

THE POLICY & PRACTICE FORUM 2023

***Session 8: Water and treated used water connection - the opportunity
for augmented water conservation and management***

GROUNDWATER in the co-management of W and wW

Himanshu Kulkarni

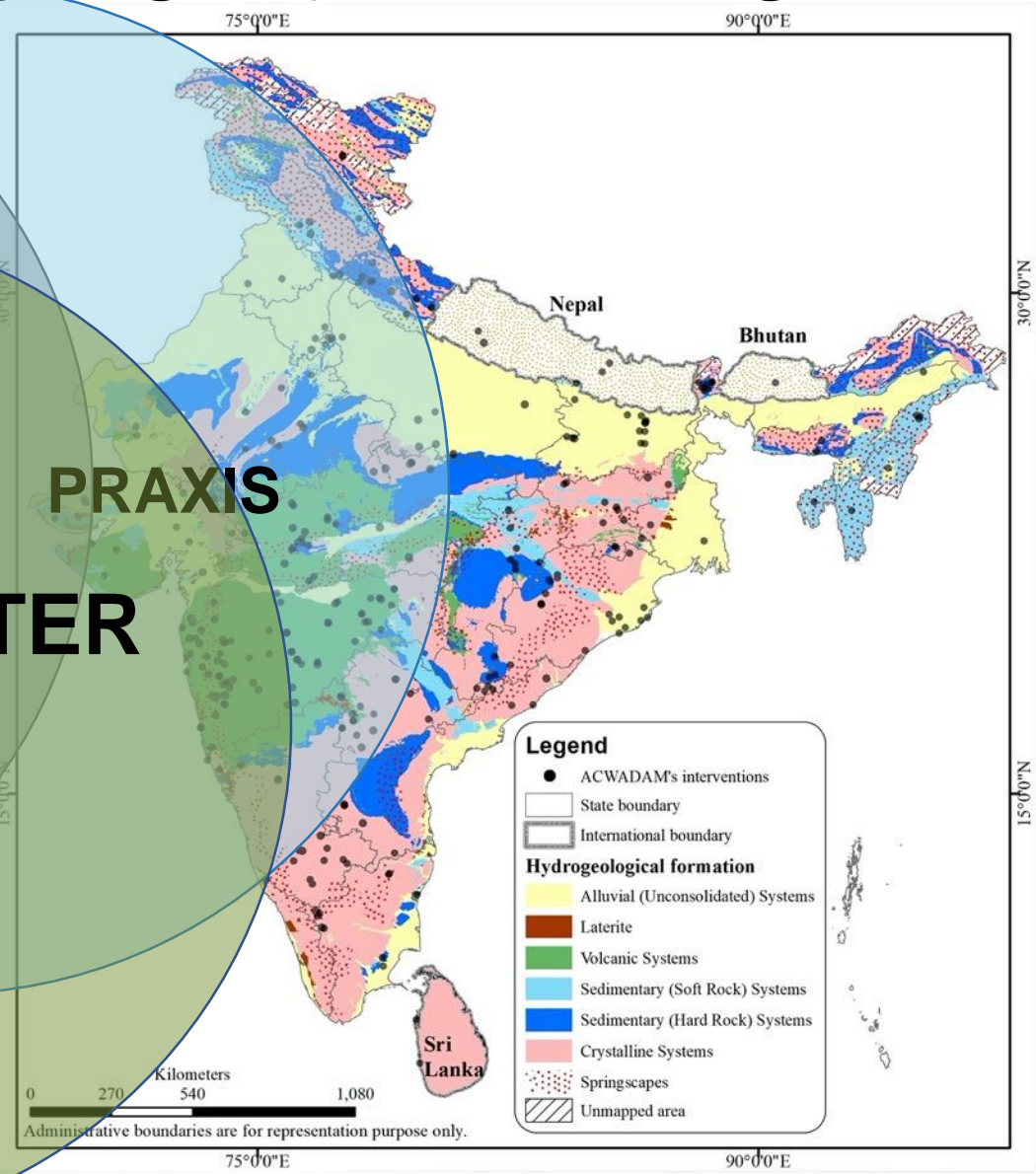
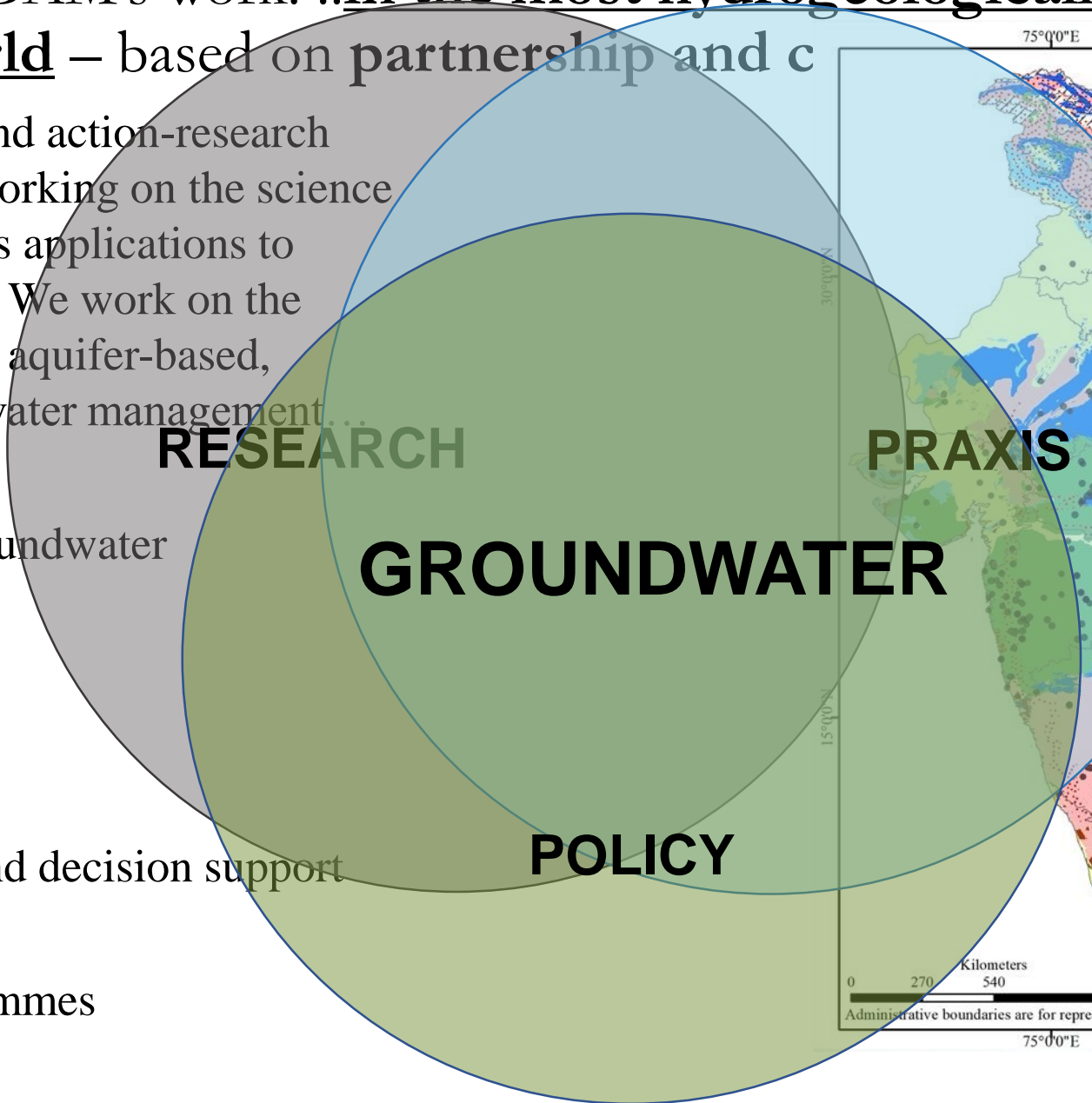


April 25 - 27, 2023

ACWADAM's work: ..in the most hydrogeologically diverse setting in the world – based on partnership and c

We are a think-tank and action-research based organization, working on the science of groundwater and its applications to societal development. We work on the practice and policy of aquifer-based, participatory groundwater management.

- Aquifer-based groundwater management
- Training
- Action research and decision support
- Policy and programmes



Features that are important in urban water planning (India)

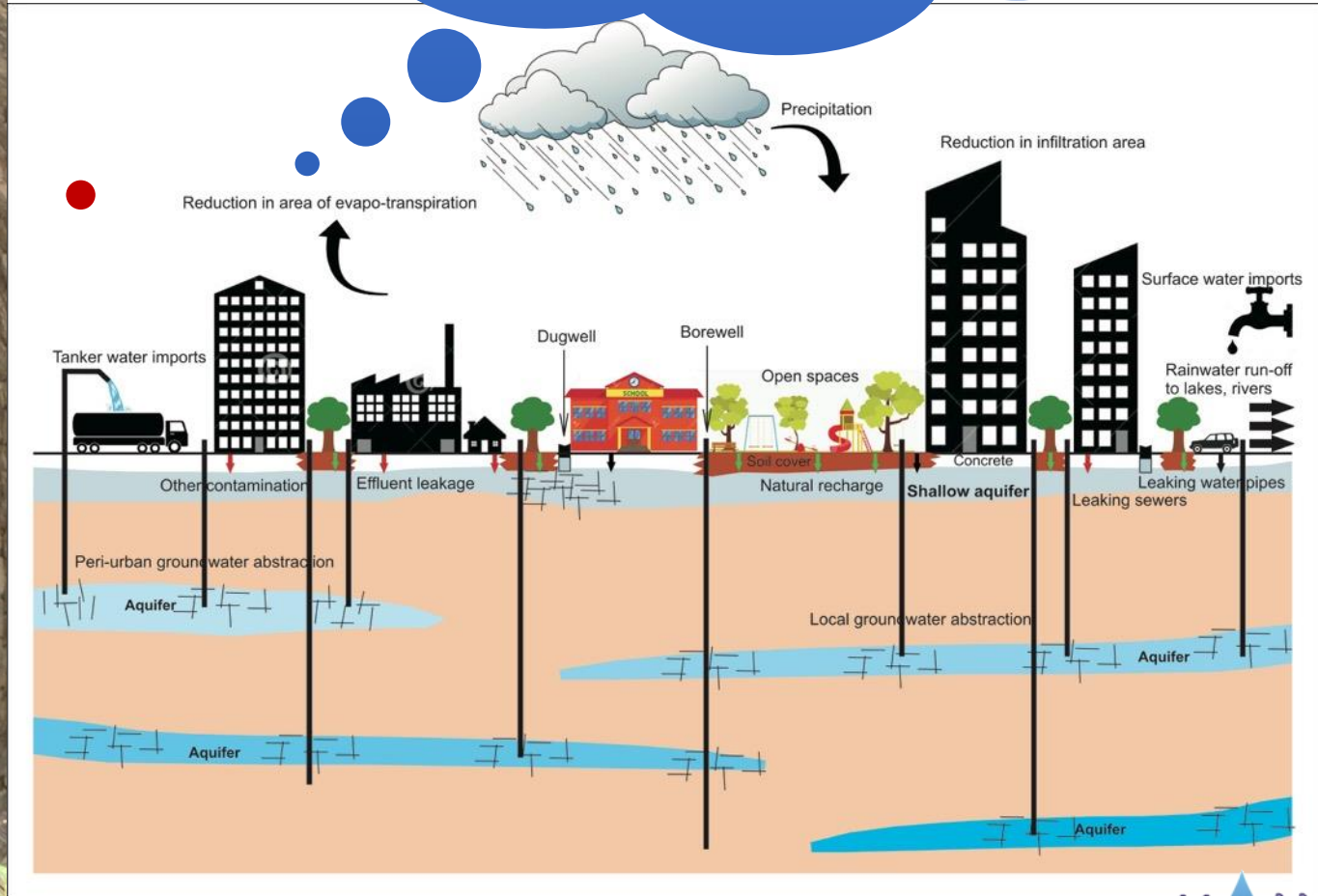
- Groundwater as a source and a sink
- Groundwater dependency is high but is seldom acknowledged
- Paucity in planning
- Groundwater beyond the reference to wells is hardly known in the urban sector – especially aquifers, their natural recharge zones, where and how they naturally discharge etc.
- Aquifers – urban watersheds – rivers (their myriad interconnections – hydrological, environmental and social)

Groundwater and leaking wastewater

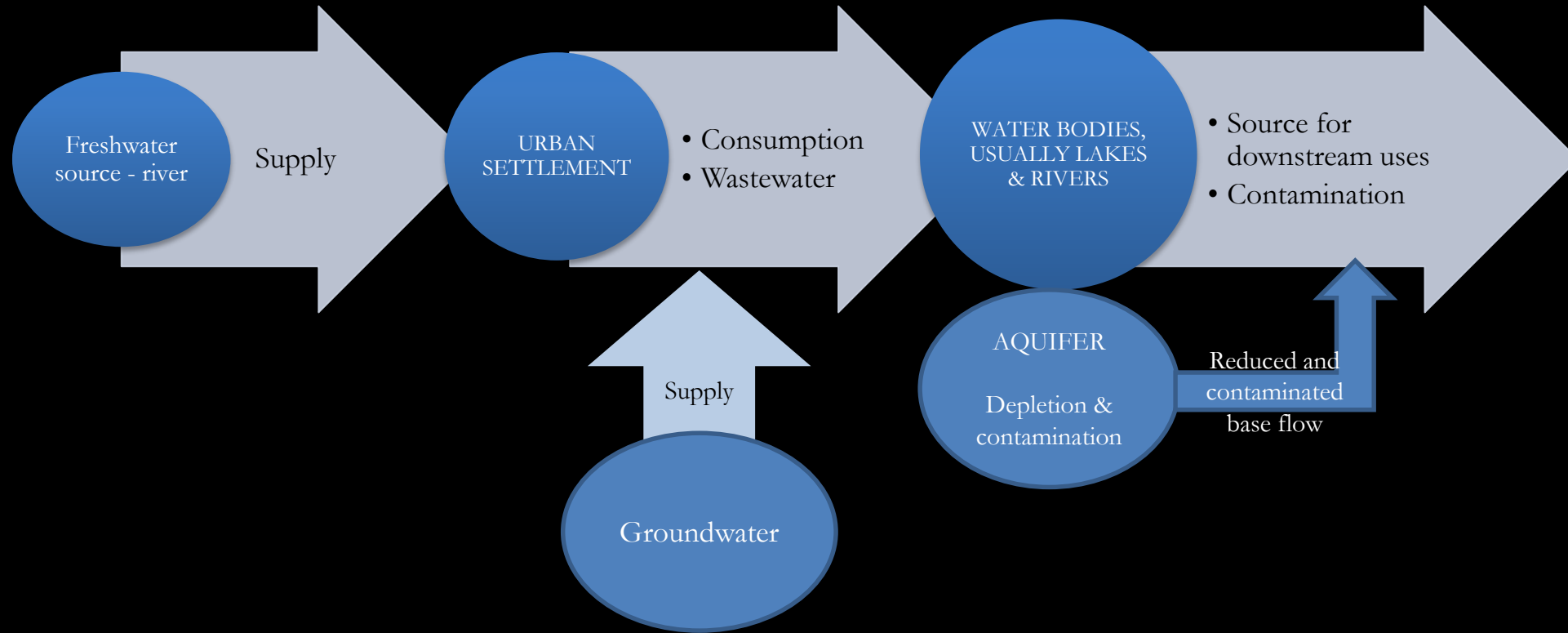
- Drop in natural groundwater recharge in cities often remains hidden behind this zero sum game...



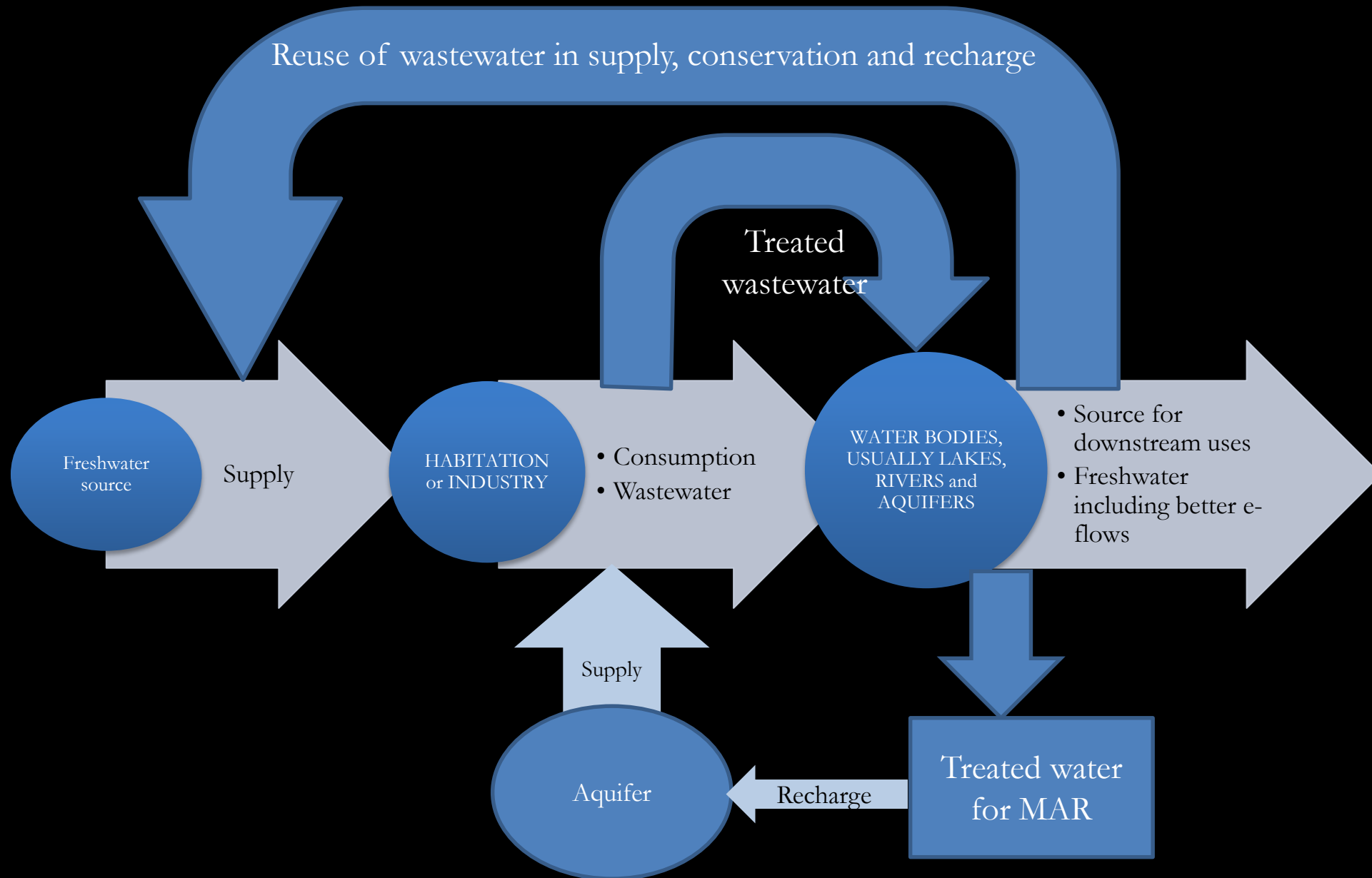
- Reduction in surfaces that induce infiltration of rainwater
- Leaking mains and sewers



A business-as-usual scenario



Closing the loop: reuse, recharge and recycle



Groundwater: the urban bl...

- Aquifers: a source and a sink – *largely un...*
- Quantitative
 - Potential storage
 - Recharge (natural, engineered and incidental)
 - Extraction – pumped
 - Natural discharges – through springs and seeps – baseflow in streams and rivers
- Quality
 - Natural state of groundwater (local profiles)
 - Changes – seasonal and long-term
 - Contamination

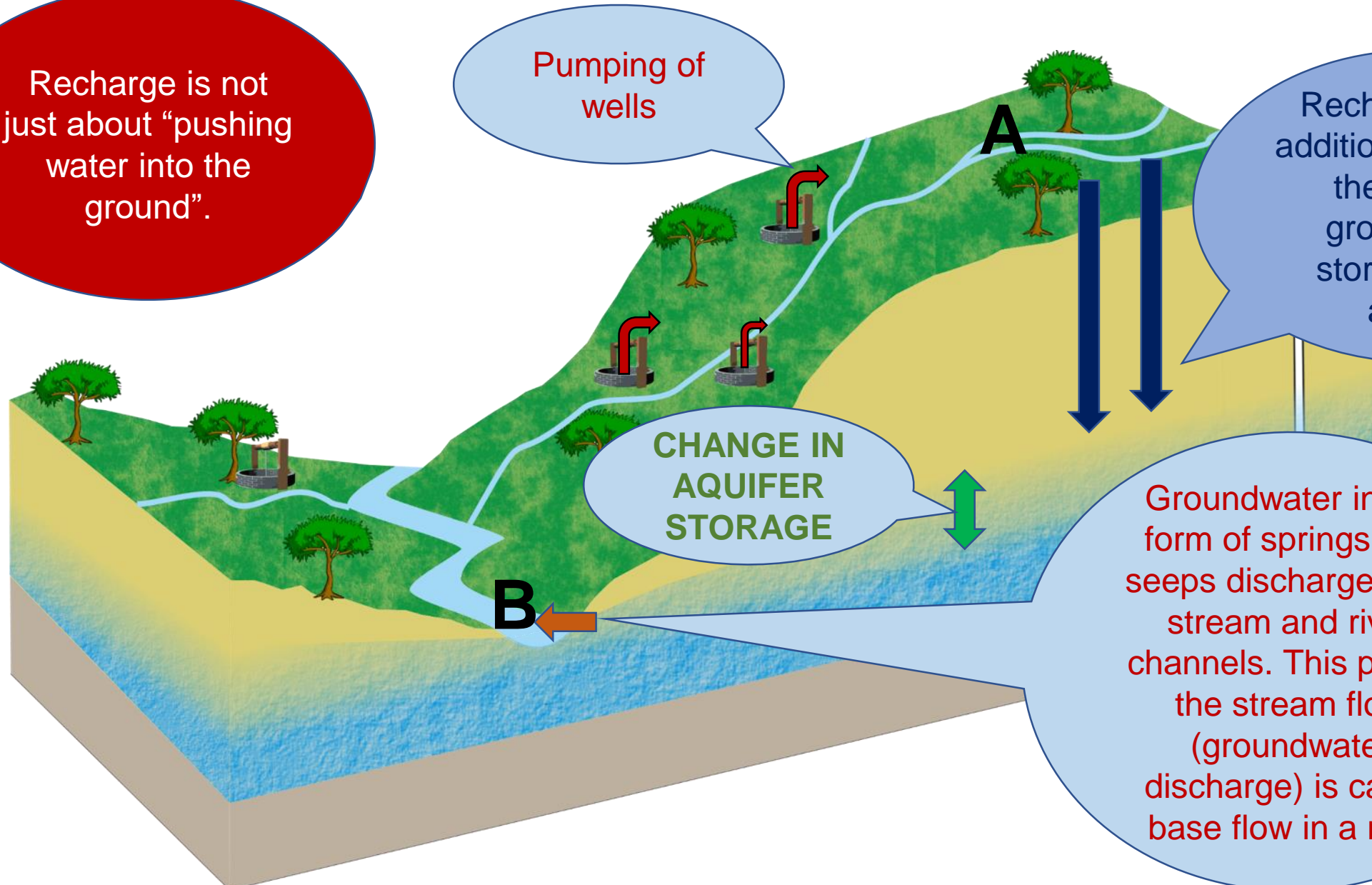
How do we make the connection between water and wastewater in conservation, reuse and recharge?

Groundwater recharge and discharge: with reference to aquifers...

Recharge is not just about "pushing water into the ground".

Pumping of wells

Recharge is the addition of water to the existing groundwater storage in the aquifer



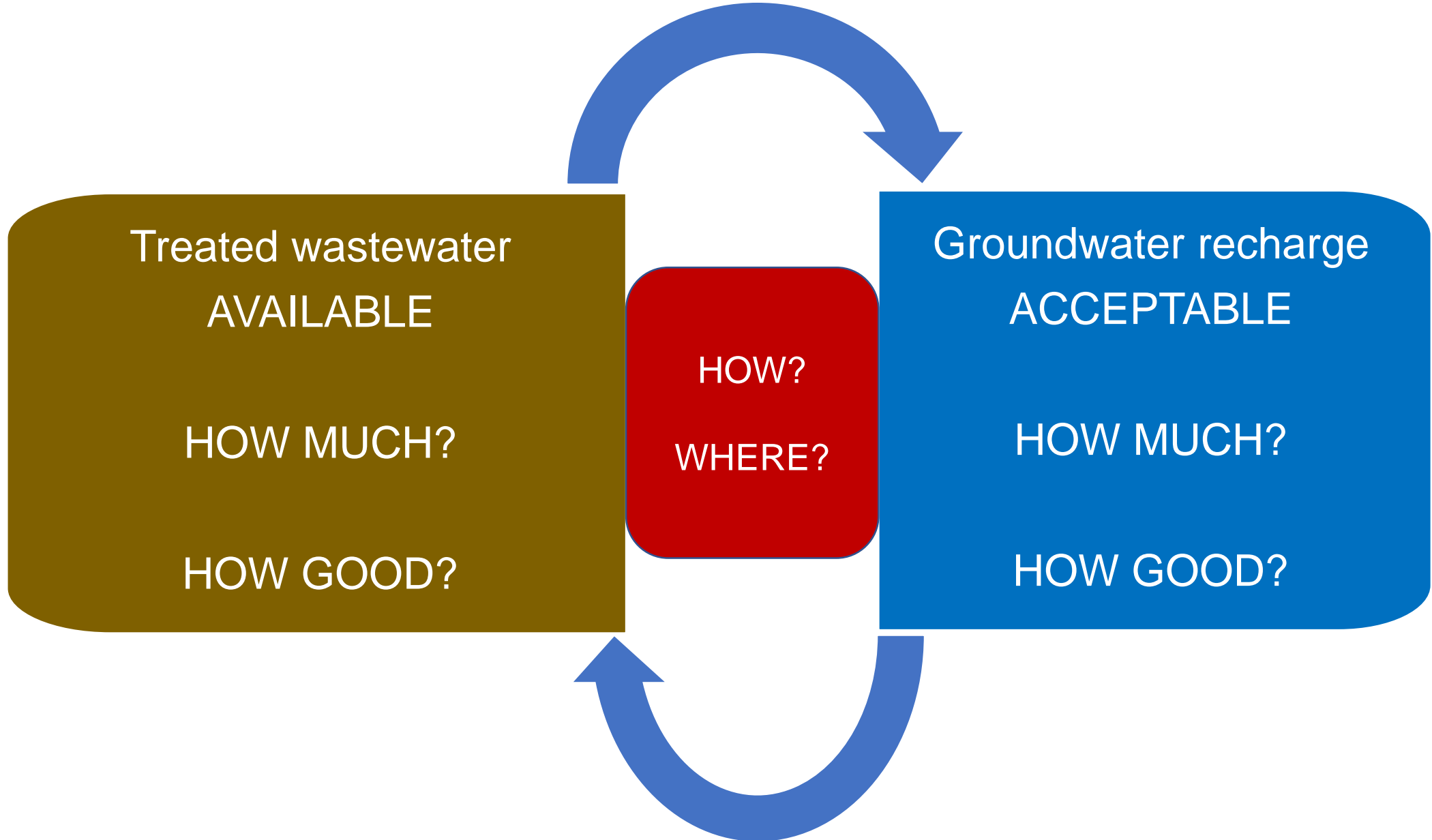
Groundwater in the form of springs and seeps discharges into stream and river channels. This part of the stream flow (groundwater discharge) is called base flow in a river

Managed Aquifer Recharge

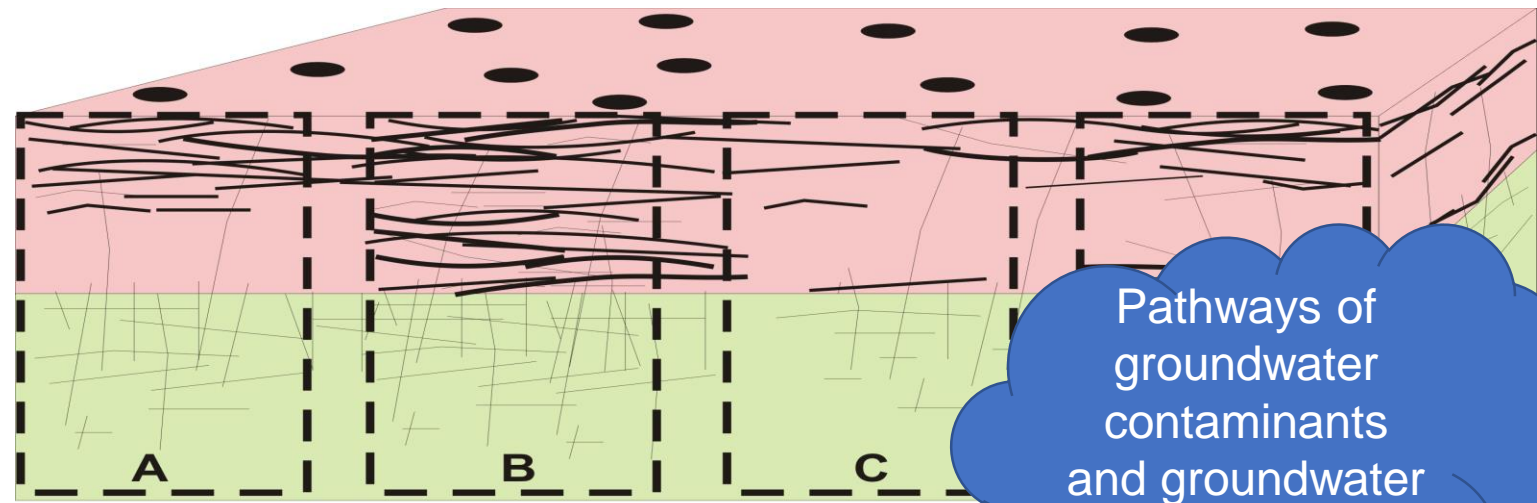
- MAR is the intentional or designed recharge of water to an aquifer
 - Subsequent recovery for meeting anthropogenic needs
 - Environmental benefit
- Hence, the managed process strives for adequate protection of human health and the environment
- Aquifers may be recharged by diversion of water into wells or infiltration of water through the floor of basins, galleries or rivers

- Local precipitation & stormwater
- Treated wastewater




Wastewater and groundwater



Groundwater recharge and contamination are two sides of the same coin



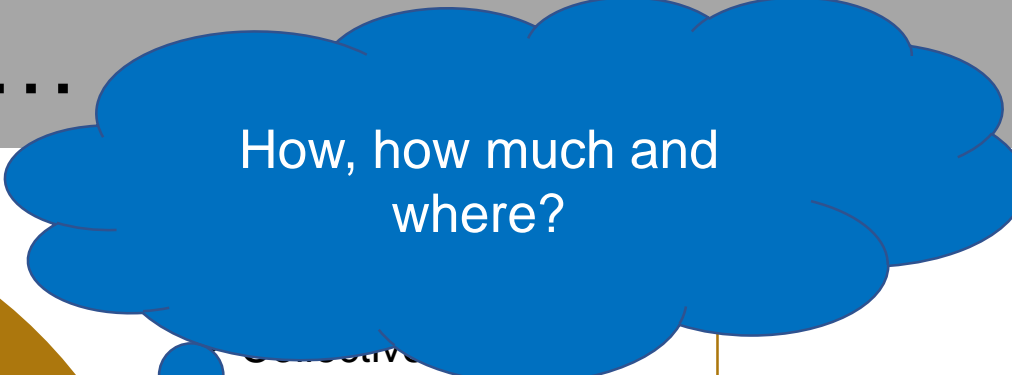
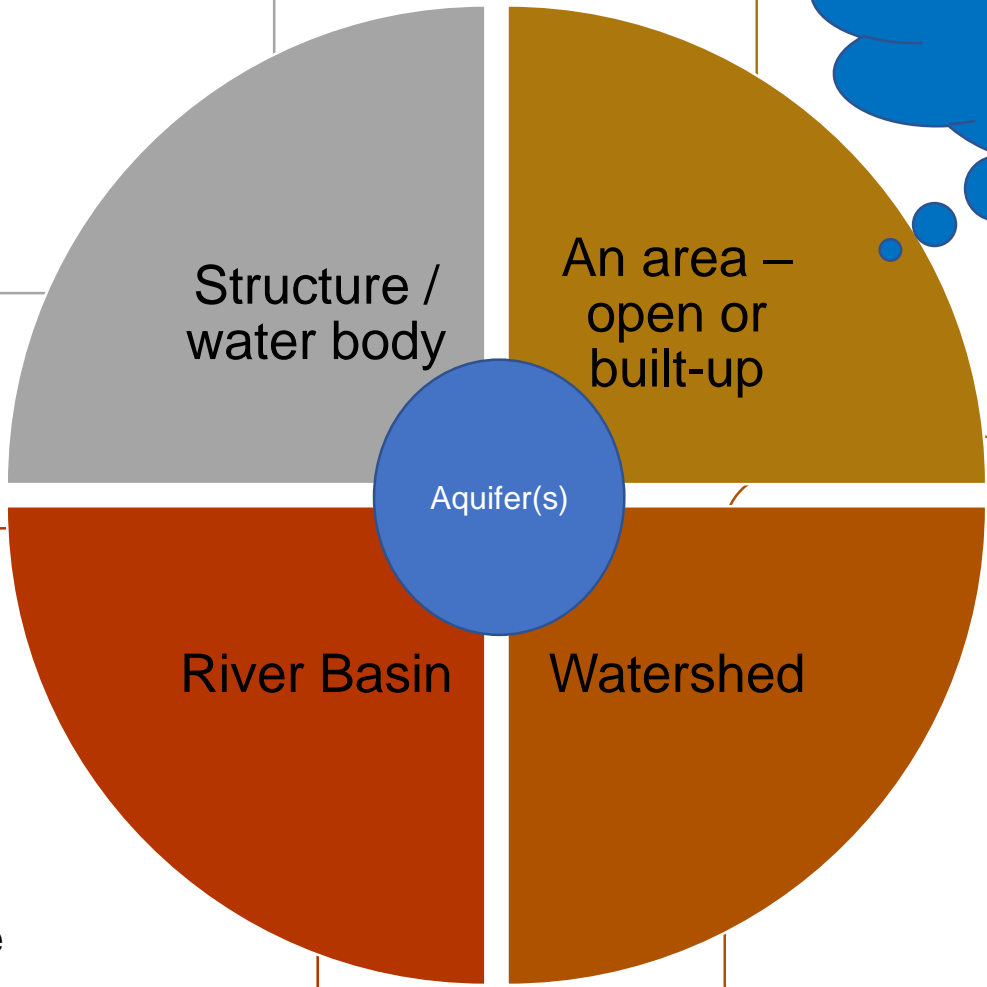
Pathways of groundwater contaminants and groundwater recharge are common...

-  Dug well
-  Vesicular - amygdaloidal basalt with horizontal joints
-  Compact basalt dominated by sub-vertical joints

	A	B	C	D
Aquifer diffusivity				
Travel time				
Degree of vulnerability of source to poor sanitation				
Nature of contaminant – chemical and biological load				

Recharge at different scales...

- Strategic location of structures
- Efficiency of recharge structures
- Operation and maintenance of structures - sustainability

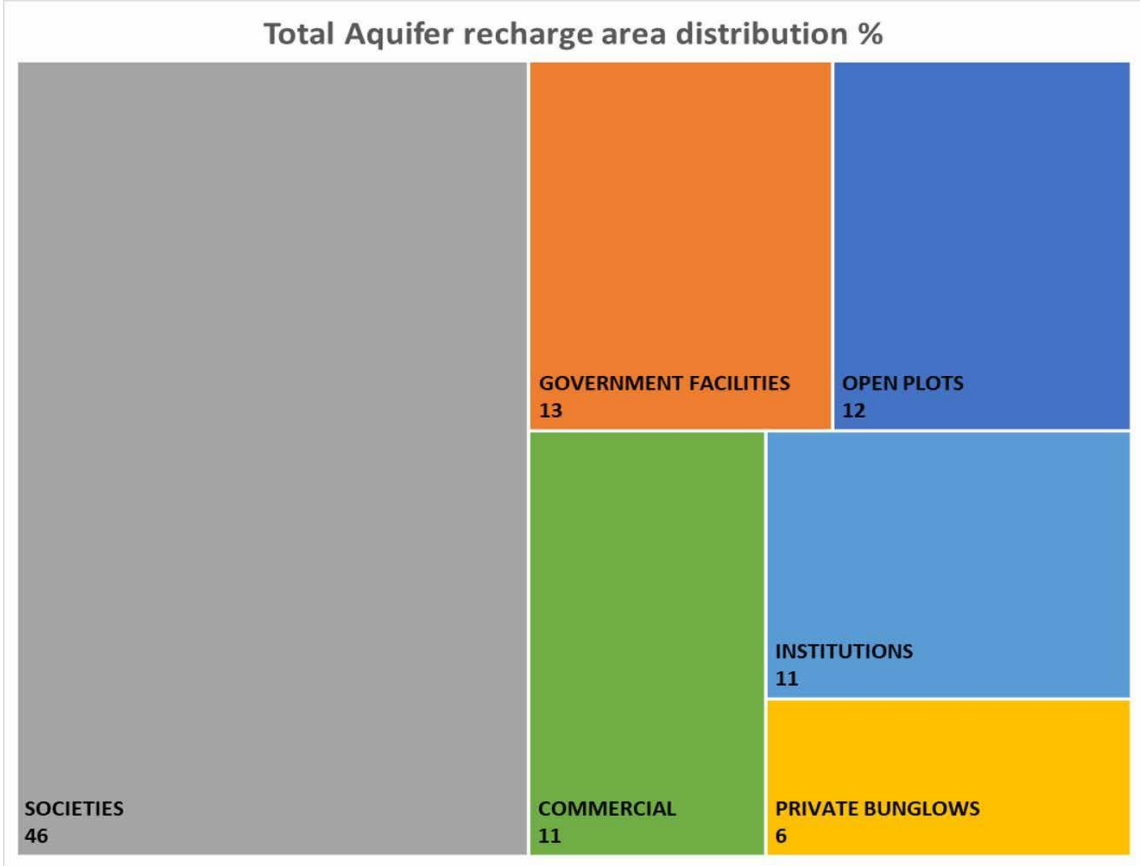
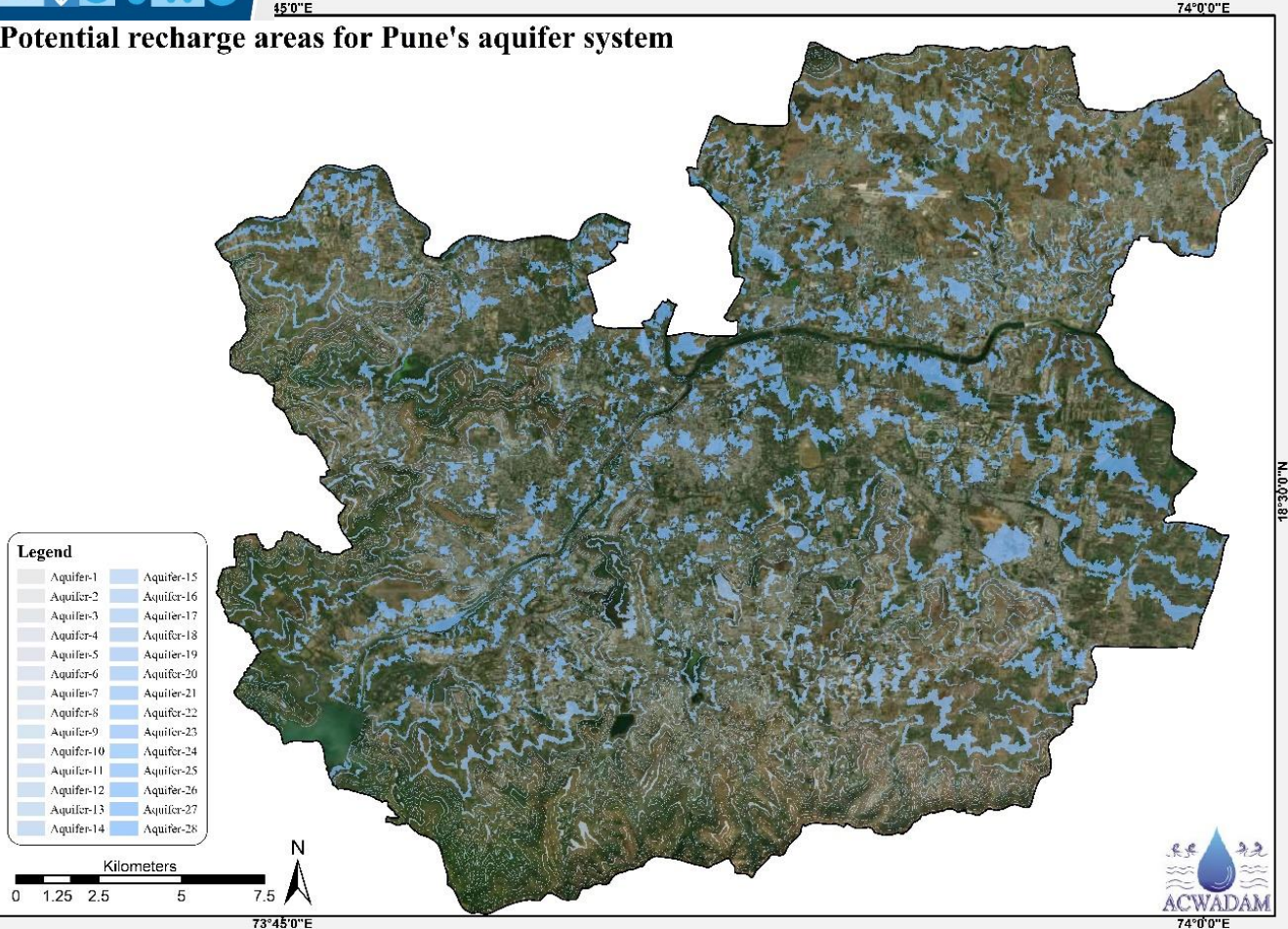


Integrated into larger context of gwM and gwG

- Scale of recharge – watersheds, aquifers...
- Upstream – downstream issues of equity
- Significance in the larger river basin water balance

- Purpose of recharge
- Efficiency of watershed development and management plan
- Aquifer and watershed relation
- Communities and scale

Natural groundwater recharge areas - Pune



After: ACWADAM, 2022



Unravelling Pune's Aquifers
Framework for Groundwater Management and Governance



wipro foundation

<http://dx.doi.org/10.13140/RG.2.2.34683.18724>

Thank you !



Dr. Himanshu Kulkarni
Scientist (Emeritus)
ACWADAM

Email: acwadam@gmail.com

