ICRIER'S

PROGRAM ON CAPACITY BUILDING & KNOWLEDGE DISSEMINATION ON URBANIZATION IN INDIA

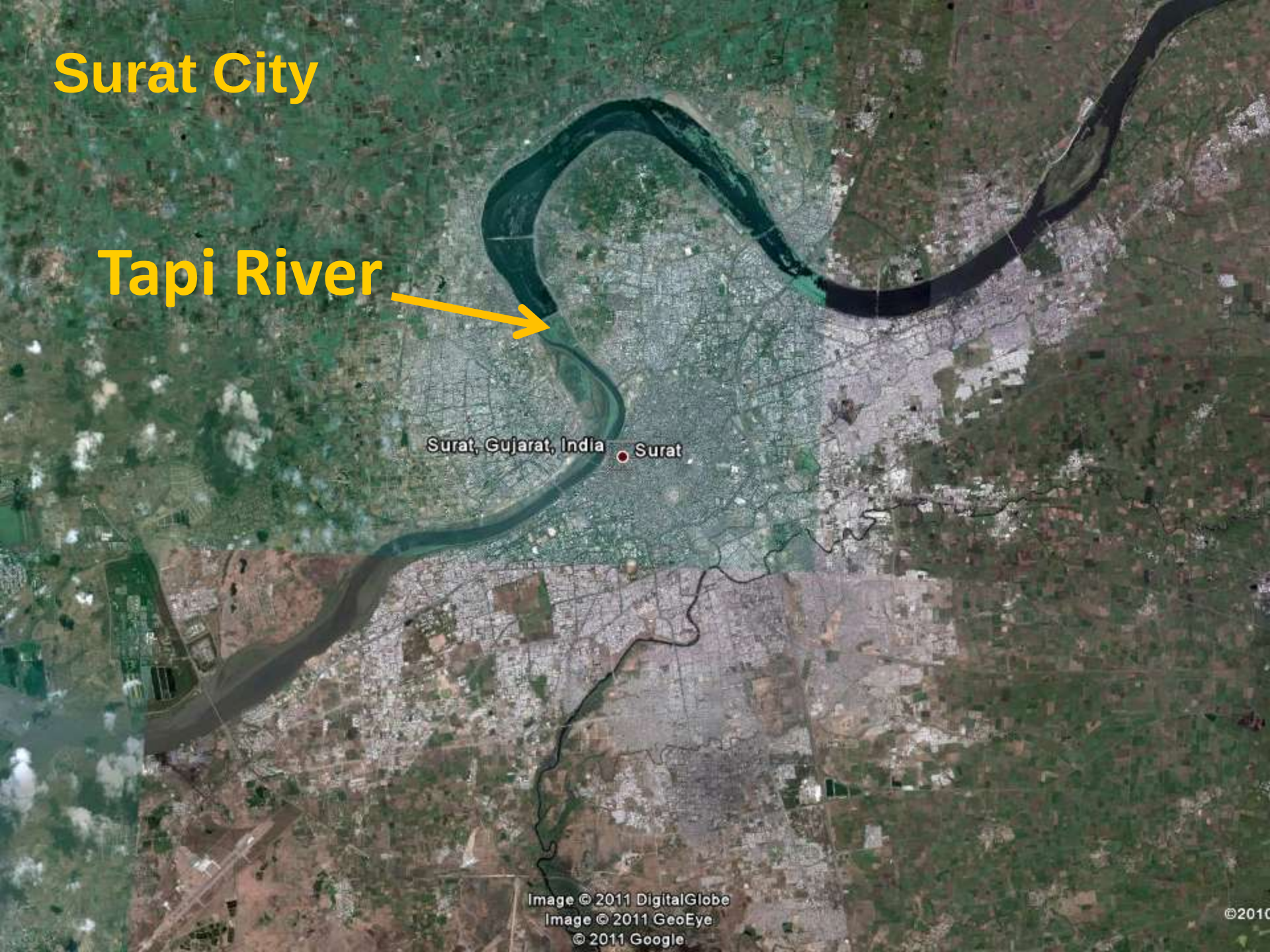
PREPARING FOR THE URBAN CHALLENGES OF THE 21ST CENTURY

SERVICE DELIVERY OF WATER AND SANITATION - CHALLENGES FACED BY METROPOLITAN CITIES (SURAT CITY)

FEBRUARY 06, 2013

Mr.Jatin Shah, City Engineer,
Surat Municipal Corporation

Surat : Water Supply System


Surat City
Tapi River
Surat, Gujarat, India
Surat
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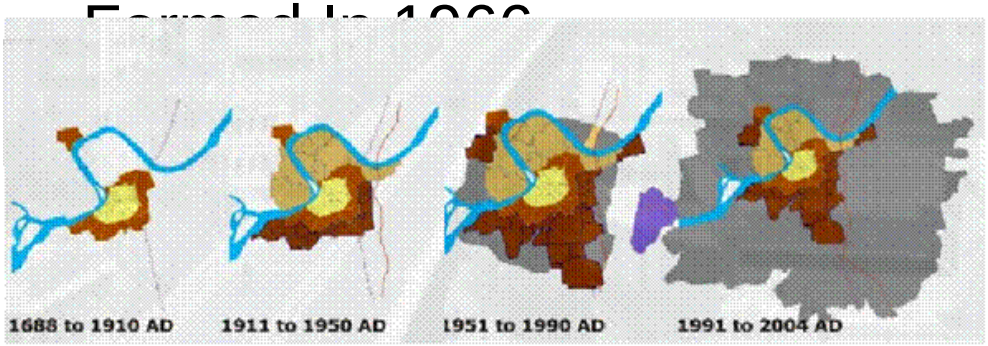
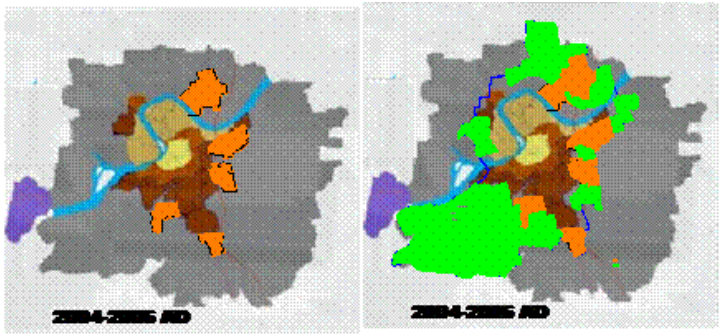
Growth of Surat City

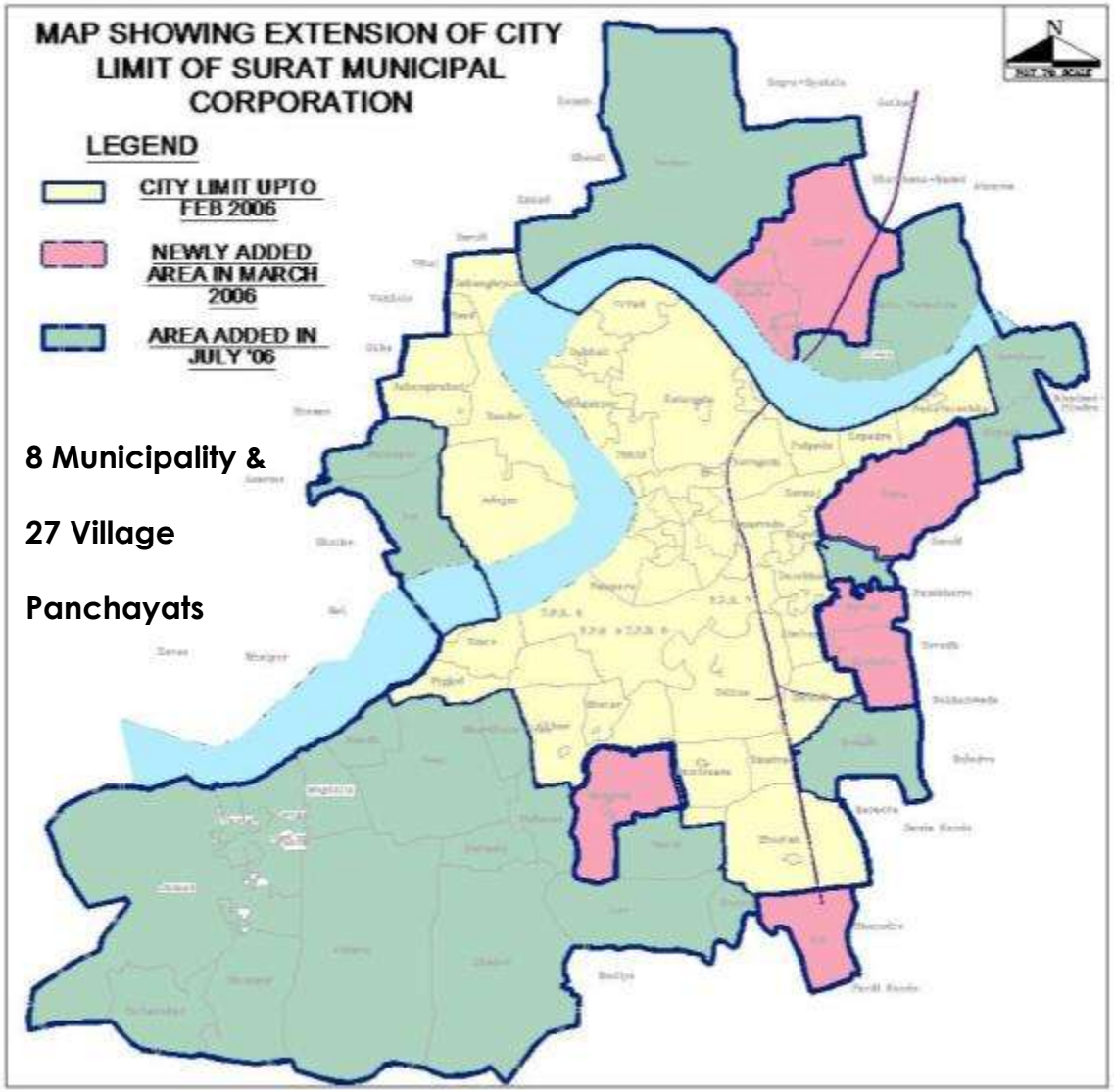
- Historical Development Of Surat Dates Back To 300 BC.
- Municipality Established In 1852 AD.
- Municipal Corporation Formed In 1966

Year	Area in Sq. Km	Population
1951	8.18	223182
1961	8.18	288026
1971	33.85	471656
1981	55.56	776583
1991	111.16	1498817
2001	112.27	2433785
2001*	326.51	2877241
2011	326.51	44.7 Lakhs





Surat : City Expansion



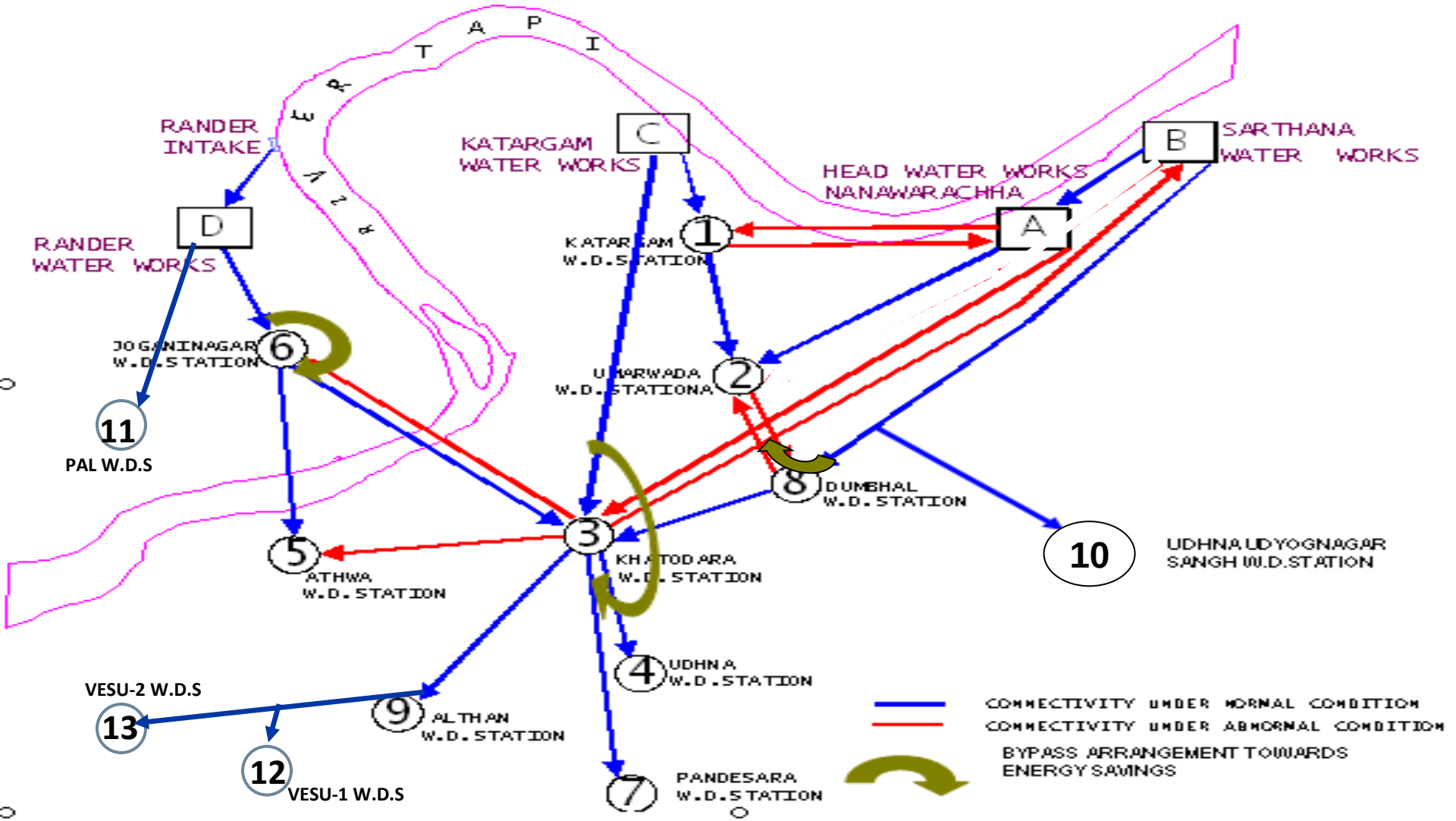
- Unprecedented growth in last four decades.
- 10-fold population rise in last 4 decades.
- 3-fold increase in area in 2006
- Now ranks the 8th most populated city in the country.

Water Supply – Present Status

- Source of Water: **River Tapi**
- Population covered under piped network*:- **94 %**
  (out of 47 Lacs present pop. of city)
- Present installed capacity of Intake Wells: **1463 MLD**
- Present installed capacity of Water Works : **1178 MLD**
- Present gross daily average water supply: **840 MLD**
- Average Per capita Water Supply per day : **140 lpcd**
- Total storage capacity of all WDS & WW: **653 ML**
- Total app. length of water supply pipelines: **2750**

Water Supply Grid Network

Water Works and WDS



Water Supply

Increase in water supply since year 1995

Sr. No.	Year	Area (Sq.Km.)	Est. Population (Lacs)	Gross Av. Daily Water Supply (MLD)	% Population Coverage
1	1995	112.28	19.00	180	59
2	2000	112.28	24.00	440	88
3	2005	112.28	30.00	580	95
Area of city increased in year 2006 from 112.28 Sq.Km. to 326.51 Sq.km					
4	2013 Present	326.51	47.00	780 domestic + 60 Industrial = 840 MLD	*94%
* Remaining area to be covered by Dec., 2013					

Water Supply Master Plan

As per Water Supply Master Plan for Surat city

Year	2026	2041
Population	87.48 Lac	123.04 Lac
Projected Water demand	1682.63 MLD	2331.67 MLD

Water Supply:
Increase in water supply Infrastructure

	Water Supply Components	Present Year 2013	Ongoing/ tender works Year2013	Ultimate capacity Master Plan Year 2041
		Cumulative capacity Increase		
1	Intake wells (in MLD)	1463	2033	2425
2	Water Treatment Plants (in MLD)	1178	1468	1678
3	UGSR Capacity (in ML)	624.7	680.9	726.7
4	ESR Capacity (in ML)	28.6	70.9	124.3
5	Distribution Network (in Km)	2750	3100	3400

Preparing for Urban Challenges in 21st Century – Water Supply

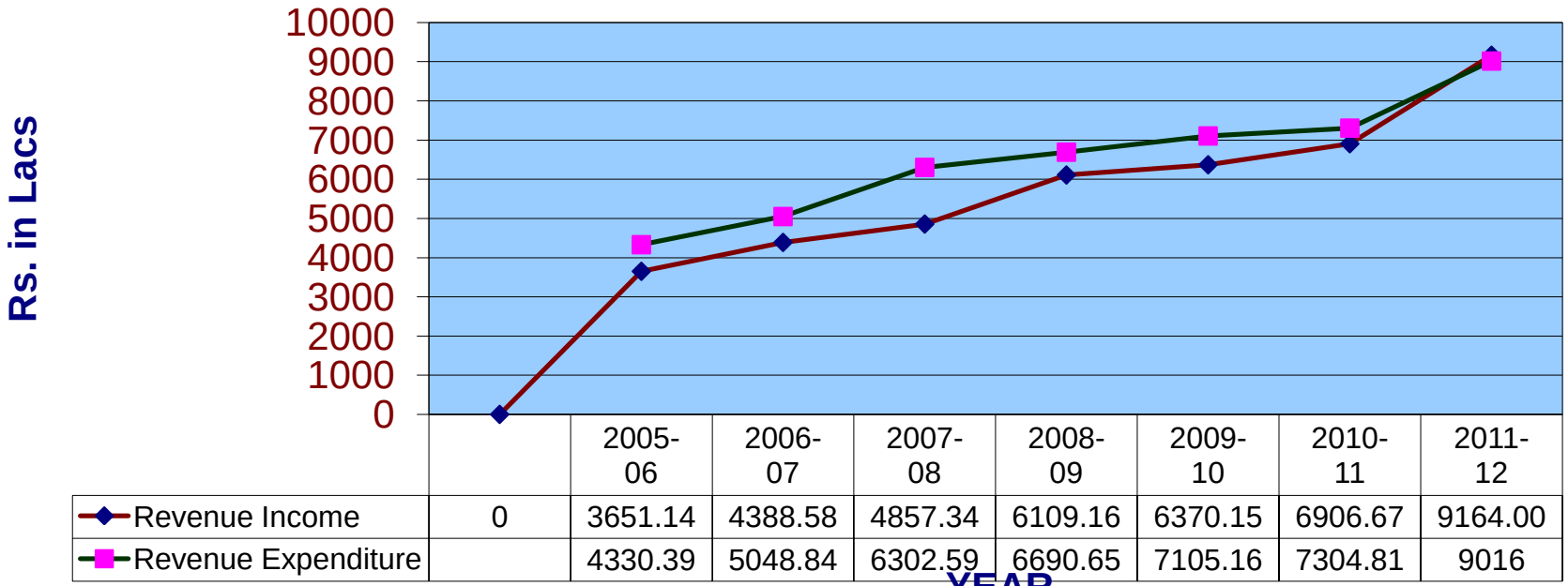
- Efficient Water Supply Management
- Water Quality Monitoring
- Operation and Maintenance practices
- Energy Efficiency and savings measures
- NRW Reduction initiatives
- Water Conservation

Efficient Water Supply Management

- Strict Water Quality compliance in adherence to drinking water standard IS 10500
- Adequate water supply (meeting LPCD norms) through effective O&M Practices
- Water conservation and IEC activities
- Optimum O&M Cost with
  - Lowest production cost (Rs./KL)
  - Reduced energy consumption level (KWH/ML)
  - Loss reduction / control
- Effective Service Delivery in sustainable manner
- 100% cost recovery

100% Cost Recovery

WATER SUPPLY
REVENUE INCOME V/S EXPENDITURE



		2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Revenue Income	0	3651.14	4388.58	4857.34	6109.16	6370.15	6906.67	9164.00
Revenue Expenditure		4330.39	5048.84	6302.59	6690.65	7105.16	7304.81	9016

Water Quality Monitoring

Testing Parameters & Testing Frequency

Sr.	Location	Frequency	Parameter	Stage
1	Generation (more than 445 samples)	Round the Clock	pH, Turbidity, TDS, Free Residual Chlorine (FRC), Dissolved Oxygen (DO)	Raw Water, Treated / Supply Water from Water Works
2		Hourly	pH, Turbidity, Free Residual Chlorine (FRC)	Raw Water, Treated Water
3		Shift wise	pH, Turbidity, Colour Index, Taste, FRC, TDS, Alkalinity, DO	Raw Water, Treated Water, Supply Water
4		Weekly	pH, Turbidity, Colour Index, Taste, FRC, TDS, Alkalinity, DO, Total Hardness, Nitrate, Iron, Fluoride, Ammonical Nitrogen, Chloride, Chlorine Demand, BOD, COD, MPN Index (17 parameters)	Raw Water, Treated Water, Supply Water
5		Quarterly	All heavy metals as per IS 10500 including above 17 parameters	Raw Water, Treated / Supply water
1	WDS (12 samples)	Twice in Supply hour	Turbidity, FRC	Supply water to consumer from WDS
2		Weekly	pH, Turbidity, Colour Index, Taste, FRC, TDS, Alkalinity, DO, Total Hardness, Nitrate, Iron, Fluoride, Ammonical Nitrogen, Chloride, MPN Index (17 parameters)	Supply water to consumer from WDS
1	Consumer (more than 660 samples)	Daily	Odour, pH, TDS, Ammonical Nitrogen, FRC	Consumer samples

Operation & Maintenance Practices
Installation of SCADA System at WTP

- Installed SCADA (Supervisory Control and Data Acquisition) System at,
  - Intake well machinery operations
  - Booster / Pump House in water works
  - Water Treatment Plant – Plant unit operations
    - 250 MLD capacity WTP at Rander Water Works
    - 200 MLD capacity WTP at Sarthana Water Works
    - 150 MLD capacity WTP at Katargam Water Works
    - 150 MLD capacity WTP at Sarthana Water Works

- Benefits of SCADA
  - Optimization in deployment of manpower
  - Remote monitoring and control
  - Reduction in overall maintenance and in down time, helps better inventory management for spares, consumables etc.
  - Rationalization in Utilization of equipments / machineries (Transformers, pump sets etc.)

Operation & Maintenance Practices

Water Treatment Plants & Grid Network

- **GRID System**
  - All Water Works and Water Distribution Stations are interlinked
  - Any water works can feed water to any water distribution station
  - Helped to restore entire water supply system within 36 hours during the floods of August 2006

Energy Efficiency and savings measures

- Installation of thyristor based APFC panels
- Coating for Energy Saving to various pumps
- Rationalisation of contract demand at WW/ WDS etc.
- Replacement of pumps and trimming of impellers of pumpsets at various Water Works and Water Distribution Stations after energy audit.
- Replacement of Zero Velocity Valve
- Re-engineering in Water Supply routes
- Various Energy Saving measures reduced specific energy consumption in water supply (Specific Energy Consumption has reduced from 355 KWH/ML to 279 KWH/ML)

Renewable Energy for Water Supply

Wind Power Generation:

- Installed 2nos. of 1.5 MW Wind Power Plant

  at Village : Gosa, Dist.: Porbander
- Total Expected energy generation: - 6.40 GWH/ annum
- Total Expected energy saving : - Rs.2.83 Cr. per annum
- Total Capital Investment: - Rs.18.43 Cr.
- Total O & M cost up to 10 years: - Rs.3.76 Cr.
- Actual energy generated till Jan -2013: - 1.76 Crore Unit
- Effective energy saving till Jan -2013: - Rs. 8.48 Crore

Renewable Energy for Water Supply

Wind Power Generation:

(Expected to be commissioned by Feb 2013 End)

- **8.4 MW capacity Wind Power Plant**
- **Total Expected energy generation: -**

  1.72 Crore units/ annum

- **Total Expected energy saving : -**

  Rs.7.4 Crore per annum

- **Total Capital Investment: -**

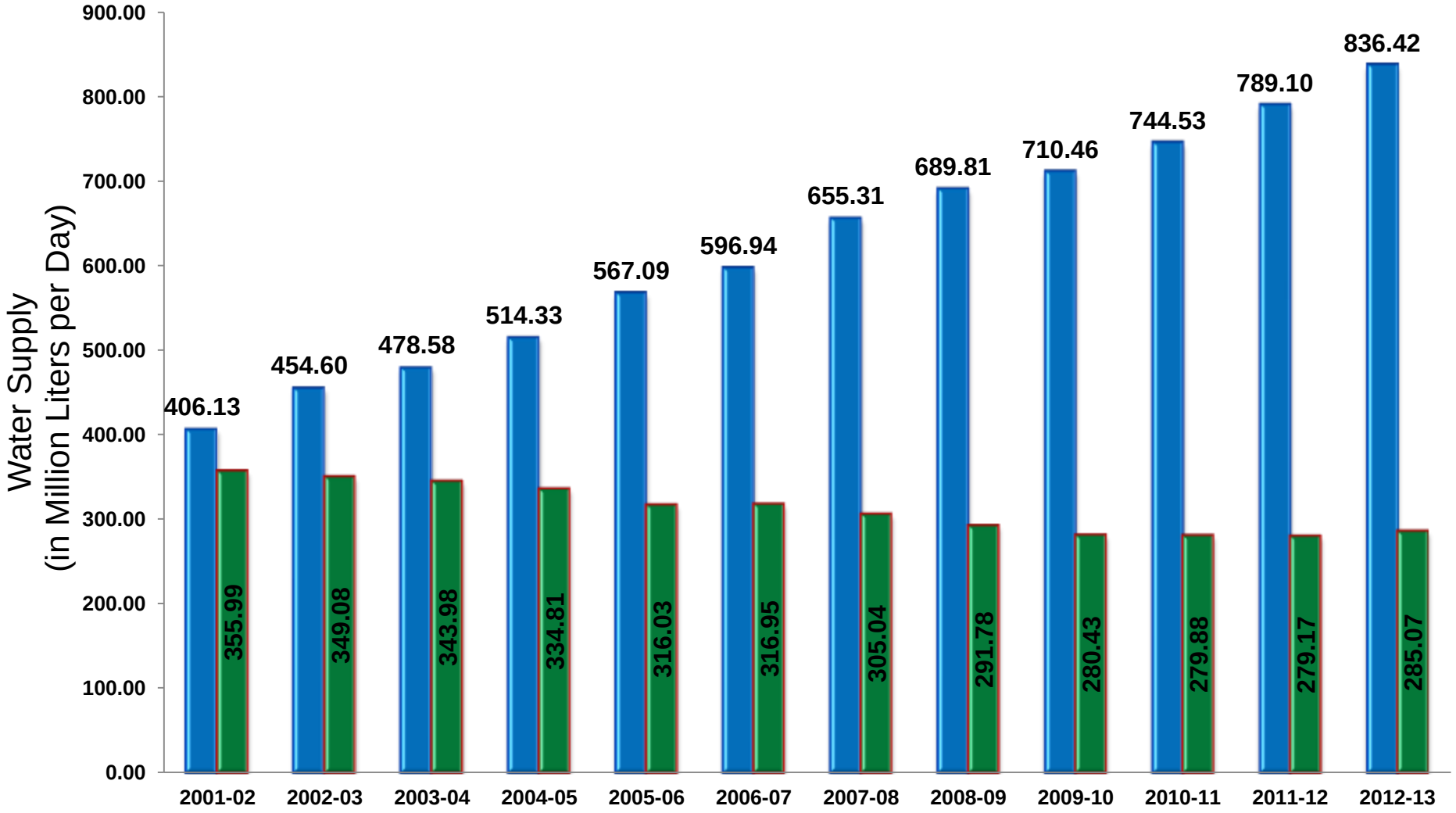
  Rs.52.18 Crore

Energy Efficiency
Total Energy Savings in Water Supply

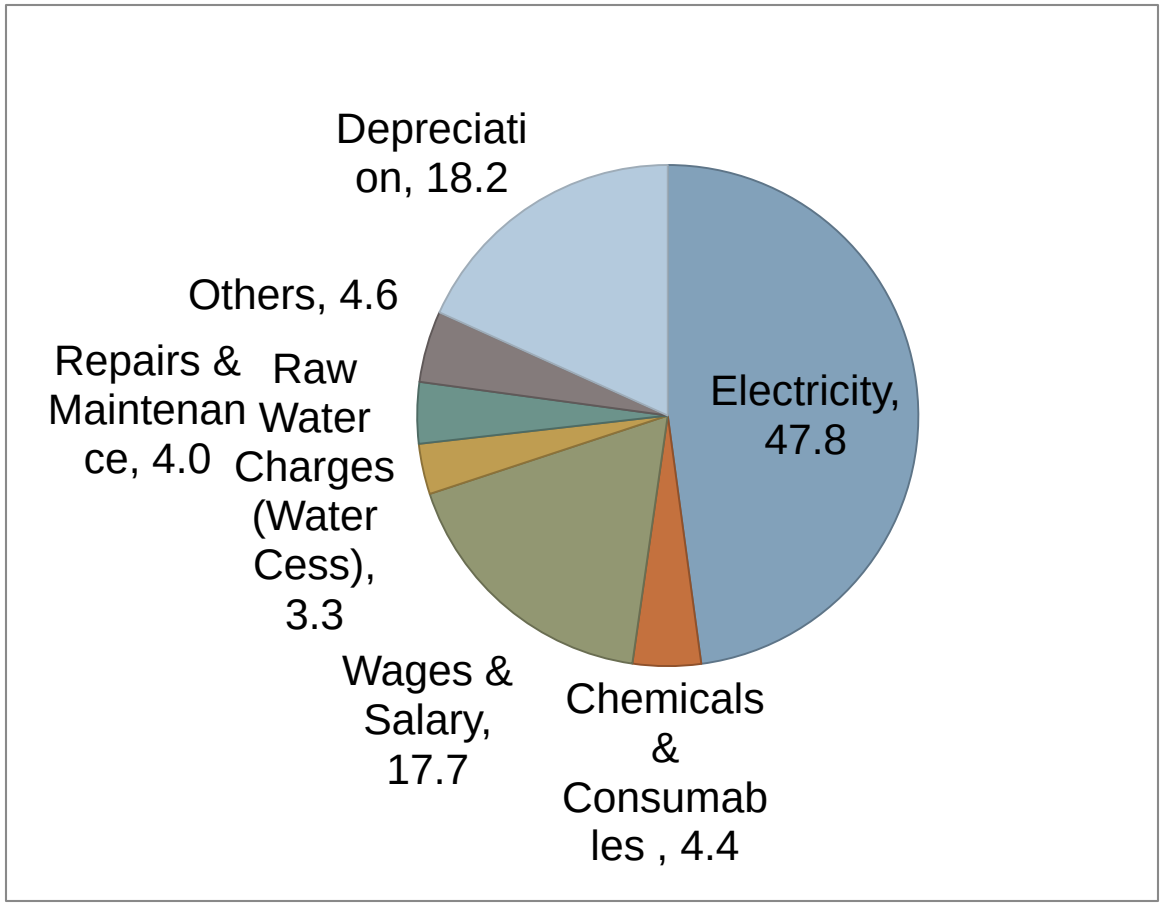
- Conventional energy efficiency measures, re-engineering of water supply routes and wind energy generation, the total savings have reached a level of
  - 1.26 CroreKWH/ annum
  - Rs. 5.96 Crores/ annum

Energy Efficiency and savings measures - Results

Water Supply (in MLD) Vs. Specific Energy Consumption (kWH/ML)



Energy Savings in Operation and Maintenance Cost – Water Supply: FY 2011-12



- Total Energy Cost is Rs. 43.1 Crore
- Recurring Energy Saving by all means is Rs.5.96 Crore.
- Hence, through energy savings measures, 13.83% savings towards Electricity cost is realized

Total Annual O&M Cost : Rs.90.16 Crore

NRW reduction initiatives

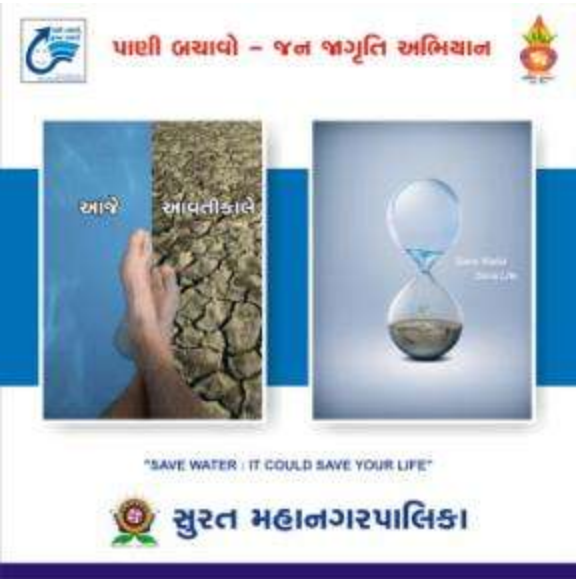
- Establishment of NRW Cell- Tasks on hand
  - Planning for comprehensive Water Audit
  - Flow measurement & Metering
    - Generations (100% implemented) – Non contact type – ultrasonic flow meters
    - Distribution Stations (100% implemented) – Electromagnetic flow meters
    - Consumer metering
      - Consumers having connection sizes more than 0.5” are metered
      - All Industrial connections are metered (Electromagnetic

WATER CONSERVATION PRACTICES

- Promoting Rain water harvesting system for ground water recharging
  - As per DCR – Gujarat, it is mandatory to install RWH in all new development permission for High rise building and plot area more than 4000 m^2.
  - Rebate scheme for Rain Water Harvesting
    - Residential societies, apartments
    - Industrial units
    - Open plots
    - Subsidy offered by SMC for People participation – 50% of actual amount or Rs. 2000/- (whichever is less).
  - SMC's own premises/ buildings -198 Nos 6" to 8" dia. RWH completed till date.

Water Conservation – IEC Activity

- IEC Activities related to Water Conservation
  - Designing & Execution of campaign
  - Awareness program for water conservation
  - Seminar, Workshop
  - Survey



Water Conservation – IEC Activity

- Imparting Education: Visit of
  - School going Children to all water works on continuous basis
  - Colleges
  - NGOs

SLB – Water Supply
Target Vs. Achievement FY 2012-13 (Till Dec 2012)

Performance Indicator	Target 2012-13	Achievement 2012-13 till Dec-2012	Service Level Benchmark
Coverage	93%	94.2%	100%
Per Capita Supply of Water	140 lpcd	140 lpcd	135 lpcd
Extent of Metering	5.8%	2.4%	100%
Extent of Non-revenue Water	Can be known after Water audit results.		15%
Continuity of water supply	3.5 Hours	3.5 Hours	24x7
Eff. in redressal of customer complaints	95%	98.5%	80%
Quality of Water Supplied	99.5%	99.9%	100%
Cost Recovery	100%	100%	100%
Eff. In Collection of Water Charges	88%	90%	90%

Water Supply : Challenges of 21st Century

- To reduce sole dependency on surface source water, SMC has planned in the direction of alternate source of water in following ways;
  - Construction of 2 Radial collecting wells in river bed
  - Construction of Balloon Barrage on the downstream of existing weir on river Tapi to create a water reservoir.
  - Laying of pipeline from Kakrapar to Surat

Water Supply : Challenges of 21st Century

- To maintain the financial self sustainability by 100% recovery of O&M Cost by;
  - 100% metering
  - Creating public awareness for willingness to pay for the service of water.
  - Regular revision of water charges
  - Reducing NRW & UFW below 20%
  - Encouraging PPP model for comprehensive O&M of 24x7 water supply system

Water Supply : Challenges of 21st Century

- To cope up with haphazard rapid urbanization on the outskirts of the city;
  - Comprehensive Water Supply Master Plan is prepared for long term – up to year 2041
  - Synchronized Water Supply Planning in Coordination with Urban Development Authority for the area surrounding the city.
- Better Water Supply Management by
  - Utility Mapping in GIS (in progress)
  - Phase-wise Implementation of 24x7 water supply system
  - Technological up-gradation like SCADA for whole water supply system (presently it is already installed at Water Works)

Surat : Sewerage System

Sewerage Scenario in Surat

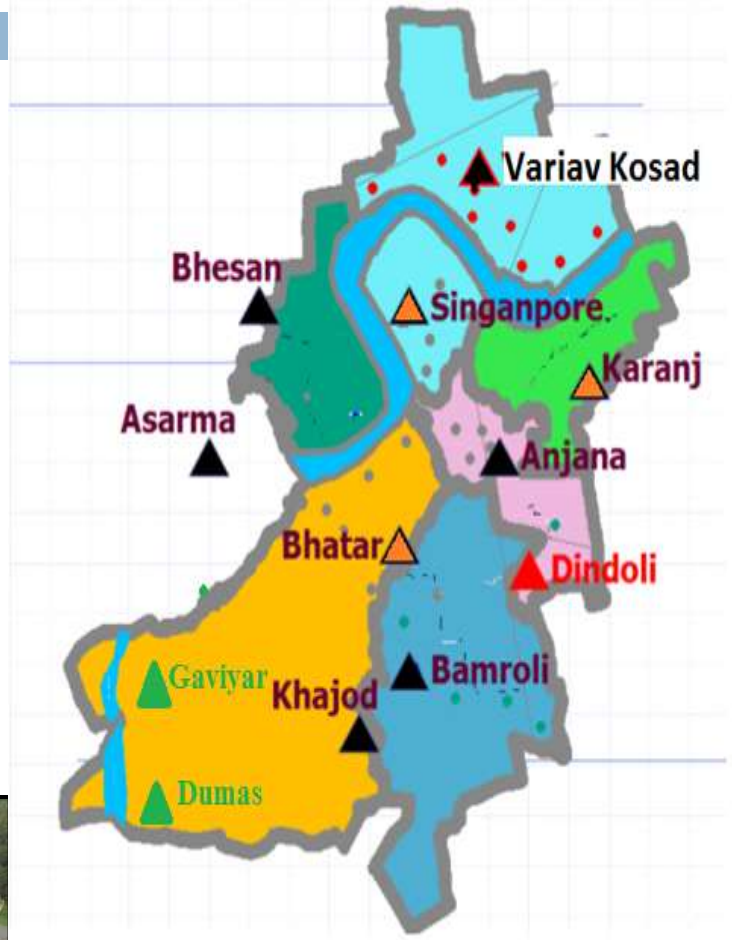
	Year 2012-13	Year 2014
Coverage	149 sq. km. (i.e. 76 % of present habitable area & 92 % of total Population)	204 sq.km. (i.e. 100 % of present habitable area)
Length of sewer network	1428 km.	~ 1600 km.
Sewage Pumping Stations	35 Nos (1483.78 MLD)	58 Nos (1949.98 MLD)
Sewage Treatment Plants	9 Nos. (726.5 MLD)	12 Nos (992.50 MLD)

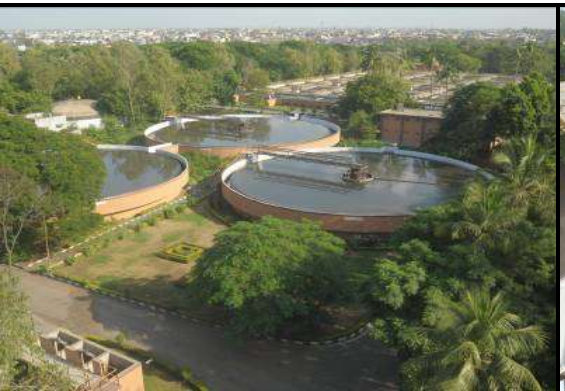
Sewerage Zones and STPs

Total Existing Sewage Treatment Plants 9 nos.

Total Existing Capacity :726.5 MLD

- **STP Under Augmentation– 3 Nos. –150 MLD**
- **STP Under Construction – 1 Nos.–66 MLD**
- **STP Under Planning– 2 Nos.–53 MLD**





Preparing for Urban Challenges in 21st Century – Sewerage

- Sewage Treatment Plants : Utilization of Latest Technologies
  - compliance with the Discharge Norms of GPCB for Sewage Treatment
- Cost Effective Implementation : Sewage Pumping Station and Rising (Pumping) Main
- Energy Efficiency Reforms
  - Sewage Gas Based Power Plant
  - Carbon Credit : Clean Development Mechanism
- SCADA and Automation
- PPP Initiatives
  - Common Effluent Treatment Plant
  - Wastewater Recycling Project
- Efficient O&M Practices for Sewerage System

Sewage Treatment Plants : Utilization of Latest Technologies

Sr. No	STP Location	Year of commission	Capacity (MLD)		Process
			Design	Utilizing	
1	Anjana	1995	82.5	85	Conventional Activated Sludge
2	Bhesan	1995	100	70	Conventional Activated Sludge
3	Bhatar	1999	120+42	108	Conventional Activated Sludge+ SBR technology
4	Karanj	1999	100	98	Conventional Activated Sludge
5	Singanpore	2003	100+55	100	Conventional Activated Sludge+ SBR technology
6	Bamroli	2002	100	65	UASB + Extended Aeration
7	Asharma	2009	15	8	Moving Bed Bio Reactor
8	Khajod	2009	25	15	Moving Bed Bio Reactor
9	Variav-Kosad	2012	84	35	UASB + Moving Bed Bio Reactor
10	Dindoli	Under execution	66	--	Conventional Activated Sludge
TOTAL			**726.5 +163**	**584**	

Sewage Pumping Stations

- Submersible Type Sewage Pumping Station
  - Use of High Efficiency Sewage Submersible pumps
  - Only Wet-Well is required – No Dry Well – Cost of Civil Construction and construction time is reduce substantially

Green Energy Generation

Sewage Gas Based Power Plants

GAS SUCTION BLOWERS

H_2S SCRUBBER SYSTEM

SEWAGE GAS HOLDER

ENGINE FEEDING BLOWER

ENGINE-GENERATOR SET

FLARE STACK

Initiatives

Sewage Gas Based Power Plant:

- First Sewage Gas to Electricity Generation at Anjana Sewage Treatment Plant of 0.5 MWe capacity was set up in 2003.
- 3 another Sewage Gas based power plants each of 1 MWe capacity were commissioned in 2008.
- Additional two sewage gas based power plants each of 0.55 MWe and 0.75 MWe are installed and on verge of commissioning.
- The total electricity generated till Dec 2012 from sewage gas is
  - 3.87 Crore units
  - worth Rs. 17.96 Crore

Carbon Credit:

- The proposal to get the carbon credit from 3 Sewage Gas Based Power Plant is approved by Ministry of Environment & Forest and is under process for validation and project registration at UNFCCC. It is estimated that the project would generate 58586 CER (Certified Emission



Energy Efficiency
Total Energy Savings in Sewerage System

- Through Energy efficiency measures and Green Energy Generation through Sewage Gas has resulted the total savings of
  - 68.7 Lac unit per annum
  - Rs. 3.18 Crores/ annum

Initiatives

SCADA (Supervisory Control And Data Acquisition)

- On existing 23 SPS and 6 STPs at project cost of Rs. 33 cr.
- On line Data Monitoring and Controlling.
- Advance Planning for preventive maintenance and reduced break down period
- On line electrical data to be used to improve energy efficiency and energy audit

PPP Initiatives

PPP Initiatives

Common Effluent Treatment Plant (CETP)

- **Estimated Cost : Rs. 119.00 Crores**
- **Project Components**
  - **Wastewater Collection Network – 21 km**
  - **Pumping Station - 140 MLD**
  - **Conveyance Line - 3.5 km**
  - **CETP - 100 MLD**
- **Public Private Partnership :**
  - **Expenditure for Wastewater Collection Network, Pumping Station and Conveyance line will be borne by SMC**
  - **Expenditure for CETP will be borne by Pandesara Industries.**
- **Commissioned in January 2011**

PPP Initiatives

Common Effluent Treatment Plant (CETP)

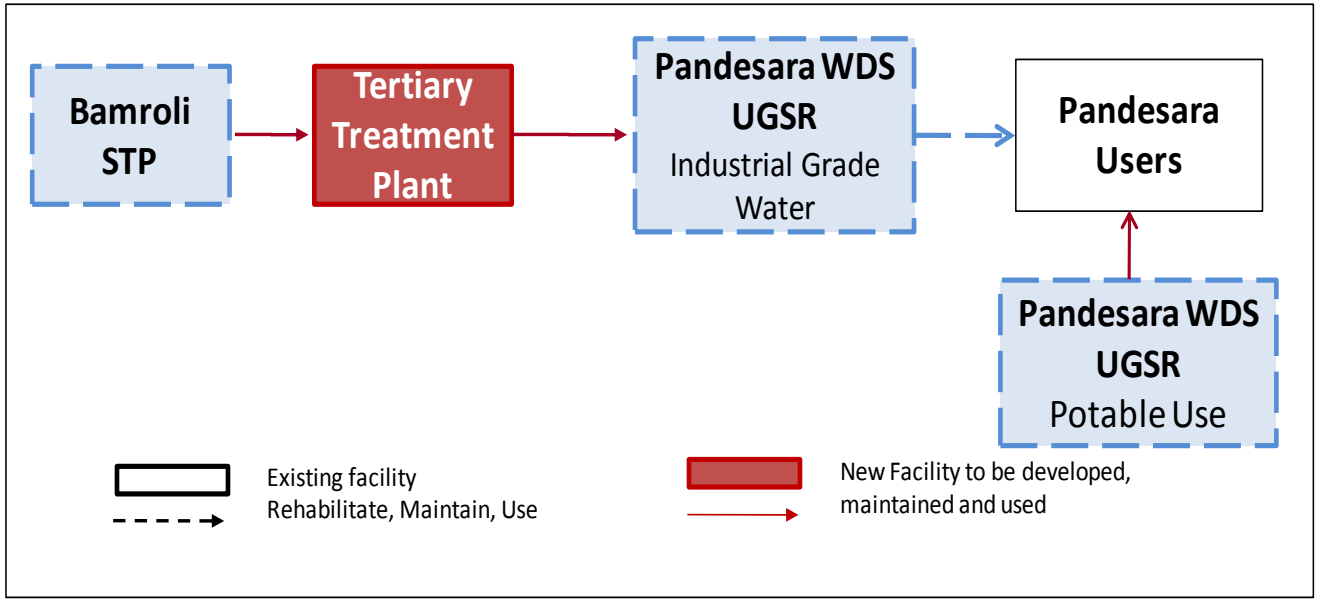
Effluent Pumping Station

Common Effluent Treatment Plant (CETP)

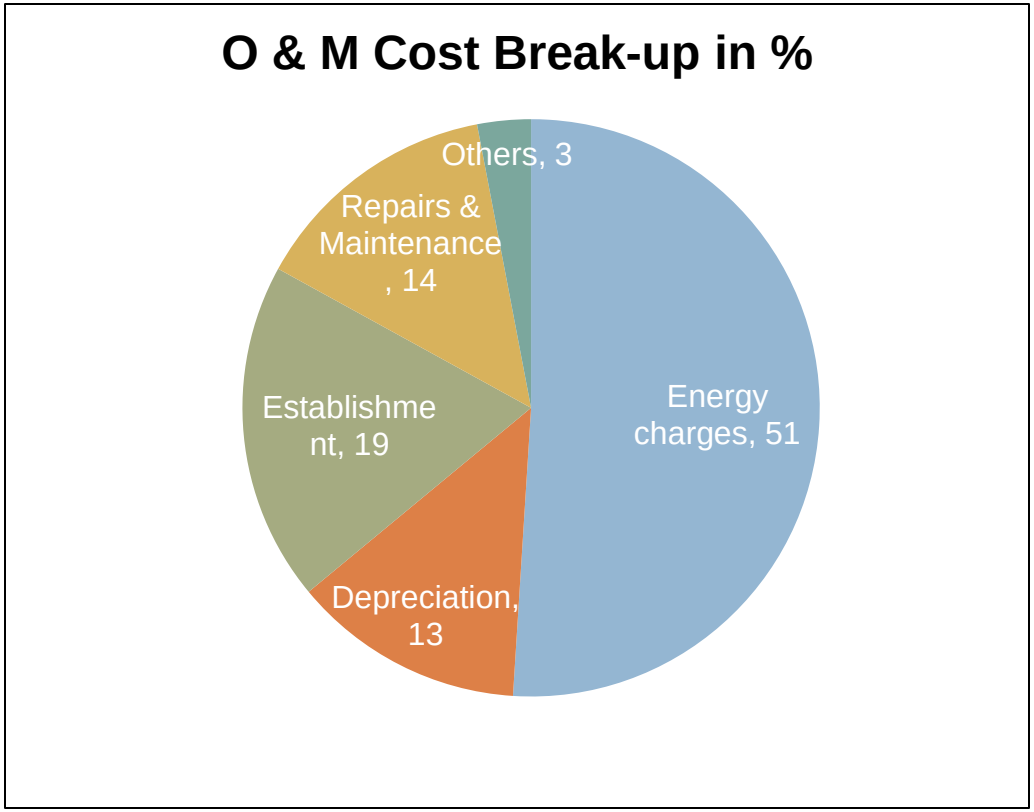
Initiatives – Waste Water Recycling Project

Tertiary Treatment Plant

- 40 MLD Industrial Grade Tertiary Treated Water supply to Industries at Pandesara GIDC from Bamroli STP is under execution.
- Commissioning of this project will help to reduce the load on drinking water resources.



Operation and Maintenance Cost – Sewerage System FY 2011-12



- Total Energy Cost is Rs. 23.50 Crore
- Recurring Energy Saving by all means is Rs.3.18 Crore.
- Hence, through energy savings measures, 13.53% savings towards Electricity cost is realized

Total O&M Cost : Rs.46.02 Crore

SLB – Sewerage
Target Vs. Achievement FY 2012-13

Performance Indicator	Target 2012-13	Achievement 2012-13 (till Dec-12)	Benchmark
Coverage of Toilets	98%	92%	100%
Coverage of Sewerage Network	98%	92%	100%
Collection efficiency of Network	96%	100%	100%
Adequacy of Sewage Treatment	100%	100%	100%
Quality of Sewage Treatment	96%	92.28%	100%
Extent of reuse and recycling of Sewage	2.5%	2.29%	20%
Efficiency in redressal of customer complaints	95%	98%	80%
Cost Recovery	100%	95%	100%
Eff. In Collection of Sewage Charges	88%	90%	90%

Sewerage: Challenges of 21st Century

- To cope up against the challenge of rapid urbanization; following points are planned;
  - No disposal of sewage to be allowed in open gutter/ Nallah /ground by covering 100% city area under sewage network.
  - Reuse & Recycle of sewage (zero disposal concept)
  - Protection of water bodies/ ground water against pollution
  - Conservation of ground water quality & quantity
  - Controlled generation of sewage by imposing sewage tax
  - To enhance public awareness about ill-effects of open defecation

Sewerage: Challenges of 21st Century

- To cope up with haphazard rapid urbanization on the outskirts of the city;
  - Comprehensive Sewerage Master Plan is being prepared for long term – up to year 2044.
  - Synchronized Planning in Coordination with Urban Development Authority.

Thank You