Bangalore's Lake System: Blueprint for a circular water economy?

Nature Based Solutions

Centre for Science and Environment

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Two water futures

A linear system

Bring water from further and further away
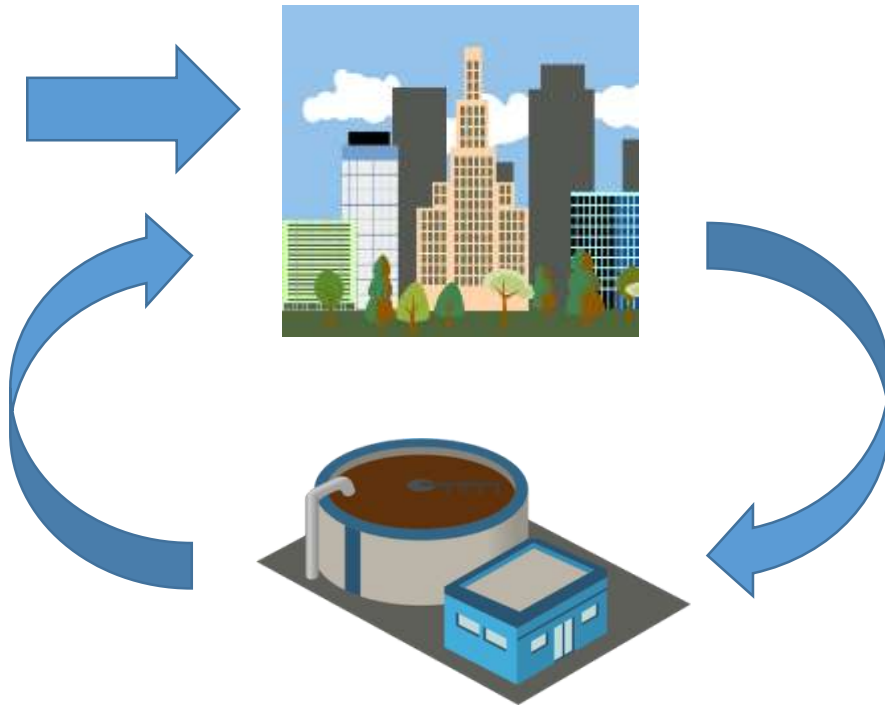
Dispose the wastewater far away.

"High infrastructure" scenario:

1. Large inter-basin mega-projects

2. Centralized wastewater treatment.

3. Separation of sewage and wastewater in storm water drains.

4. Transfer of wastewater to parched rural districts

The question is: What are the ecological and financial implications?
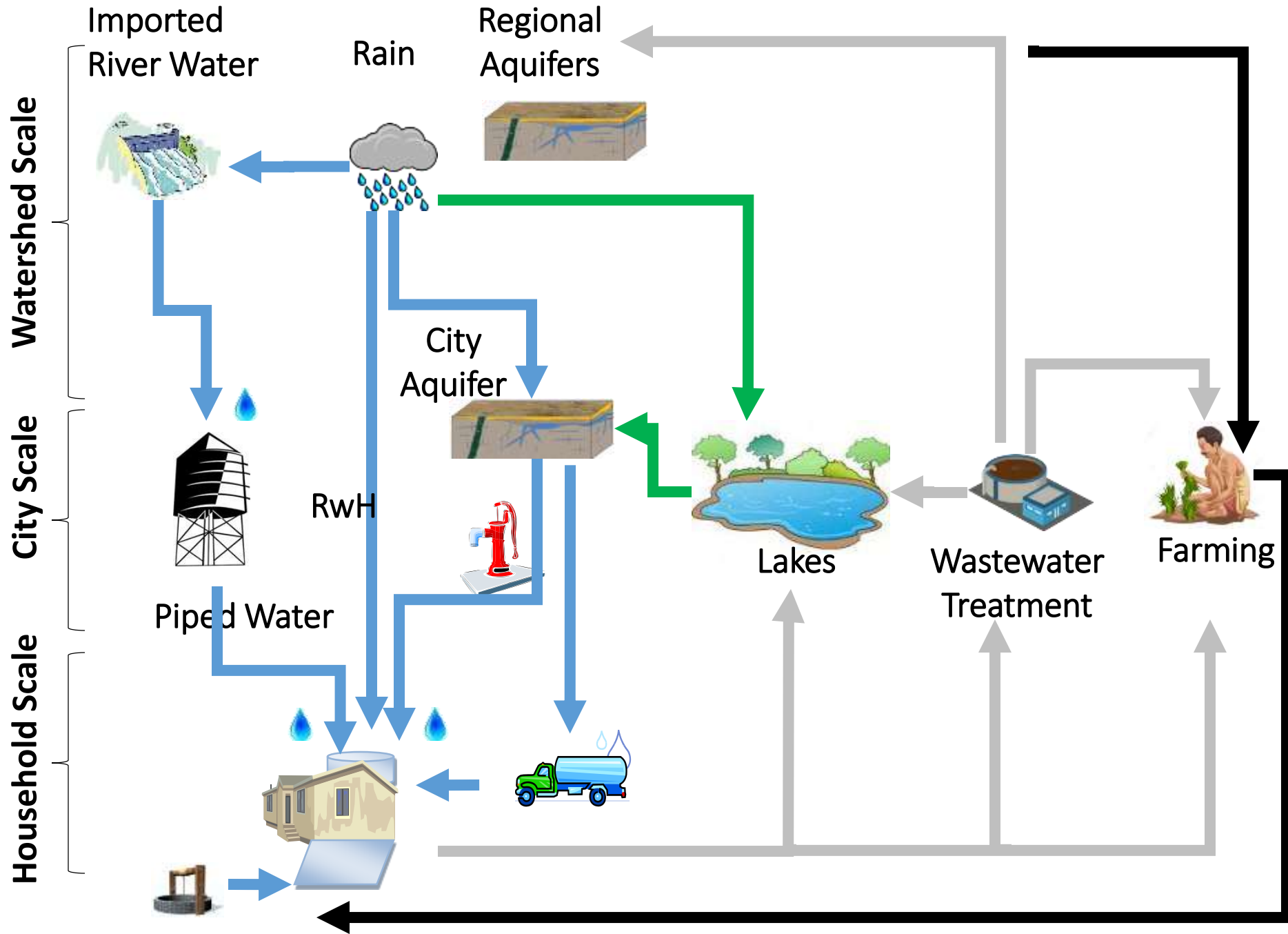
Two water futures

A circular system

Treat the wastewater fully

The question is: Is the feasible? Desirable?
If so, what will it take to get there?

"Integrated urban water management" scenario:

1. Limit dependence on external sources

2. Neighborhood-scale wastewater treatment.

3. Separation of sewage and wastewater in storm water drains.

4. Storage of tertiary treated water in lakes for blending with Cauvery piped supply
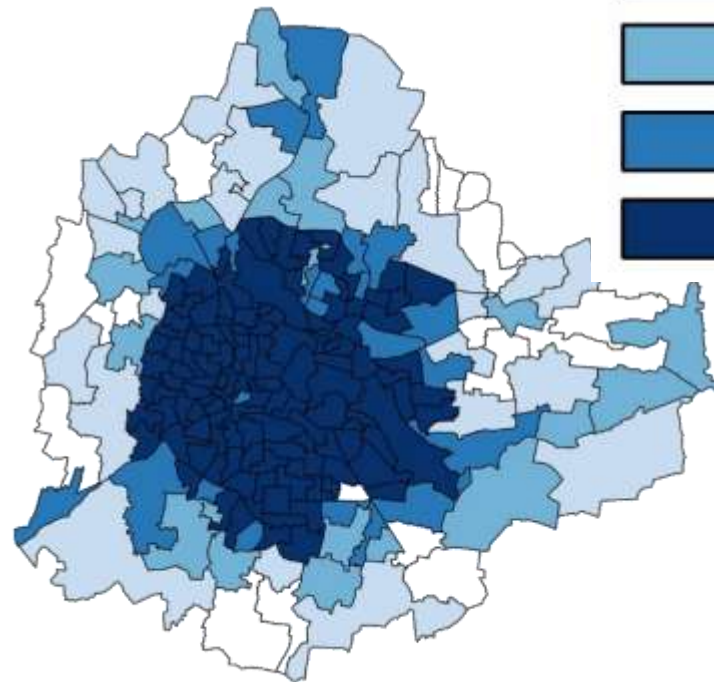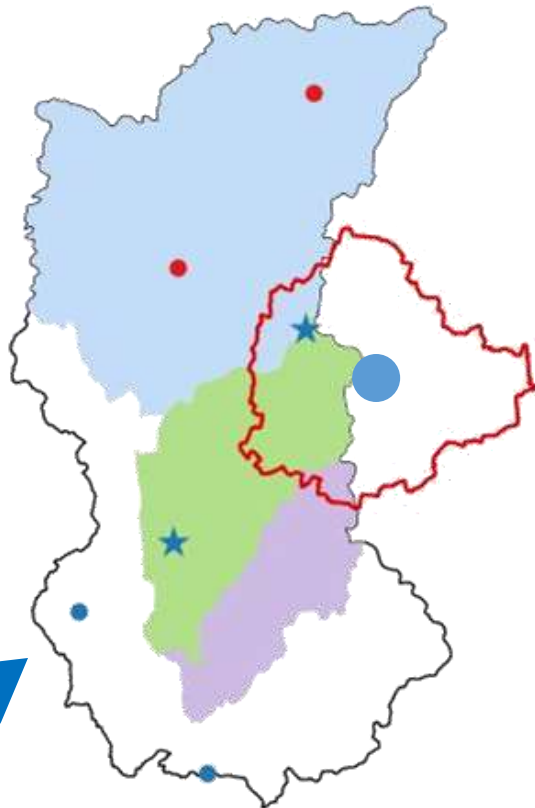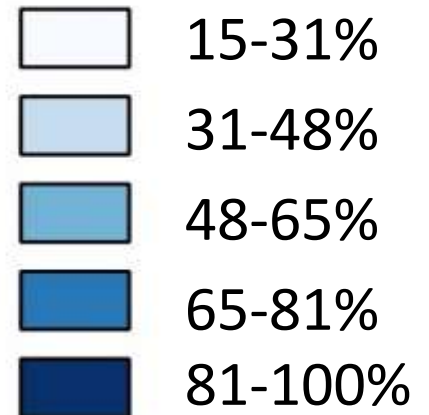
AN INTEGRATED FRAMEWORK

Imported River Water

Rain

Regional Aquifers

Watershed Scale

City Aquifer

RwH

City Scale

Piped Water

Lakes

Wastewater Treatment

Farming

Household Scale

WATER SUPPLY AND USE

Bangalore's water situation
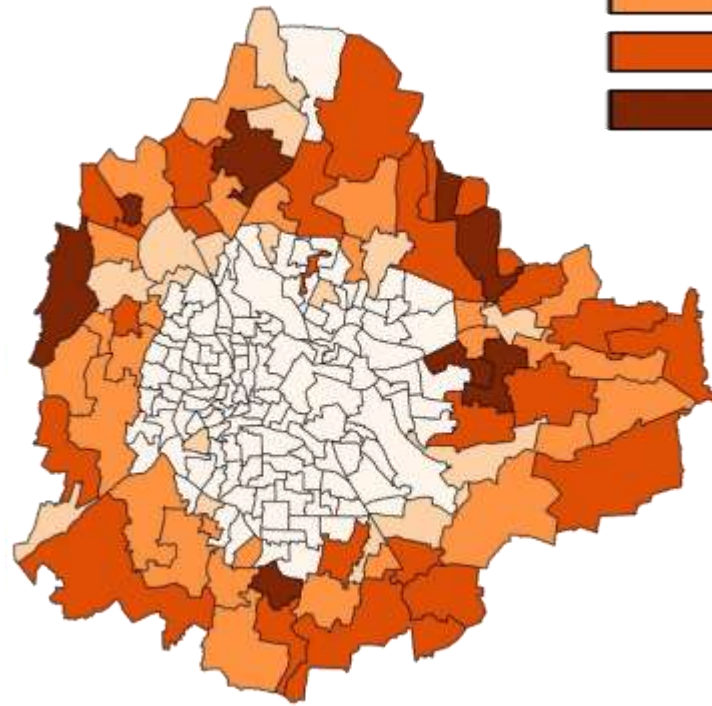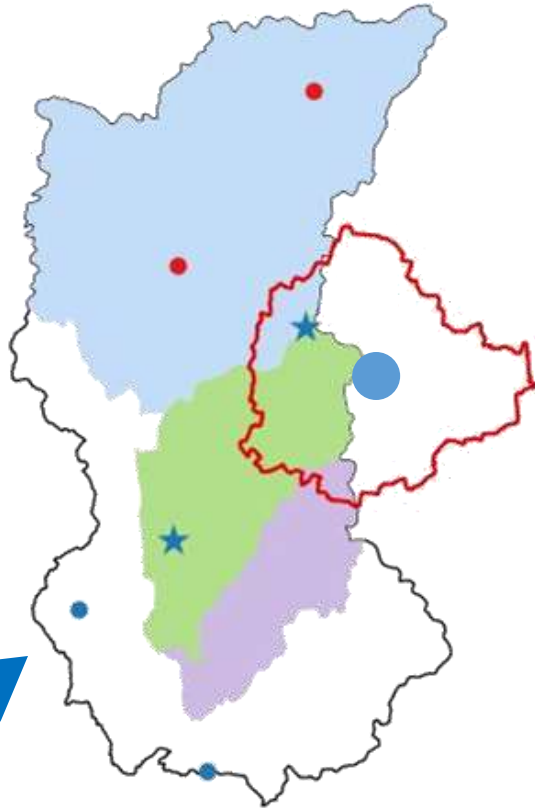
Both unsustainable and inequitable

% HH
- 15-31%
- 31-48%
- 48-65%
- 65-81%
- 81-100%

Water pumped 300 m, rest
is unsustainable GW

Source: 2011 Housing Census Data
Analysed by Lele and Kuttawa

Bangalore's water situation
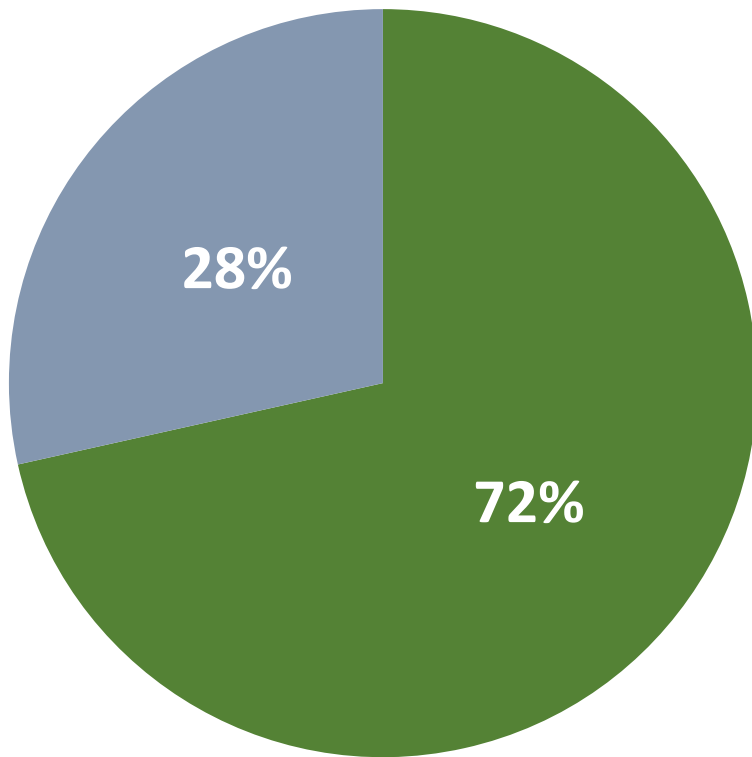
Both unsustainable and inequitable

% HH
- 0-10%
- 10-20%
- 20-30%
- 30-40%
- 40-50%

Water pumped 300 m, rest is unsustainable GW

Source: 2011 Housing Census Data
Analysed by Lele and Kuttawa
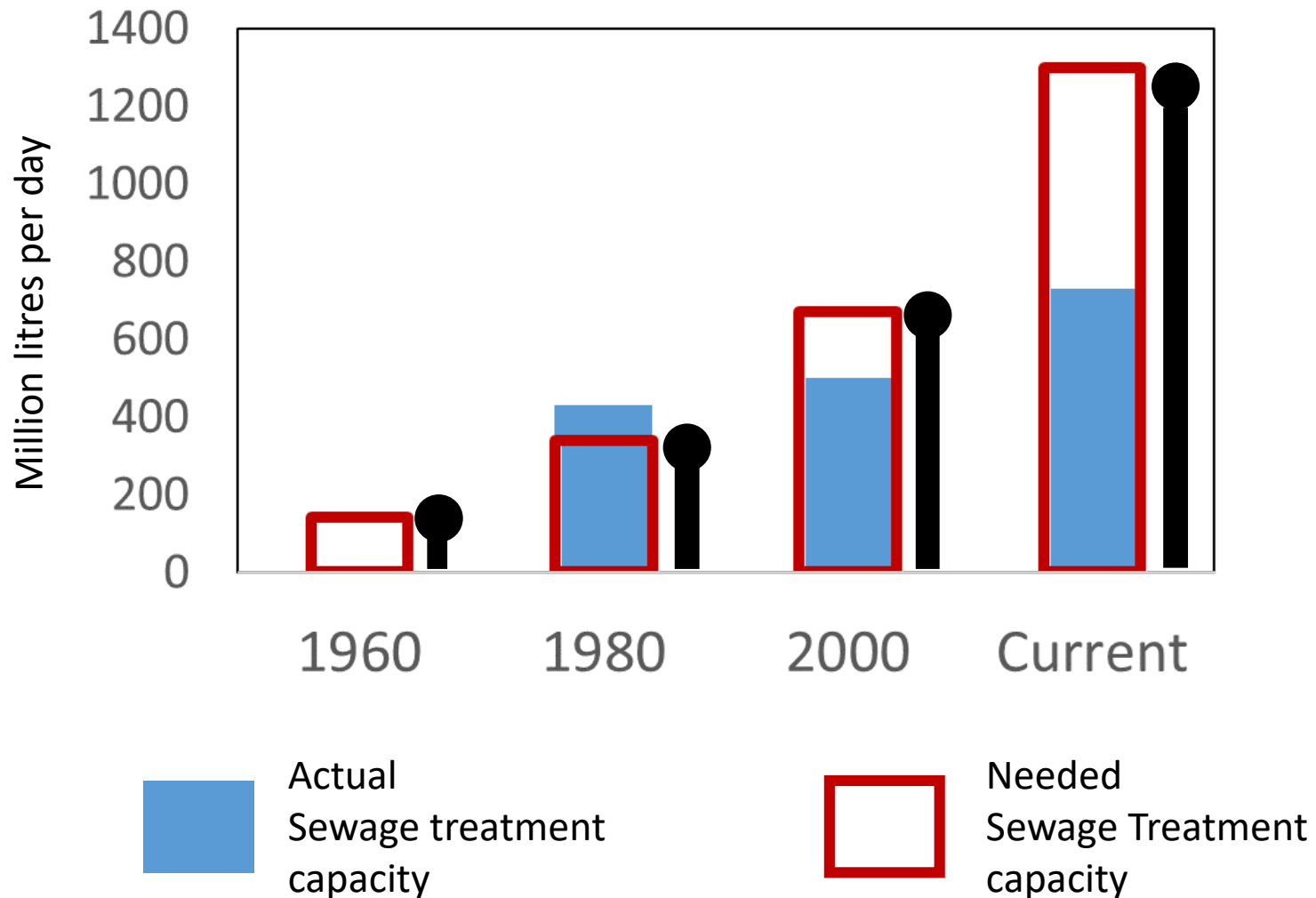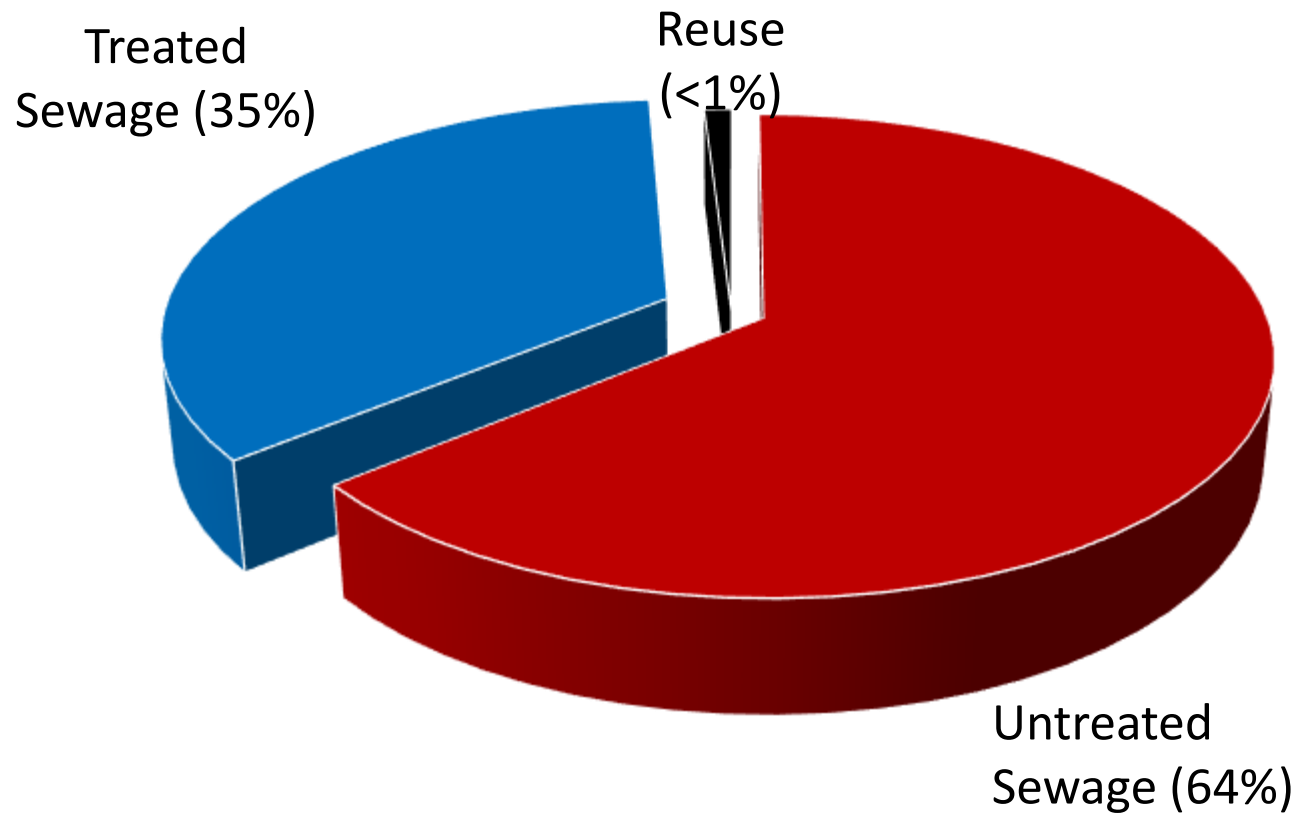
CII Water Use

28%

72%

Ground water

- Billed BWSSB piped water use = 109 MLD

- Estimated groundwater use = 273 MLD

- **Estimated total freshwater use = 381 MLD**

- Treated water use ~ 15 MLD

- Construction water ~ 40 MLD

- Public park water   ~ 10 MLD

- **Total Gross use ~ 396 MLD**

- *Price response > GW use*

WASTEWATER TREATMENT

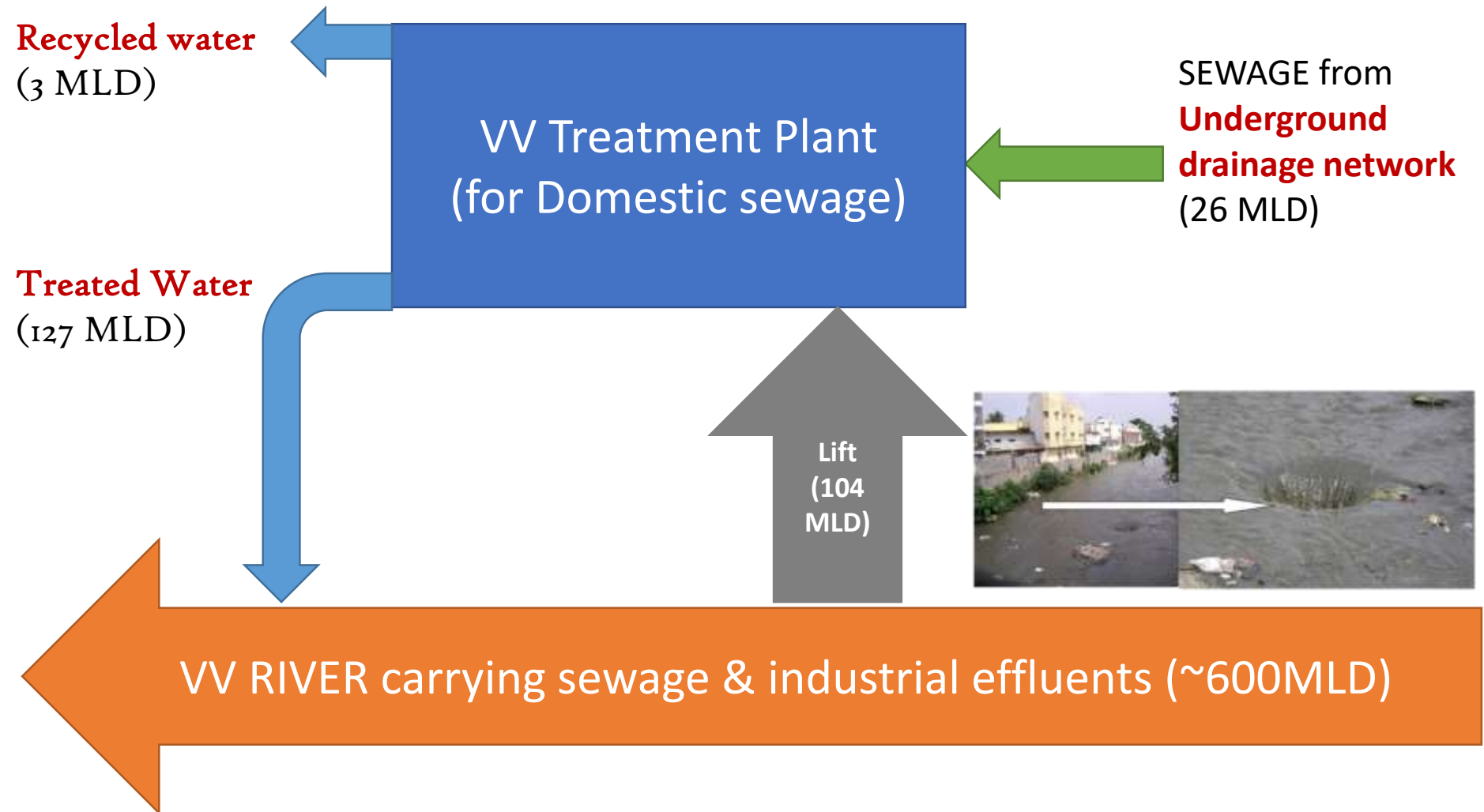# Problems with the current system: Sewage in storm water drains

Actual Sewage treatment capacity

Needed Sewage Treatment capacity

Problems with the current system: Sewage in storm water drains

Treated Sewage (35%)

Reuse (<1%)

Untreated Sewage (64%)

Data Source: Jamwal, 2017

Even where there are STPs, they are not actually getting sewage

Recycled water
(3 MLD)

VV Treatment Plant
(for Domestic sewage)

SEWAGE from
**Underground
drainage network**
(26 MLD)

Treated Water
(127 MLD)

**Lift
(104
MLD)**

VV RIVER carrying sewage & industrial effluents (~600MLD)
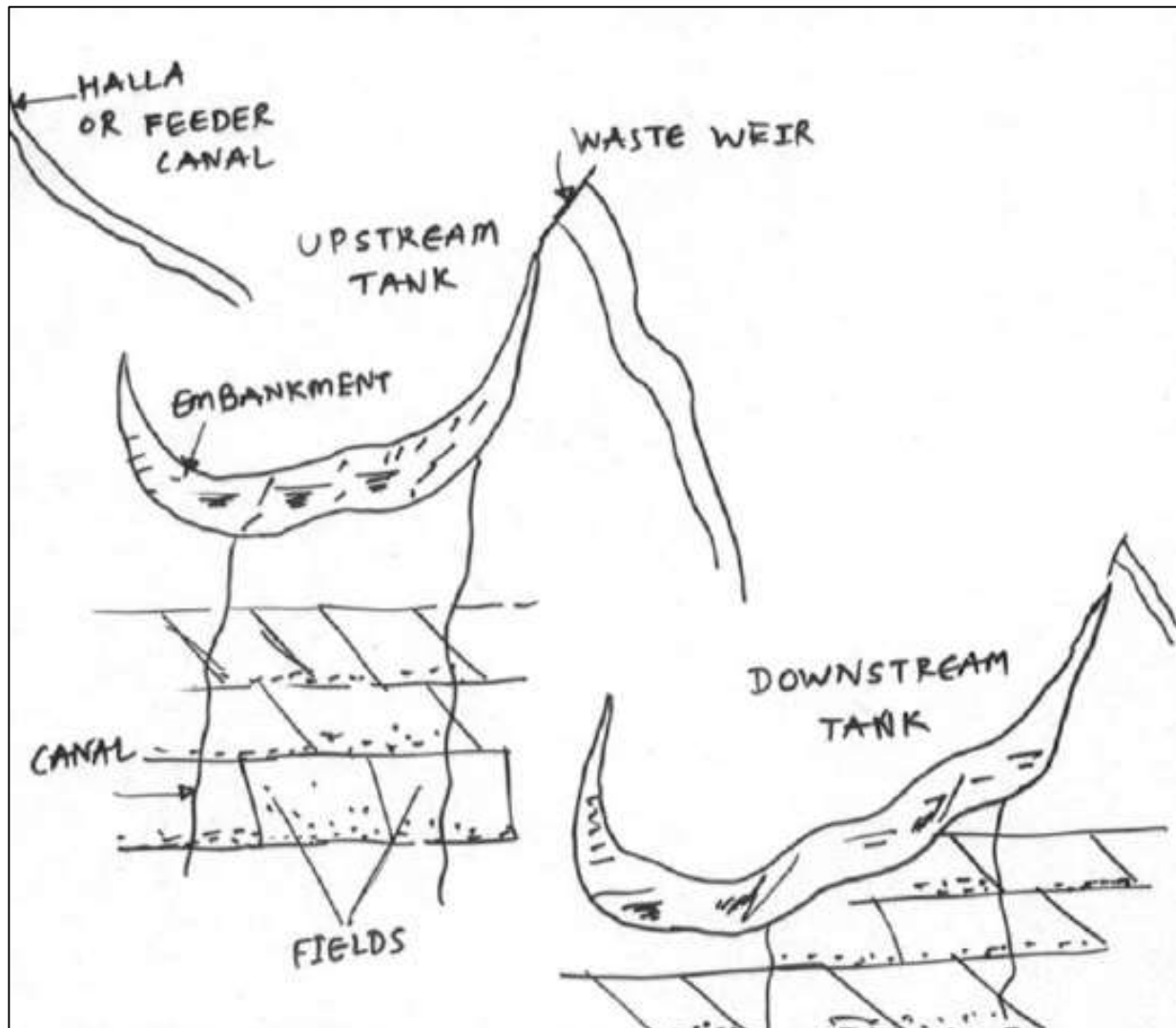
LAKES AS INTERMEDIARIES

Most were originally irrigation tanks built centuries ago,
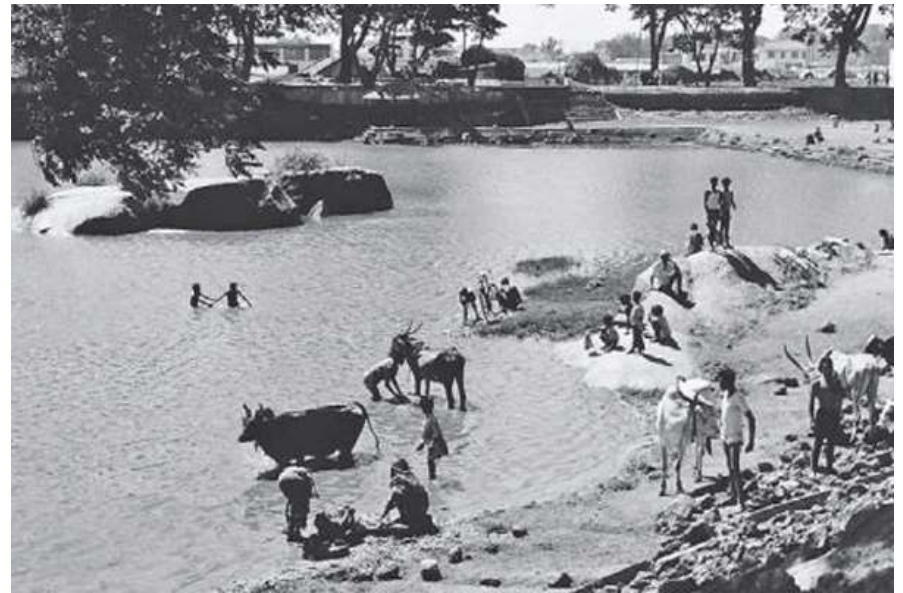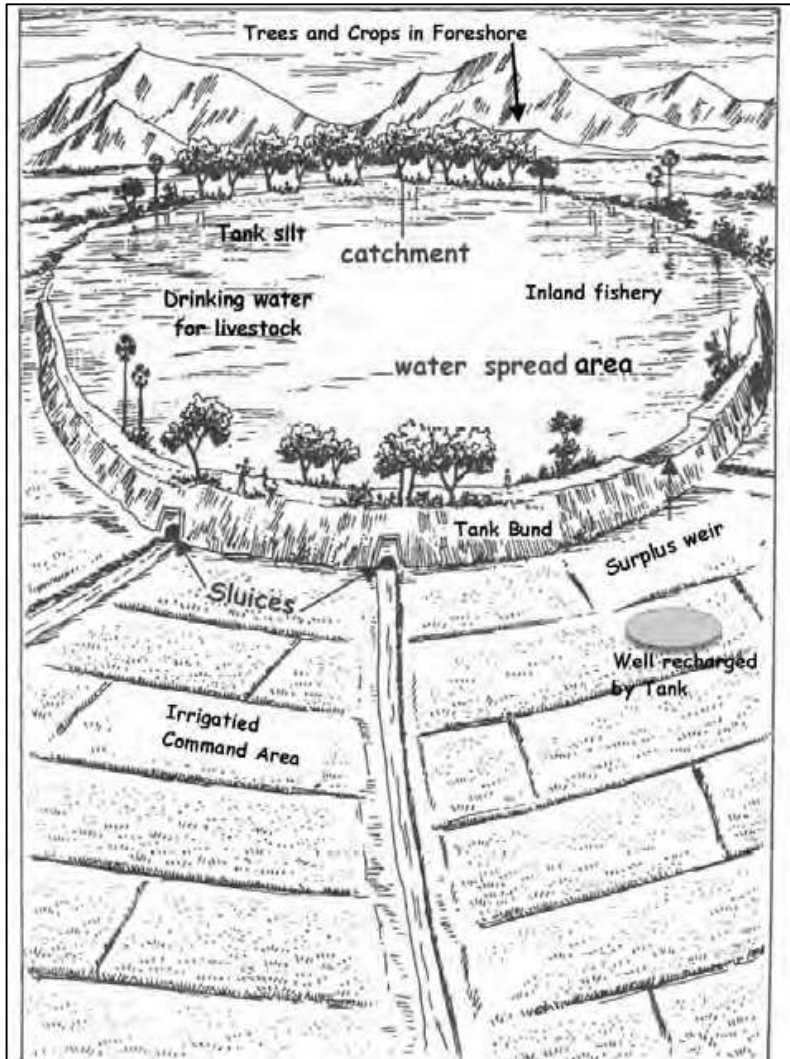
Source: Dhan Foundation

Ulsoor Lake, 1882

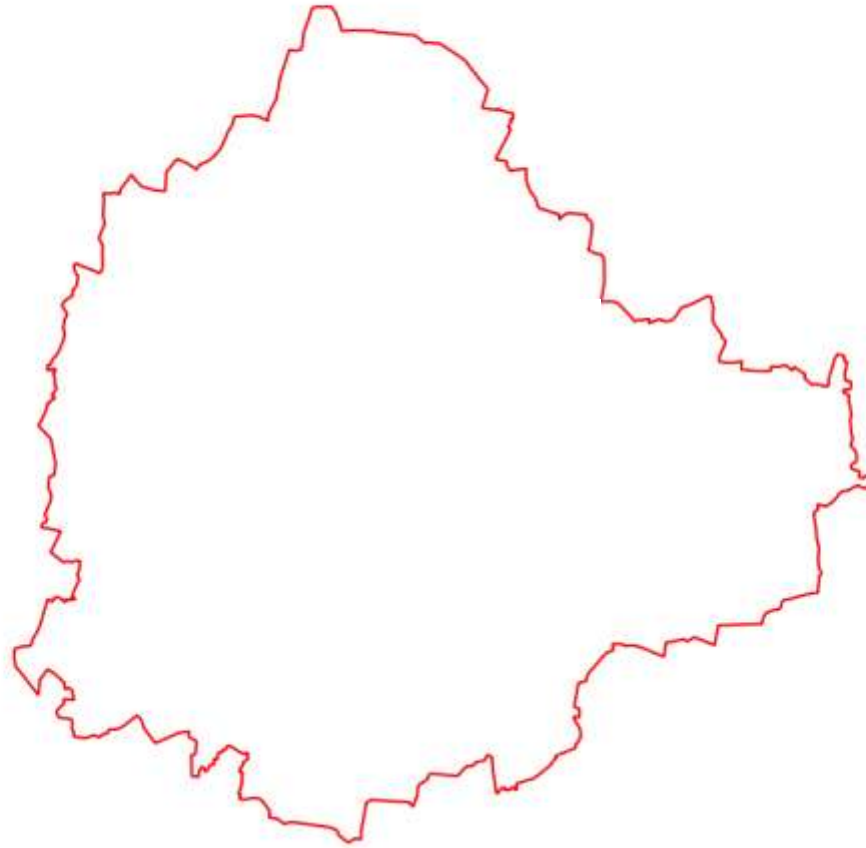# The tanks were built on stream channels to form a cascading chain
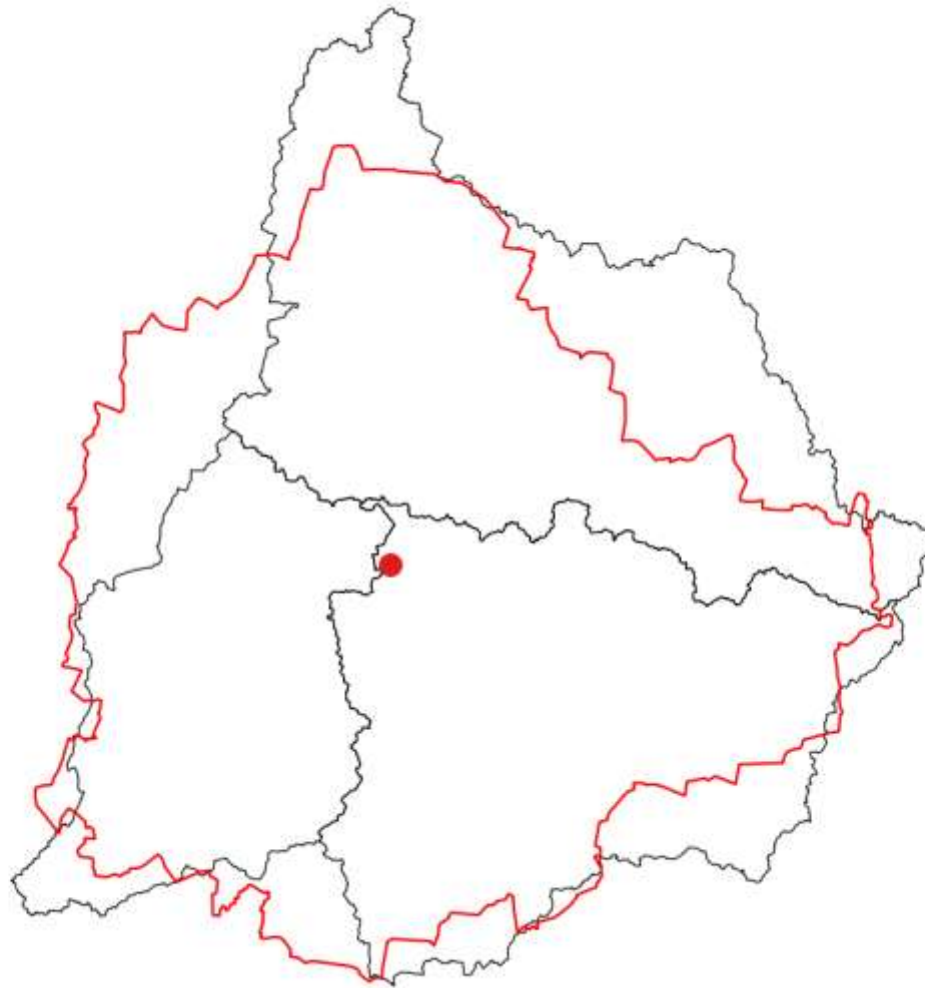

Source: Shah, 2003

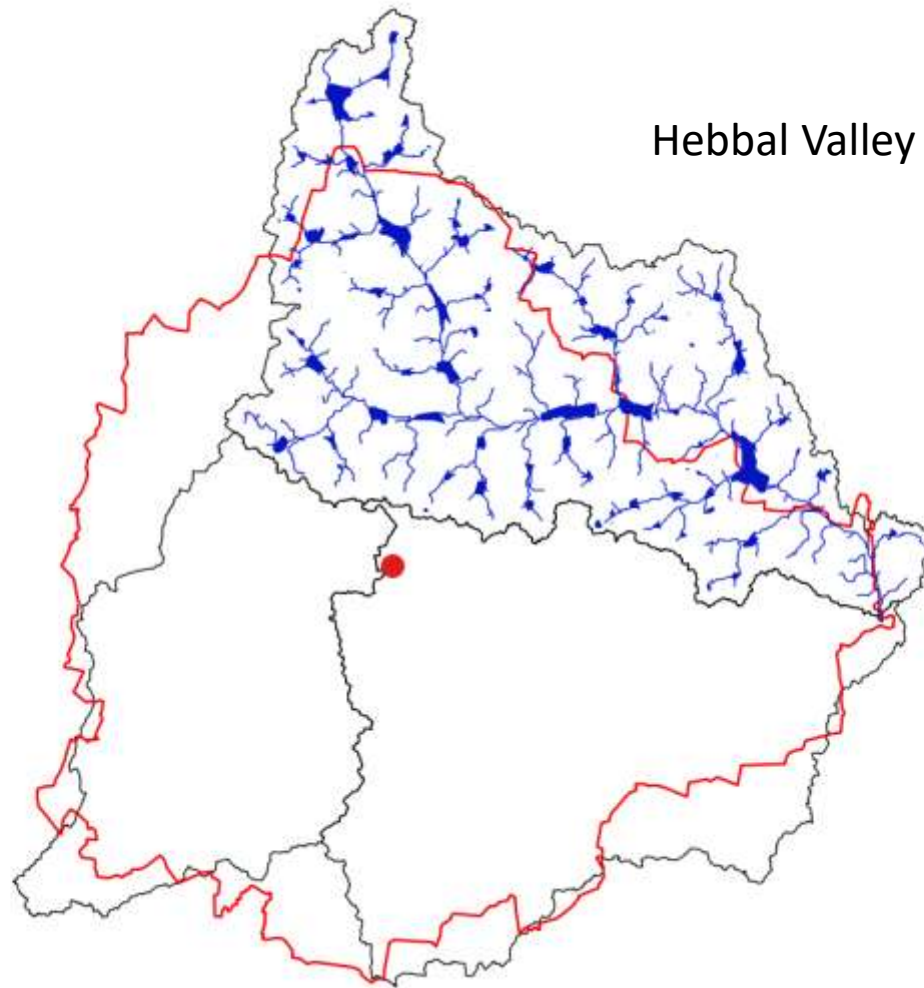# As tanks became "lakes" the management mandate changed from storage to balancing multiple uses
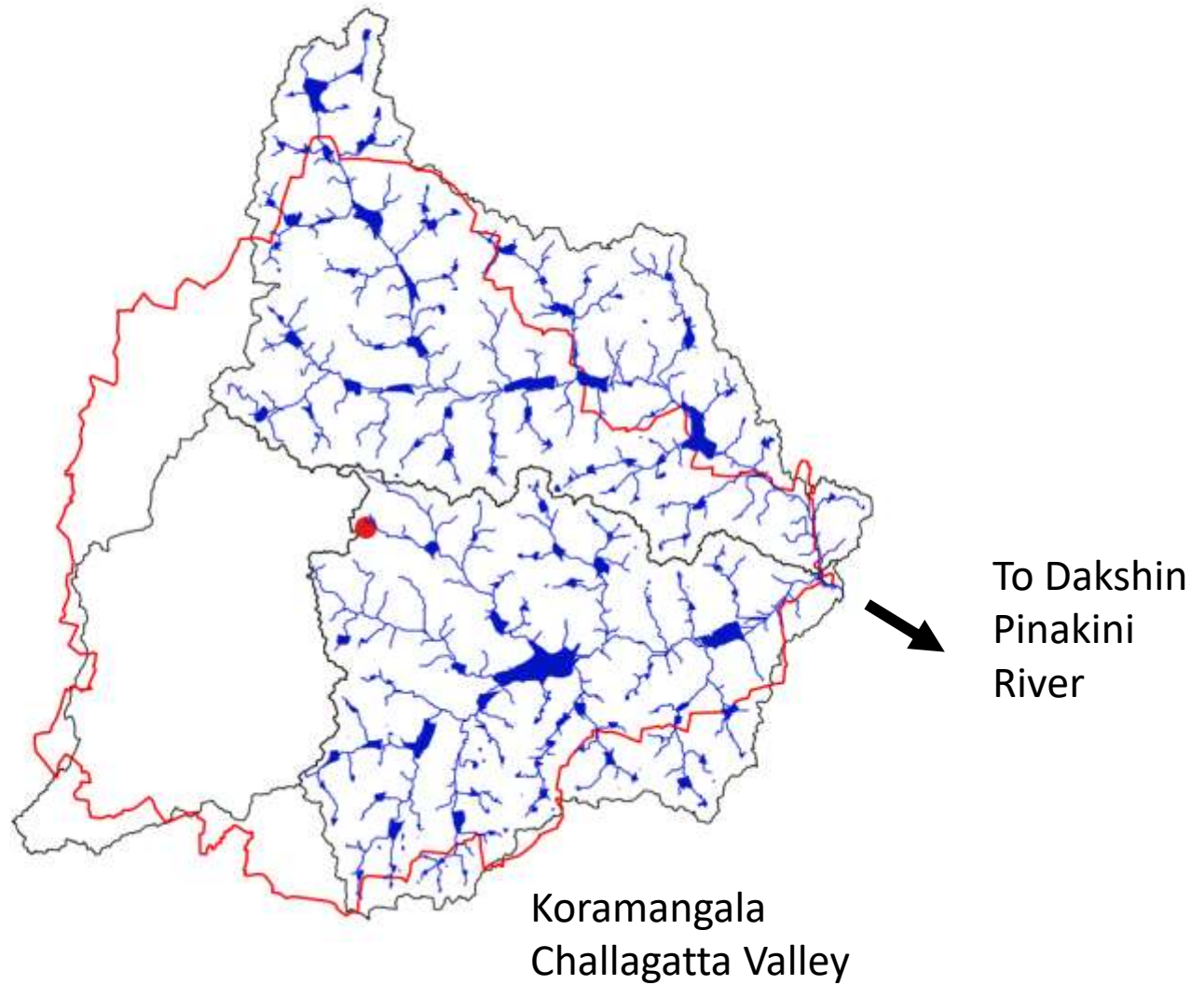
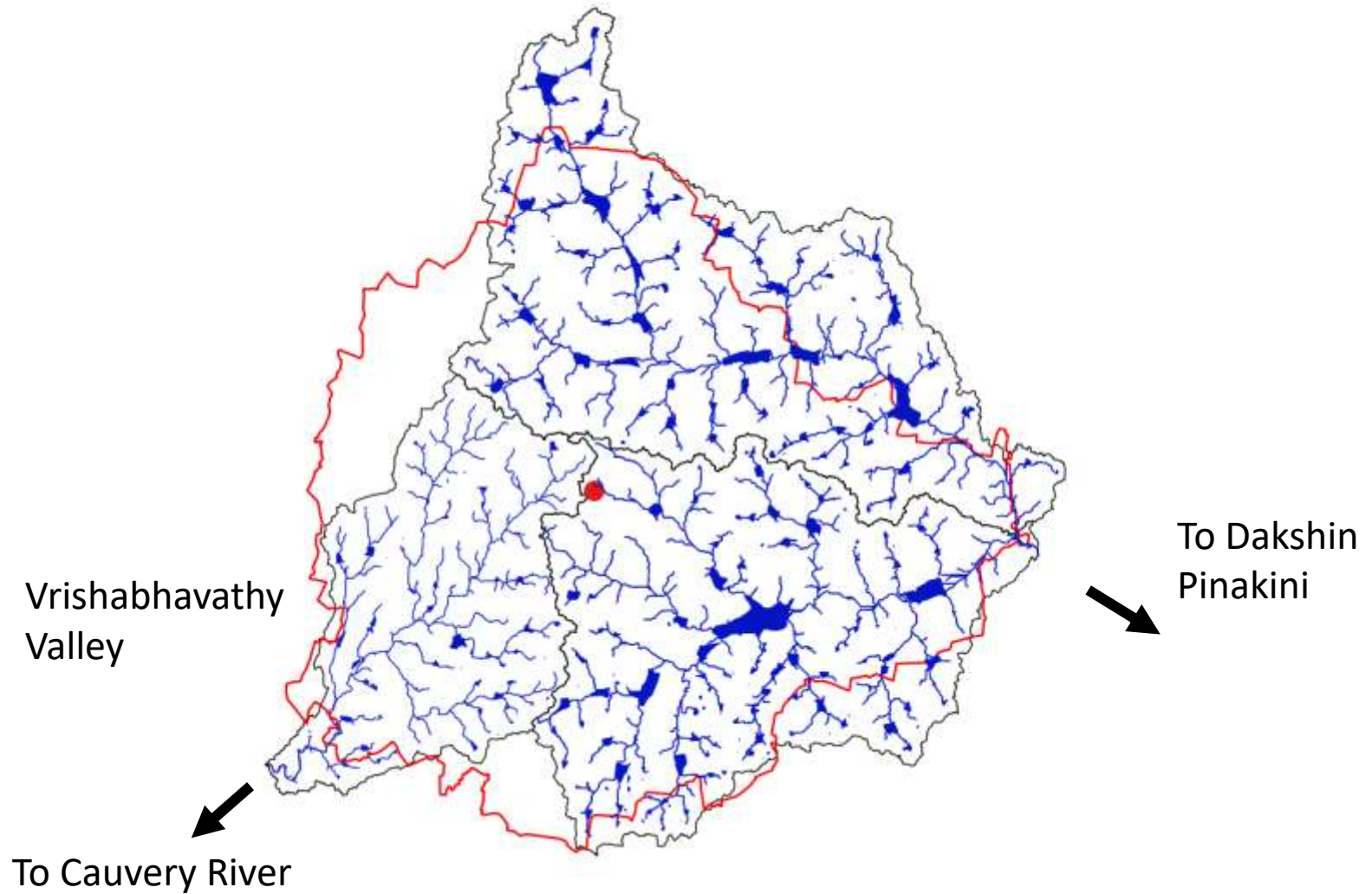# Bangalore's Cascading Lake System

Bangalore's Cascading Lake System

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Hebbal Valley

Bangalore's Cascading Lake System

To Dakshin Pinakini River

Koramangala Challagatta Valley

Bangalore's Cascading Lake System

Vrishabhavathy Valley

To Cauvery River

To Dakshin Pinakini

Problems with the current system: Encroachment and Development

Kanteerva Stadium

Majestic Bus Terminus

Problems with the current system: Sewage in storm water drains

Bangalore "rivers" are really open drains.

One solution is to divert
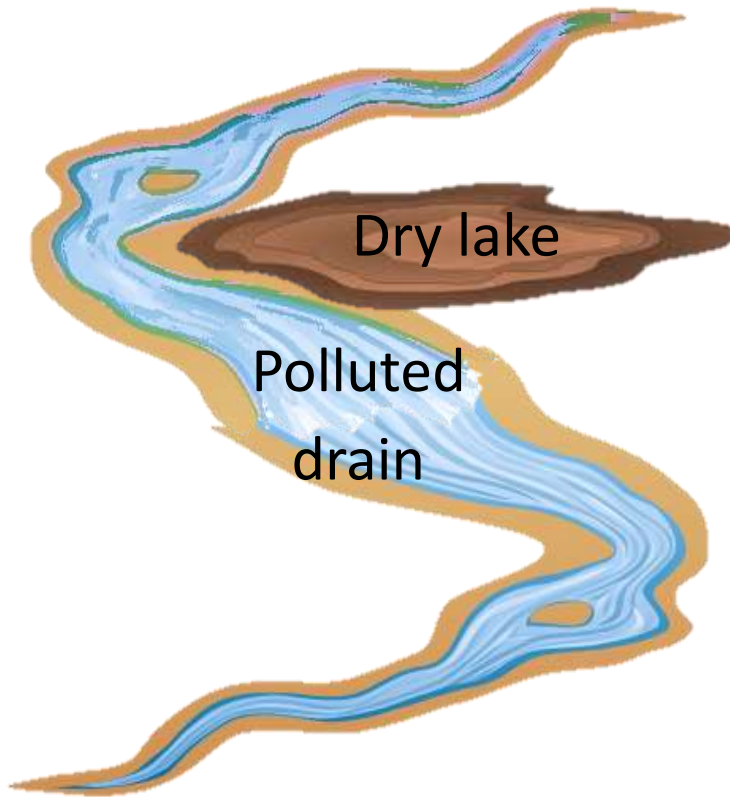

Dry lake

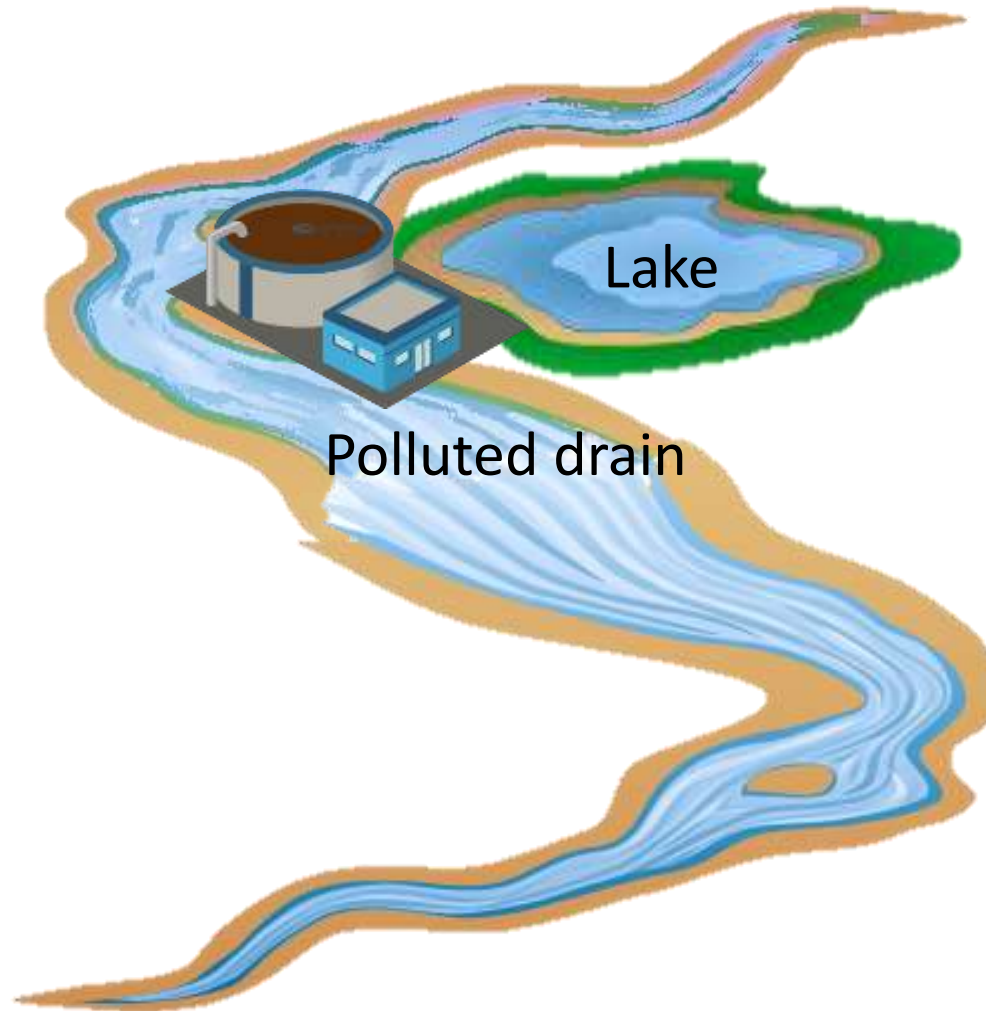Polluted
drain

Photo: Daniel Phillip

Throwing the (rainwater) out
with the bath (sewage) water.

Problems with diversion:
Saul kere – mostly dry lake

Sewage AND Storm water completely diverted

The second solution is a lake side sewage treatment plant (STP)
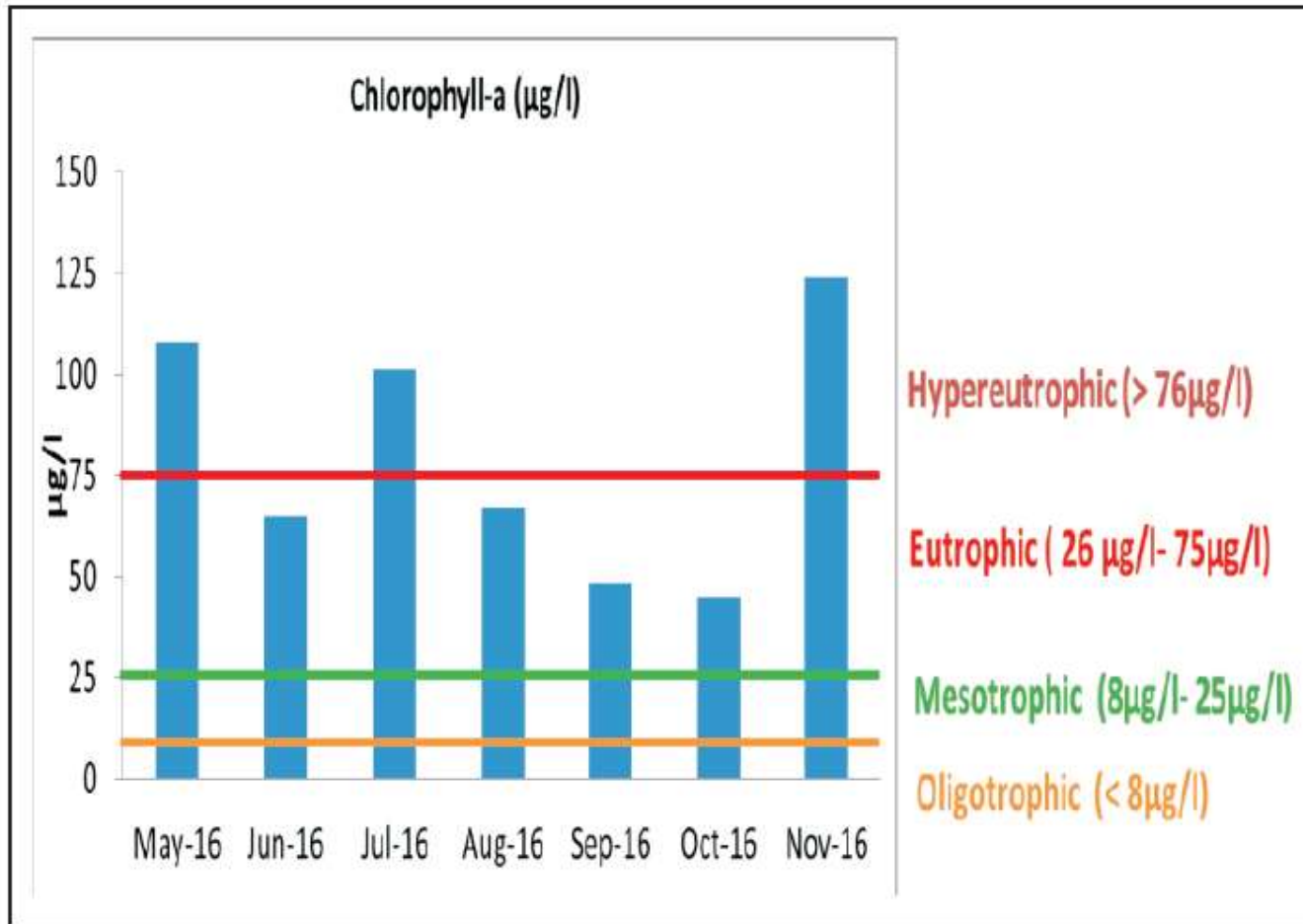

Lake

Polluted drain

Problems with the current system: Jakkur – full throughout the year

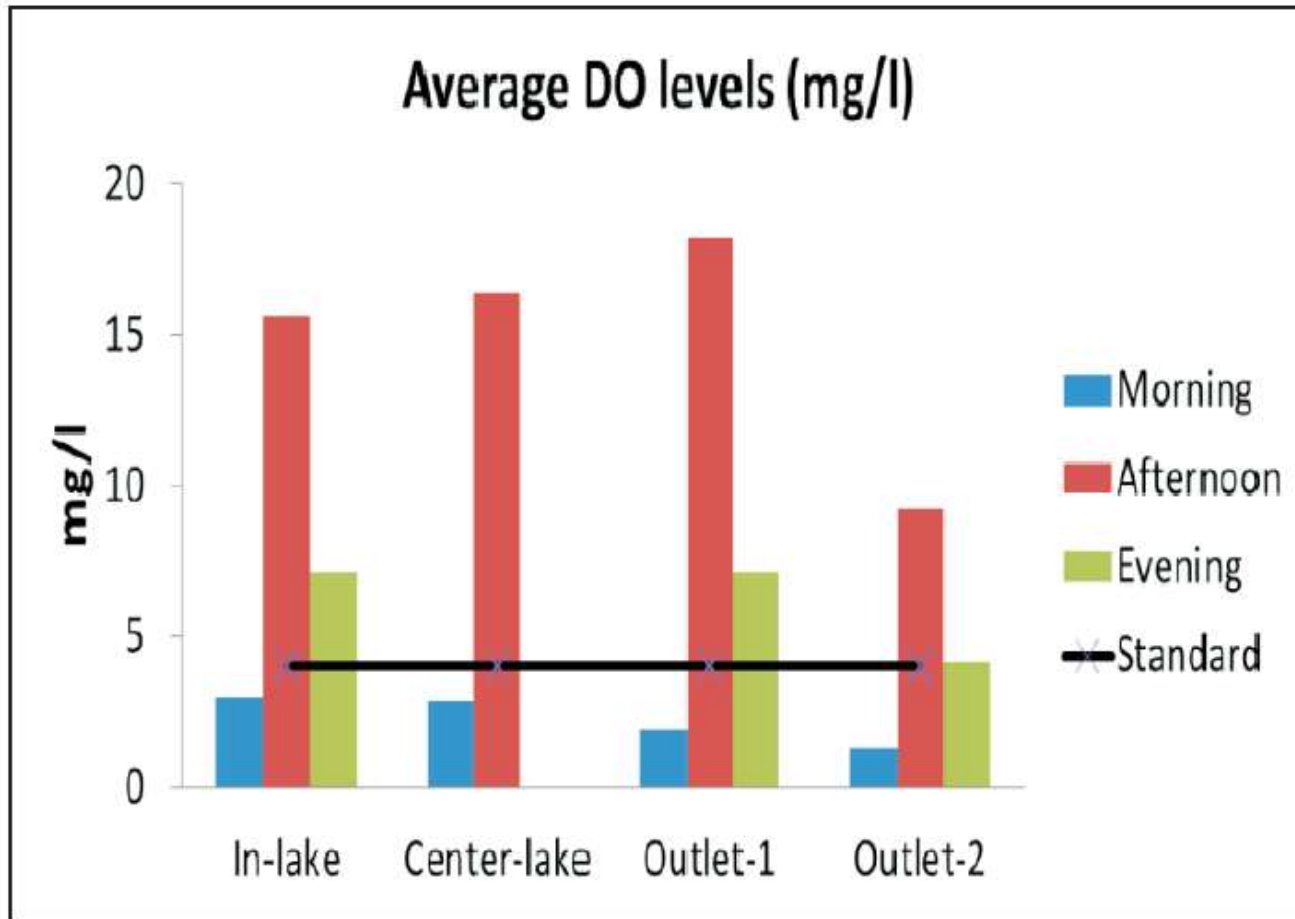Receives 10 MLD of treated sewage each day

Problems with the current system: Jakkur – full throughout the year

Source: Jamwal, 2017

Even Jakkur suffers from hyper-eutrophic conditions

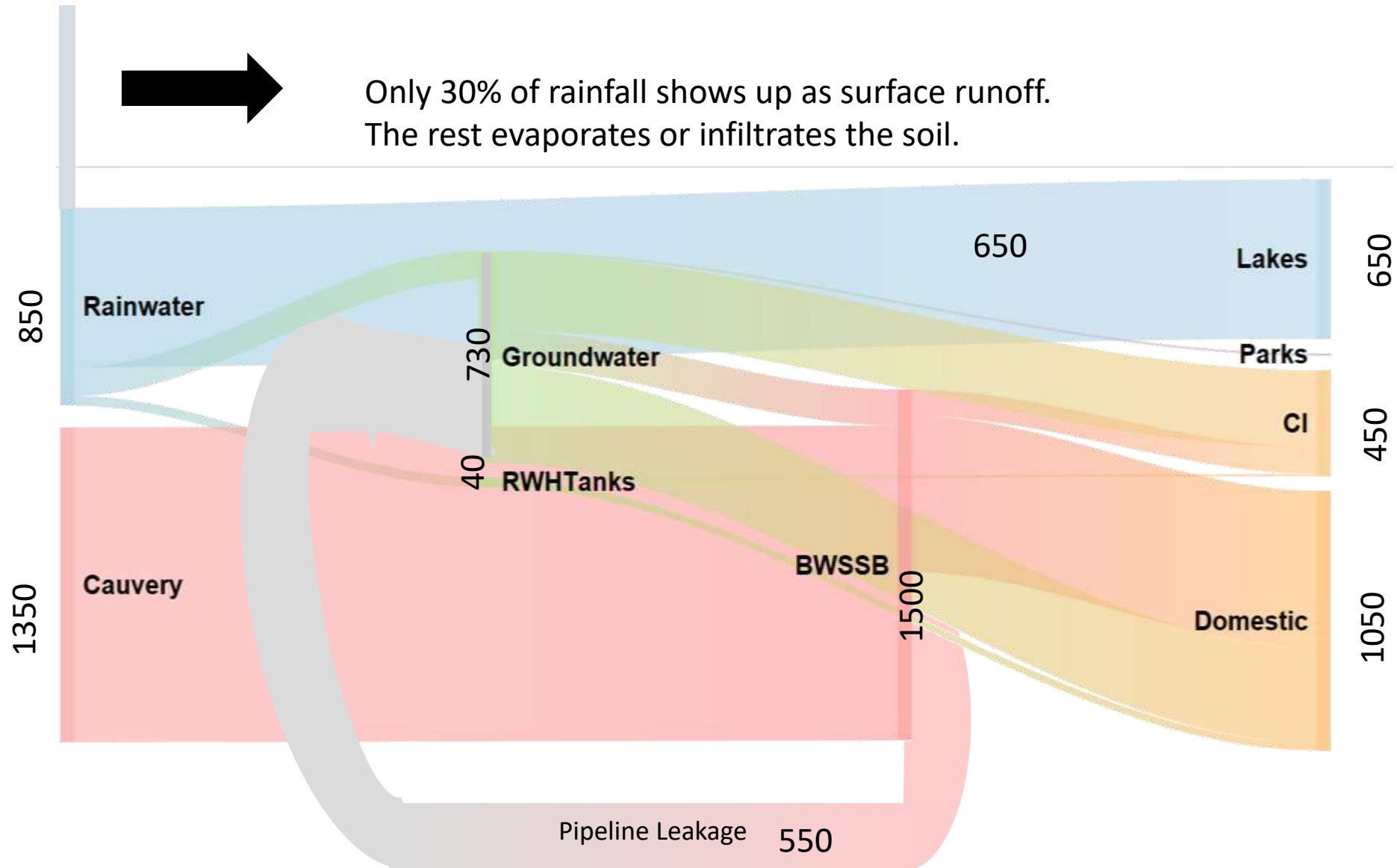# Problems with the current system: Jakkur – full throughout the year
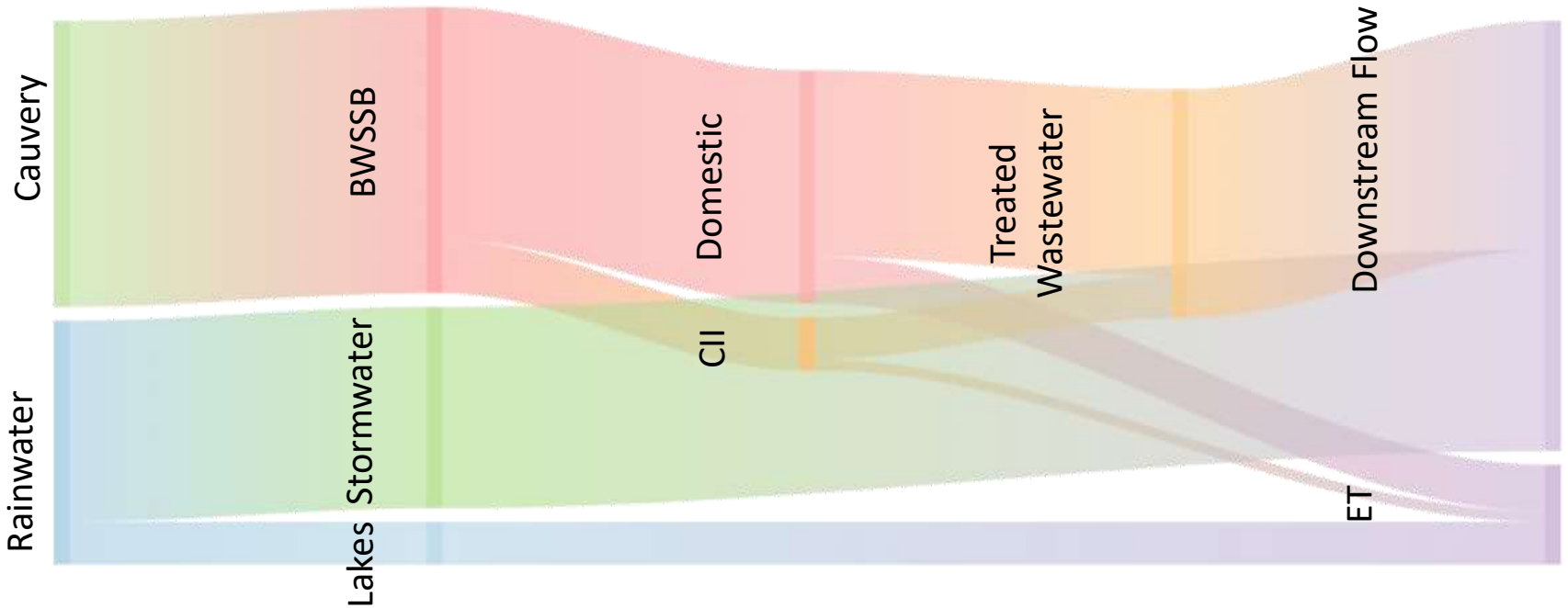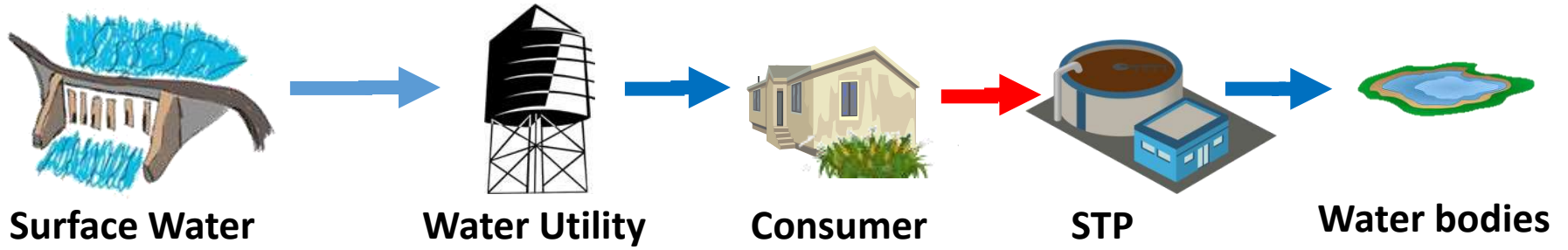

Source: Jamwal, 2017

This causes huge fluctuations in Dissolved Oxygen levels

CURRENT WATER BALANCE

Sources and Uses of Water (MLD)

Only 30% of rainfall shows up as surface runoff.
The rest evaporates or infiltrates the soil.

A Linear Water Economy

Surface Water → Water Utility → Consumer → STP → Water bodies

Cauvery — BWSSB — Domestic — Treated Wastewater — Downstream Flow

Rainwater — Lakes Stormwater — CII — ET
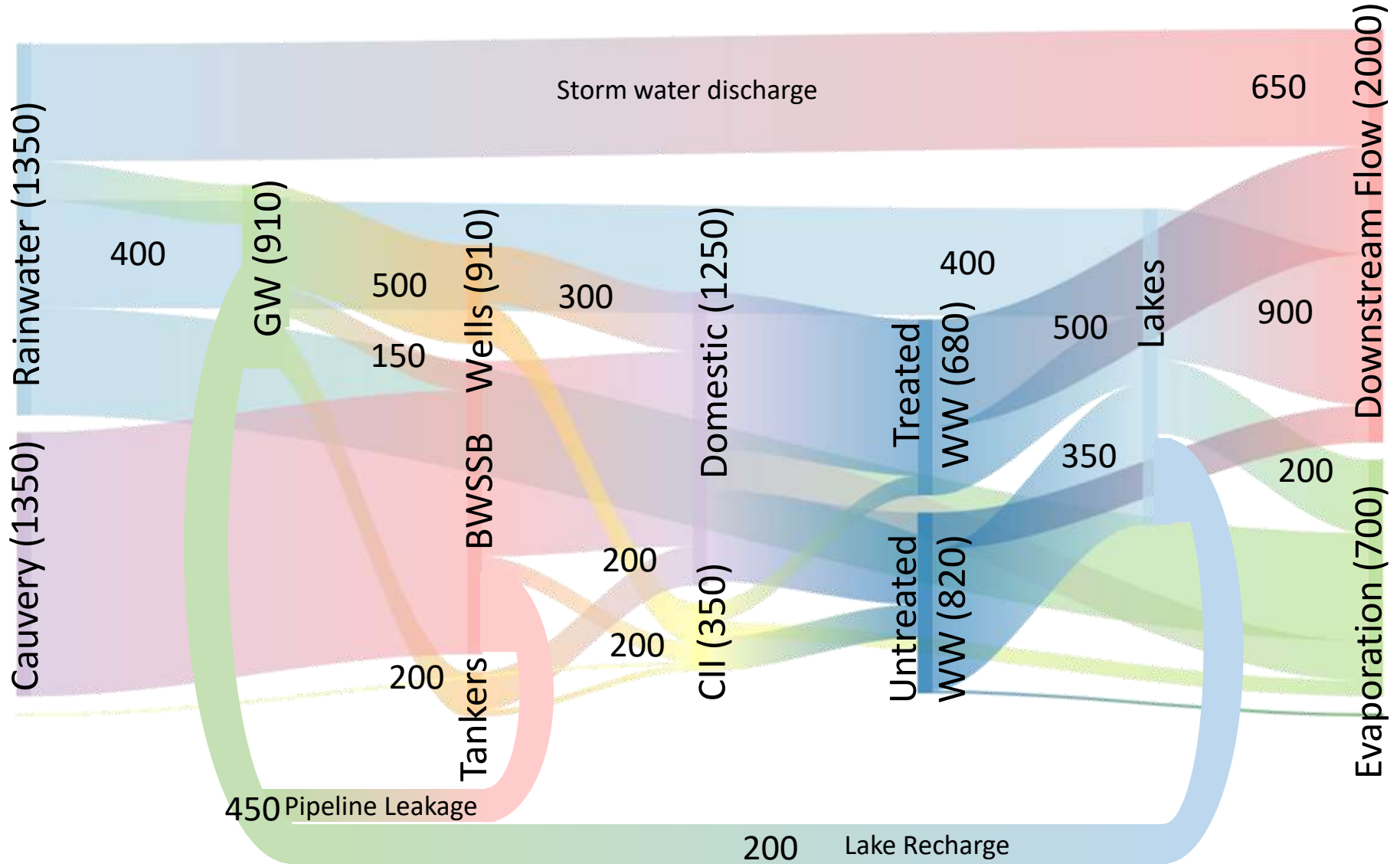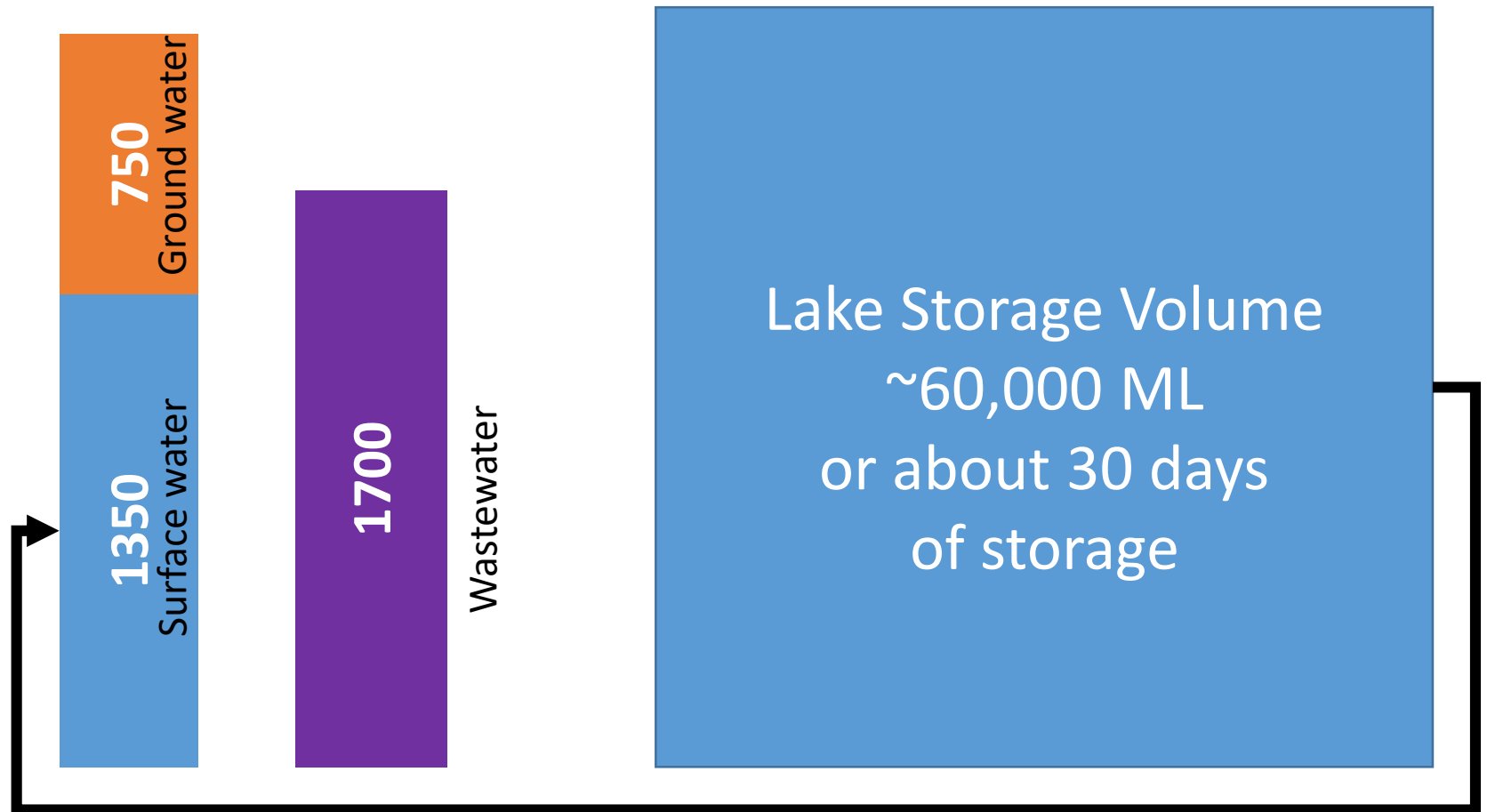
*CII = Commercial, Industrial, Institutional
ET = Evapotranspiration

A Loopy Water Economy

Is a Circular Water Economy possible?

750 Ground water

1350 Surface water

1700 Wastewater

Lake Storage Volume
~60,000 ML
or about 30 days
of storage

How do we get there?

1. Laws (Legal Clarity)

2. Agencies (Fragmented Agencies)

3. Citizens

3. Empowering Citizens

Citizens +
Government+
Domain Experts

Eutrophication

Information Gap:
Nutrient balance of
lakes

Domain Experts
+ ICT

Problem:
Deteriorating
lake water
quality
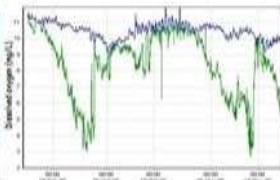
Sensing , Analytics
:Measuring N, P, DO

Citizens +
Government

Solution: Citizens
empowered to act

ICT
+ Citizens

Thank you!

Faculty:
Priyanka Jamwal,
Sharad Lele

Researchers:
Apoorva R.
Sayan Roy
Mrinalini Bakshi
Praveen Raje Urs
Chandan Gowda

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IDRC Canada
Oracle CSR