Group Toilets

Persons per seat (WC)	15		
No. of seats required	65		
No. of Toilet Blocks required	16	11	66 seats
Seats per toilet block	4	6	
Toilet block size	8 x 4 m		

Cost/Block : Rs. 1,50,000 (Rs. 25000/seat)

Total Capital Cost : Rs. 16,50,000

Total O&M Cost : Rs. 9,90,000 / yr₇₃

BACKGROUND

Understanding Water & Sanitation Sector

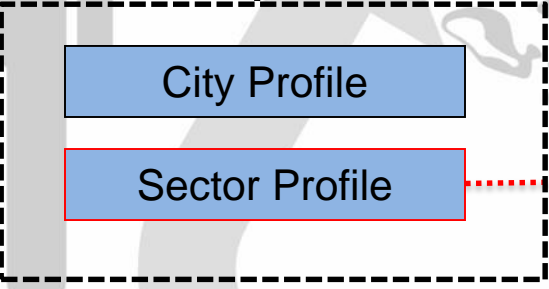
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City Situation Analysis



Water

Sanitation

Solid Waste

Identification of Issues/Gaps

PROPOSALS

Proposals

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT

DISPOSAL

Finance

Issues

Existing and Ongoing proposals

ISSUES IN SANITATION

CAPTURE

- Low coverage of toilets -70%
- HH don't have space for toilets.
- HH other than EWS HH

STORAGE

- Inappropriate construction & design of soak pits.
- Contamination of ground water.

TRANSPORTATION

- Non-mechanized system adopted for de-sludge.
- Lack of de-sludging machine.

TREATMENT DISPOSAL

- No treatment of sludge before disposal
- Run off of disposed sludge into the sea.

FAECAL SLUDGE MANAGEMENT(FSM)

Institutional

- inappropriate redressal system for fecal sludge management.

Finance

- No financial support for construction of individual toilets other than EWS HH.
- Low cost recovery in fecal sludge management.

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL, Reuse

Residential

Non-Residential

Restaurants

Schools

Public places

Public toilets

Shops

Tourism

•Total no. of HH = 7700

	2011	2012	2013	2014	2015	2016	2017
Number of HH without toilets	1644			1044	544	44	0
No. of toilets will be constructed under NGSP		600		500	500	44	0
other No. of HH without toilets with lack of space	220	220	220	220	220	220	220

Immediate recommendations

- Identification of the location of HH with out individual toilets due to lack of space.
- Refurbishment of existing unusable community toilets.
- IEC campaigns for OD Free cities

Long term recommendations

- Monitoring of OD sites
- Including the details of toilets with septic tanks in Development control regulations.
- IEC campaigns for OD Free cities
- Water quality monitoring protocol

SECTORS

Residential

Non-Residential**Hotels****Restaurants****Hospitals****Schools****Shops****Tourism****Bus Stop****Proposal for “Non-Residential Area” :****➤ Non - Residential Area**

- Capacity Increase and Cost Estimation : (Issue Oriented)
- Designing of Typical Model for pay & use toilet : (Area, Num of Units)
- Spatial Location



SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

Shops

Tourism

Bus Stop

Proposal:

➤ Amendment in 'Development Control Regulation' of Dwarka City

Proposed Toilet Requirement

For Restaurants




	Water Closet (WC)	Urinals
Existing	0	0
Required	1 for 50 persons	1 for 20

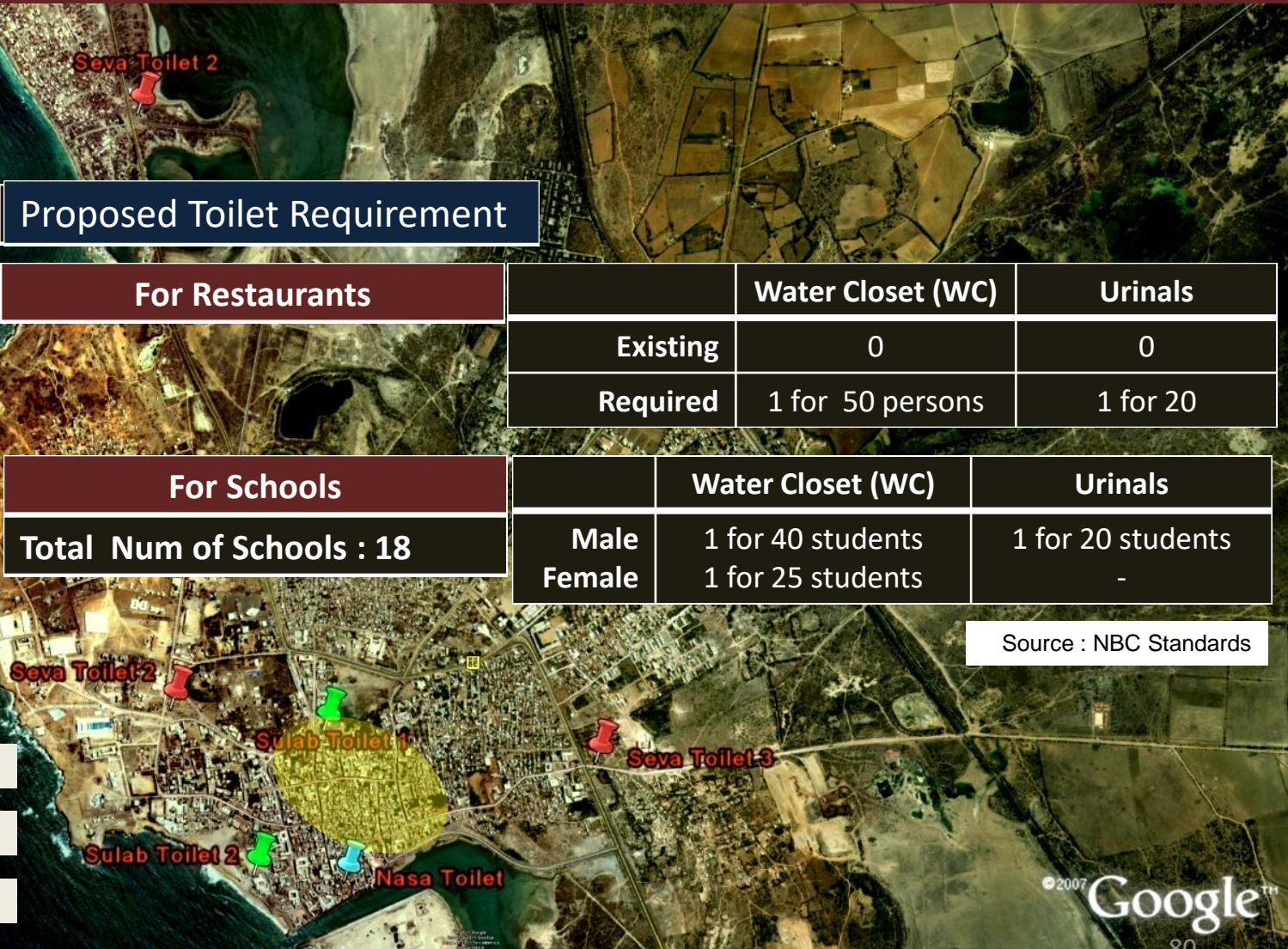
For Schools

Total Num of Schools : 18

	Water Closet (WC)	Urinals
Male	1 for 40 students	1 for 20 students
Female	1 for 25 students	-

Source : NBC Standards

-  Existing Sulab Toilets
-  Existing Nasa Toilets
-  Existing Seva Toilets



SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

Shops

Tourism

Bus Stop

Proposal:




- Increase in capacity

Total Num Shops : 2120

	Water Closet (WC)	Urinals
Existing	43	18
Required	106	80

Proposed Toilet Requirement

WC (Num)	Urinals (Num)
106 (115 sqm)	80 (22 sqm)

	Existing Sulab Toilets
	Existing Nasa Toilets
	Existing Seva Toilets



SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

Shops

Tourism

Bus Stop

Proposal :

- Increase in Toilet capacity

Location Criteria For Pay & Use Toilets :






- Tourist circuit & Tourist Spots
- Availability of open space (Land ownership is not considered)
- Land Use

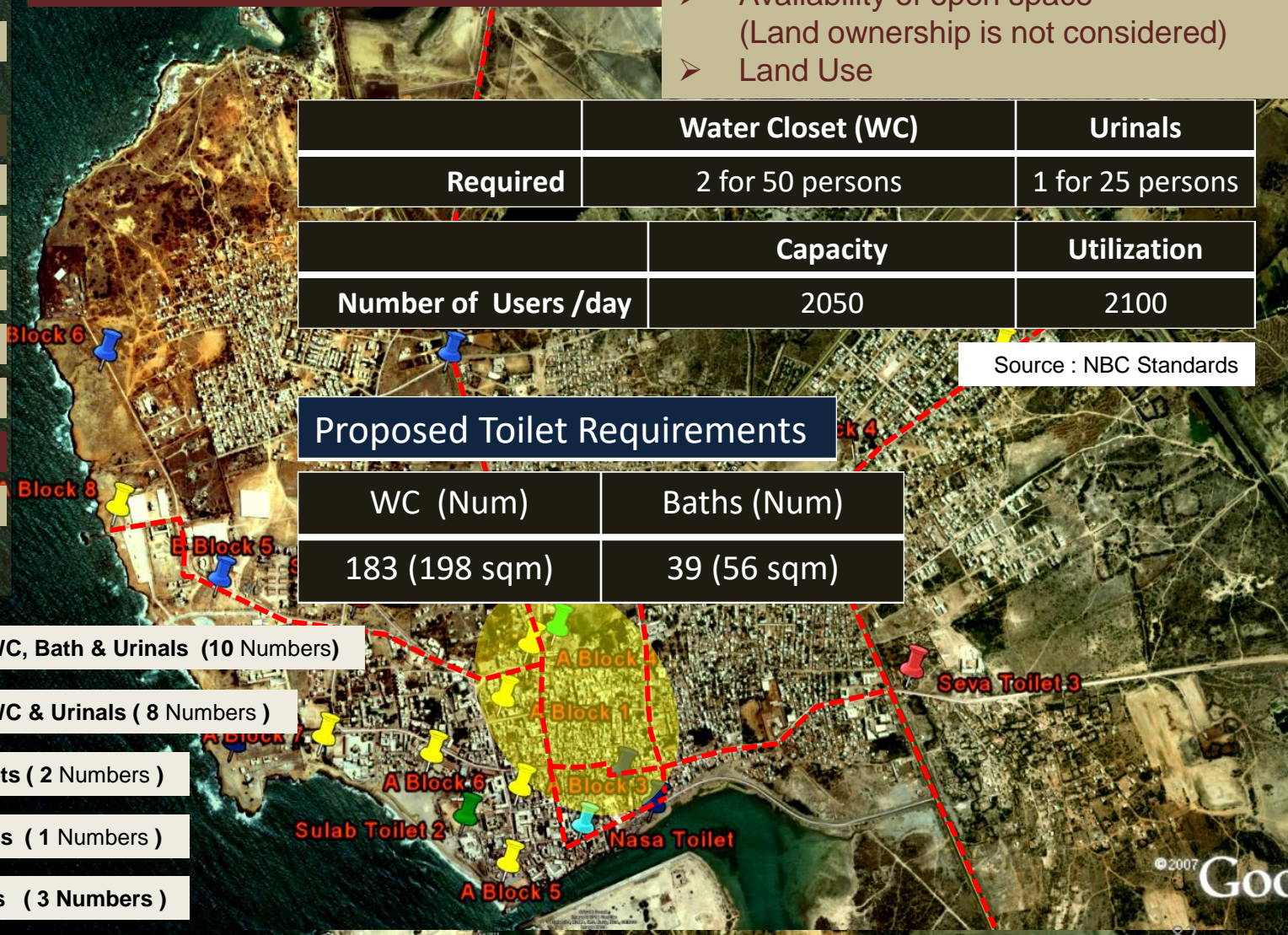
	Water Closet (WC)	Urinals
Required	2 for 50 persons	1 for 25 persons
	Capacity	Utilization
Number of Users /day	2050	2100

Source : NBC Standards

Proposed Toilet Requirements

WC (Num)	Baths (Num)
183 (198 sqm)	39 (56 sqm)

-  Prop. Toilets With WC, Bath & Urinals (10 Numbers)
-  Prop. Toilets With WC & Urinals (8 Numbers)
-  Existing Sulab Toilets (2 Numbers)
-  Existing Nasa Toilets (1 Numbers)
-  Existing Seva Toilets (3 Numbers)



CAPTURE

STORAGE

TRANSPORTATION

TREATMENT

DISPOSAL

SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

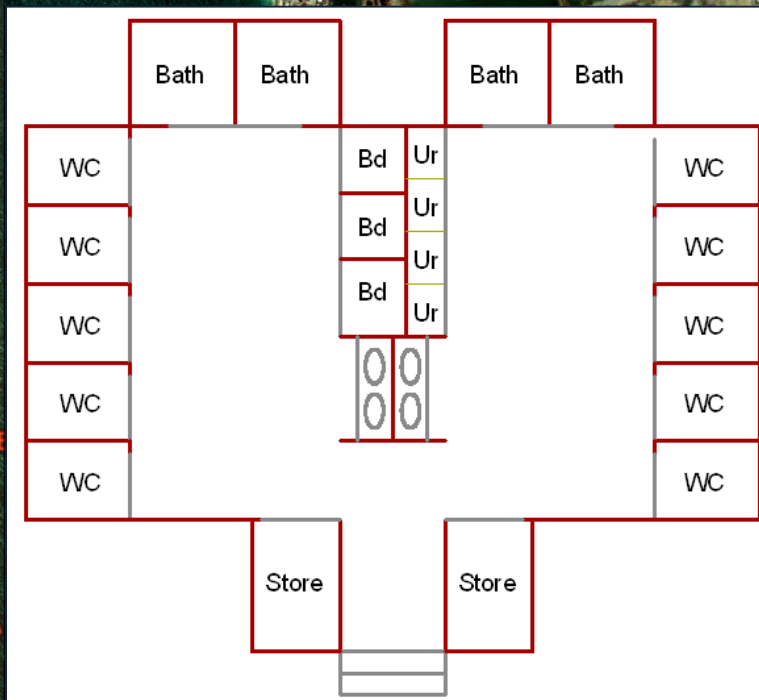
Shops

Tourism

Bus Stop

Proposal :

➤ Typical Design of Proposed Pay & use toilet



TYPICAL TOILET BLOCK : 'A' TOILET BLOCK (10 NUMBERS)

Inventory :

- Water Closets : 10 num
- Urinals : 4 num
- Bath : 4 num
- Bedet : 4 num
- Basin : 4 num
- Doors : 16 num

Quantity :

- Excavation : 7 cum
- Brickwork : 32 cum
(55*0.23*2.5)
- Plinth area : 48 sqm
- Slab area : 48 sqm
- Num Doors : 16

Source : NBC Standards

Proposed Module of Toilets : Block 'A'

Total Num of Modules	Total Area of all Modules	Cost of '1' Module	Total Cost of '10' Module
10	480 Sqm	4.8 Lakhs	48 Lakhs

Source : Schedule of Rates (SOR)

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT

DISPOSAL

SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

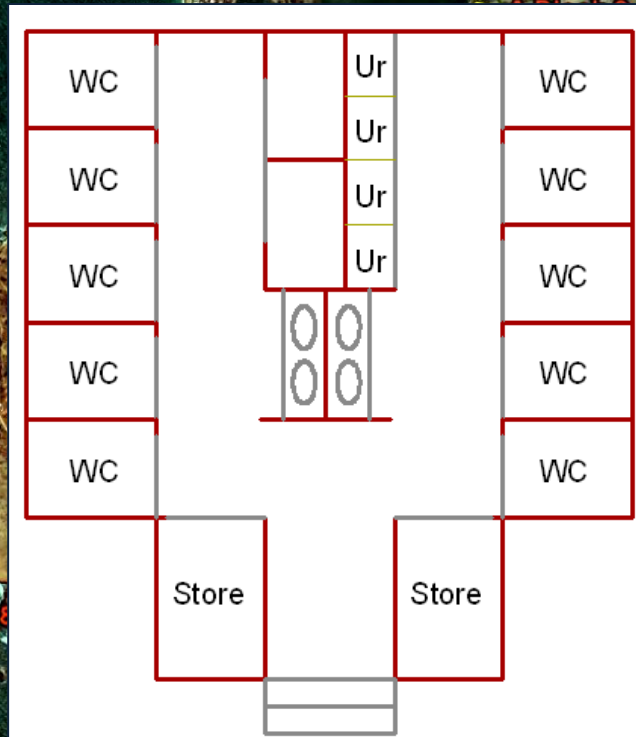
Shops

Tourism

Bus Stop

Proposal :

➤ Typical Design of Proposed Pay & use toilet



TYPICAL TOILET BLOCK : 'B' TOILET BLOCK (8 NUMBERS)

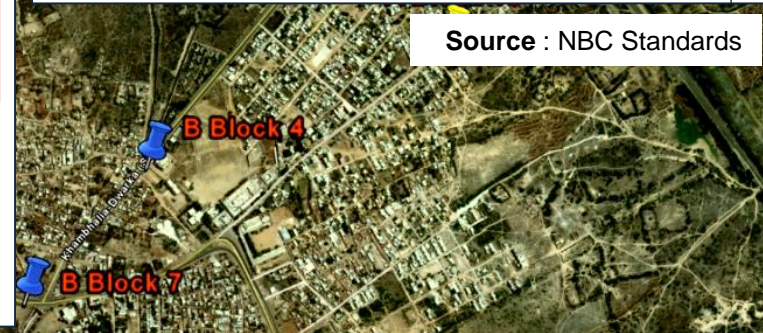
Inventory :

- Water Closets : 10 num
- Urinals : 4 num
- Bedet : 4 num
- Basin : 4 num
- Doors : 16 num

Quantity :

- Excavation : 5.5 cum
- Brickwork : 25 cum
(43*0.23*2.5)
- Plinth area : 30 sqm
- Slab area : 30 sqm
- Doors : 12 num

Source : NBC Standards



Proposed Module of Toilets : Block 'A'

Total Num of Modules	Total Area of all Modules	Cost of '1' Module	Total Cost of '10' Module
8	240 Sqm	4.4 Lakhs	35 Lakhs

Source : Schedule of Rates (SOR)

A Block 5

SECTORS

Residential

Non-Residential

Hotels

Restaurants

Hospitals

Schools

Shops

Tourism

Bus Stop**Proposal:**

➤ Increase in capacity

Number of Bus Stop: 6

	Water Closet (WC)	Urinals
Existing	6	8
Required	15	8

Source : NBC Standards

Proposed Toilet Requirements

WC (Num)	Area Required	Estimated Cost
9 (10 sqm)	10 sqm	1.8 lakhs



Existing Sulab Toilets

Existing Nasa Toilets

Existing Seva Toilets

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL, Reuse

Complaint readressal system

Inefficient readrasal and monitoring system.

•**Process as per ULB**

Manual complaint system

Pay the bill for De-sludging

Receipt is issued

Readdressed with in 2 days

•**Process as per Primary survey**

Complaint to the sweeper

Readdressed with in 3-4 days

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL, Reuse

Immediate recommendations

- Setting up of a readressal system, through phone, in personal and include sweepers in the readdressed system.
- Awareness of the availability of the services through
 1. Local channel
 2. Giving the redrassal system contact number in local new papers

Long term recommendations

- Improving the efficiency of the readressal system i.e readressal in 24 hours.

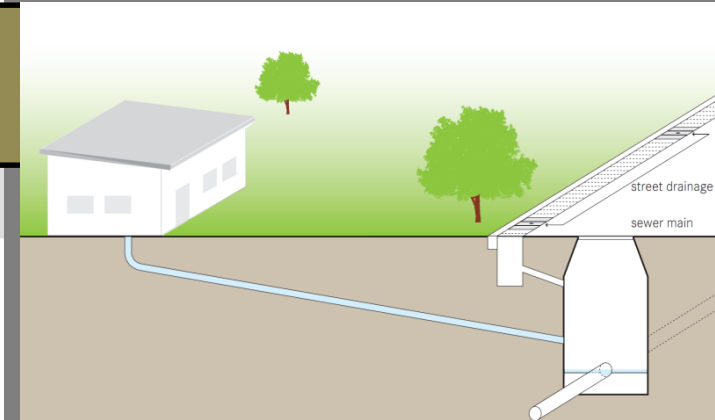
IDENTIFICATION OF APPROPRIATE NETWORK

OPTION 1: CONVENTIONAL SEWERAGE SYSTEM

System is appropriate when water supply is 140 lpcd or more and when Centralized Treatment Facility

No storage : Liquid + Solid component transported

- Blackwater, GreyWater and Storm water can be handled at the same time
- High Capital Costs
(Large depth of excavation, High structural strength)
- High Operational Costs and maintenance requires well-trained staff

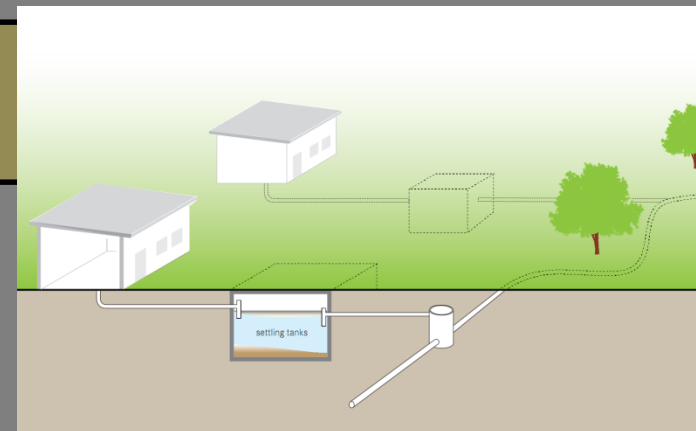


OPTION 2: SMALL BORE SEWERAGE SYSTEM

System is most appropriate for areas that already have septic tank, but where soil can not absorb the effluent.

Solid Component : Interceptor Chamber (Single Chamber Septic tank)
Liquid Component : PVC, HDDP pipes

- The system uses less water, since solids do not need to be transported (90 to 120 lpcd).
- Small diameter of pipes
(the sewage flow rates in do not have to be self-cleansing rates)
- Low capital costs
(50 to 80% lower costs as compared to conventional sewer network)
- Fewer effluent treatment required
(Since solids are captured by Interceptor Tanks)



PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

Project prepared under UIDSSMT

NETWORK DESIGN PERIOD – 30 years (2011-2041)

Population considered 2041: 70450*

- Dwarka population- 58290
- Floating population- 12160

* Projected population by Incremental Increase method

- **INSPECTION CHAMBER**
- **GRAVITY FLOW BASED SECONDARY SEWERS**
 - Combined Length 21 kms
- **SEWAGE PUMPING STATIONS (SPS)**
 - 4 Auxiliary SPS
 - 1 Terminal SPS
- **RISING MAIN UPTO DWARKA STP**
 - DI Pipeline of 450 mm dia
- **SEWAGE TREATMENT PLANT**
 - Waste Stabilization Ponds with Maturation Ponds
 - 9 MLD Capacity

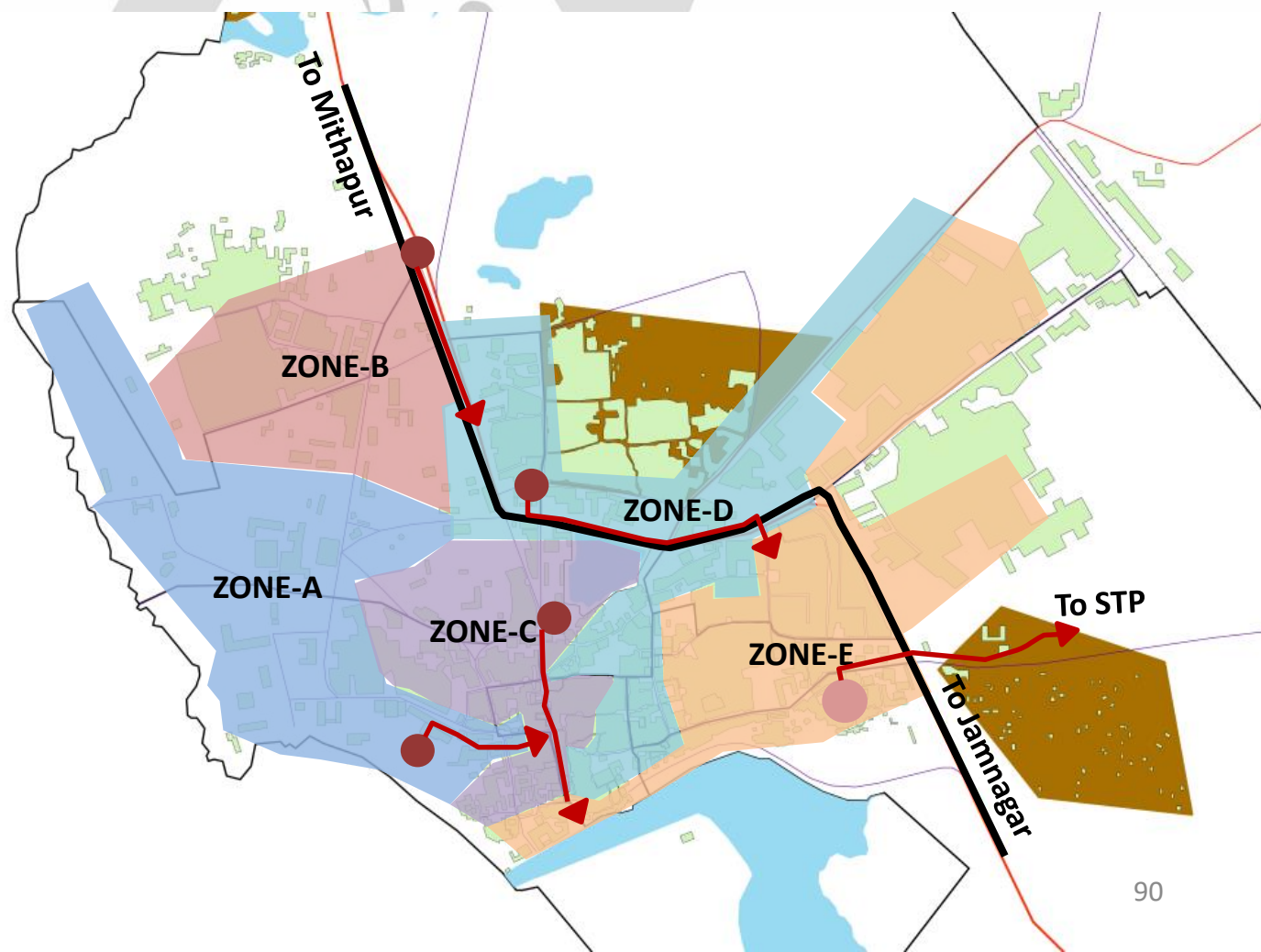


PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

Spatial Coverage

Sewerage network covers 73% of inhabited 5.2 sq.km
Slums not covered under the network.



Adopted from GUDM, Final DPR on Underground Sewerage System for Dwarka (March 2011)

PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

Spatial Coverage

Capital Cost

Capacity Building

	DESCRIPTION	AMOUNT (Rs in lakh)
1.	Gravity Collection System (sewerage system 21 kms long with min depth 0.4m)	1025.30
2.	Sewage Pumping Stations in five Zones (Four auxiliary SPS and one terminal SPS)	236.48
3.	Pumping Mains from SPS to TSPS/STP (DI K-9 Pipes)	224.82
4.	Sewage Treatment Plant (9 MLD capacity STP at Charakala road)	328.22
Total Base Cost		1814.82
Total Cost for Approval		2051.46

FOR OVERALL SEWERAGE SYSTEM

Engineer	- 2
MH Cleaning	- 12
Accountant	- 1
Clerks	- 2
Labour	- 6

SEWAGE TREATMENT PLANT

Operators	- 6
Lab Tech	- 1
Labour	- 6

5 SEWAGE PUMPING STATION

SPS- A to E (each employing)

Operators	- 3
Watchmen	- 1

Total Staff Required : 61

Adopted from GUDM, Final DPR on Underground Sewerage System for Dwarka (March 2011)

PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

SOURCES FOR FINANCE

	INSTITUTE	%age	AMOUNT (Rs in Lakhs)
1.	Central	80	1641.17
2.	State	10	205.15
3.	ULB	10	205.15
	Total		2051.46

Spatial Coverage

Capital Cost

O & M OF NETWORK

Base Year	Energy Charges	Cost of Manpower	Maintenance & Misc	Total (lakhs)
2011	46.26	39.78	5.05	91.09
2026	75.19	49.72	6.32	131.23
2041	123.28	62.15	7.90	193.34

Capacity Building

Financial Sustainability

PROPOSED TARRIF

- (1) **House Connections-** Rs 1200 per connection per year(pcpy)
- (2) **Commercial Connections-**
 - a. Shop – Rs 3000 pcpy
 - b. Cinema Hall – Rs 10000 pcpy
 - c. Hotels – Rs 20,000 pcpy
 - d. Restaurant – Rs 10000 pcpy

Challenges and Disadvantages

Adopted from GUDM, Final DPR on Underground Sewerage System for Dwarka (March 2011)

SMALL BORE SEWERAGE SYSTEM

Network Components and Design

Spatial Coverage

NETWORK DESIGN PERIOD – 30 years (2011-2041)

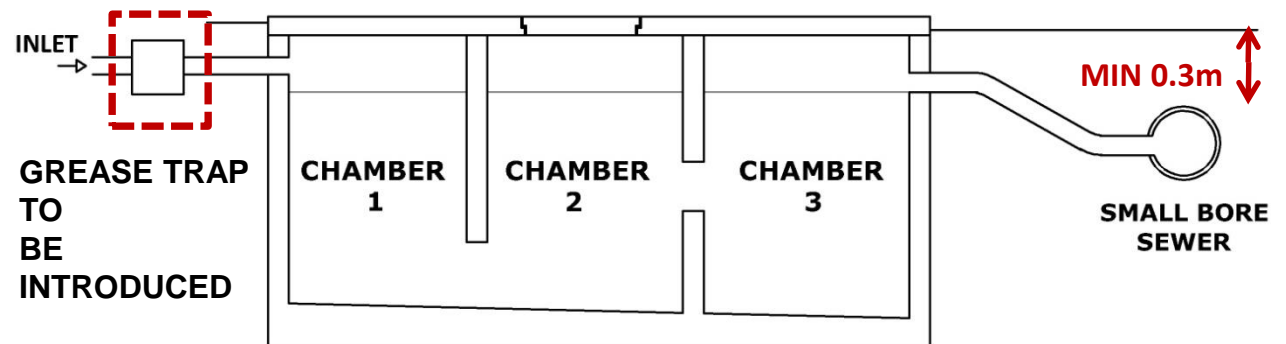
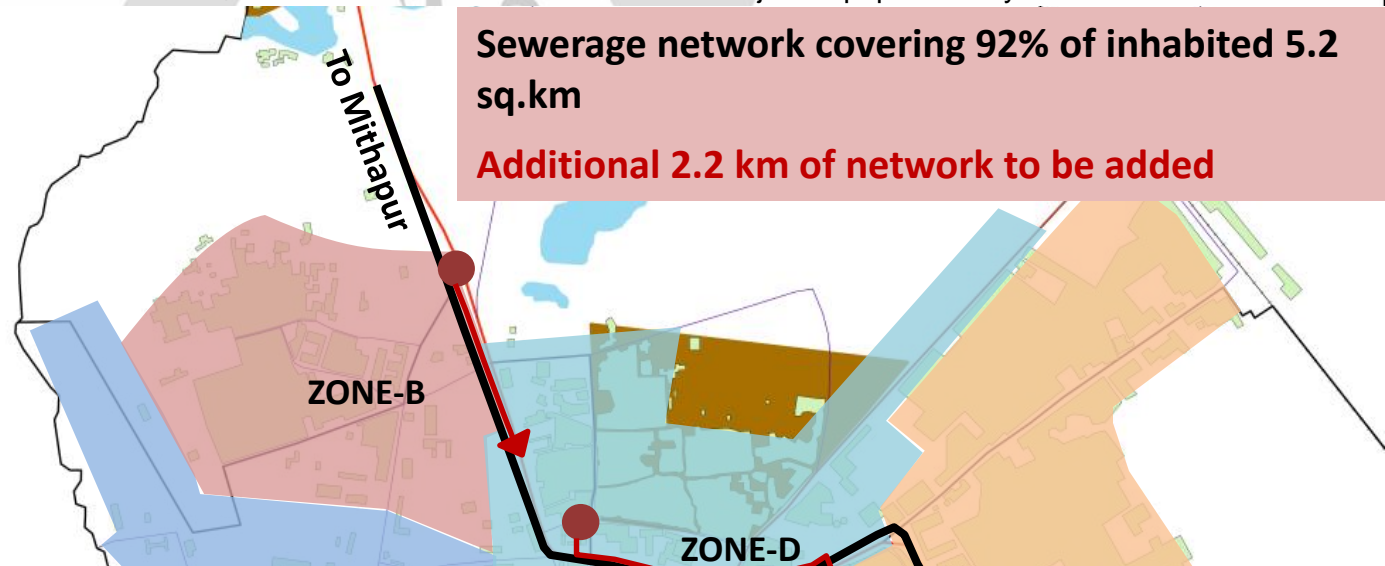
Population considered 2041: 70450*

- Dwarka population- 58290
- Floating population- 12160

* Projected population by Incremental Increase method

Sewerage network covering 92% of inhabited 5.2 sq.km

Additional 2.2 km of network to be added



DESIGN CRITERIAS ADOPTED FROM
-The Design of Small Bore Sewer System
by Richard J. Otis and D. Duncan Mara,
Technology Advisory Group (TAG)
- Compendium of Sanitation Systems
and Technologies
by EAWAG Aquatic Research, 2005

PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

Spatial Coverage

Capital Cost

Capacity Building

	DESCRIPTION	AMOUNT (Rs in lakh)
1.	Gravity Collection System (sewerage system 23.4 kms long with min depth 0.3m)	163.09
2.	Sewage Pumping Stations in five Zones (Four auxiliary SPS and one terminal SPS)	169.77
3.	Pumping Mains from SPS to TSPS/STP (DI K-9 Pipes)	224.82
Total Base Cost		592.69

FOR OVERALL SEWERAGE SYSTEM

Engineer	- 2
MH Cleaning	- 10
Accountant	- 1
Clerks	- 2
Labour	- 6

5 SEWAGE PUMPING STATION

SPS- A to E (each employing)

Operators	- 3
Watchmen	- 1

Total Staff Required : 41

DESIGN CRITERIAS ADOPTED FROM
 -The Design of Small Bore Sewer System
 by Richard J. Otis and D. Duncan Mara,
 Technology Advisory Group (TAG)
 - Compendium of Sanitation Systems
 and Technologies
 by EAWAG Aquatic Research, 2005

PROPOSED CONVENTIONAL SEWERAGE SYSTEM

Network Components and Design

Spatial Coverage

Capital Cost

Capacity Building

Financial Sustainability

Challenges and Disadvantages

- **Effluent and sludge (from septic tanks) require secondary treatment and/or appropriate discharge**
- **Requires rigorous monitoring for new connections to be added to the network**
 - introduction of grease trap
 - monitoring of direct connection into the network (bypassing the septic tank)
 - outlet levels of septic tanks to be checked
- **Acceptance by the community**
- **Operation and Maintenance requires well-trained staff**
- **Maintenance of Grease trap to be done by Household**

COMPARING FSM, UNDERGROUND SEWERAGE SYSTEM & SMALL BORE SEWER

	COSTS (in lakhs)		EXPENDITURE					REVENUE
			Household	Hotels	Restaurants	Schools	Hospitals	Annual Revenues to ULB (in Lakhs)
FSM (existing)	Capital : 1.27 per annum	O & M (cost/est)	900	18860	10750	6960	7830	2.97
	O & M : 11.76							
Sewerage Network	Capital : 1814.82	O & M* (cost/est)	1200	20000	10000	10000	20000	112.24
	O & M : 91.01							
Small Bore Network	Capital : 592.69	O & M (cost/est)	720+140	12000+150	6000	6000+300	12000+180	67.35
	O & M : 51.38		860	12150	6000	6300	12180	

FSM to Conventional Sewers : High Cost of capital as well as O & M for ULB
High user charges for Households, Schools and Hospitals

FSM to Small Bore Sewers : Moderate Cost of capital as well as O & M for ULB
Lower user charges for all stakeholders as compared to Sewerage or FSM

CAPTURE

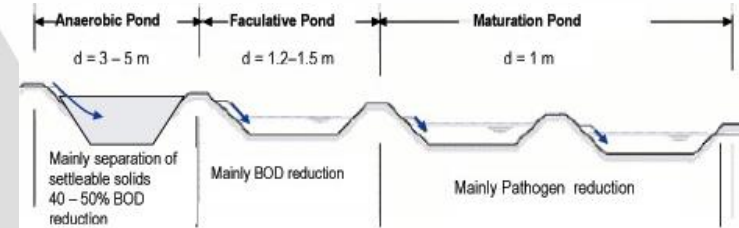
STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL , Reuse

Option – 1 , Oxidation ponds

- Theory: Bacteria and Algae symbiosis
- Area required = 4 hec with 2m depth
- Detention period in India is generally 10 to 15 days in India.
- Oxidations doesn't have on site foul smell and is usually located 300m from Colonies or towns.



	present de-watering frequency		Smal bore		Conventional swerage
	26 LPCD	140 LPCD	26 LPCD	140 LPCD	140 LPCD
Land required	0.004784	0.0483	2.3023	12.397	12.397
Totla capital cost	19136	193201	9209245	49588243	49588243
O& M cost (60 thousand /MLD)	124.8	1260	60060	323400	323400

Advantages:

- No skilled workers are required.
- Negligible for O &M cost.
- BOD removal is very high

Disadvantages:

- It creates mosquito nuisance if not maintained well.
- Might nor be financially viable for high waste waster produced.

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL , Reuse

Option – 3 , **Facultative aerated lagoon**

- Similar to Oxidation ponds.
- Need land requirement less than Oxidation pond.



	present de-watering frequency		Small bore		Conventional sewerage
	26 LPCD	140 LPCD	26 LPCD	140 LPCD	140 LPCD
Land required (0.3 ha/MLD)	0.000624	0.0063	0.3003	1.617	1.617
Total capital cost	5616	56700	2702700	14553000	14553000
O& M cost (60 thousand /MLD)Rs.	124.8	1260	60060	323400	323400

Advantages:

- No skilled workers are required.
- Negligible for O & M cost.
- BOD removal is very high

Disadvantages:

- It creates mosquito nuisance if not maintained well.
- Might not be financially viable for high waste water produced. 98

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL , Reuse

Option – 2 , **Trickling filter**

- Packing material used: rock, gravel, sand, plastic synthetic material.

Effluent Quality:

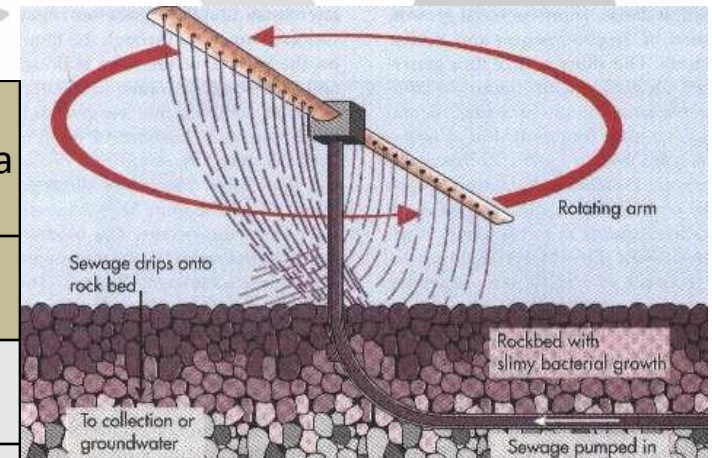
BOD: 10-20 mg/L.

Suspended solids (SS):20-50 mg/L.

The effluent obtained is colourless.

Disadvantages:

- Low power requirements.
- Might not be financially viable for high waste water produced.



	present de-watering frequency		Small bore		Conventional sewerage
	26 LPCD	140 LPCD	26 LPCD	140 LPCD	140 LPCD
Land required (0.65 ha/MLD)	0.001352	0.0136	0.6506	3.5035	3.5035
Total capital cost	5408	54600	15	81	14014081
O& M cost (3 lakh /MLD)Rs.	624	6300	0	0	1617000

PROPOSALS & RECOMMENDATIONS

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL , Reuse

BOD(mg/l)

		Inland surface water	Land for irrigation	Marine costal area
Oxidation ponds	30-50	30	100	100
Facultative aerated lagoon	30-51			
Trikling filter	10 to 20			

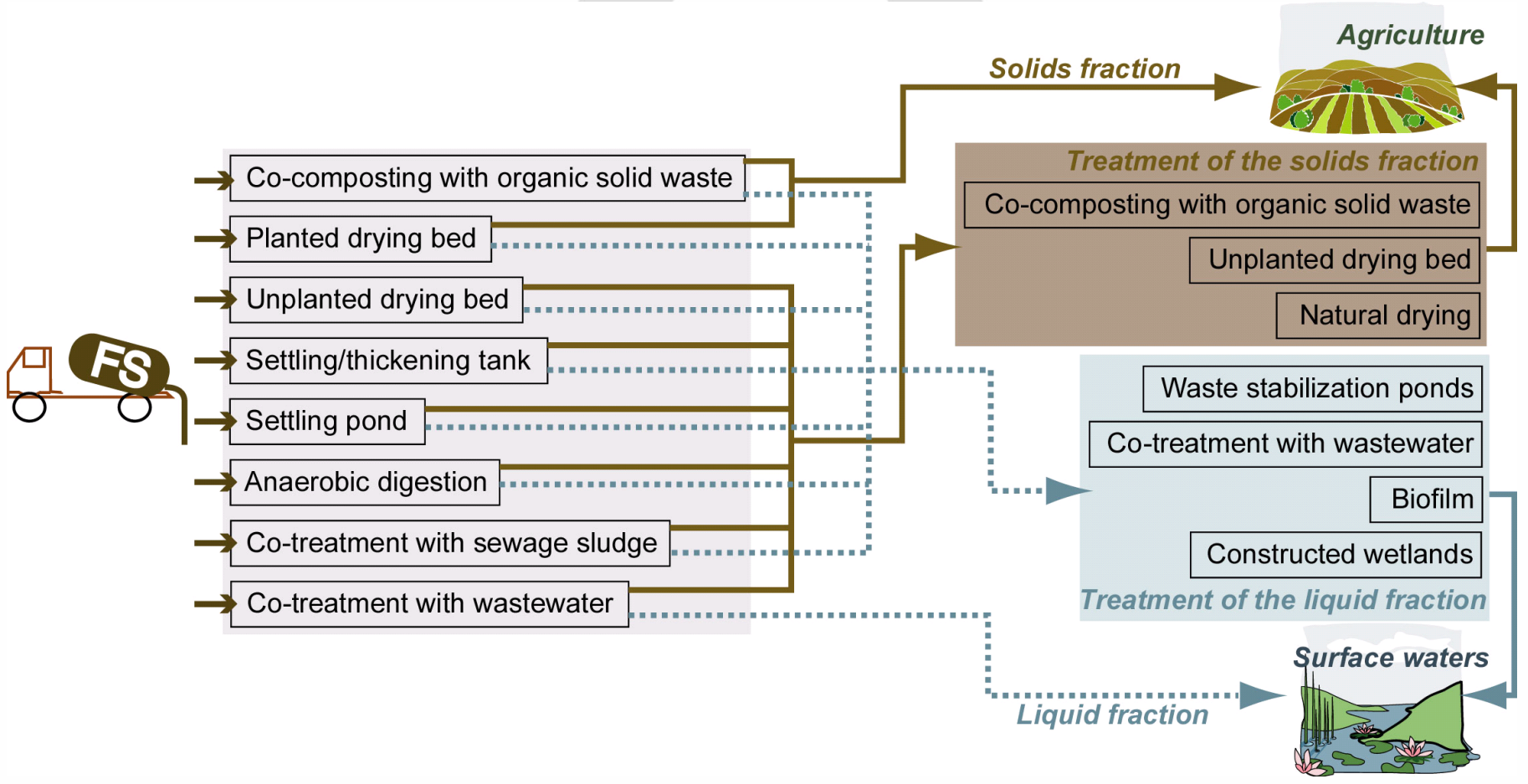
SS

		Inland surface water	Land for irrigation	Marine costal area
Oxidation ponds	75-125	100	200	100
Facultative aerated lagoon	75-126			
Trikling filter	20-50			

Physical characteristics

		Inland surface water	Land for irrigation	Marine costal area
Oxidation ponds	The colour of water is greenish.	All efforts should be made to remove colour and unpleasant odour as far as practicable	All efforts should be made to remove colour and unpleasant odour as far as practicable	All efforts should be made to remove colour and unpleasant odour as far as practicable
Facultative aerated lagoon	The colour of water is greenish.			
Trikling filter	The effluent obtained is colorless			

Options of fecal sludge treatment plant



A detailed study of each option should be carried out.

CAPTURE

STORAGE

TRANSPORTATION

TREATMENT & DISPOSAL , Reuse

Producing Effluent of Recyclable Quality

- None of the technological options discussed earlier produce water of recyclable quality (i.e., BOD < 5 mg/L, SS < 5 mg/L).
- For recycling purpose, tertiary treatment of the biologically treated effluent through
 - Sedimentation and rapid sand filtration (RSF)/
 - Dual media filtration (DMF) is required.
- Alternatively, advanced processes like Membrane Bioreactor (MBR) and SBR process may produce recyclable effluent.

BACKGROUND

Understanding Water & Sanitation Sector

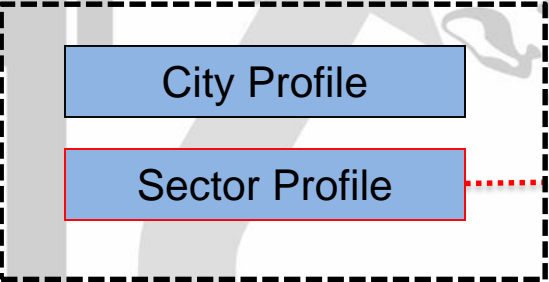
Aim & Objectives

City Selection

Diagnostic Framework

CITY DIAGNOSIS

City Situation Analysis



Water

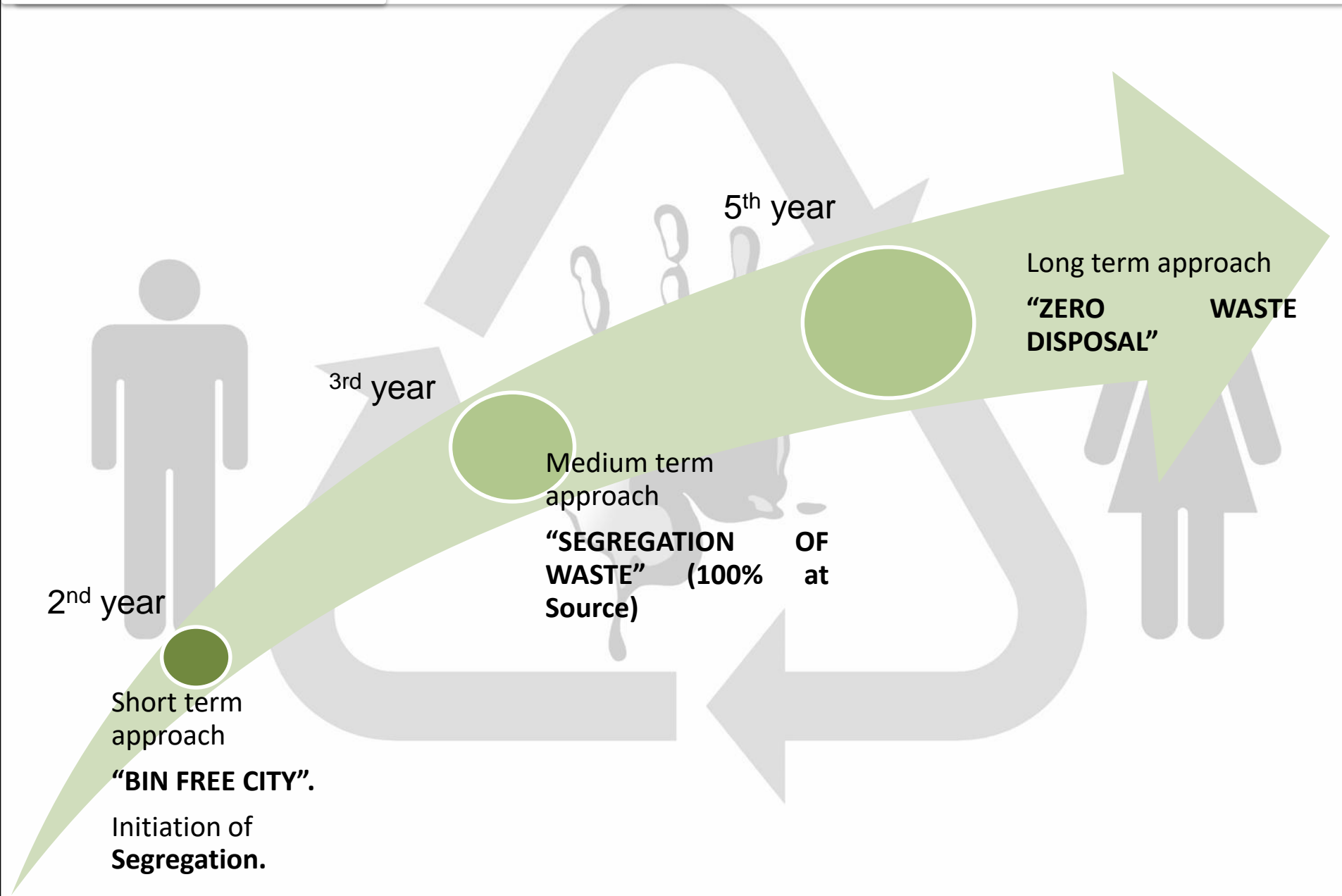
Sanitation

Solid Waste

Identification of Issues/Gaps

PROPOSALS

Proposals



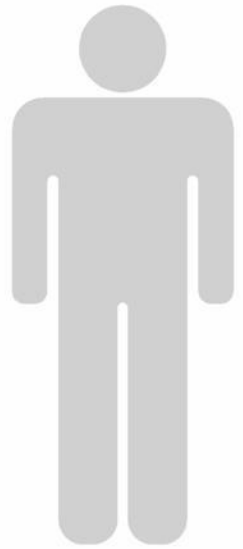
SHORT TERM GOAL

MEDIUM TERM GOAL

LONG TERM GOAL

IEC CAMPAIGN

FINANCIAL DETAILS



**SHORT TERM
GOAL-
BIN FREE CITY**



COLLECTION

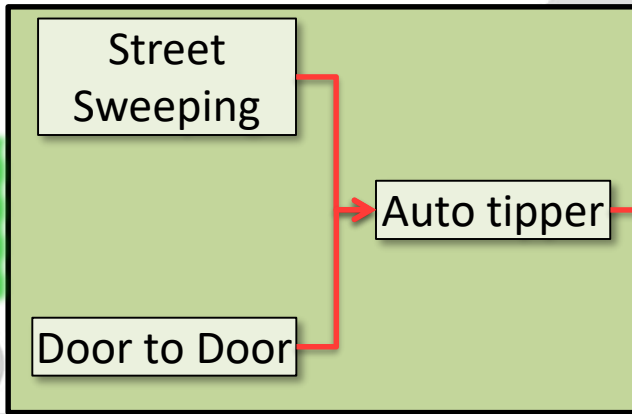
TRANSPORT

TRANSFERSTATION

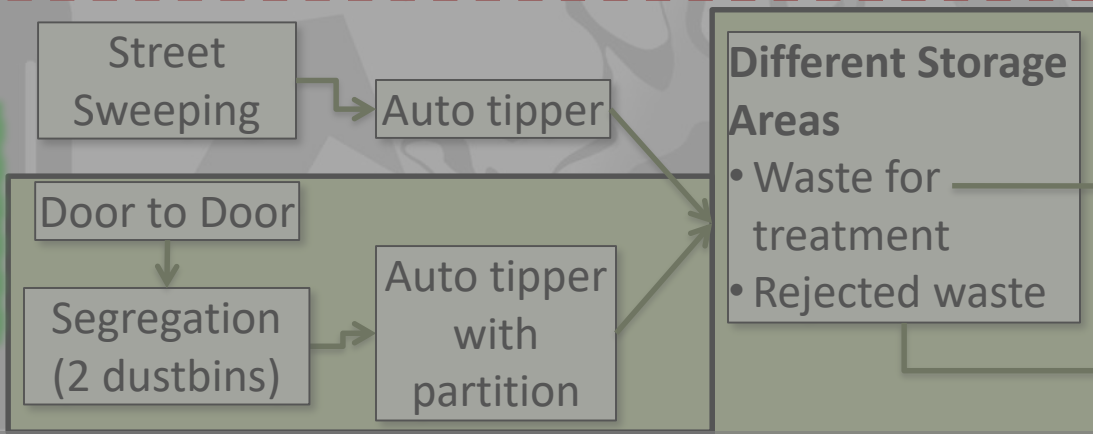
TREATMENT

DISPOSAL

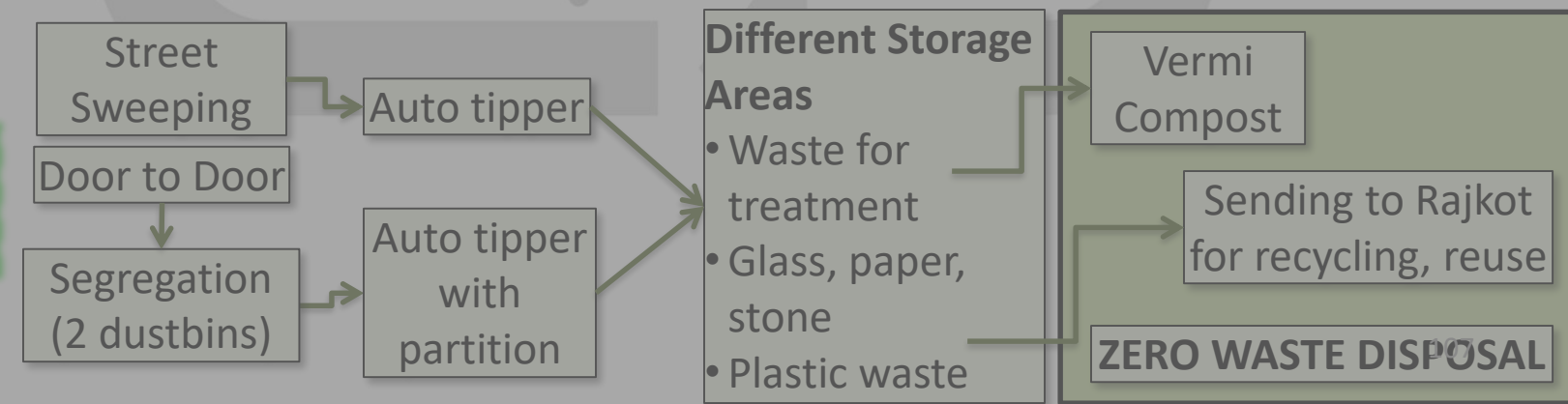
"BIN FREE CITY"



"SEGREGATION & RECYCLING OF WASTE"



"ZERO WASTE DISPOSAL"



COLLECTION

TRANSPORT

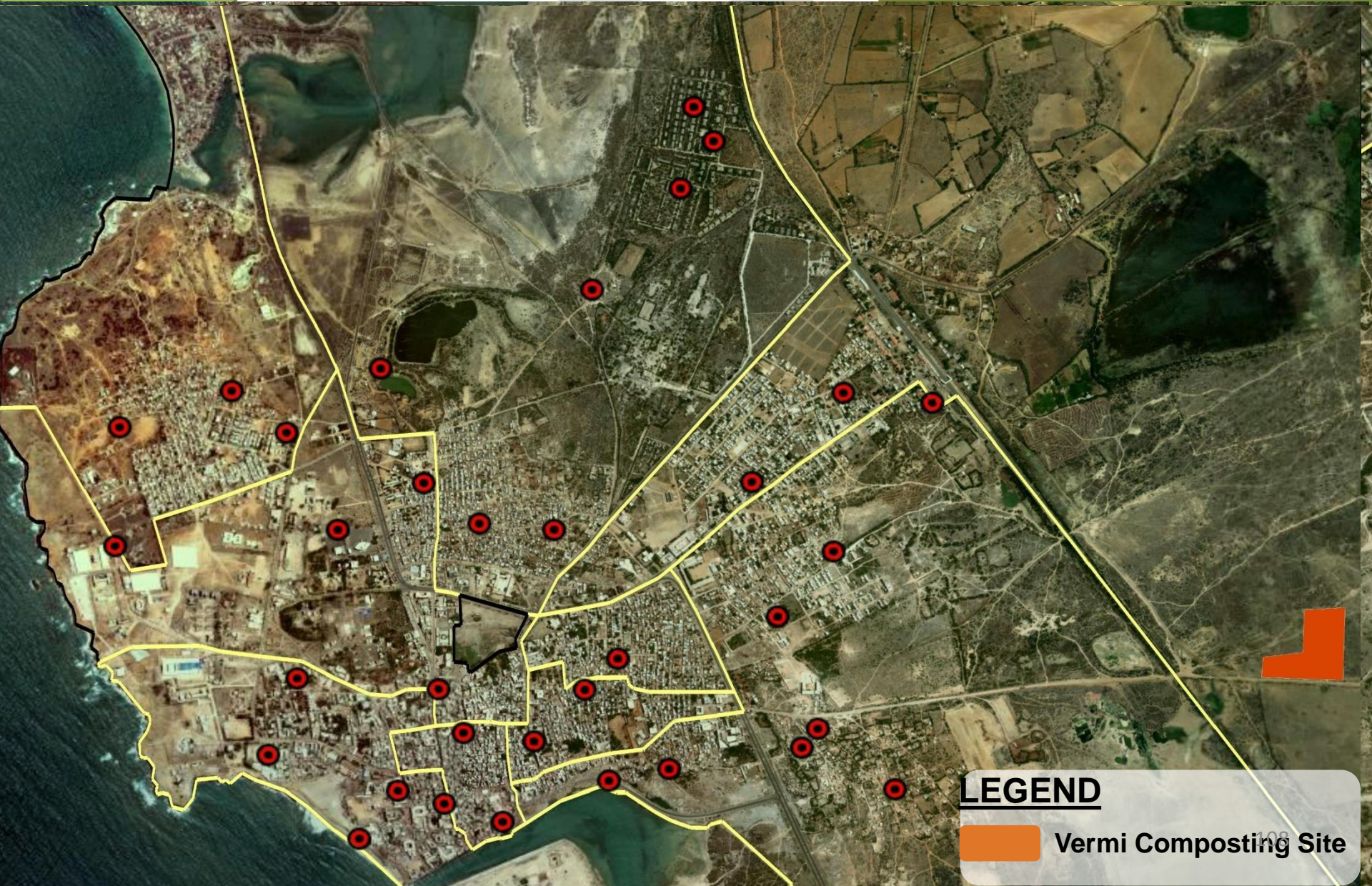
TRANSFERSTATION

TREATMENT

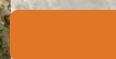
DISPOSAL

SWEEPING

COLLECTION



LEGEND

 Vermicomposting Site

SEGREGATION

SEGREGATION

- Compostable waste
- Non compostable waste

Destination**Vehicle Trip (Inflow)- auto tipper****Waste brought at transfer station**

Street Sweeping

17**6 tonnes**

Door to Door Collection

61**10 tonnes****Vehicle Trip (Outflow) - tractor****Waste send out****Destination****2****3 tonnes**

Vermi composting plant

8**13 tonnes**

Scientific landfill site

STAFF REQUIRED

- 4 workers for segregation
- 4 workers for loading the vehicles

EQUIPMENTS

- Weigh bridge
- Screening belts

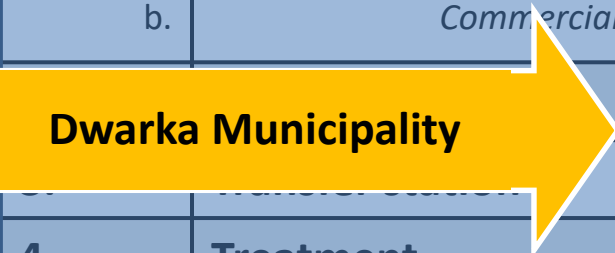
TREATMENT

- Treatment of waste will be carried out using existing Vermi composting plant.
- Plastic waste and other waste will be sold to other treatment facilitator for reuse, recycling

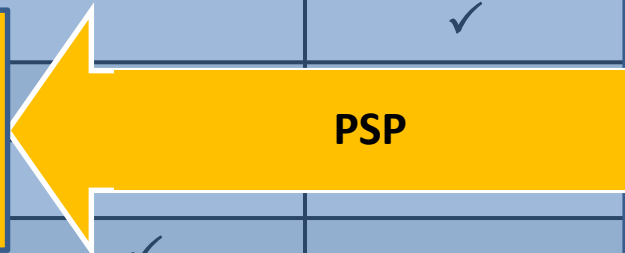
DISPOSAL

- Rejected waste will be dispose in scientific landfill site, 15 km away from dwarka

SR. NO.	TASKS	OWNER SHIP OF ASSETS		O & M	
		ULB	PSP	ULB	PSP
1.	Collection				
I	Street Sweeping		✓		✓
II	D to D Collection				
a.	<i>Residential (HHs)</i>		✓		✓
b.	<i>Commercial</i>		✓		✓
4.	Treatment	✓		✓	
5.	Disposal*	✓		✓	

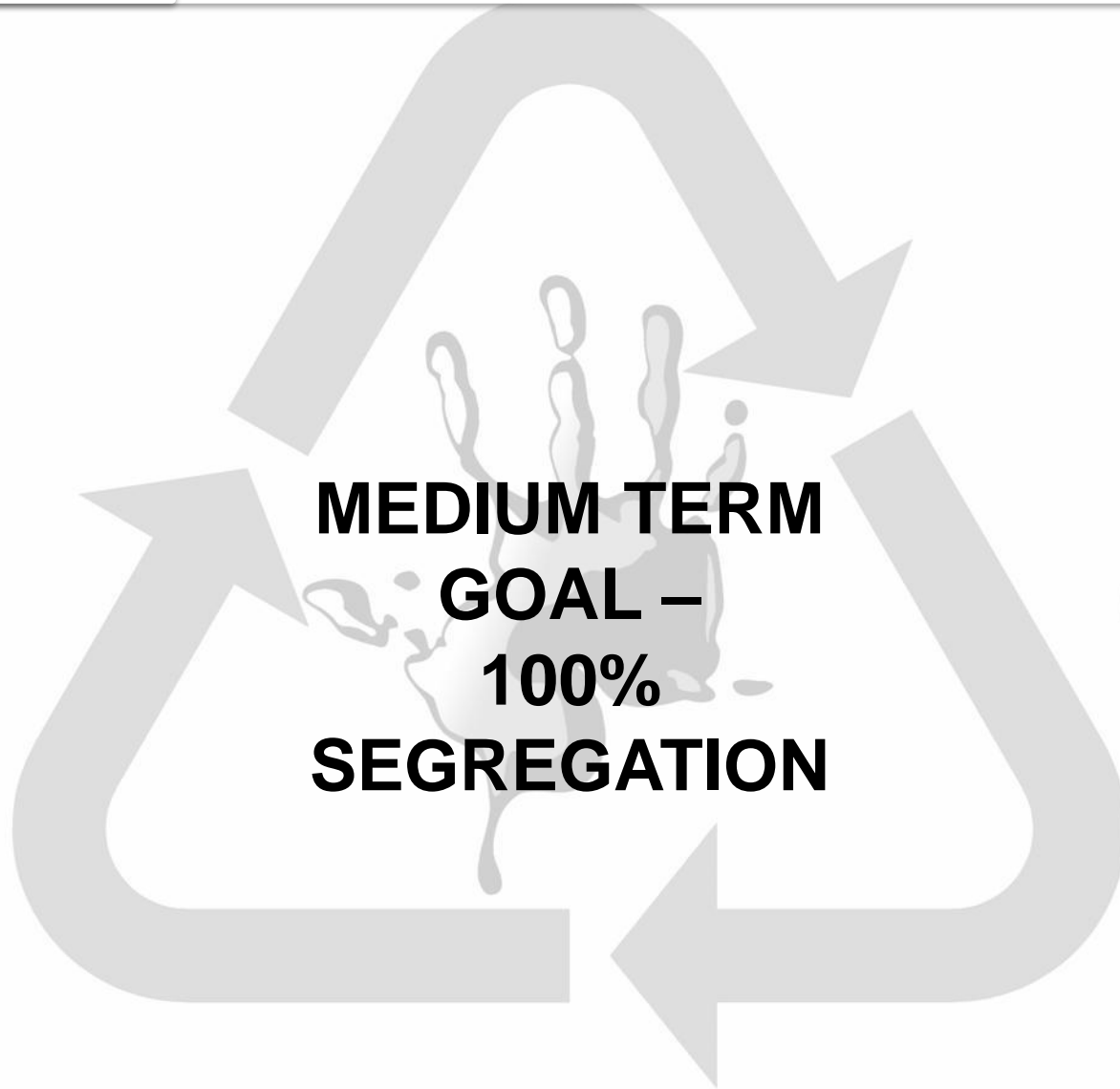
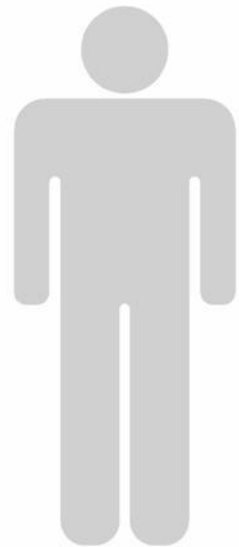


Contract of 5 years, to delivery SWM services. (Operation & Maintenance for Door to Door Collection and Street Sweeping. All the Staff and Vehicle PSP will have to Procure)



Note:

- Common Landfill site, at Vasai.
- Existing ULB staff of 90 temporary sweepers needs to be deployed by PSP.
- Single Private contractor to carry out street sweeping and Door to door collection in all of dwarka.



**MEDIUM TERM
GOAL –
100%
SEGREGATION**



COLLECTION

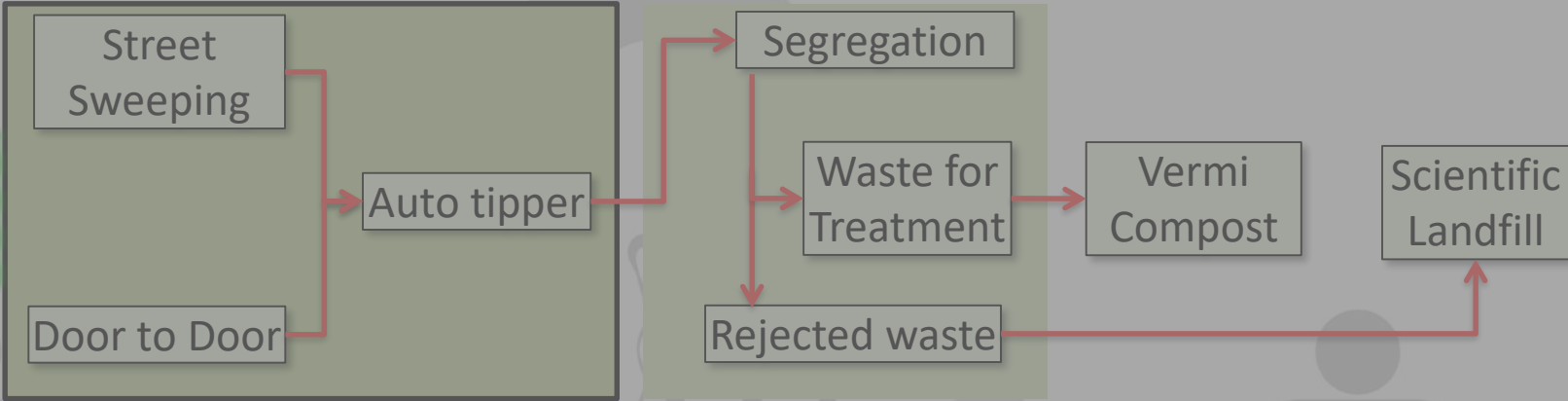
TRANSPORT

TRANSFERSTATION

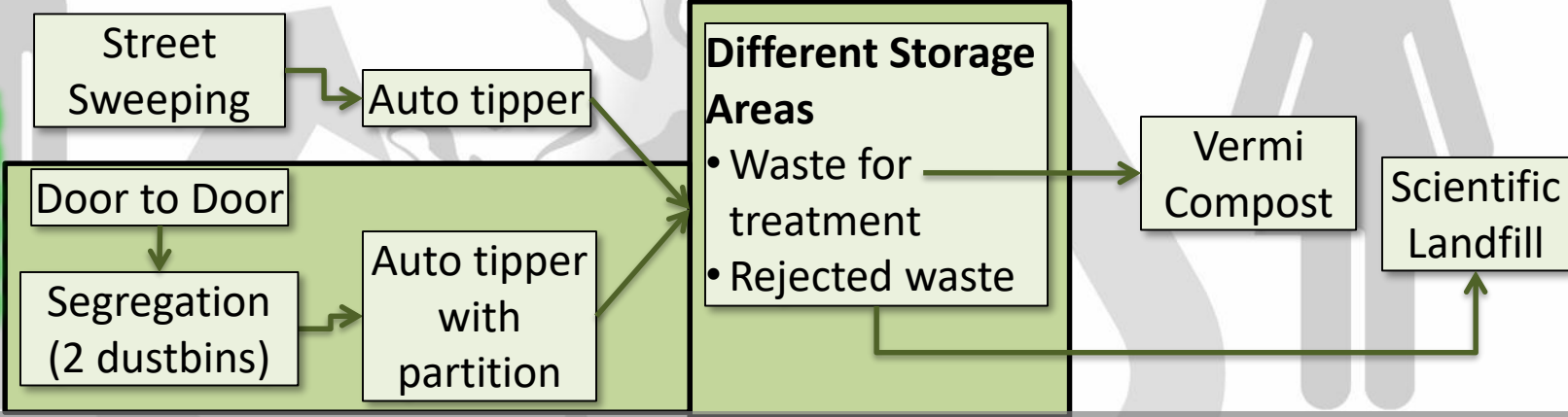
TREATMENT

DISPOSAL

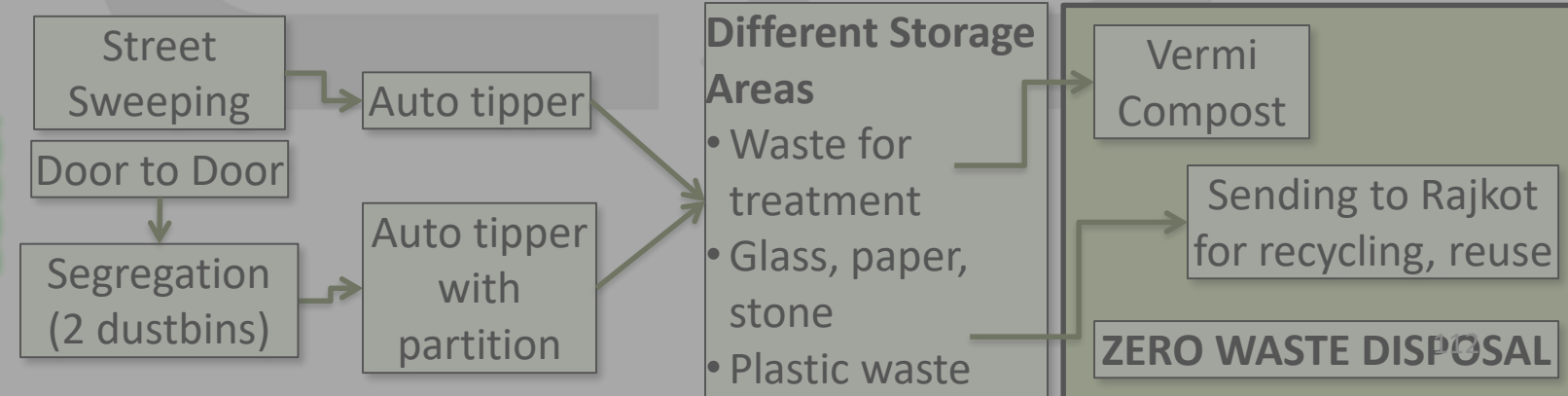
“BIN FREE CITY”



“SEGREGATION & RECYCLING OF WASTE”



“ZERO WASTE DISPOSAL”



100% SEGREGATION AT SOURCE

ADDITIONAL INTERVENTION

Provide dustbins (for dry and wet waste)

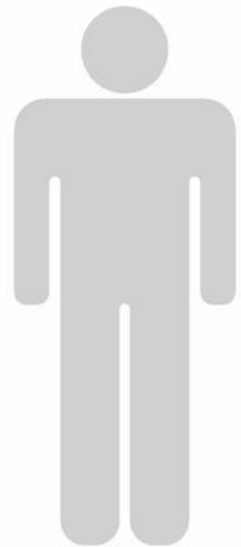
Provision of partition in vehicles

COST

ULB	HH's
50%	50%
70%	30%
100%	0%

No additional cost. Should be included in contract

- Capacity building of the existing staff about the segregation at source.
- IEC campaigning about the advantages of segregation and awareness how community can participate.



**LONG TERM
GOAL –
ZERO WASTE
DISPOSAL**



COLLECTION

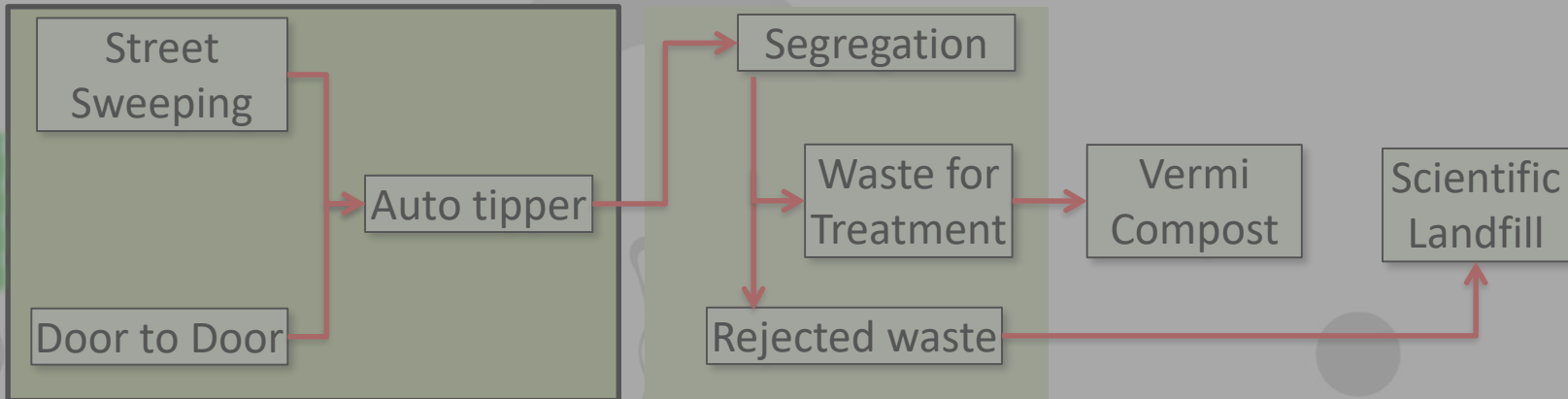
TRANSPORT

TRANSFERSTATION

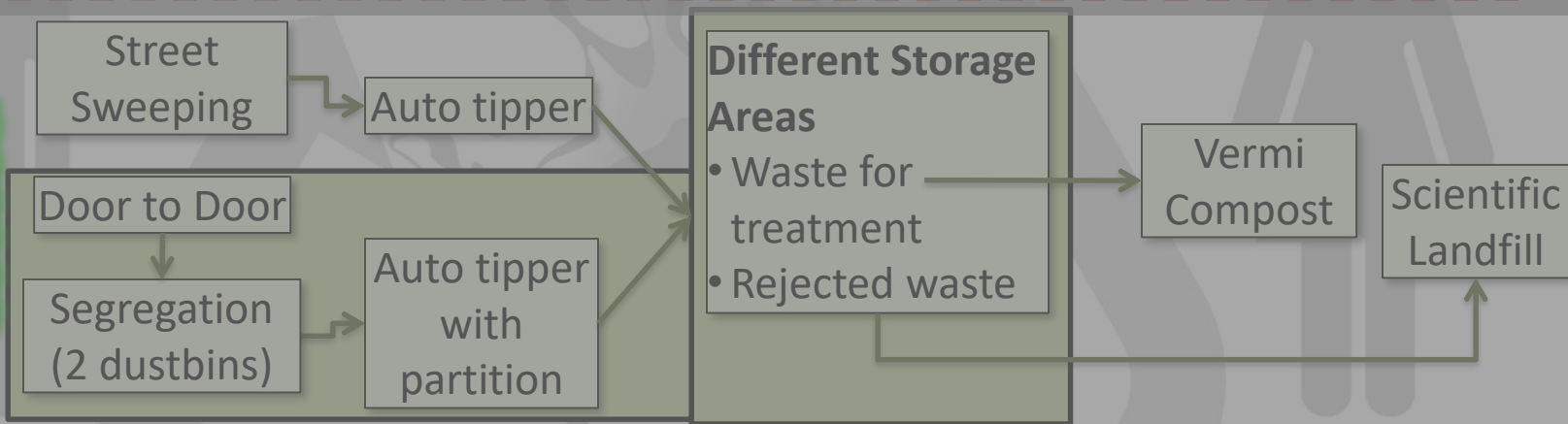
TREATMENT

DISPOSAL

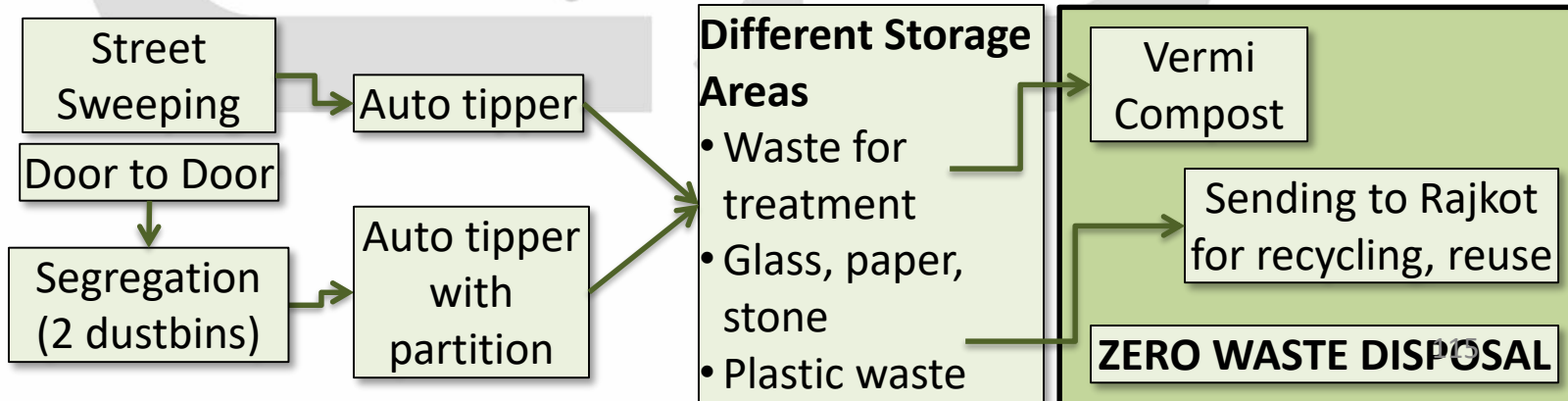
“BIN FREE CITY”



“SEGREGATION & RECYCLING OF WASTE”



“ZERO WASTE DISPOSAL”



Segregation of each type of waste and separate storage

PAPER & CARD BOARD	PLASTIC AND PLASTIC BOTTLE	RAGS	METALS	GLASS	SAND /EARTH	STONES	COMPOSTABLE MATTER
Reuse, recycle	Recycle	Reuse, recycle	Recycle	Recycle	Reuse	Reuse	Treated (Vermi composting)
For making decorative items, building decoration		For needy	Within city, for construction activity				
Selling the segregated waste to Rajkot based recycling plant for making green coal, eco bricks and plastic pallets.							

IEC Campaign Broadly focusing on awareness of Stake Holder to Achieve Following Vision

“BIN FREE CITY”

“SEGREGATION & RECYCLING
OF WASTE”

“ZERO WASTE
DISPOSAL”

• Identification of Target Groups:

Waste generators

Waste collectors

Sanitary Supervisors

For Tourist Awareness : Advertisement on publicity boards at Strategic locations.

• Capacity Building Program Implementation:

- Training and orientation programmes will be plan for all staff and department of solid waste Management.

• Public awareness campaigns based on a public IEC strategy.

- Encourage Practicing Reduce, Reuse, and Recycle.
- workshops, exhibitions, lectures, street play.

• Things to be discussed during public awareness and motivation campaigns

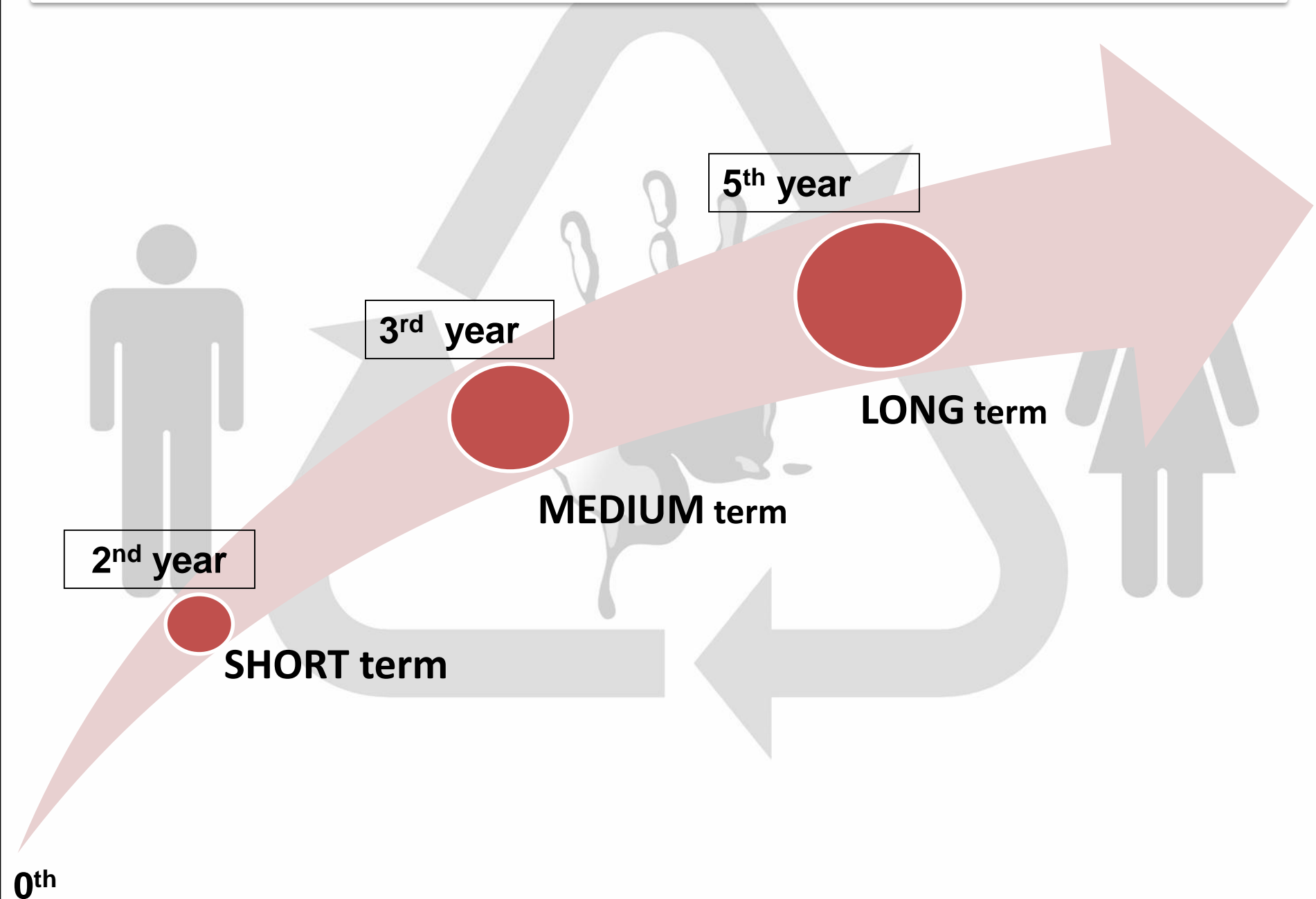
- Littering and indiscriminate dumping of refuse on open spaces, footpaths, lanes, streets, and into drainage channels or water bodies.

ZERO WASTE DISPOSAL
FINANCIAL DETAILS

SR. NO.	DESCRIPTION	CAPITAL INVESTMENT (PER TERM)	O & M EXPENSES (PER/ANNUM)	TOTAL COST (PER TERM)
1.	SHORT TERM (Bin free city)	15,506,087	14,796,258	22,886,345
2.	MEDIUM TERM (Segregation)	4,627,200		12,007,458
3.	LONG TERM (Zero waste disposal)	0		7,380,258

SR. NO.	TASKS	CAPITAL INVESTMENT		O & M EXPENSES	
		ULB	PSP	ULB	PSP
1.	SHORT TERM				✓
I	Vehicles		✓		
II	Transfer station	✓		✓	
2.	MEDIUM TERM				✓
3.	Purchase of dustbins	✓			
4.	Long term				✓ 118

SUMMARY_PROPOSALS



WATER

Ongoing Proposal:

- ✓ Express line (21 Km, 400 dia) from Gorinja to Dwarka.
- ✓ Mayasar Talav Project
- ✓ Narmade Water :Shorter route .
- ✓ Modification & addition of distribution network

New Proposals:

- ✓ **DO MINIMUM**
- ✓ **Full Utilisation of Existing source**
- ✓ **Provision of 100 lpcd supply with alternate sources.**
- ✓ **Provision of 140 lpcd with alternate sources**
- ✓ **Revision in water tariff**
- ✓ **Introducing water tax .**
- ✓ **Increase in new connection charges.**

SANITATION

Residential:

- ✓ Identification of the location of HH with out individual toilets due to lack of space.
- ✓ Refurbishment of existing unusable community toilets.
- ✓ IEC campaigns for OD Free cities.

Non-Residential :

- ✓ **Amendment of 'DCR'** of Dwarka.
- ✓ Provision of **'Pay & Use Toilet'** for Tourist, Shop owners & Bus Stop .

SOLID WASTE MANAGEMENT

"BIN FREE CITY".

Initiation of **Segregation.**

"SEGREGATION OF WASTE" (100% at Source)

"ZERO WASTE DISPOSAL"

PROPOSALS

FINANCIAL IMPLICATIONS

SHORT TERM

Utilization of 3.07 MLD of Sani water.

CAPITAL COST

31.00

O&M COST

53.00

SANITATION :

Residential:

1. IEC campaigns for OD Free cities
2. Refurbishment of existing unusable community toilets.

Non-Residential :

1. Amendment of 'DCR' of Dwarka.
2. Provision of 'Pay & Use Toilet' for Tourist, Shop owners & Bus Stop .

Institutional:

1. Setting up of a readressal system.

85.00

18.00

"BIN FREE CITY".

Initiation of **Segregation.**

155.06

147.96

PROPOSALS

FINANCIAL IMPLICATIONS

MEDIUM TO LONG TERM

CAPITAL COST (in lakhs)

O&M COST (lakh per annum)

- 1. Provision of 100 lpcd water supply
- 2. Addition & Modification of Distribution network
- 3. Provision of 140 lpcd

41.00
128.57
1393.00

74.00
133.00

- 1. Conventional Sewerage
- 2. Small bores
- 3. Oxidation Pond Or , Facultative aerated lagoon Or , Trickling filter.

1723.24

91.01

592.69

51.38

328.22

“SEGREGATION OF WASTE” (100% at Source)

46.27

147.96

“ZERO WASTE DISPOSAL”

147.96

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THANK YOU !!!

Under Guidance of:

Dr. Meera Mehta

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Prof. Mona Iyer

- **Public awareness campaigns based on a public IEC strategy.**
 - RRR-slogan – reduce, reuse, and recycle.
 - Advertisement on publicity boards, on local radio channels, and in local newspapers.
 - workshops, exhibitions, lectures, street play.
- **Things to be discussed during public awareness and motivation campaigns are as follows:**
 - Consumption patterns and a sustainable development,
 - The natural source of products,
 - Recycling and reuse,
 - Littering and indiscriminate dumping of refuse on open spaces, footpaths, lanes, streets, and into drainage channels or water bodies,
 - Environmental degradation and its effects on human health.

PROPOSAL FOR SWM

	Technical	Institutional	Financial	IEC Provision
Street Sweeping	<ul style="list-style-type: none"> • Permanent area allocation 	<ul style="list-style-type: none"> •Reliever 's to cope up staff irregularities 	<ul style="list-style-type: none"> • Cost for buying equipments 	<ul style="list-style-type: none"> •Awareness to People not to litter •Training to staff
Collection	<ul style="list-style-type: none"> •D to D collection •Placement of dustbin on tourist circuits •Segregation at source* 	<ul style="list-style-type: none"> •Contract out to PSP or strength the staff capacity •monitoring 	<ul style="list-style-type: none"> •Cost for contracting work or expenses for new staff and equipments 	<ul style="list-style-type: none"> • awareness amongst citizens •Training to staff
Transport	<ul style="list-style-type: none"> •Routes and trip planning 	<ul style="list-style-type: none"> •Contract out to PSP or strength the staff capacity 	<ul style="list-style-type: none"> •Cost for contracting work or expenses for new vehicles 	-
Treatment	<ul style="list-style-type: none"> • Segregation of the waste and reuse of waste 	<ul style="list-style-type: none"> •Contract out to PSP or strength the staff capacity 	-	<ul style="list-style-type: none"> •Training to staff • Awareness
Disposal	<ul style="list-style-type: none"> •Proper disposal on site (no littering around) 	<ul style="list-style-type: none"> • Monitoring 	-	<ul style="list-style-type: none"> •Training to staff

Organic waste converter

- Organic waste converter is generate compost from organics waste.
- Composting is a natural process and when held in an oxygen rich environment it prevents odor and emission of green house gases.
- The weight and volume of the waste is reduced by around 60% through these machines.
- The labor requirement in these machines is very less.



Organic waste converter for Dwarka ULB

Making Stand alone system for Hotels and Restaurants

Waste Generation Break up	Tonnes.	Organic waste (tonnes/day)	1
Residential	13.28	Hotel and restaurants covered	67 no.
Hotel and restaurants	3.00	Area require , Sq.m	5.72
Street sweeping	1.72	Require Waste Converter	3 no.
		Cost of Converter 15.5 lack each.	46.5 lack

Advantages:

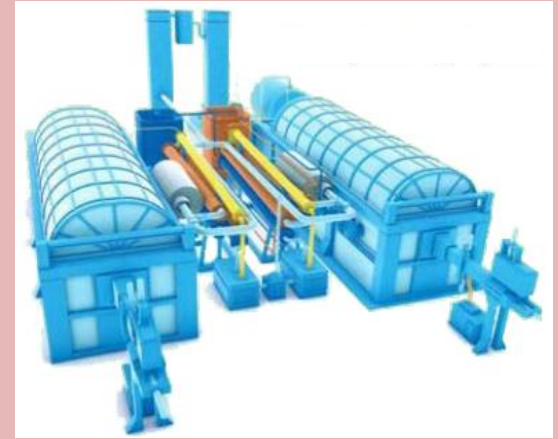
- Prevent worms, bugs, or trash odours and emission of GG.
- Compost is Good for gardening.

Waste Plastic to Fuel

- Plastic to Fuel System uses a process called **catalytic pyrolysis** which efficiently convert plastics to crude oil.
- System provides an integrated plastic waste processing system that offers an alternative to landfill disposal, incineration and recycling.
- Polymers from plastic waste are converted to oil, vapor, water and solids.
- 1 kg. of plastic waste yields up to .78 kg. of final product.
- A single Polymer Energy Unit generates up to 300 liters of finished product per hour.
- Volume Produced 720 liters/ton of waste plastic processed

Advantages:

- Environmentally responsible waste management solution
- Cost-effective
- Modular design, easily scalable plant capacity
- Self-cleaning unit minimizes offline maintenance
- Solution for nuisance and difficult to recycle plastic waste.



Waste Plastic to Fuel Pilot Project, Pune.

- The project will seek to convert 9000 kg of plastic a month into 5400 litres of fuel.
- Trials have been successful in the disintegration of all kinds of plastic waste, including bottles, small micron bags, food wrappers, cable covers and even old tyres.
- The project will be implemented of 300 kg plant could yield 180 litres of fuel a day. in all the 14 wards.
- The yield is claimed to be 50 to 55% of the plastic disintegrated.

Product Use:

- The poly fuel generated from this process can be used in gensets to produce electricity.
- This can also be used to light up local parks, street lights.



Disposal option	Non-engineered Diposal	Sanitary Landfill	Composting	Incineration	Segregation and sale out	Waste Plastic to Fuel Plant	Organic waste converter
Volume reduction	No	Yes	Yes	Yes	Yes	Yes	Yes
Expensive	No	Yes	Yes	Yes	No	Yes	Yes
Long term-maintenance	Yes	Yes	No	No	No	Yes	Yes
By-product recovery	No	No	Yes	No	Yes	Yes	Yes
Adaptability	Yes	Yes	No	No	Yes	Yes	Yes
Adverse environmental effect	Yes	Yes	No	Yes	No	No	No

- Above Highlighted System Can adopted for Integrated Solid waste Management of Dwarka.
- Waste Plastic to Fuel plant and Organic converter system is Expensive but it give good solution to keep city clean.
- Vermi Composting is more adaptive for Dwarka because it easy to maintain and it is exist in Dwarka city.