Living Rivers, Dying Rivers – Indian International Centre Lecture Series

Living Waters: Cauvery

Stuffed Rivers: Vrishabhavathi-Arkavathi

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Cauvery

She craved to serve humanity, but her husband Sage Agasthya, did not want her out of his sight.

Turning her into sacred waters, he carried her everywhere he roamed, in his Kamandala.

Claustrophobic, unwilling to suffer such bondage, Cauvery prays to be set free.

Naughty Ganesha descends as a crow and gamefully knocks over the Kamandala, spilling Cauvery.

With boundles joy she flows to fulfill her desire to become the breath of life.

Celebrating life, Revering Cauvery

Kings bequeathed land along her banks to attract the best talent.

Her waters fertilise fields and forests, a lifeline to millions.

Revered everywhere she flows, exemplified by countless temple towns that are littered on her shores.

Replete with life, memories and stories, a very River of Life.

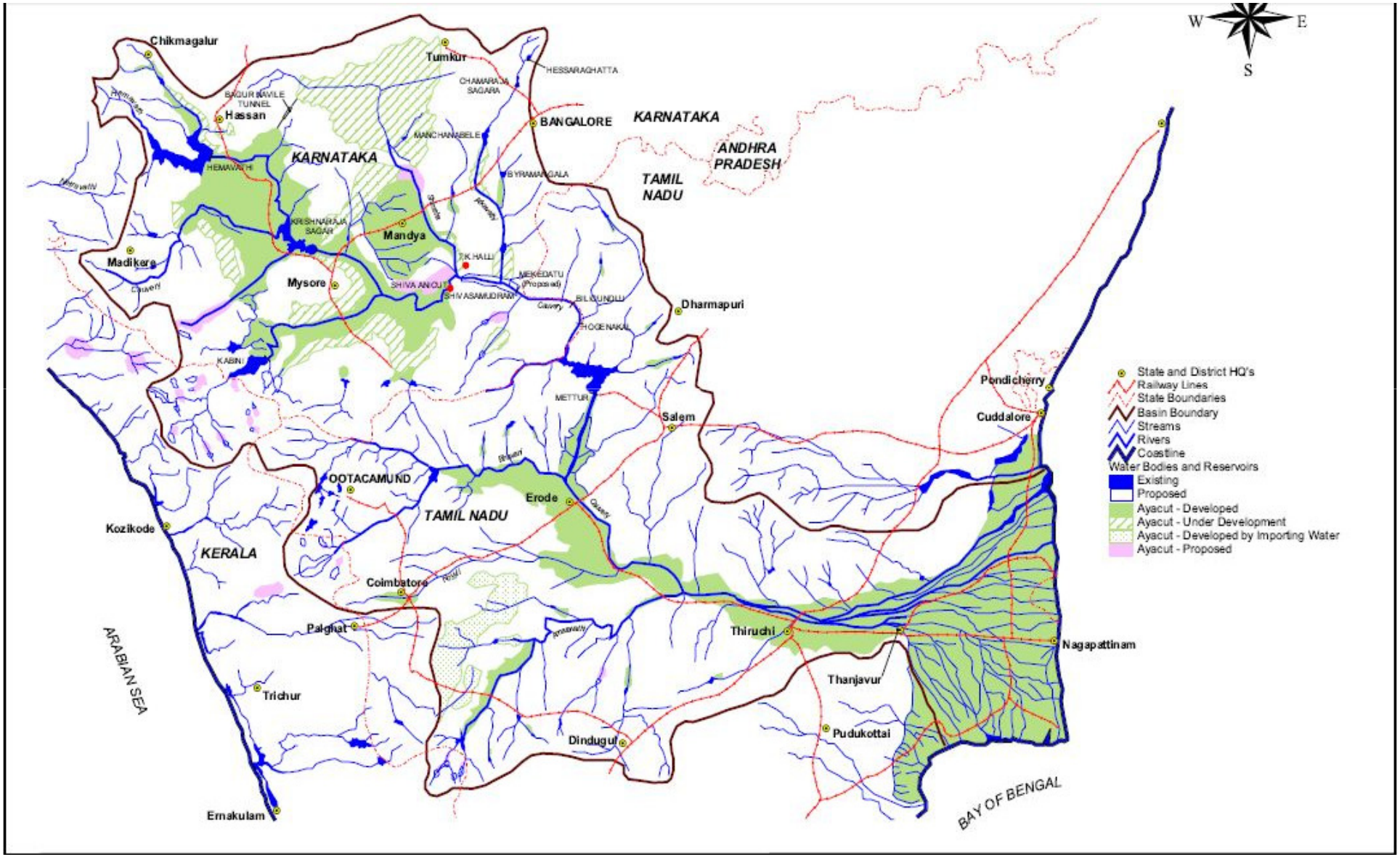
Cauvery's waters

Cauvery's flow is augmented by her many tributaries: Kabini, Kapila, Hemavathy, Shimsha, Lokapavani, Arkavathy, Bhavani and many others.

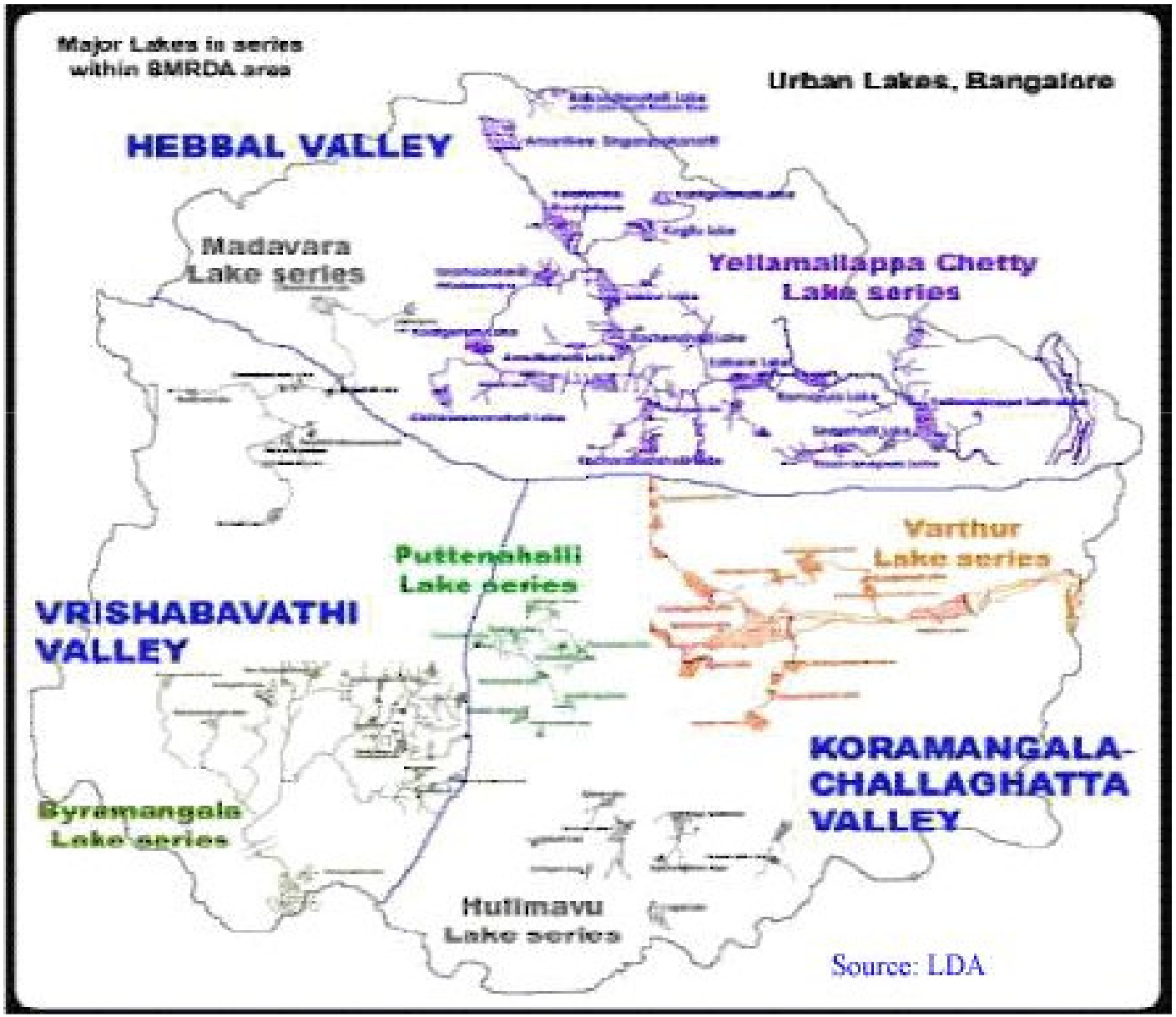
Each of these tributaries draws waters from an intricate nework of tanks.

Together they enhance river flow that improves supplies for farming and urban supply.

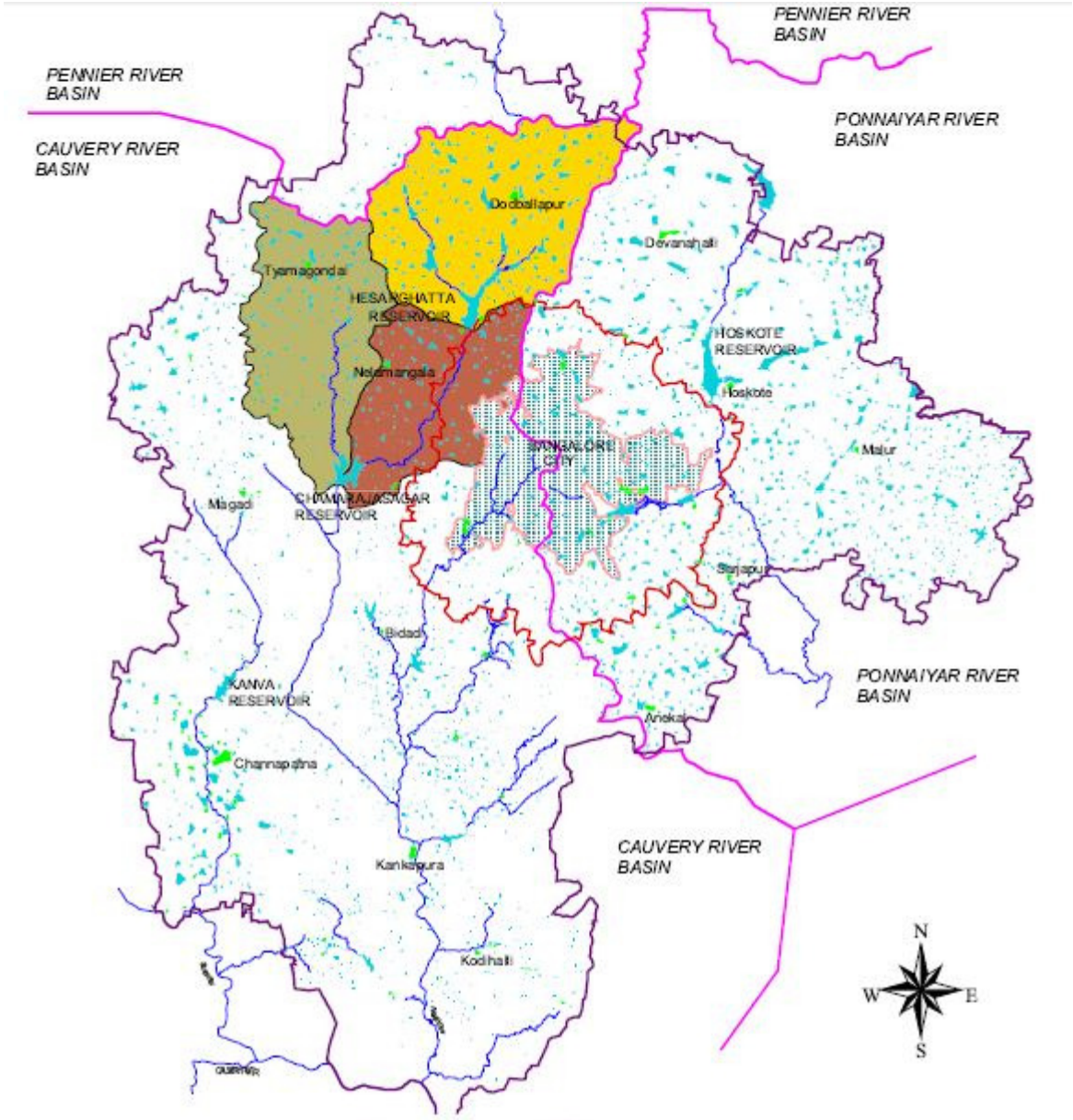
Cauvery Basin



Bengaluru Drainage Pattern



Greater Bangalore Watershed



Sacred origins of Vrishabhavathi

An inscription on the 17th century Nandi in Bangalore mentions the place as the source of a river.

Vrishabhavathi, (*Vrishaba*, Bull)**,** it is claimed, flows underground for a while before emerging as a proper rivulet.

That flow now, hardly resembles living waters .

Birth place of Vrishabhavathi today

Kempabudhi tank that feeds Vrishabhavathi

Revering Vrishabhavathi's splendour?

Sri Vyasaraya of Channapattana, philosopher-saint and Rajguru of the Vijayanagar Empire, was enamoured by Vrishabhavathi's grandeur.

In reverence, he established Gali Anjaneya temple in 1425, at the convergence of Vrishabhavathi with Suvarnamukhi south west of Bengaluru.

Today, the river is full of Bangalore's sewage, which seasonally spills into the temple.

Vrishabhavathi's banks are heavily urbanised and industrialised

Vrishabhavathi or
V*ishabhavathi*?

Vrishabhavathi that once breathed life to the region, is now a toxic river.

Its putrefying, dying waters carrying Bangalore's refuse feed Arkavathy which soon after joins Cauvery.

Vrishabhavathi passes through Sewage Treatment Plants

A costly clean-up that fails to deliver

Largely untreated waters of Vrishbhavathi enters Byramangala tank which irrigates vegetable gardens, orchards, paddies, ragi and sugarcane fields

Byramangala Tank

Dark, Heavy, Toxic, Vishabhavathi!

A large bird population feed off the toxic waters

Vrishabhavathi Ground Water Averages from 30 Samples

Table 2: Maximum, minimum and average concentrations of critical parameters and BIS permissible limits

No.	Parameter	Maximum	Minimum	Average	BIS limits
1	p^H	8.42	6.55	7.40	6.5to 8 .5
2	Chlorides	1338	60	320.63	1000
3	TDS	2850	200	921.77	2000
4	Total Hardness	1960	70	563.67	600
5	Calcium	386	15	137.83	200
6	Magnesium	249	08	52.63	100
7	Nitrate	157	05	47.6	50
8	Sulphate	216	10	54.17	400
9	Fluoride	2.5	nil	0.87	1.50
10	Iron	1.24	Nil	0.225	1.0

Vrishabhavathi flows dark and toxic for miles and miles

Vrishabhavathi, joins Arkavathy, and together they feed Cauvery

Growing migration to cities

Farming distress, low yields and crop failures are causing massive migration into cities.

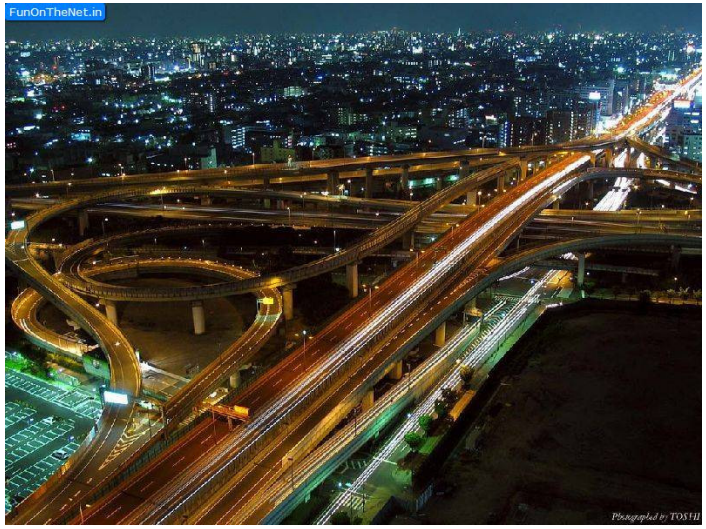
Pollution is making farming increasingly difficult in large agrarian areas.

Mega urban-industrial projects are disrupting lives and livelihoods by the thousands

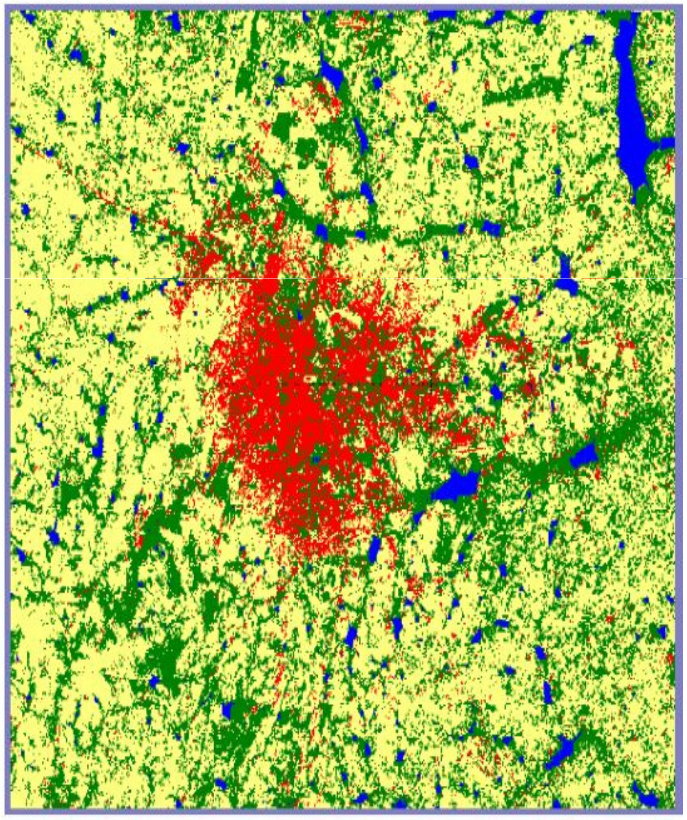
A river that nurtured people, now needs nurturing.

Aren't cities overreaching their environmental limits

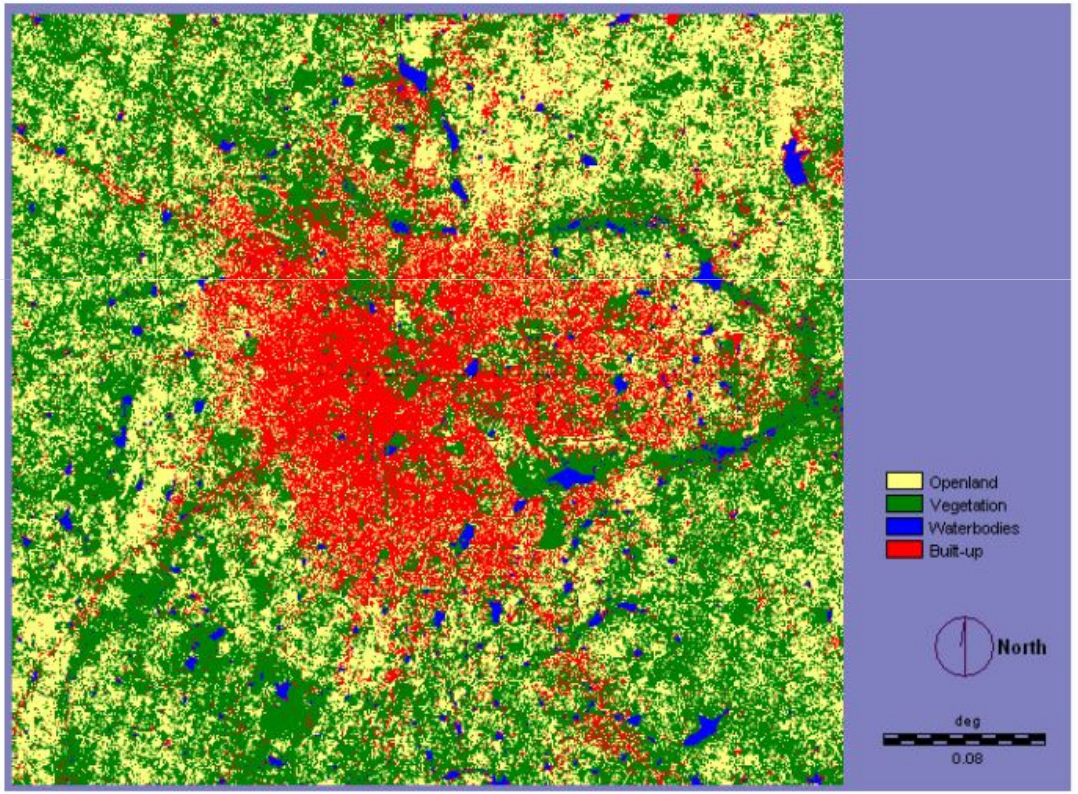
A city's ambition is quite independent of its environmental limits. Can this growth be sustained?



Bangalore's sprawl at the cost of water security



Map 3: Land-use classification - Bangalore (Landsat TM 1992)



Map 5: Land-use classification - Bangalore (IRS LISS-III 2006)

Lifting Cauvery to quench Bangalore's thirst

Cauvery water is supplied to Bangalore from 100 kms. away and lifted over 500 metres head.

This demands enormous investment of energy and infrastructure.

Cauvery waters meet needs of half the city's populus. Rest depend on ground water

1 crore live in Bangalore today

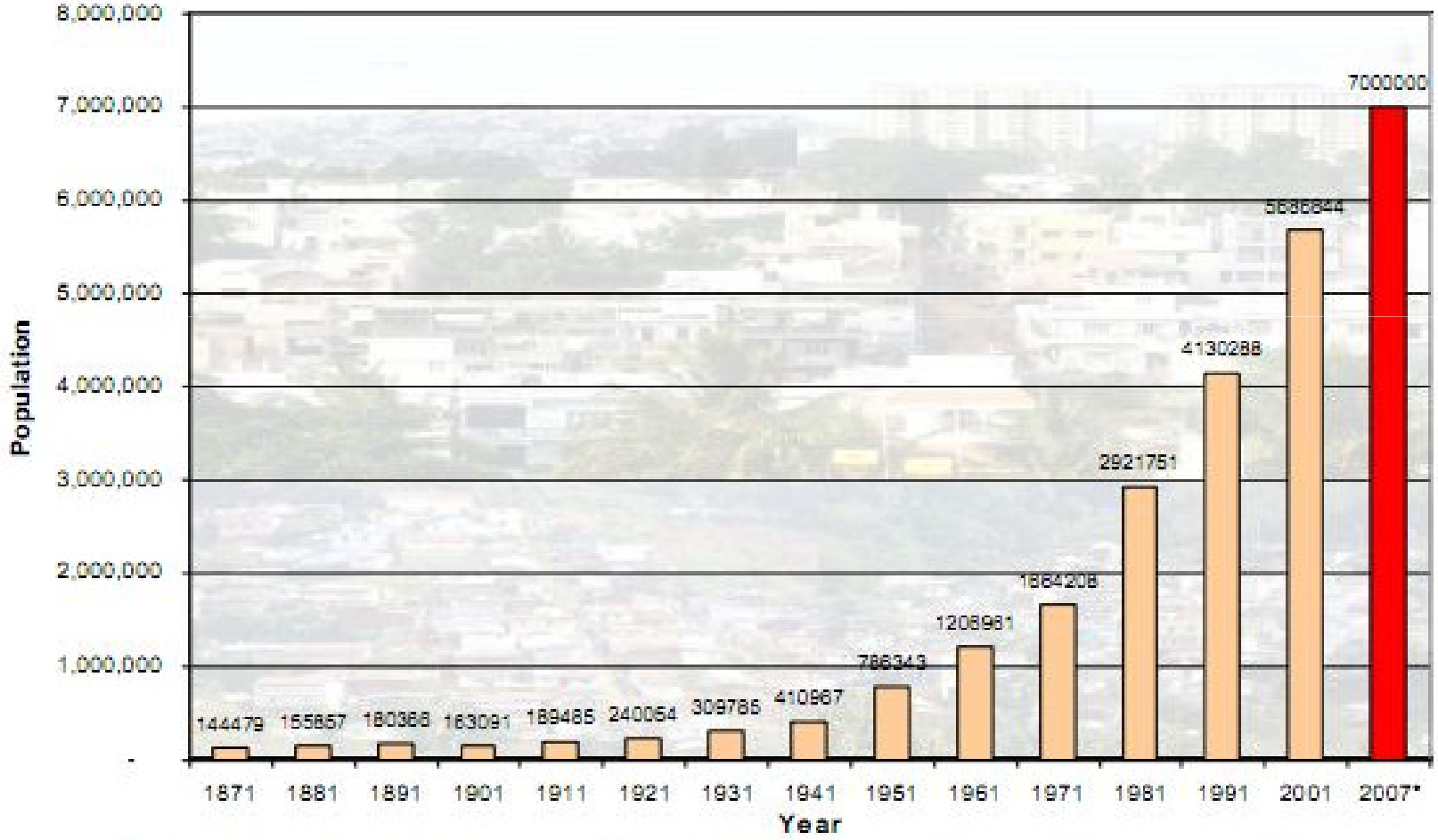


Figure 3-4: Population growth of Bangalore City during 1871 – 2007*

Bangalore Water Resources

Bangalore Water Supply and Environmental Sanitation Masterplan Project
Water Resources of the Bangalore Region - SAP

Table ES1 – Summary of Water Resources for Bangalore City

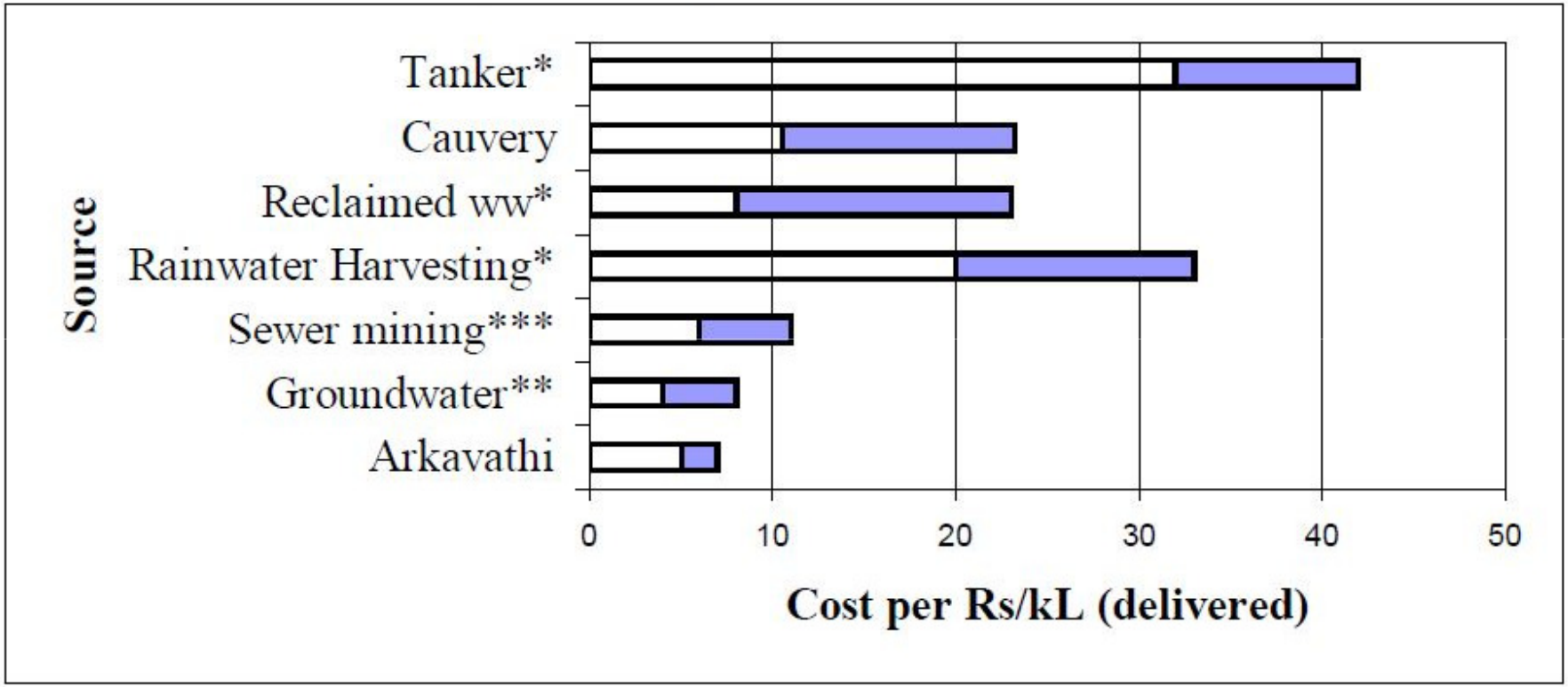
Water Source	Potential Yield * (MLD)	Distance from Bangalore (km)	Applications For Water Resource	Comments
1. Cauvery River Stages I, II and III (existing) Stage IV Phase I (under construction) Stage IV Phase II Part 1 Stage IV Phase II Part 2 Stage V	 540 270 258 257 686 **Total 2011**	 Source Options: 99 (Shiva Anicut) 126 (KRS Dam) 175 (Hemavathi) 205 (Netra/Hemavathi)	Municipal supply (potable quality)	1. Allocation for Stage V is subject to CWDT ruling. 2. Seasonal storage capacity must be developed for BWSSB use. 3. Interim arrangements for flow regulation prior to storage are needed. 4. Most economic source development is from Shiva Anicut and KRS Dam. 5. Complete reliance on this resource exposes BWSSB in event of conflict. 6. Bulk of Cauvery resource proposed for irrigation (398 out of 465 TMC).
2. Arkavathi River T.G.Halli (average) Hessaraghatta	 100 4 **Total 104**	 25 17	Municipal supply (potable quality)	1. Sources are strategically located close to Bangalore. 2. Declining yield is a major concern for T.G.Halli and Hessaraghatta. Potential for Hessaraghatta was 36 MLD and is estimated to be 4 MLD under present catchment conditions. 3. Catchment management measures are needed to control yield reductions. 4. Large area of tanks leads to decreased runoff and increased evaporation. 5. Water quality problems may arise due to development within catchments.
3. Groundwater	190	Within City limits	Municipal supply (potable quality)	1. No current legislative regulation on access to, or use of, groundwater. 2. Current usage exceeds sustainable yield in the BMA (falling GW levels). 3. Estimate of sustainable yield for BMA is 480 MLD (>50% to irrigation). 4. Artificial recharge could be used to improve situation. 5. High nitrate levels are a common problem (and increasing). 6. Improved monitoring (water level, quality) is essential to manage resource. 7. Sustainable rate of groundwater use will decrease as UFW rate falls.
4. Rainwater Harvesting	20-50	Within City limits	Small scale supply (commercial, households)	1. Large seasonal variations in rainfall necessitate storages and supplementary supply. 2. Some potential where no piped WS available. 4. Potential yield (20-50 MLD) is a broad estimate only, subject to costs. 5. General intended use is for washing water and non-potable uses.
5. Treated Effluent Re-use	170-220	Within City limits (from BWSSB STP's)	Non-potable supply (industrial/non-domestic)	1. Primary purpose is to reduce demand on freshwater sources. 2. Extent of usage will depend on regulations, pricing and level of service. 3. Distribution likely to be viable within a limited radius (3 km) of STP's. 4. For non-potable applications only. 5. Groundwater recharge (via tanks) is an option for effluent re-use.
TOTALS	**2730**	-	-	

- *Potential Yield for surface water sources refers to yield available after treatment losses have been deducted*

Water Economics for Bangalore

Figure 2-2:- Comparative Water Source Economics

Range of costs expected are shown in blue



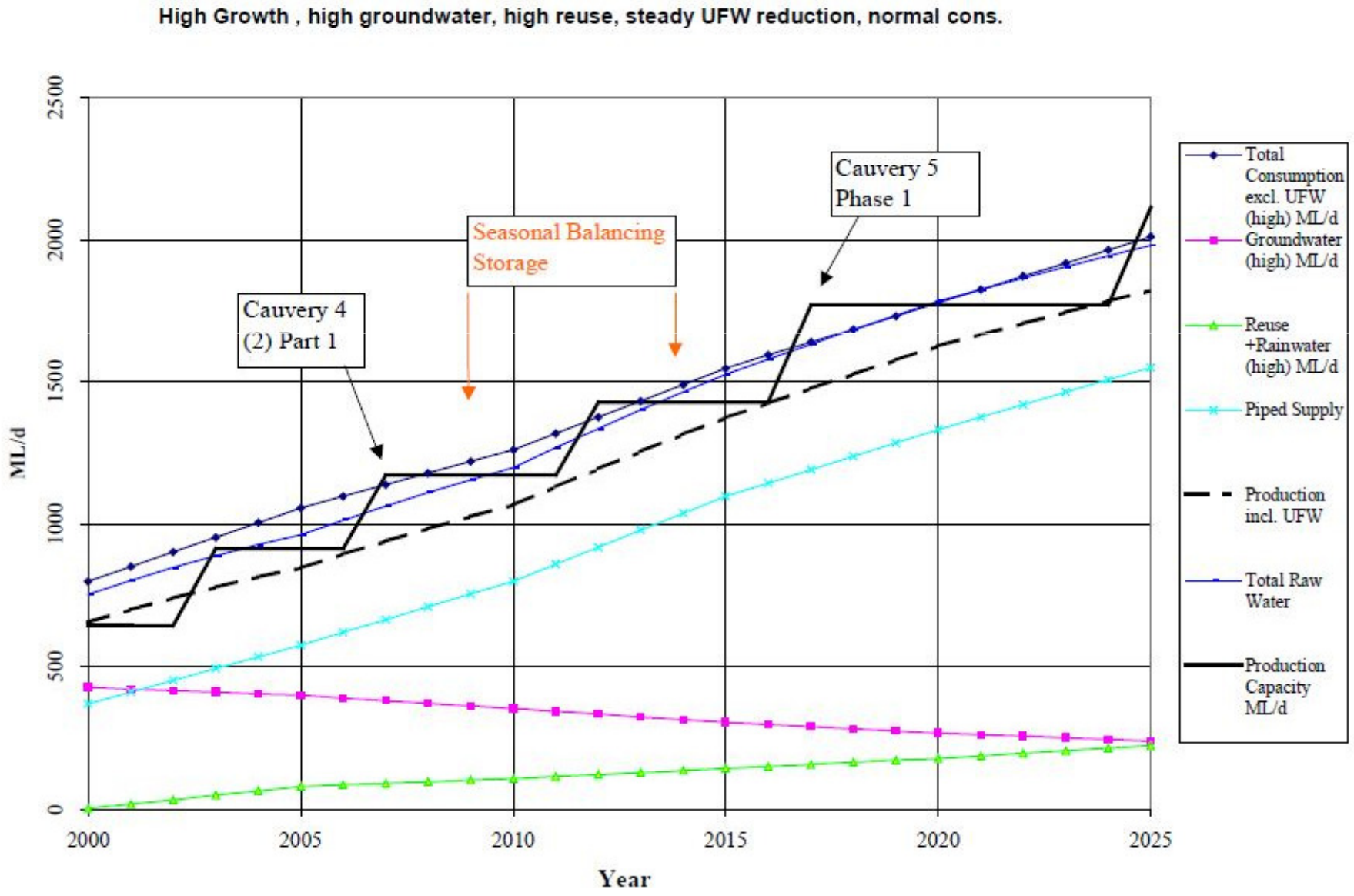
* requires supplementary source

** at current water levels

*** few locations only

Blore Water Supply Demand Conundrum

Fig ES 1 Water Resources – High Growth Scenario



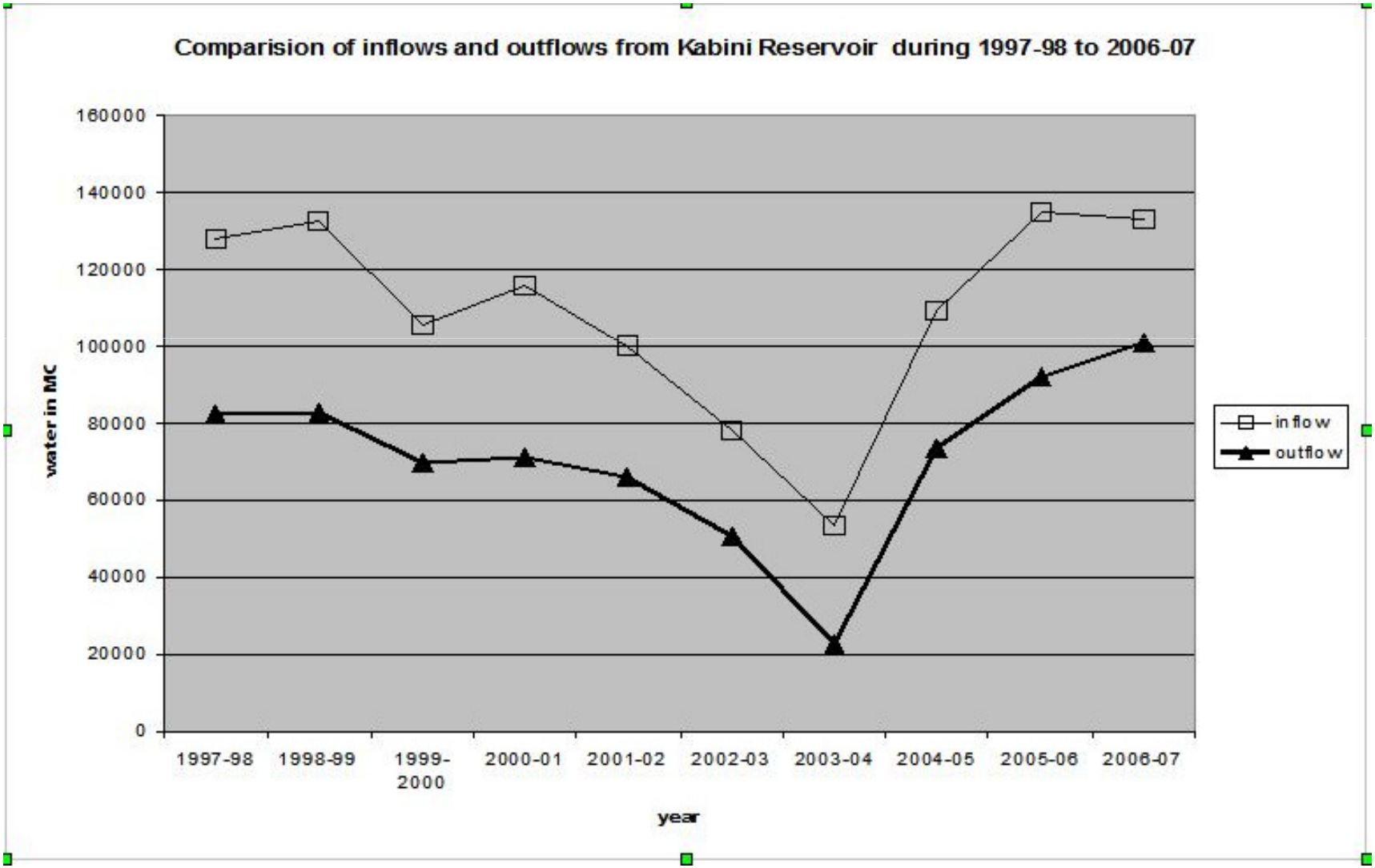
Cauvery: Perpetually in Dispute?

	Karnataka	Tamil Nadu	Kerala	Pondicherry	Total
Basin Area (in km²)[1]	34,273 *(42%)*	44,016 *(54%)*	2,866 *(3.5%)*	148(-)	**81,155**
Drought area in the basin (in km²) [2]	21,870 *(63.8%)*	12,790 *(29.2%)*	--	--	**34,660**
Contribution of state (in billion ft³ according to Ktaka)[3]	425 *(53.7%)*	252 *(31.8%)*	113 *(14.3%)*		**790**
Contribution of state (in billion ft³ according to TN)[3][4]	392 *(52.9%)*	222 *(30%)*	126 *(17%)*		**740**
Quantity demanded by each state[*citation needed*]	465 (41%)	566 (50%)	100 (9%)	9.3 (1%)	**1140.3**
Share for each state as per TN's demand[*citation needed*]	177 (24%)	566 (76%)	5 (1%)	-	**748**
Share for each state as per tribunal verdict of 2007 [5]	270 (37%)	419 (58%)	30 (4%)	7 (1%)	**726**

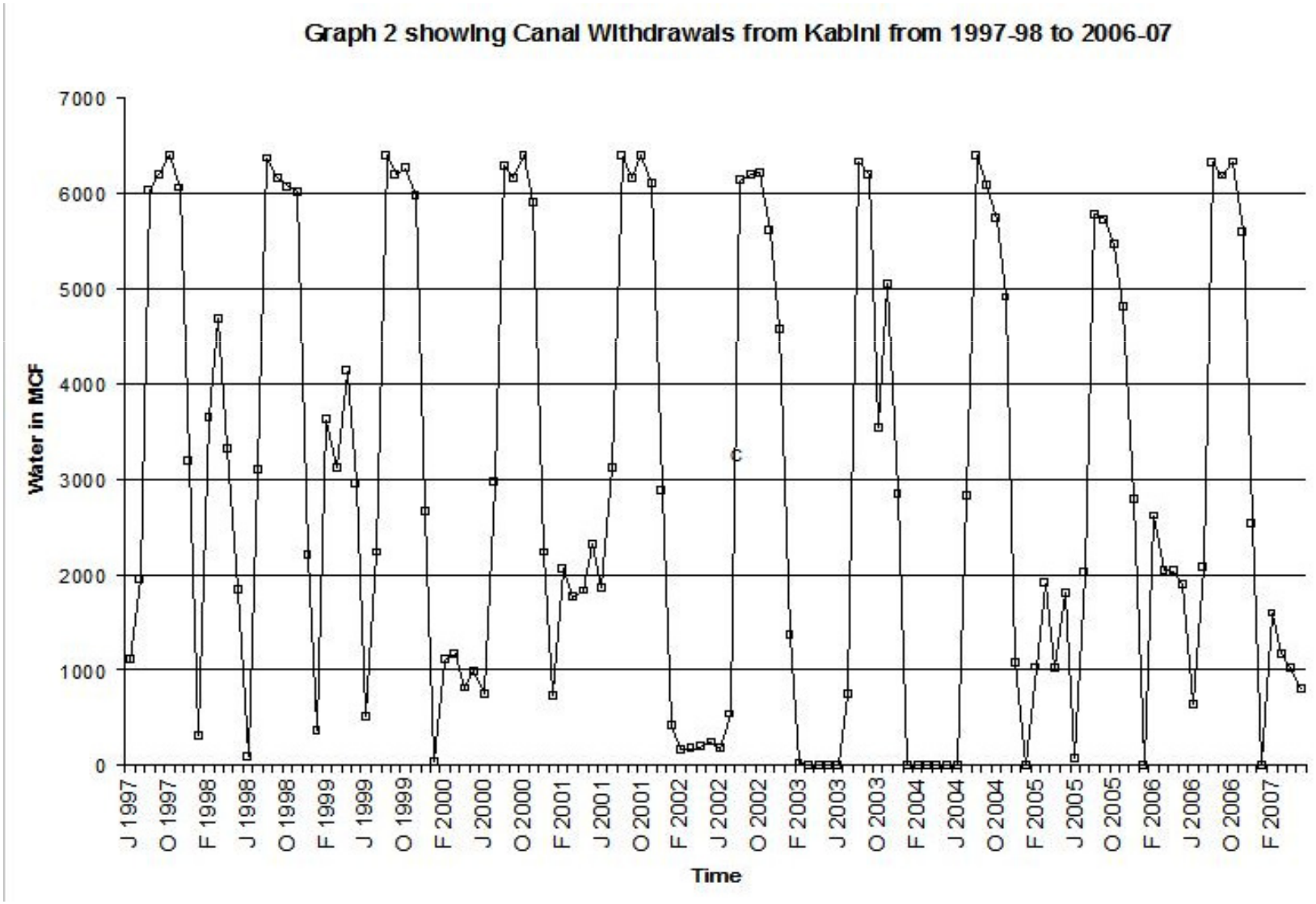
Can Kabini Sustain a Super Thermal Power Station?

3.9 TMC of Kabini water
allocated by Karnataka
for a slew of thermal
power plants near Mysore

How much water in Kabini?



Canal Withdrawals from Kabini



Kabini Water Utilisation