Safeguarding Rivers and Watersheds
Case Study of Bangalore

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Revering Cauvery, Celebrating life

Kings bequeathed land along Cauvery’s banks to attract the best talent into their cities.

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

Countless temple towns that grace her shores exemplify how deeply she is revered everywhere she flows.

Replete with life, memories and stories, she is the very River of Life.
Cauvery's waters

The many tributaries that augment Cauvery’s flow include Kabini, Kapila, Hemavathy, Shimsha, Lokapavani, Arkavathy, Bhavani and many others.

Each of these tributaries draw waters from an intricate and extensive network of tanks built over the centuries.

The river thus provide water for farming, urban and industrial needs.
Cauvery Basin spreads across four southern States
Bengaluru is within the Cauvery Watershed
Greater Bangalore Watershed
Vrishabhavathi: A Dying River?
Sacred origins of Vrishabhavathi

An inscription on the 17th century Nandi mentions the Bull Temple in Bangalore as the source of this 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 in today’s Basavanagudi, Bangalore
Kempabudhi tank, once fed rain that it had gathered into Vrishabhavathithi
Revering Vrishabhavathi's splendour?

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

In reverence and awestruck, 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
Dark, Heavy, Toxic
Vrishabhavathithi’s Waters Now!
Vrishabhavathi or Vishabhavathi?

Vrishabhavathi once breathed life to the region. Now it is tragically called Vishabhavathi - a poisonous river. Its putrefying, dying waters carry Bangalore's refuse, which then feed Arkavathy.
Vrishabhavathi passes through Sewage Treatment Plants in South Bangalore
A costly clean-up that has not delivered
Largely untreated waters of Vrishbhavathi enters Byramangala tank which irrigates vegetable gardens, orchards, paddies, ragi and sugarcane fields, and also recharges ground water.
Byramangala Tank – heavily polluted and a major public health concern
A large bird population feed off these toxic waters
# Vrishabhavathi Ground Water

## Averages from 30 Samples

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Average</th>
<th>BIS limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>8.42</td>
<td>6.55</td>
<td>7.40</td>
<td>6.5 to 8.5</td>
</tr>
<tr>
<td>2</td>
<td>Chlorides</td>
<td>1338</td>
<td>60</td>
<td>320.63</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>TDS</td>
<td>2850</td>
<td>200</td>
<td>921.77</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>Total Hardness</td>
<td>1960</td>
<td>70</td>
<td>563.67</td>
<td>600</td>
</tr>
<tr>
<td>5</td>
<td>Calcium</td>
<td>386</td>
<td>15</td>
<td>137.83</td>
<td>200</td>
</tr>
<tr>
<td>6</td>
<td>Magnesium</td>
<td>249</td>
<td>08</td>
<td>52.63</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>Nitrate</td>
<td>157</td>
<td>05</td>
<td>47.6</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>Sulphate</td>
<td>216</td>
<td>10</td>
<td>54.17</td>
<td>400</td>
</tr>
<tr>
<td>9</td>
<td>Fluoride</td>
<td>2.5</td>
<td>nil</td>
<td>0.87</td>
<td>1.50</td>
</tr>
<tr>
<td>10</td>
<td>Iron</td>
<td>1.24</td>
<td>Nil</td>
<td>0.225</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Vrishabhavathi flows dark and toxic for miles and miles.
Vrishabhavathi, joins Arkavathy a major drinking water source for Bangalore which then joins Cauvery near Kanakapura, south of Bangalore.
Growing migration to cities from along these rivers

Pollution of rivers is making farming increasingly difficult all along these rivers.

Low yields and crop failures and overall farming distress from along these rivers is causing massive migration into cities.

In parallel, mega urban-industrial projects are disrupting lives and livelihoods of thousands.

A river system that nurtured generations, 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, much of which is polluted.
1 crore live in Bangalore today

Figure 3-4: Population growth of Bangalore City during 1871 – 2007*
### Table ES1 – Summary of Water Resources for Bangalore City

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Potential Yield * (Mill D)</th>
<th>Distance from Bangalore (Km)</th>
<th>Applications For Water Resource</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Cauvery River</strong>&lt;br&gt;Sunges I, II and III (existing)&lt;br&gt;Stage IV Phase I (under construction)&lt;br&gt;Stage IV Phase II Part 1&lt;br&gt;Stage IV Phase II Part 2&lt;br&gt;Stage V</td>
<td>540&lt;br&gt;270&lt;br&gt;258&lt;br&gt;237&lt;br&gt;696</td>
<td>Source Options: 99 (Shiv Anicut)&lt;br&gt;126 (KRS Dam)&lt;br&gt;175 (Hemavathi)&lt;br&gt;(Netra/Hemavathi)</td>
<td>Municipal supply (potable quality)</td>
<td>1. Allocation for Stage V is subject to CWDT ruling.&lt;br&gt;2. Seasonal storage capacity must be developed for BWSSB use.</td>
</tr>
<tr>
<td><strong>2. Arkavathi River</strong>&lt;br&gt;T.G.Halli (average)&lt;br&gt;Hessaraghatta</td>
<td>100&lt;br&gt;4</td>
<td>25&lt;br&gt;17</td>
<td>Municipal supply (potable quality)</td>
<td>1. Sources are strategically located close to Bangalore.&lt;br&gt;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.</td>
</tr>
<tr>
<td><strong>3. Groundwater</strong></td>
<td>190</td>
<td>Within City limits</td>
<td>Municipal supply (potable quality)</td>
<td>1. No current legislative regulation on access to, or use of, groundwater.</td>
</tr>
<tr>
<td><strong>4. Rainwater Harvesting</strong></td>
<td>20</td>
<td>Within City limits</td>
<td>Small scale supply (commercial, households)</td>
<td>1. Large seasonal variations in rainfall necessitate storages and supplementary supply.</td>
</tr>
<tr>
<td><strong>5. Treated Effluent Re-use</strong>&lt;br&gt;From BWSSB STP'5</td>
<td>170-220</td>
<td>Within City limits</td>
<td>Non-potable supply (industrial/ non-domestic)</td>
<td>1. Primary purpose is to reduce demand on freshwater sources.</td>
</tr>
</tbody>
</table>

**TOTALS** | 2730 | - | - | 1. Current usage exceeds sustainable yield in the BMA (falling GW levels). |

*Potential Yield for surface water sources refers to yield available after treatment losses have been deducted*
Figure 2-2: Comparative Water Source Economics

Range of costs expected are shown in blue

- Tanker*: requires supplementary source
- Cauvery
- Reclaimed ww*
- Rainwater Harvesting*
- Sewer mining***
- Groundwater**
- Arkavathi

Cost per Rs/kL (delivered)

* requires supplementary source
*** few locations only
** at current water levels
Blore Water Supply Demand Conundrum

Fig ES 1  Water Resources – High Growth Scenario

High Growth, high groundwater, high reuse, steady UFW reduction, normal cons.

- Cauvery 4 (2) Part 1
- Cauvery 5 Phase 1
- Seasonal Balancing Storage

Graph showing water resources over time with various components and labels for consumption, groundwater, and other water sources.
## Cauvery: Perpetually in Dispute?

<table>
<thead>
<tr>
<th></th>
<th>Karnataka</th>
<th>Tamil Nadu</th>
<th>Kerala</th>
<th>Pondicherry</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basin Area (in km²)</strong></td>
<td>34,273 (42%)</td>
<td>44,016 (54%)</td>
<td>2,866 (3.5%)</td>
<td>148(-)</td>
<td>81,155</td>
</tr>
<tr>
<td><strong>Drought area in the basin (in km²)</strong></td>
<td>21,870 (63.8%)</td>
<td>12,790 (29.2%)</td>
<td>--</td>
<td>--</td>
<td>34,660</td>
</tr>
<tr>
<td><strong>Contribution of state (in billion ft³ according to Ktaka)</strong></td>
<td>425 (53.7%)</td>
<td>252 (31.8%)</td>
<td>113 (14.3%)</td>
<td>790</td>
<td></td>
</tr>
<tr>
<td><strong>Contribution of state (in billion ft³ according to TN)</strong></td>
<td>392 (52.9%)</td>
<td>222 (30%)</td>
<td>126 (17%)</td>
<td>740</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity demanded by each state</strong></td>
<td>465 (41%)</td>
<td>566 (50%)</td>
<td>100 (9%)</td>
<td>9.3 (1%)</td>
<td>1140.3</td>
</tr>
<tr>
<td><strong>Share for each state as per TN's demand</strong></td>
<td>177 (24%)</td>
<td>566 (76%)</td>
<td>5 (1%)</td>
<td>-</td>
<td>748</td>
</tr>
<tr>
<td><strong>Share for each state as per tribunal verdict of 2007</strong></td>
<td>270 (37%)</td>
<td>419 (58%)</td>
<td>30 (4%)</td>
<td>7 (1%)</td>
<td>726</td>
</tr>
</tbody>
</table>
Can Kabini, Cauvery’s tributary, sustain a Super Thermal Power Station?

- 3.9 TMC of Kabini water
- allocated by Karnataka
- for a slew of thermal power plants in Chamalapura near Mysore
How much water in Kabini?

Comparison of inflows and outflows from Kabini Reservoir during 1997-98 to 2006-07
Canal Withdrawals from Kabini
Kabini Water Utilisation

Bar Diagram Illustrating the Differences in the Planned and Actual Utilisation of Water for Summer Crops from 1997-98 to 2006-07

- Planned Utilisation of Water for Summer Crops
- Actual Utilisation of Water for Summer Crops

Year

Water in TMC


0 2 4 6 8 10 12 14 16