Mashreq Waters Knowledge Series Disruptive Technologies for Improved Groundwater Management in the Mashreq Region

Innovative Groundwater Storage and Managed Aquifer Recharge

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Water

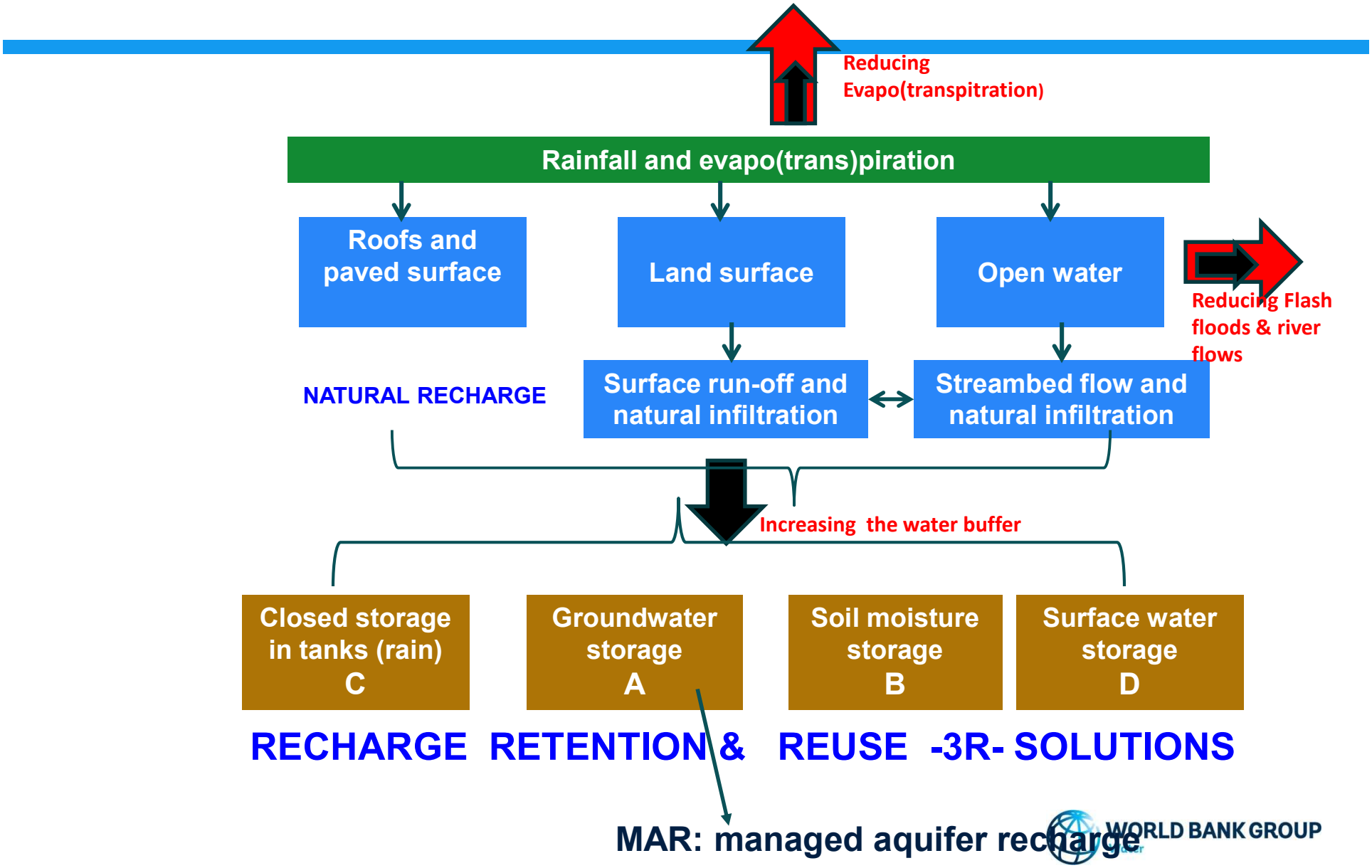
Water Harvesting: what is in a name?

Water harvesting: interventions to store water during periods of excess water for use during periods of shortage. Different names used:

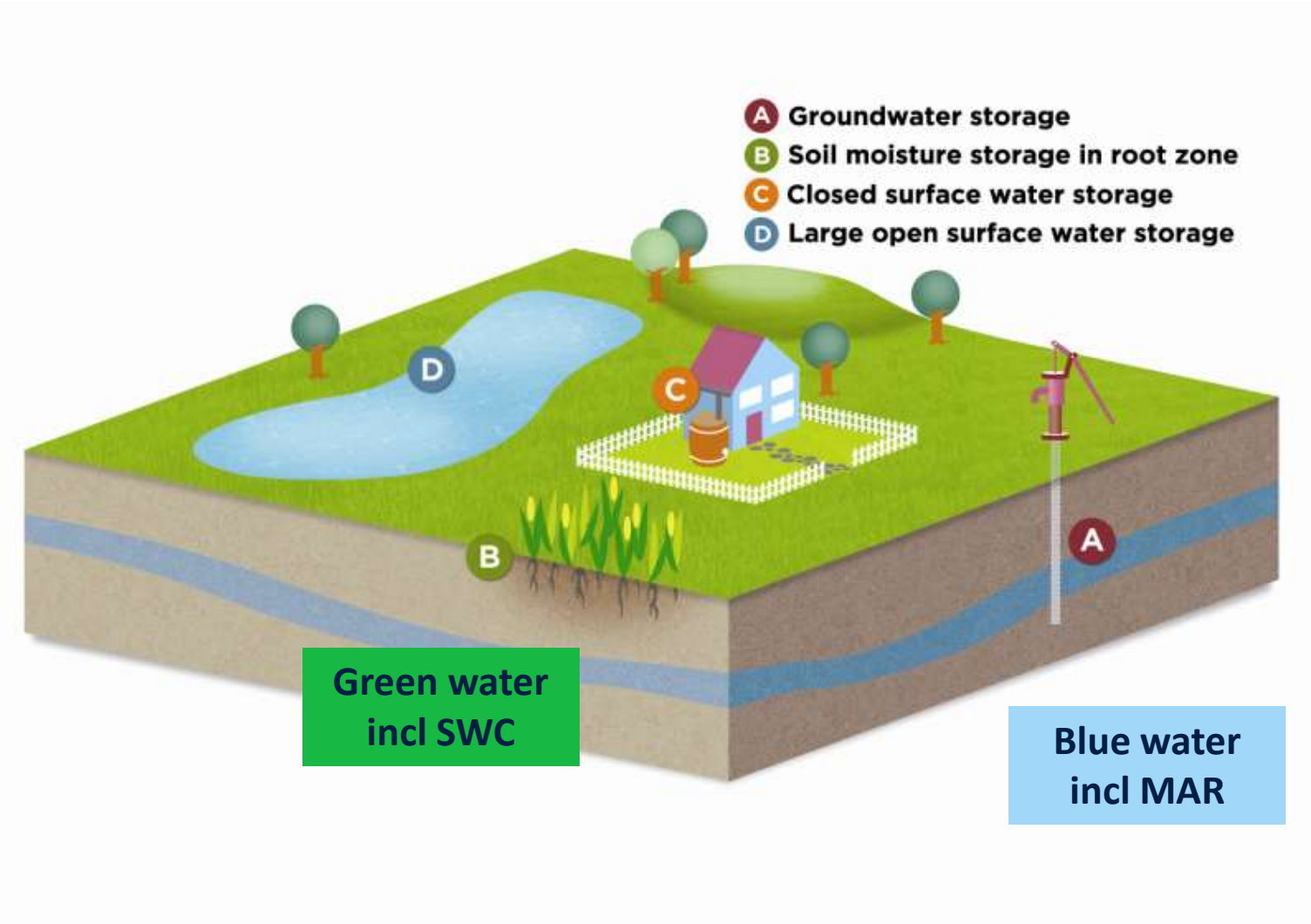
- (Rooftop) Rainwater harvesting,
- 3R (Recharge- Retention - Reuse)
- Water Buffering
- Soil and Water Conservation (SWC)
- Managed Aquifer Recharge (MAR)

Managed Aquifer Recharge (to supplement the natural groundwater recharge): interventions to intentionally recharge an aquifer under controlled conditions for later recovery, environmental benefit, or to mitigate the impacts of over abstraction

Framework for managing the water buffer

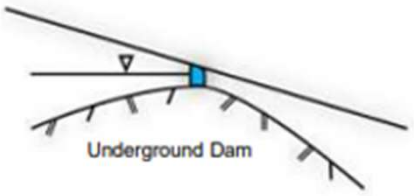


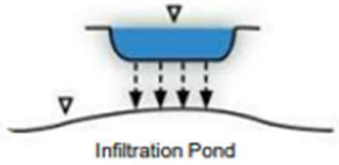
The storage options

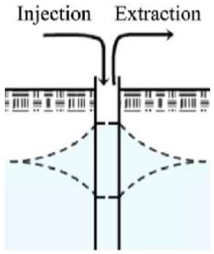


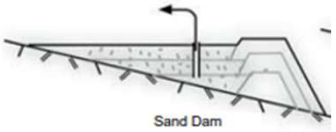
MAR typologies

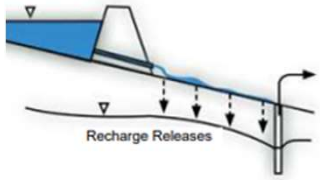
Riverbed Infiltration	Land Surface Infiltration	Direct Infiltration
• Sand Dams • Sub Surface Dams • Recharge dams / • Retention Weirs	• Infiltration ponds • Trenches,drains, ditches • Wetland protection • Floodwater spreading	• Infiltration wells • Injection wells • River bank Infiltration • Dune infiltration

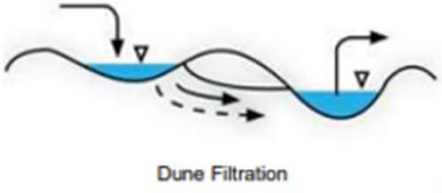












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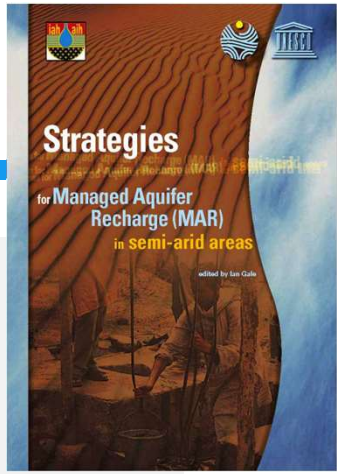
Developments in the last 15-20 years



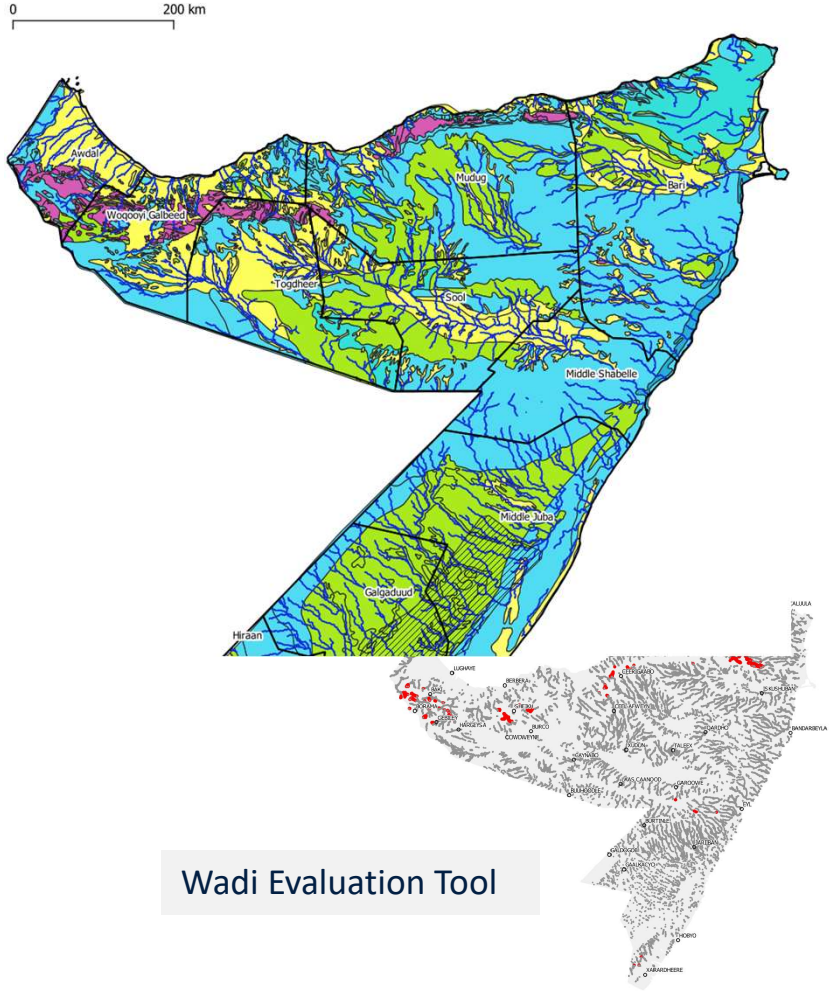
- Documenting and sharing experiences from around the world:
  - IAH- UNESCO Strategies for MAR (Ian Gale / Peter Dillon) 2005
  - IAH - MAR Symposia every 3-4 yrs since 1988 (nr 11 in 2022) www.IAH.org
  - Global MAR inventory by IGRAC (2006) www.un-igrac.org
  - Series of booklets in Water buffering: www.bebuffered.com
- Evolvement from a typical (semi)arid solution for rural water supply >> to application in industrialized, intensive agricultural and densely populated areas for different uses (water quality, climate change, environmental protection).
- In rural setting: development of (remote sensing) tools for mapping, design and impact assessment of dams, catchment-based /community-based approach, solar energy
- In urban/industrialized setting: technology development in construction (ASR, ASTR), remote control & monitoring (dashboard)
- Linkage with IWRM, integration in catchment management and physical planning, financing instruments (climate funds, IFI

Scaling up sand dams & subsurface dams

Sand dam in dry season

Sand dam during runoff

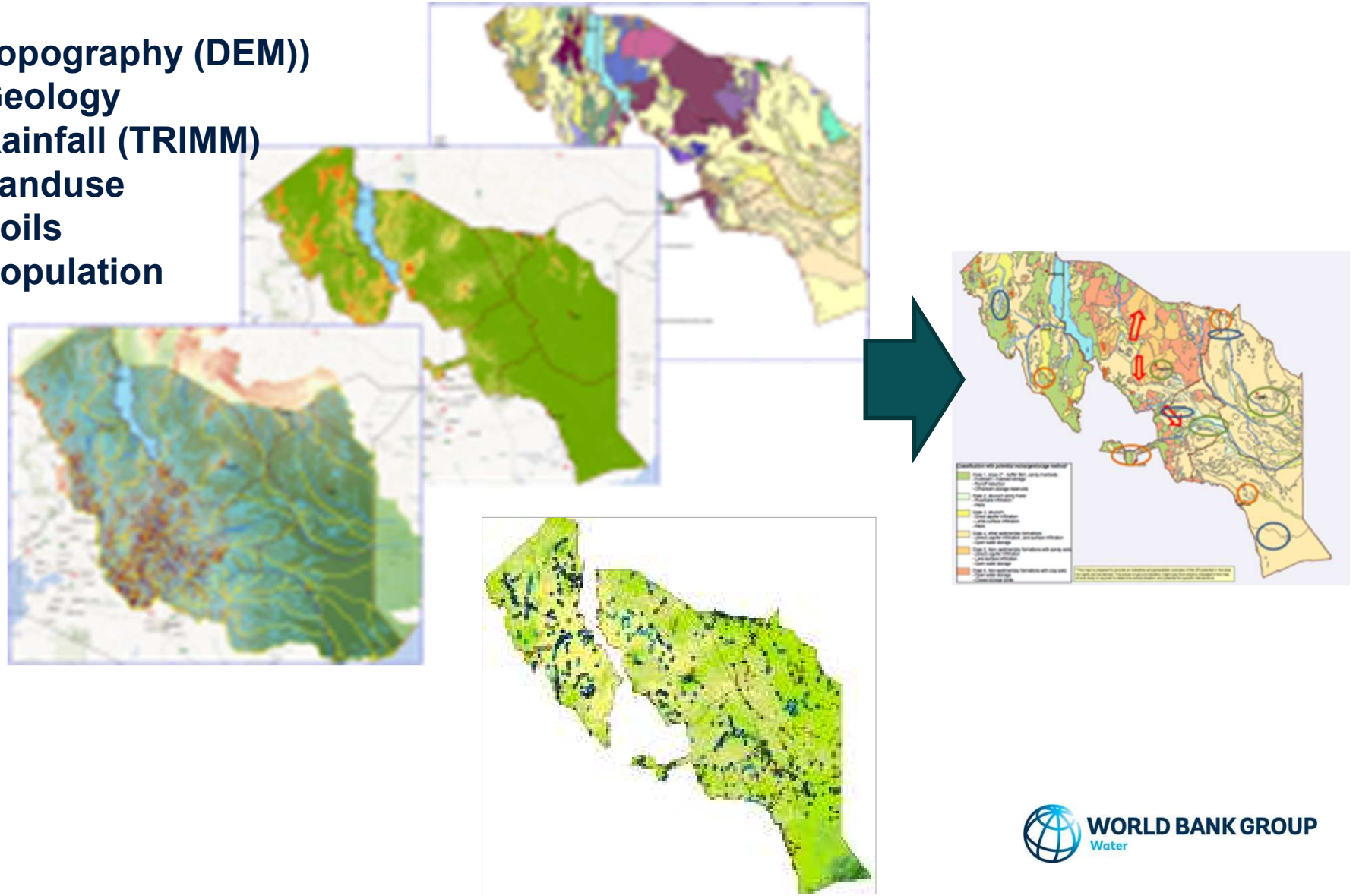
Worldbank Somalia /Biyoole Project / $0 Million USD
Water for Agro-pastoral Productivity and Resilience



Wadi Evaluation Tool

Kenya: water buffering in dry lands

Topography (DEM))
Geology
Rainfall (TRIMM)
Landuse
Soils
Population



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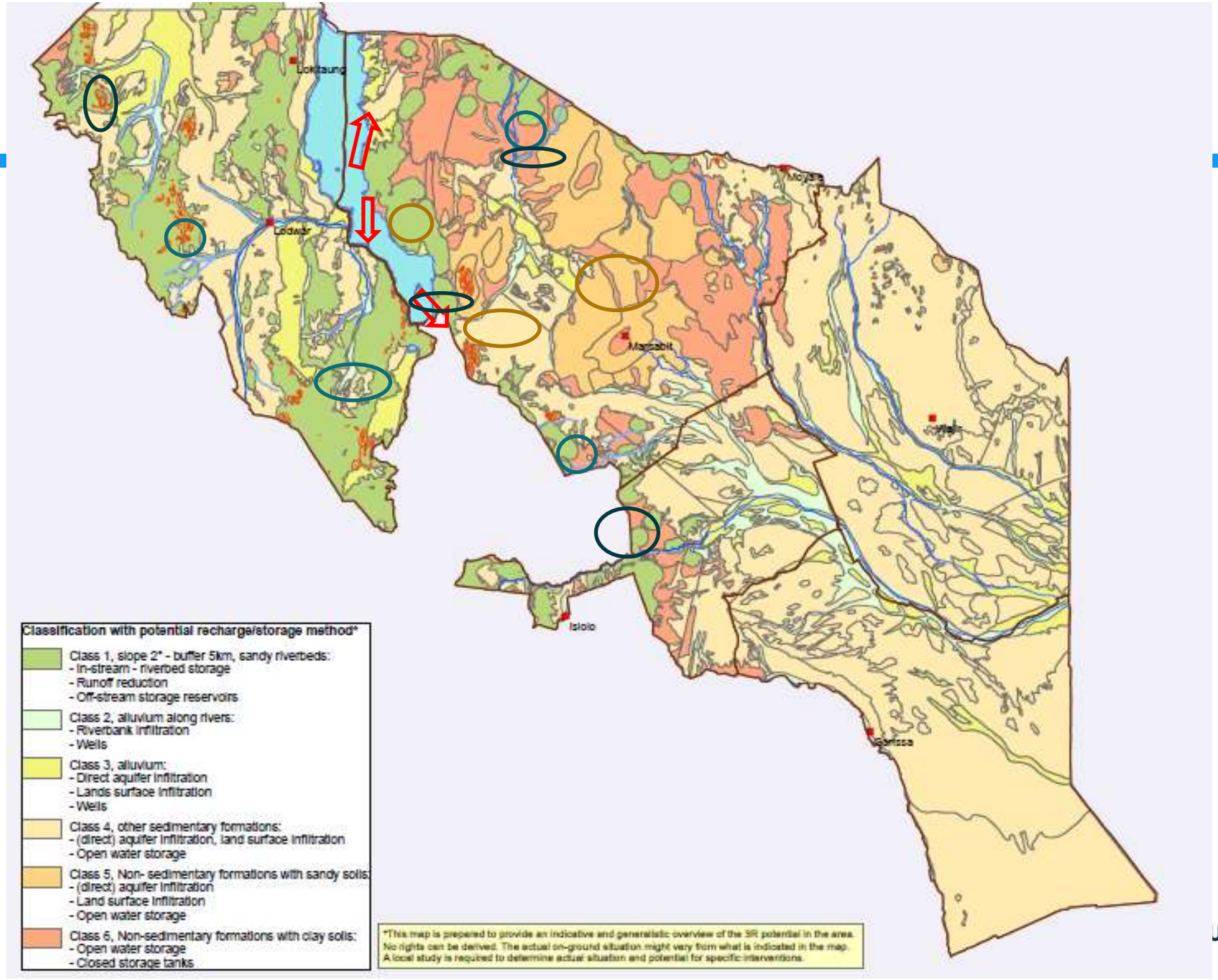
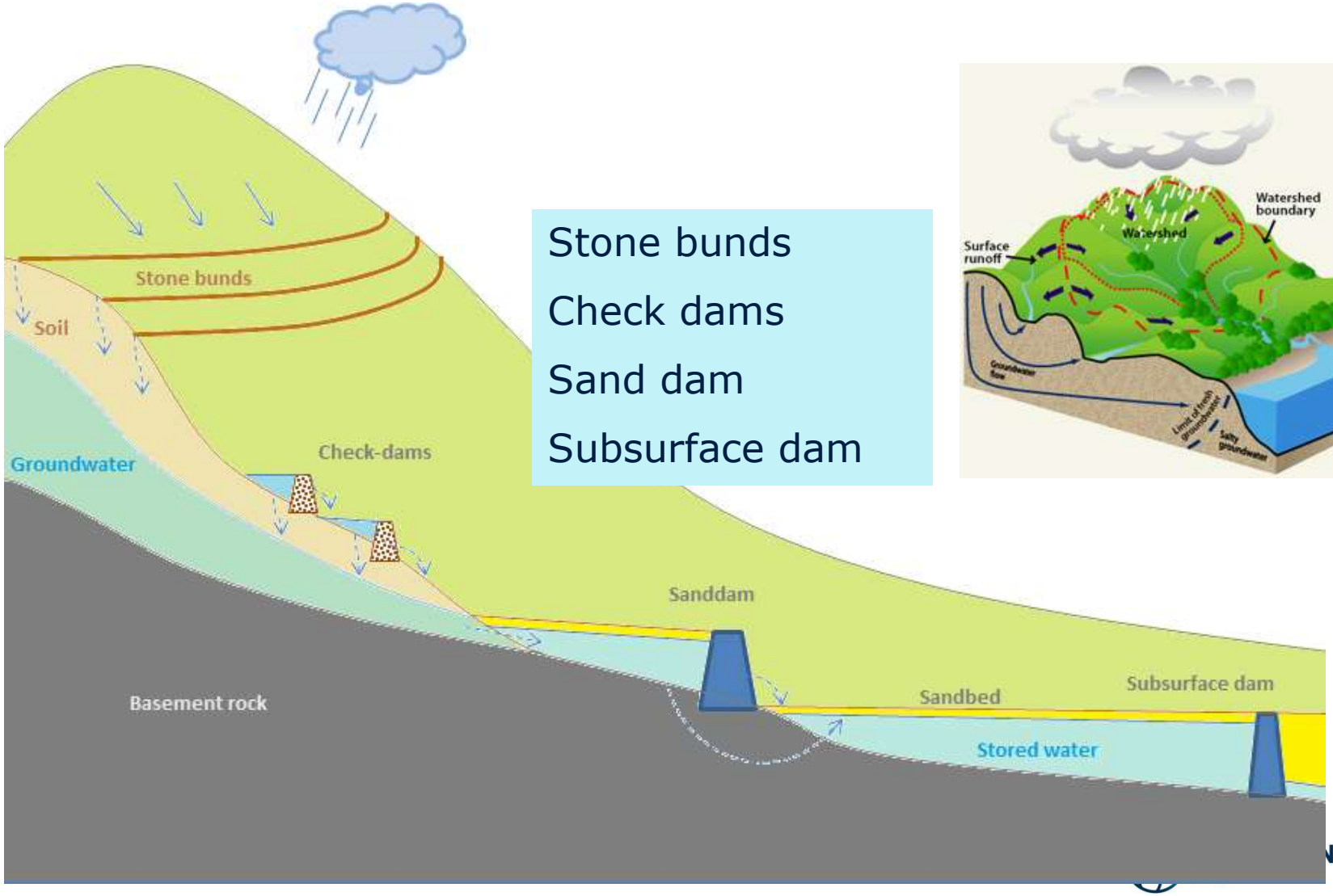

Loldaung
Lodwar
Marsabit
Isiolo
Garissa
Classification with potential recharge/storage method*
Class 1, slope 2° - buffer 5km, sandy riverbeds:
- In-stream - riverbed storage
- Runoff reduction
- Off-stream storage reservoirs
Class 2, alluvium along rivers:
- Riverbank infiltration
- Wells
Class 3, alluvium:
- Direct aquifer infiltration
- Lands surface infiltration
- Wells
Class 4, other sedimentary formations:
- (direct) aquifer infiltration, land surface infiltration
- Open water storage
Class 5, Non- sedimentary formations with sandy soils:
- (direct) aquifer infiltration
- Land surface infiltration
- Open water storage
Class 6, Non-sedimentary formations with clay soils:
- Open water storage
- Closed storage tanks
*This map is prepared to provide an indicative and generalistic overview of the SR potential in the area. No rights can be derived. The actual on-ground situation might very from what is indicated in the map. A local study is required to determine actual situation and potential for specific interventions.

Catchment based multiple interventions



Stone bunds

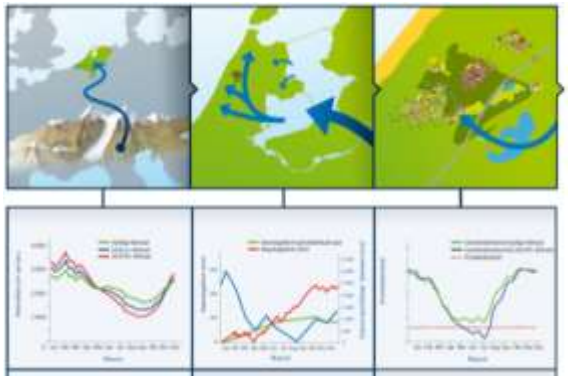
Check dams

Sand dam

Subsurface dam

Participatory planning process

Facts



Stakeholder priorities

Dialoque

Context

Strategies

Based on facts and knowledge of all stakeholders, sustainable strategies and measures are determined.

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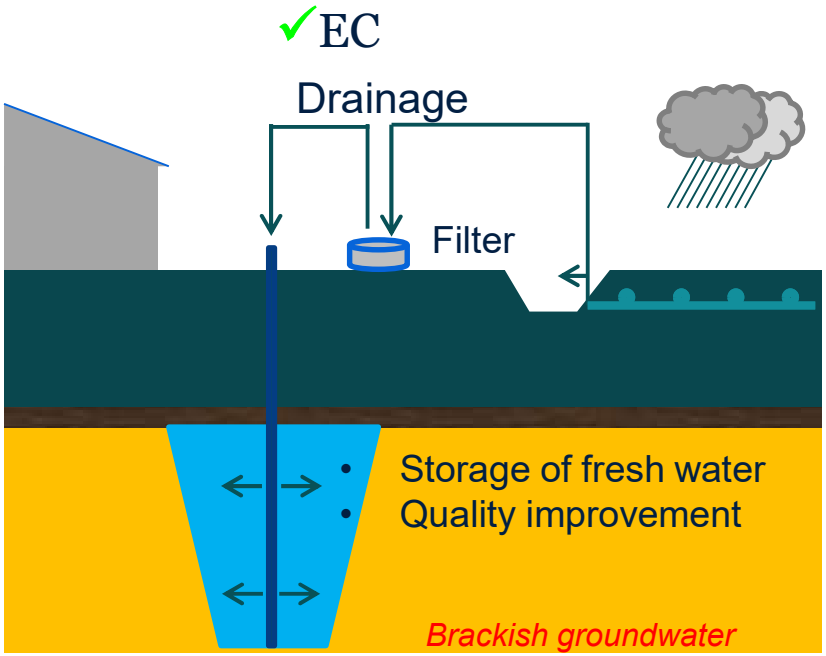
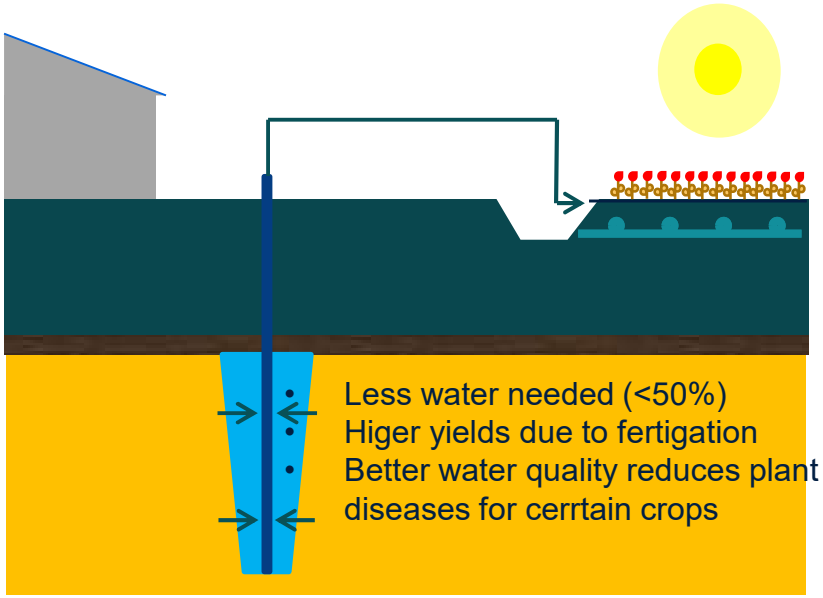
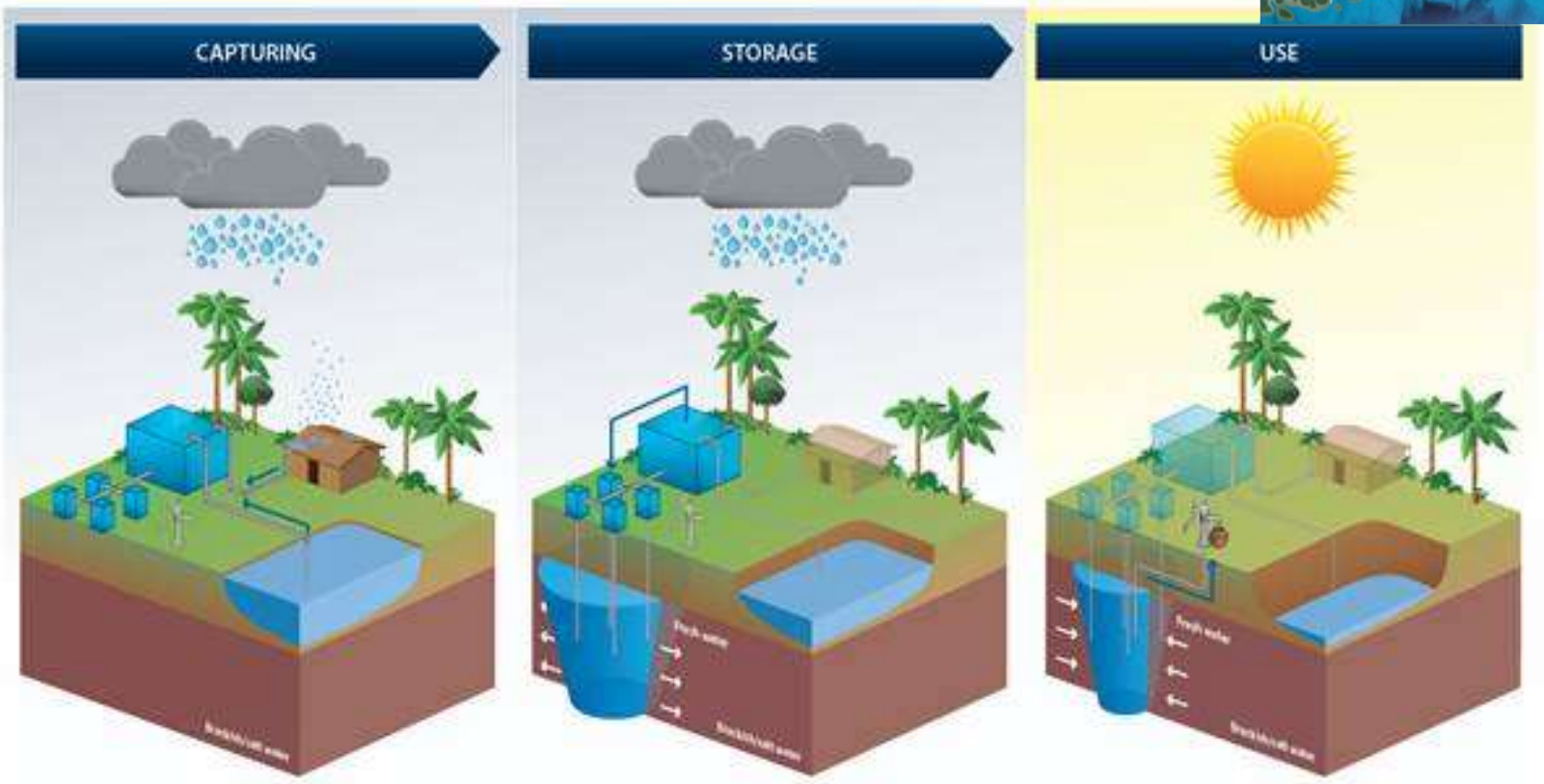
Agricultural MAR in coastal zones





MAR for RWS in coastal Bangladesh



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Conclusion

- MAR is about increasing additional groundwater storage and therefore is a water harvesting measure which has specific advantages for improving resilience under the present challenges to cope with the impacts of climate change (drouth, floods) and pollution threads due to population growth , urbanization etc

- Sharing the MAR technology development and operating experiences in the different countries and for different purposes and scale) will greatly help to expand its application and use

- In the same time, the sustainability of MAR system in the rural sector will greatly benefit from a community based approach in planning, design, construction and management