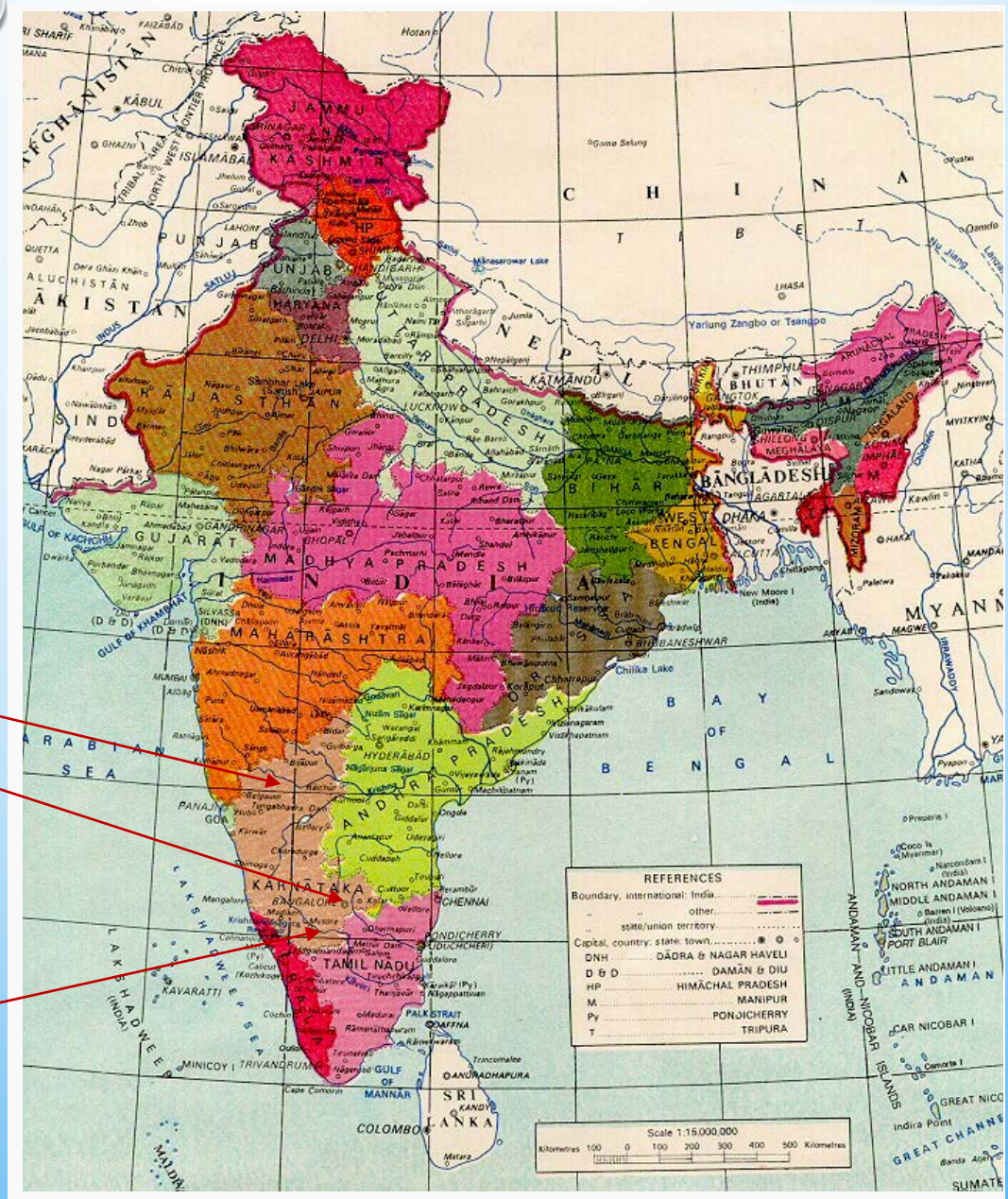




WATER RESOURCE MANAGEMENT PLAN FOR THE CITY OF BANGALORE



Mr. S Krishnappa, Engineer IN Chief
Bangalore Water Supply and Sewerage Board (BWSSB),
Karnataka State, India

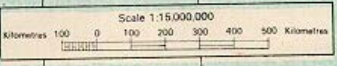


Karnataka State

Bangalore City

Cauvery River

REFERENCES	
Boundary, international:	India: ————
	other: - - - - -
	state/union territory: ······
Capital, country, state, town:	● ● ● ●
DNH	DĀDRA & NAGAR HAVELI
D & D	DAMĀN & DIU
HP	HIMĀCHAL PRADESH
M	MANIPUR
PY	PONJICHERY
T	TRIPURA





BANGALORE WATER SUPPLY AND SEWERAGE BOARD

FORMED UNDER AN ACT OF STATE LEGISLATURE ON 10-09-1964

- Jurisdiction covers Extended Bangalore Metropolitan Area of 800 Sqkm which includes
 - Bangalore Core area of 245 Sqkm
 - 8 ULD of 330 Sqkm (7 CMC AND 1 TMC)
 - 110 Villages of 225 Sqkm
- Providing water supply & sewerage network and sewage disposal systems
- Ensuring sufficient amount of domestic water supply to the required standards.
- Levying & collecting water/sanitation charges on a no loss/no profit basis.



BANGALORE WATER SUPPLY AND SEWERAGE BOARD – OUR STRENGTHS

- ✓ BWSSB is undoubtedly one of the best managed and most efficient utilities in the country– (The World Bank)
- ✓ Nearing 100% metering of consumers
- ✓ One of the lowest ratio of staff to connections
- ✓ Citizen–friendly services which included online payment of bills, consumer kiosk at various BWSSB Office locations , online facility for applying for water supply connections, etc.
- ✓ Computerized revenue billing for the water supplied and meter readers carry hand–held computers to the door step of the customer.
- ✓ Round–the–clock Public Grievance Redressal with a 24x7 call–centre equipped with Interactive Voice Response System (IVRS) and GIS based for 100 Geo tagging of locations.



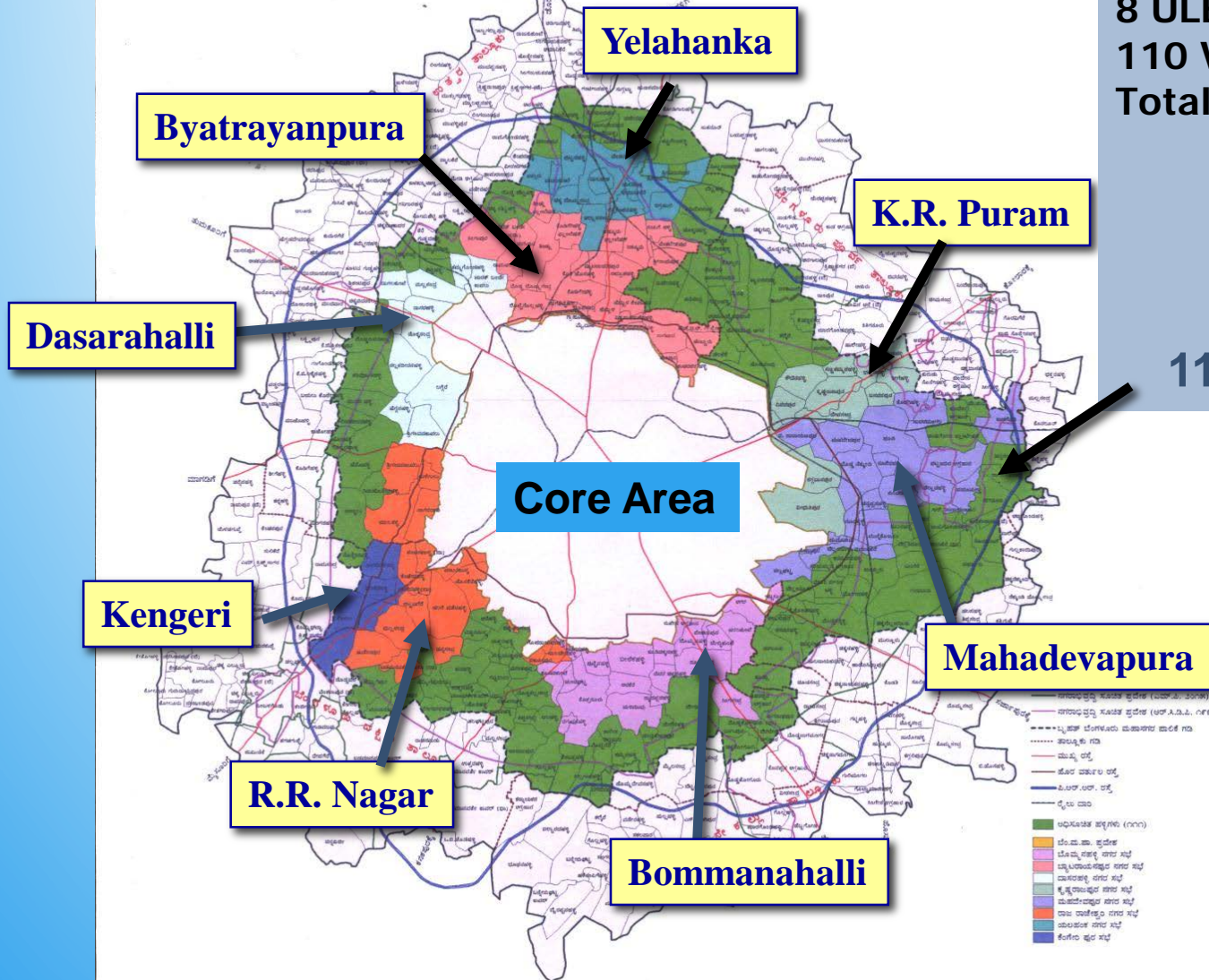
BANGALORE WATER SUPPLY AND SEWERAGE BOARD – OUR STRENGTHS

- ✓ Centralised Online Complaint Monitoring System (OCMS) has also made registration and redressal of complaints easy for the customers, and operates along with the old written complaint system
- ✓ 12 secondary and 2 Tertiary wastewater treatment plants of capacity 718 MLD
- ✓ Supervisory Control And Data Acquisition (SCADA) installed in Wastewater treatment plants and Pump houses and the same is being extended to the Distribution systems of the city for effective water management
- ✓ B.W.S.S.B Stands First in WATER SUPPLY among the Top 10 Cities as surveyed by Business Today–13/8/2006.
- ✓ Commitment to Quality – Collection of over 1,600 water samples across the city each month and tests are carried out at approved laboratories as per guidelines stipulated by the Central Public Health and Environmental Engineering Organisation (CPHEEO) and the World Health Organisation (WHO).

BWSSB Expanded Area

ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ ನಕ್ಷೆ

Core area	245 Sq. Km
8 ULB	330 Sq. Km
110 Villages	225 Sq. Km
Total	800 Sq. Km



110 Villages

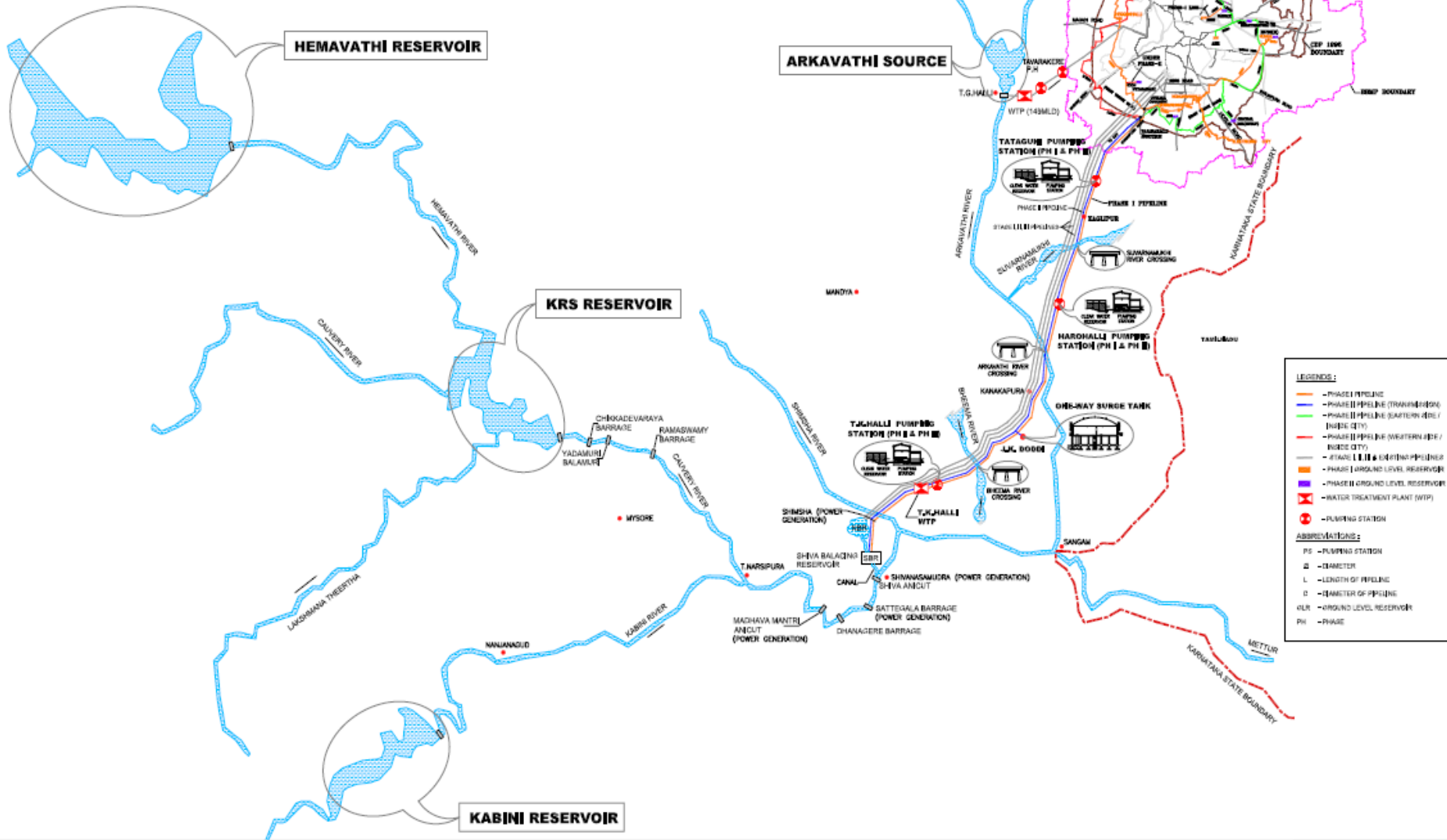
- ಸಾರ್ವಜನಿಕ ಸುರಕ್ಷಣಾ ಪ್ರದೇಶ (ಎಚ್.ಎ. 2008)
- ಸಾರ್ವಜನಿಕ ಸುರಕ್ಷಣಾ ಪ್ರದೇಶ (ಆರ್.ಎ.ಎ.ಎ. 1988)
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- ಹಿರಿಯ ಮಾರುಕಟ್ಟೆ ರಸ್ತೆ
- ಸ್ಥಳೀಯ ಮಾರುಕಟ್ಟೆ
- ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ (೧೯೯೧)
- ಹಿ.ಎ.ಎ.ಎ. ಪ್ರದೇಶ
- ಹಿ.ಎ.ಎ.ಎ. ಪ್ರದೇಶ (ಆರ್.ಎ.ಎ.ಎ. 1988)
- ಮುಖ್ಯರಸ್ತೆ ಪ್ರದೇಶ
- ಸ್ಥಳೀಯರಸ್ತೆ ಪ್ರದೇಶ
- ಮಹಾನಗರ ಪಾಲಿಕೆ ಪ್ರದೇಶ
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BANGALORE WATER SUPPLY - PREFACE

Sl. No.	Period	Year of Commissioning	Source	Site /Location	Scheme	Installed Capacity (MLD)	Present Water Supply (MLD)
1	Prior 1896	-	Dug Wells, Rain-Fed Tanks	-	-	-	-
2	1896-1933	1896	Arkavathi River (Tributary to Cauvery River)	Hessaraghatta Reservoir	Hessaraghatta Water Supply	21	-
3	1933-Present	1933	Arkavathi River (Tributary to Cauvery River)	Chamaraja Sagara Reservoir at T.G.Halli on D/S of Hesaraghatta	T.G.Halli Water Supply	149	0
4	1974-Present	1974	Cauvery River	T.K Halli	Cauvery Stage I	135	145
5	1982-Present	1982	Cauvery River	T.K Halli	Cauvery Stage II	135	145
6	1995-Present	1995	Cauvery River	T.K Halli	Cauvery Stage III	270	330
7	2002-Present	2002	Cauvery River	T.K Halli	Cauvery Stage IV, Phase-I	270	310
8	2012-Present	2012	Cauvery River	T.K Halli	Cauvery Stage IV, Phase-II	500	500

Total present Water supply is 1410 Mld

WATER SOURCES FOR BANGALORE CITY



LEGENDS:

- PHASE I PIPELINE
- PHASE II PIPELINE (TRANSFORMER)
- PHASE II PIPELINE (EASTERN AREA / INSIDE CITY)
- PHASE II PIPELINE (WESTERN AREA / INSIDE CITY)
- PHASE II PIPELINE (OUTSIDE CITY)
- PHASE II GROUND LEVEL RESERVOIR
- WATER TREATMENT PLANT (WTP)
- PS — PUMPING STATION

ABBREVIATIONS:

- PS — PUMPING STATION
- Ø — DIAMETER
- L — LENGTH OF PIPELINE
- D — DIAMETER OF PIPELINE
- GLR — GROUND LEVEL RESERVOIR
- PH — PHASE



Shiva Anicut - river Cauvery is the source of water for Bengaluru.

BANGALORE WATER SUPPLY – PROJECTED WATER DEMAND & SHORT FALL IN SUPPLY

Year	Population (Million)	Water Demand (MLD)	Water Demand (TMC)	Present Supply (MLD)	Shortfall in Demand	
					MLD	TMC
2011	9.621	1905	24.60	960	945	12.20
2015	11	2170	28.12	1410	760	9.80
2021	14.241	2820	36.40	1460	1360	17.60
2031	21.080	4174	53.90	1460	2714	35.00
2041	28.330	5610	72.40	1460	4150	53.60
2051	34.540	6840	88.25	1460	5380	69.40

Notes:

1. Water demand is taken as 150 LPCD for domestic use. 10% for Industrial demand and 20% allowance for unaccounted for water are added.
2. Increase in population is worked at 4% per annum from 2012 to 2031, 3% from 2032 to 2041 and 2% per annum from 2042 to 2051.

WATER DEMAND VS WATER SUPPLY – HUGE GAP ???

1. Rapid Urbanization and scarcity of Water Resources
2. Over Pumping – Over extraction of Ground Water
3. Crumbling Infrastructure – Storage Crunch
4. Unprecedented Population Growth
5. Pollution – Poor Industrial waste management
6. Global Warming – Chaotic Weather Problem
7. Lack of Environmental Education – Man Made crises

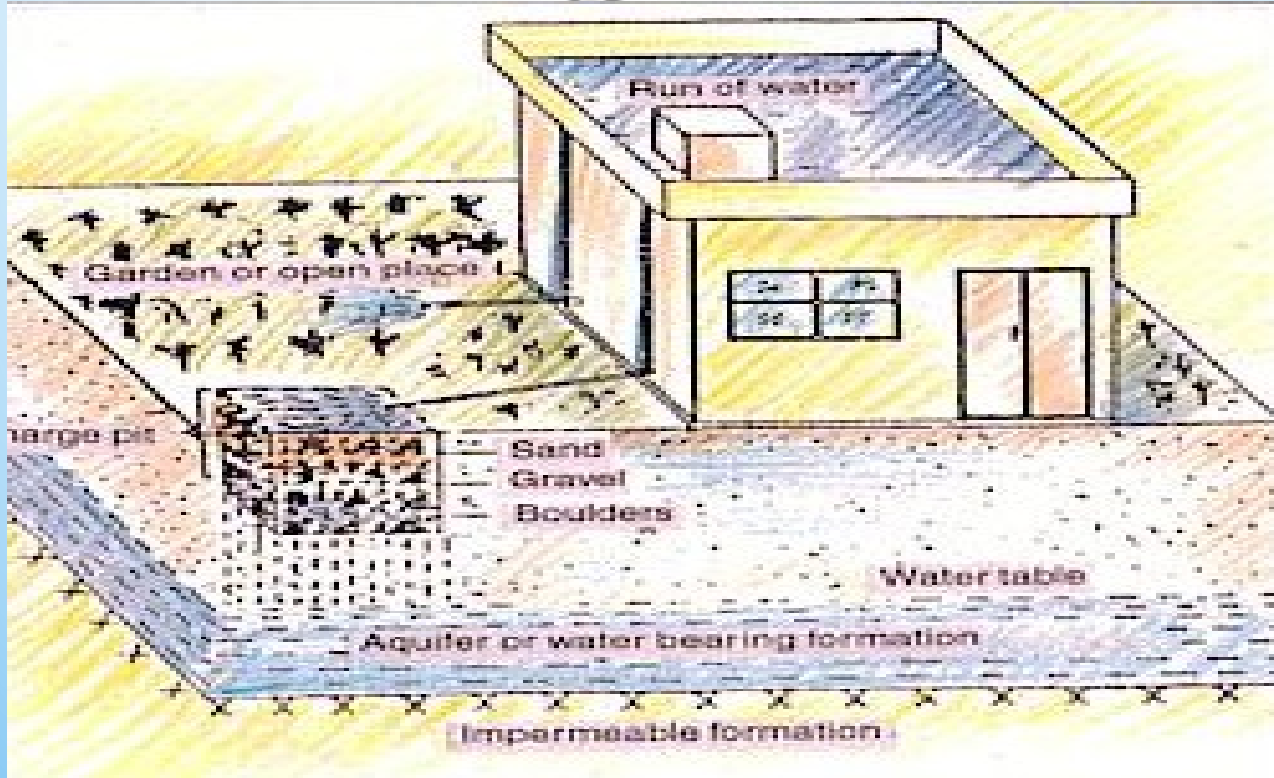
INTEGRATED APPROACH FOR MEETING FUTURE WATER DEMAND

1. An integrated approach to meet the future needs stressing not only on surface water supplies but also **ground water** with utilization of **rain water** that falls in and around Bangalore.
2. Re-use of **waste water** after treatment at the Sewage Treatment Plants for non-potable purposes and allowing some quantity of the treated effluent into the **Lakes** for dilution with rain water and percolation into the ground.
3. Rain water **Harvesting**.
4. Reduction in **Unaccounted For Water (UFW)**.
5. Laying separate pipelines for supply of water for **potable** and **non-potable** purposes.

SURFACE WATER SOURCES –OPTIONS

- RIVER CAUVERY IS MAIN SURFACE WATER SOURCE FOR BANGALORE CITY. PRESENT ALLOCATION IS (19 TMC +10 TMC) 29 TMC. DRAWAL OF ADDITIONAL WATER FROM THE RIVER CAUVERY WITHIN THE FRAME WORK OF THE CAUVERY WATER DISPUTES TRIBUNAL AWARD IS DIFFICULT.
- INTER BASIN TRANSFER–TRANSFERRING WATER FROM WEST FLOWING RIVER (NETHRAVATHI) TO EAST FLOWING RIVER, CAUVERY BASIN.
- LARGE AMOUNT OF WATER DURING 3 TO 4 MONTHS OF MONSOON PERIOD FLOWS IN TO SEA. THIS WATER COULD BE TRANSFERRED TO EAST FLOW RIVER BASINS AND STORED AND USED. BECAUSE OF ENVIRONMENTAL ISSUES IMPLEMENTATION IS STOPPED.

Rainwater Harvesting



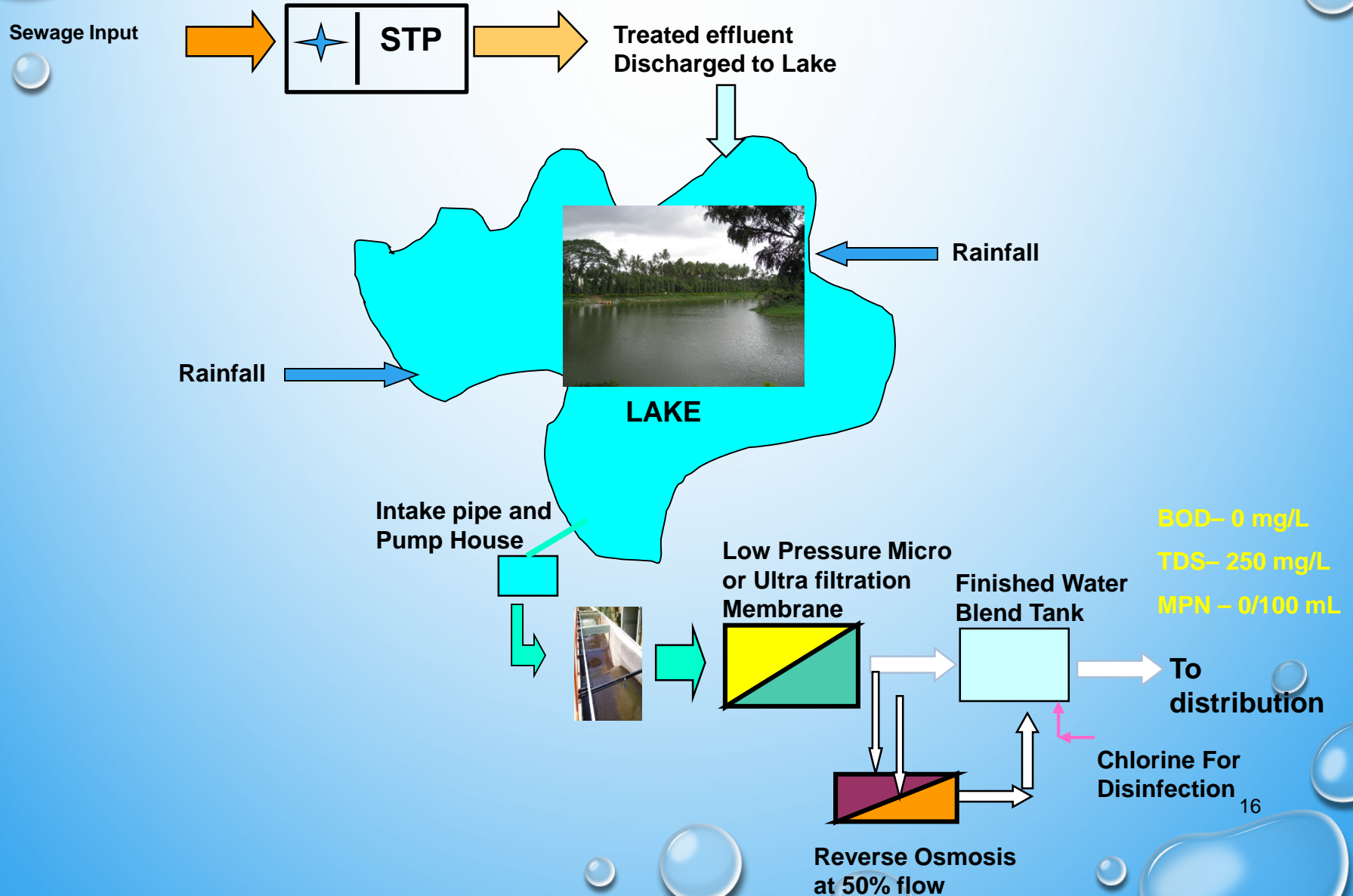
BWSSB has made mandatory for all buildings in Bangalore to have Rainwater Harvesting System

WASTEWATER MANAGEMENT SYSTEM

Recycle and Reuse of Treated Waste Water

- Existing Capacity of Sewage Treatment plants – 721 Mld
- Sewage Treatment Plants Proposed under Phase-II – 520 Mld
- Total Capacity of Sewage Treatment plants – 1241 Mld

TYPICAL TREATMENT SCHEME FOR LAKE WATER



WASTEWATER MANAGEMENT SYSTEM

Existing Waste Water Treatment Plants

Sl. No.	Location	Capacity in MLD	Treatment Facility
1.	Vrishabhavathi Valley	180	Secondary - Trickling filters
2.	K & C Valley I	248	Secondary: Activated sludge process
3.	Hebbal Valley	60	Secondary: Activated sludge process
4.	Madivala	04	Secondary: UASB + oxidation ponds+ constructed wetlands
5.	Kempambudhi	01	Secondary: extended Aeration
6.	Yelahanka	10	Activated sludge process + filtration+ chlorination (Tertiary)

WASTEWATER MANAGEMENT SYSTEM

Existing Waste Water Treatment Plants

Sl. No.	Location	Capacity in MLD	Treatment Facility
7.	Mylasandra	75	Secondary - Extended aeration
8.	Nagasandra	20	Secondary - Extended aeration
9.	Jakkur	10	Secondary - UASB + Extended aeration
10.	K. R. Puram	20	Secondary - UASB + Extended aeration
11.	Kadabeesanahalli	50	Secondary - Extended aeration
12.	Rajacanal	40	Secondary - Extended aeration
13.	Cubbon Park	1.5	Membrane
14.	Lalbagh	1.5	Extended Aeration + Plate Settlers + UV disinfection
Grand Total		721	

WASTEWATER MANAGEMENT SYSTEM

TERTIARY TREATMENT PLANTS

Plant Name	Capacity (Mld)	Current Supply
Yelahanka	10	Arvind Mills and other industries for non – potable uses
Vrishabhavathi	60	Supplied to International Airport, BEL, Rail Wheel Factory, ITC, IAF and other industries
Cubbon Park	1.5	Supplied for land scape irrigation of the parks
Lalbagh	1.5	Supplied for land scape irrigation of the parks
Total Capacity at Present	74	

VRISHABHAVATHI VALLEY TERTIARY TREATMENT PLANT



H₂O

Wastewater Management System



17 13:08
PLANT LAYOUT OF
YELAHANKA 10MLD WWTP



20 2 2004

The background is a light blue gradient with several realistic water droplets of various sizes scattered across the top and bottom edges. The droplets have highlights and shadows, giving them a three-dimensional appearance.

Ongoing / Proposed Works of Bangalore Water Supply and Sewerage Board

ONGOING PROJECTS OF BWSSB – MAJOR PROJECTS

Sl.No	Name of the Project	Project cost (Rs. Million)
1	Improvement to Distribution system, Reduction in UFW & Leakage Control –3 Divisions,(South, West and Central)	6540 (109 Mn. US\$)
2	Slum Development Component –Implementation of Water Supply and Sanitation Facilities–96 Slums in Phase-I	560 (9.3 Mn. US\$)
3	Construction of 11 Sewage Treatment Plants (STPs) and 5 Intermediate Sewage Pumping Stations (ISPS).	10070 (168 Mn. US\$)
4	Procurement, Fabrication, and Laying of Additional Raw Water Pipeline from Forbes Sagar to existing gravity mains at Netkal Balancing Reservoir.	690 (11.5 Mn. US\$)
5	Work of Providing Water Supply Facilities to CMC and TMC of BBMP under GBWASP Scheme	6580(15 Mn US\$)
6	Providing underground drainage facilities to the erstwhile CMC and TMC of BBMP under KMRP Scheme	9500(21 Mn US\$)
7	Environmental Action Plan – B: Replacement/ rehabilitation of 76 Kms of trunk sewers for collection and delivery of additional 150 MLD of wastewater into STPs. The work is expected to be completed in 2016	

ONGOING PROJECTS OF BWSSB – OTHER PROJECTS

Sl.No	Name of the Project
8	Hebbal STP Zero flow scheme : Replacement/ rehabilitation of 19 Kms of trunk sewers to establish zero flow in the SWD upto Hebbal and Nagavara Lake. This will result in full usage of Hebbal STP with additional input of 40 MLD.
9	Environmental Action Plan - C: •Replacement/ rehabilitation of 174 Kms of the trunk sewers out of 300 KMs of existing sewers to increase in flow to the treatment plants will be about 120 MLD.
10	Raw Water M.S Transmission System from Shiva Balancing Reservoir to T. K. Halli. (15.90 KM)
11	Electro–Mechanical equipment's, pump houses and pure water tanks at T. K. Halli, Harohalli & Tataguni.
12	Supervisory Control and Data Acquisition System for Water Supply Treatment Plants, Sewage Treatment Plants and Pumping Stations
13	Civil and Electro–mechanical works for 7 Reservoirs (total 152 ML) in Bangalore City (2 Packages).
14	Construction of 11 Sewage Treatment Plants at different places in the City under 7 Contract Packages to treat 339 MLD of Sewage Water.

ONGOING PROJECTS OF BWSSB – OTHER PROJECTS

Sl.No	Name of the Project
15	Replacement / Rehabilitation of existing Sewer Lines in the city (10 Packages – 45 Kms)
16	Providing sewerage system in erstwhile areas of 7 CMCs & 1 TMC under Karnataka Municipal Reforms Project (KMRP)
17	Providing water supply and UGD facilities to SMV Layout 1 to 9 Blocks of BDA, Bangalore under Deposit Contribution works of BDA
18	Providing Water Supply Facilities to Further Extension of Anjanapura BDA Layout under Deposit Contribution works of BDA
19	Providing UGD Facilities to Further Extension of Anjanapura BDA Layout under Deposit Contribution works of BDA
20	Construction of 40MLD Tertiary treatment plant at KIADB Ind. area near Devanahalli.
21	Work of supplying and laying of 700mm dia GRP raising main from Raja Canal STP to TTP at IT park Ind. area near Devanahalli.

ONGOING PROJECTS OF BWSSB – OTHER PROJECTS

Sl.No	Name of the Project
22	Work of supply of 60MLD Tertiary treated water from BWSSB V valley treatment plant to KPC combined cycle power plant at Bidadi
23	Work of supply of 15MLD tertiary treated water from Jakkur STP to KPC Gas Based Power plant at Yelahanka
24	Helium Gas Based Hidden Leak Detection Technology in Four subdivisions which are not covered under current UFW projects – Awarded to M/s Suez Environment India Pvt Ltd Project.
25	Tie-up with Mitsubishi Research Institute (Japan) for disseminating JAPANESE Technologies for water Leak Detection using L-sign Leakage Monitoring System at free of cost in E-1 Subdivision
26	Preparation of Comprehensive Vision and Strategic Master Plan for Water Supply, Sewerage System, and Asset Management, up to 2050 for Bangalore including BBMP areas– Awarded to M/s CH2MHILL India Pvt Ltd.
27	Harnessing of Rain Water from Urban Catchment in V-Valley Drainage Zone to Augment Water Supply to Bangalore – LOA is issued to M/s CH2MHILL India Pvt Ltd.
28	Singapore Programme – Co-operation between SCE/Temacik Foundation & BWSSB on Developing Capabilities For Alternate Sources of Water through Recycle and Reuse of Treated Wastewater in V Valley for BWSSB

PROPOSED PROJECTS OF BWSSB – MAJOR PROJECTS

Sl. No	Name of the Project	Project cost (Rs. Mln)
1	Improvement to Distribution system, Reduction in UFW & Leakage Control –3 Divisions,(East, South–East and North)	7170 (120 Mn. US\$)
2	Cauvery Water Supply Scheme, Stage–V, Phase–I (500Mld)	23370 (390 Mn. US\$)
3	Implementation of Water Distribution and Sewerage System in 110 Villages around Bangalore	48780 (813 Mn. US\$)
4	Slum Development Component –Implementation of Water Supply and Sanitation Facilities–68 Slums in Phase–II	460 (7.7 Mn. US\$)
5	Construction of New Water Treatment Plant of 300 Mld in lieu of Existing CWSS Sate I and II at T K Halli	1420 (23.7 Mn. US\$)
6	Additional 520 MLD waste water following treatment plants are proposed at V Valley (150 MLD), Bengaluru University (60 MLD), Doddabele (40 MLD), K & C Valley (150 MLD), Hebbal (100 MLD) and K R Puram (20 MLD)	

PROPOSED PROJECTS OF BWSSB – MAJOR PROJECTS

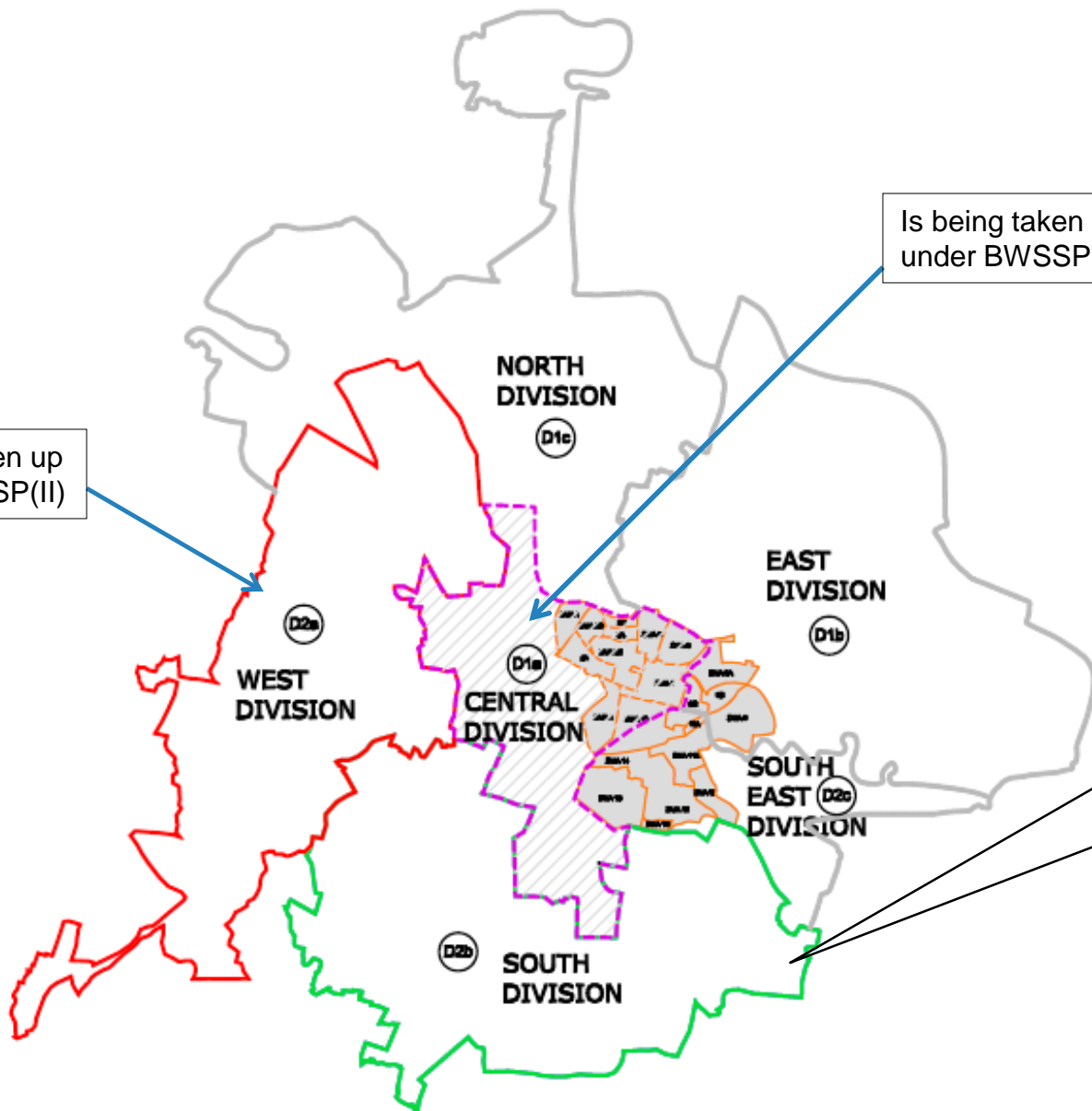
Sl. No	Name of the Project
7	Providing Water Supply to Hoskote Town (1.3 MLD)
8	Providing Water Supply to Harohalli Village (1.5 MLD)
9	Providing Water Supply and Sewerage System for the 110 Villages of the BBMP
10	Work of Construction of 11.50 ML Capacity GLR at 6th Block of SMV Layout of BDA
11	Work of Construction of 11.50 ML Capacity GLR at 8th Block of SMV Layout of BDA.
12	Work of Providing Water Supply facilities to Further Extension of Banashankari 6th Stage, BDA Layout.

DISTRIBUTION IMPROVEMENT AND UFW REDUCTION PROJECT



Is being taken up under BWSSP(II)

Is being taken up under BWSSP(II)



South Division is being implemented under JICA fund

Cauvery Water Supply Scheme, Stage –V

- Additional 10 TMC is allocated from Cauvery river to Bangalore city by GOK (letter no WRD/60/MMK/2013,dated: 02/01/2014) for supplying water to 110 villages which are part of BBMP.
- GOK (GO No UDD/269/MNI/2010, dated: 02/12/2010) accorded administrative approval to take up water supply and sanitation facilities in those 110 villages.
- Water Supply Demand of 110 Villages

Year	Population (Million)	Water Demand (Mld)
2021	1.72	330
2031	2.75	498
2041	3.45	670

Implementation Plan of BWSSB

- Cauvery Water Supply Scheme, Stage –V, Phase–I (500 Mld)
- Cauvery Water Supply Scheme, Stage –V, Phase–II (270 Mld)
- Estimated project cost of Stage–V, Phase–I is Rs. 23370 Million

AWARDS AND RECOGNISATIONS

1. OIL CONSERVATION AWARD (2000–2001) FOR EXEMPLARY WORK IN ENERGY CONSERVATION IN LARGE PROJECT CATEGORY BY THE MINISTRY OF PETROLEUM & NATURAL GASES, PETROLEUM CONSERVATION RESEARCH ASSOCIATION
2. SPECIAL ACHIEVEMENT IN GIS (2004) AWARDED BY ESRI USER CONFERENCE ON AUGUST 2004, SAN DIEGO, CALIFORNIA
3. RAJIV GANDHI ENVIRONMENT AWARD (2004– 2005) AWARDED BY THE FOREST, ENVIRONMENT & ECOLOGY DEPARTMENT, GOVT OF KARNATAKA, FOR WATER CONSERVATION, REUSE, TREATMENT & SCIENTIFIC DISPOSAL OF WASTE WATER IN PROTECTING ENVIRONMENT
4. GOLDEN PEACOCK AWARD FOR INNOVATIVE PRODUCT /SERVICES (2003)
5. SILVER ICON AWARD (2003) AWARDED BY GOVERNMENT OF INDIA FOR EXEMPLARY PERFORMANCE IN E–GOVERNANCE INITIATIVES
6. NATIONAL URBAN WATER AWARD IN FINANCIAL REFORMS CATEGORY (2009) FOR REVENUE BILLING & COLLECTION SYSTEM
7. URBAN SECTOR BEST PRACTICES AWARD (2009–2010) BY GOVERNMENT OF KARNATAKA FOR COMPUTERIZATION OF REVENUE BILLING & COLLECTION SYSTEM
8. NATIONAL URBAN WATER AWARD (2011–2012) UNDER CITIZENS SERVICE & GOVERNANCE CATEGORY BY GOVERNMENT OF INDIA FOR SIR MV RAIN WATER HARVESTING THEME PARK

The background is a light blue gradient that transitions from a slightly darker blue at the bottom to a lighter blue at the top. In the corners, there are several realistic-looking water droplets of various sizes, some with highlights and shadows, giving them a 3D effect.

THANK YOU