

STRATEGIC WATER SUPPLIES AND MANAGED AQUIFER RECHARGE

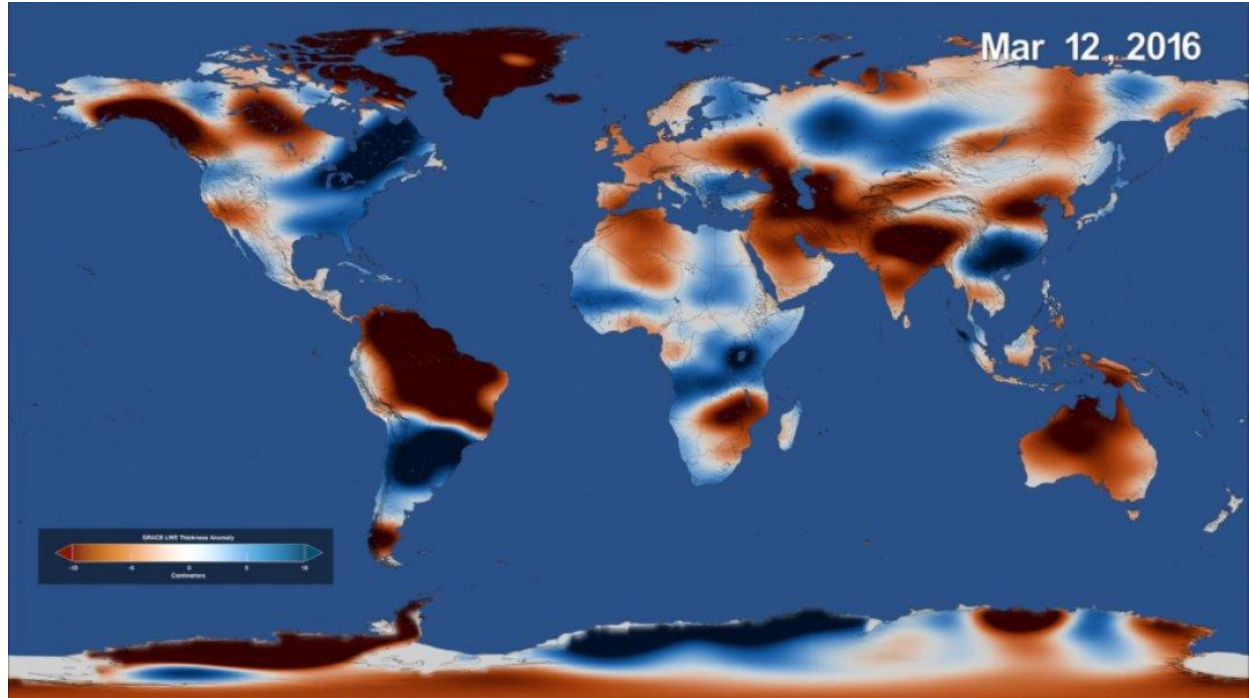
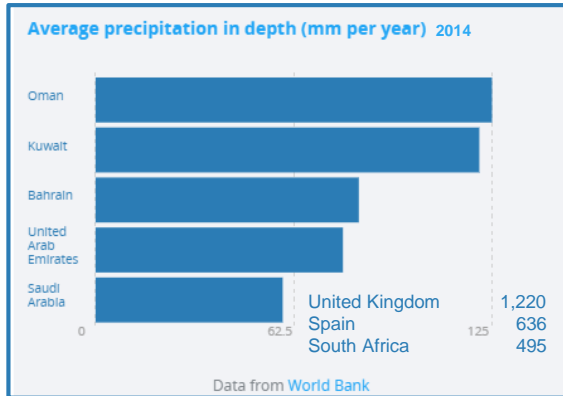
Sylvain Donnaz, Pascal Grante, Nauman Rashid
SUEZ

6th Water Arabia Conference & Exhibition
Al Khobar, Kingdom of Saudi Arabia. 11-13 February, 2020

AQUIFERS: the last line of defense against drought

subtitle

- During scarcity, people rely more heavily on groundwater”(1)
- Increase of Groundwater Depletion Worldwide
 - Decrease of Natural recharge
 - Rise of Withdrawals
- Effect due to Climate Change, human impacts



Areas in blue are where groundwater has increased;
rust color where it has decreased.

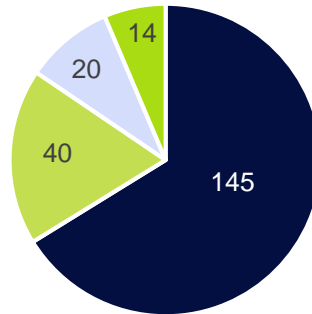
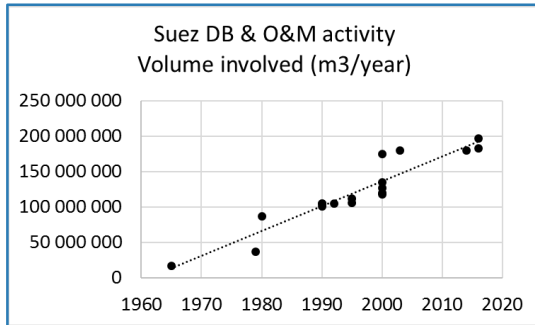
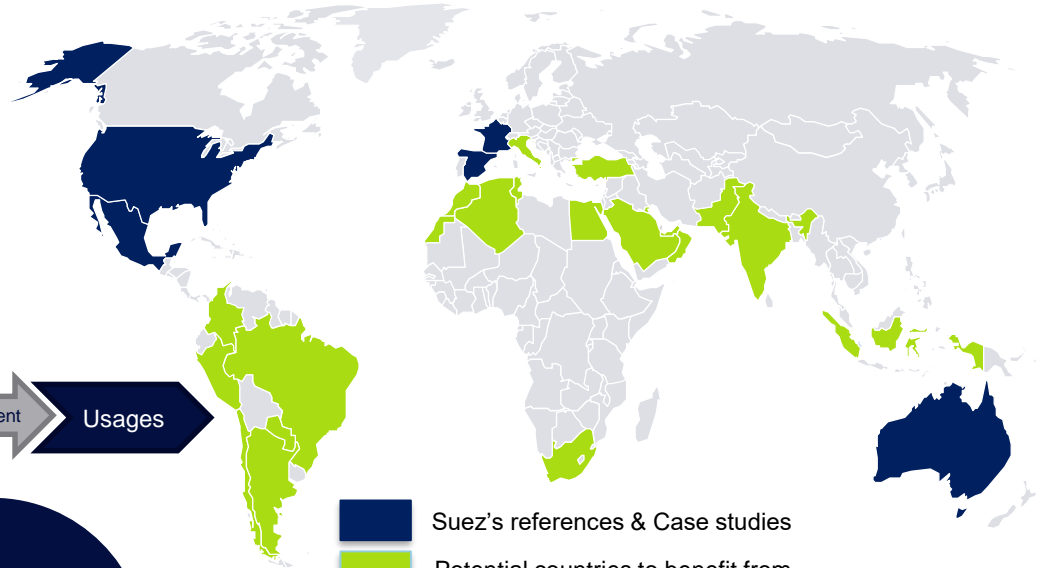
Global map of freshwater stored on land
data from the Gravity Recovery And Climate Experiment (GRACE), NASA (1)

(1) Source: ScienceDaily, May 16, 2018

SUEZ references in managed aquifer recharge (MAR) surface water and water reuse

Enabling

- Replenish Overexploited Aquifers
- Protection against Saline Intrusions
- Water Storage
- Complementary Soil Treatments
- Recover Water Quality

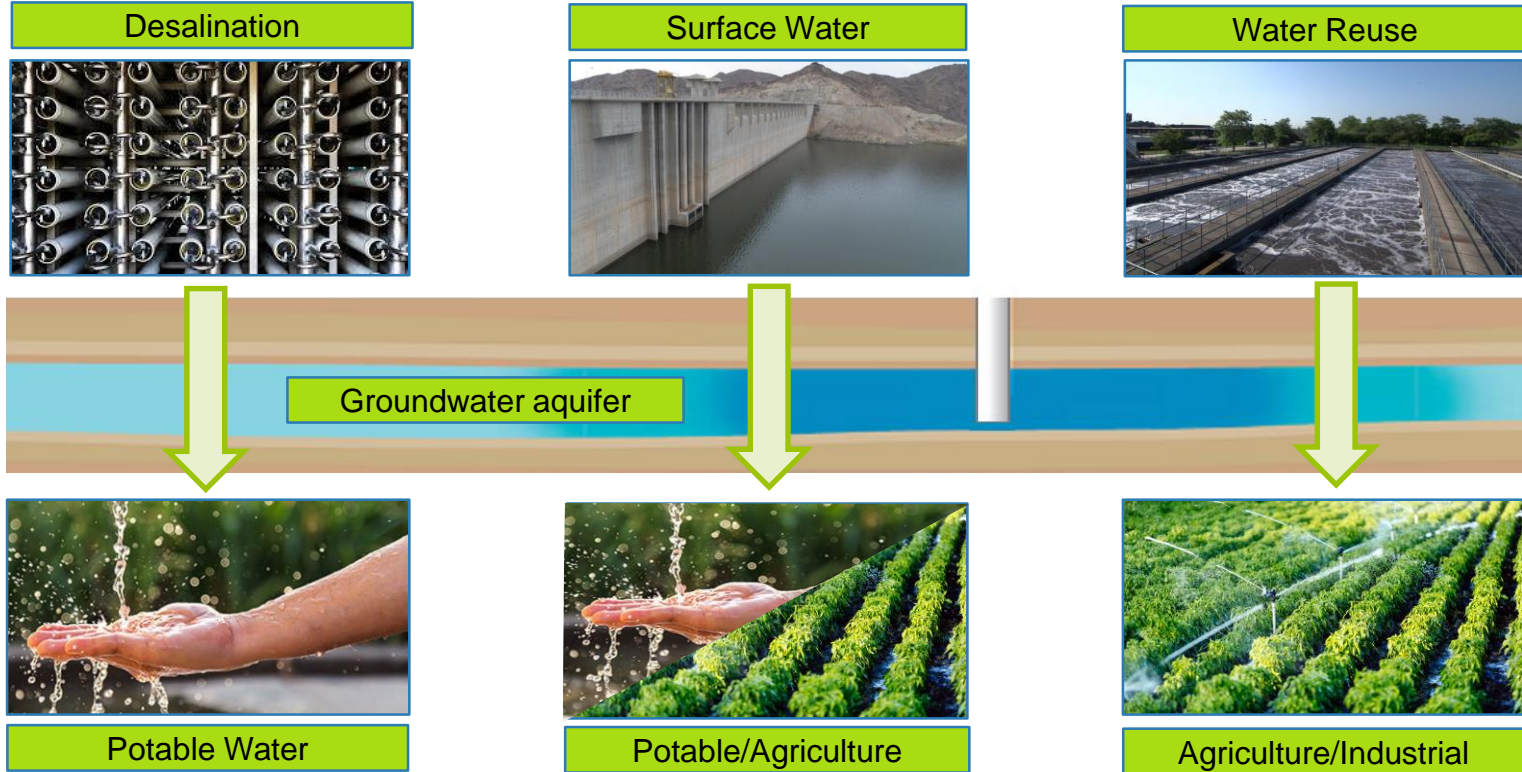


■ Suez's references & Case studies
■ Potential countries to benefit from Managed Aquifer Recharge

■ France
■ USA
■ Spain
■ Australia

managed aquifer recharge in the GCC

creating value for potable, agricultural and industrial uses

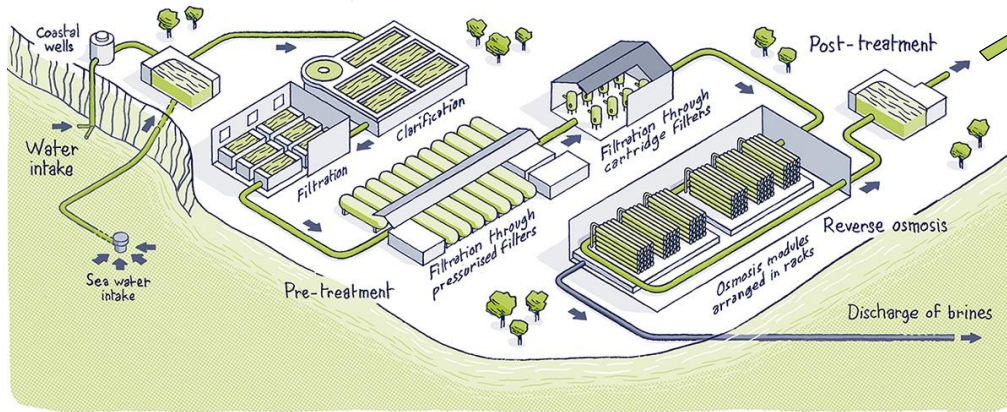


creating strategic and emergency supplies

seasonal desalinated recharge – mega reservoirs

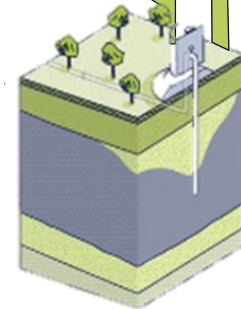
Highly competitive when compared to

- Water Storage in traditional civil structures,
- Options that require treatment and transportation over long distances
- Emergency responses



winter

summer,
emergency



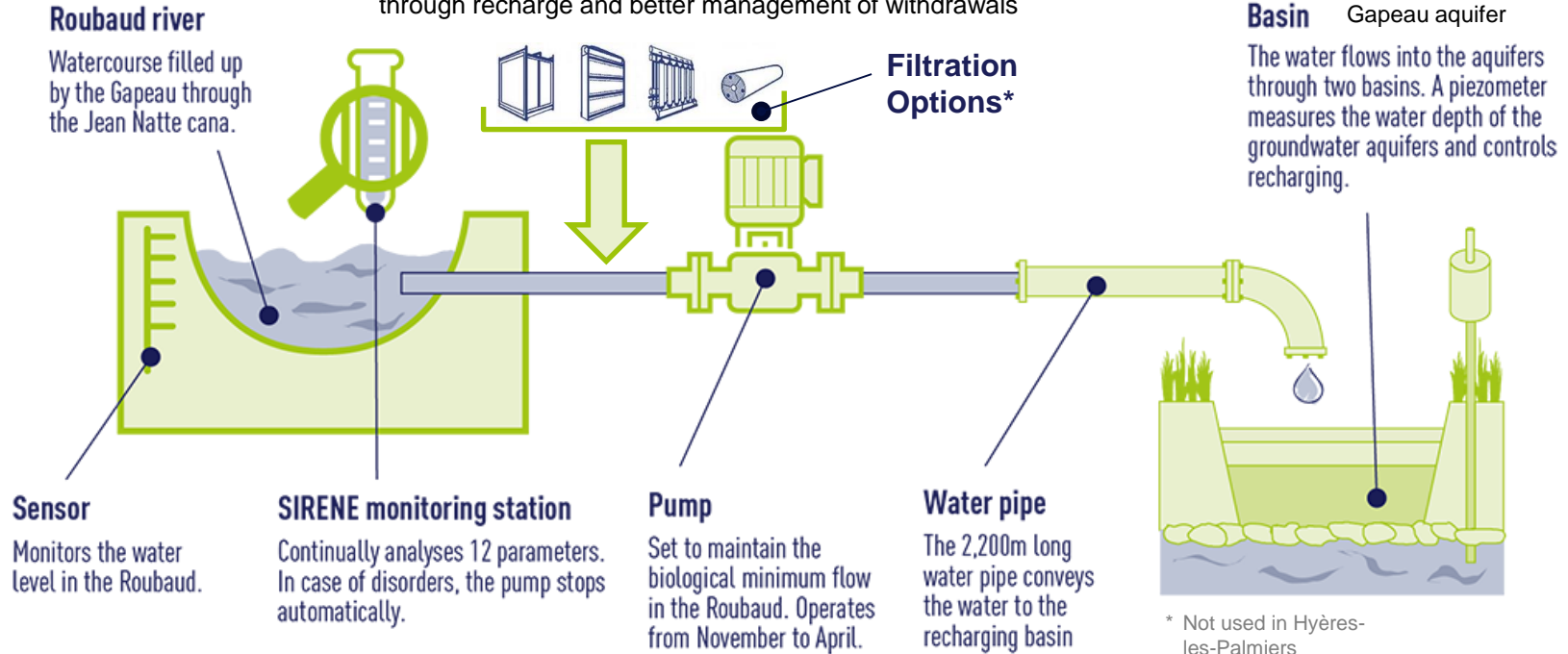
surface water capture and recharge

a solution to preserve water resources and restore groundwater aquifers

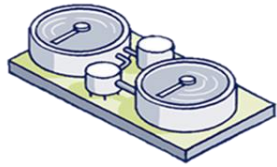
Aqua renova project City of Hyères-les-Palmiers example

- Limit the use of groundwater aquifers by increasing the potential of the water network assets through sustainable and intelligent management
- Restore the alluvial aquifer of Bas Gapeau inland by pushing out seawater through recharge and better management of withdrawals

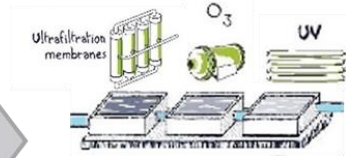
2.7 million m³
of fresh water infiltrated
from October and
April to recharge the
Gapeau aquifer



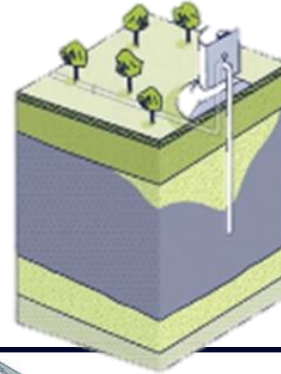
extending water reuse through aquifer recharge boosting year-round agricultural water supplies











WWTP



Advanced Treatment



Agriculture

| | | | |
|--|-------------------|----------------------------------|---|
|  Secondary | Tertiary | TSS, Turbidity, TP |  |
| | Advanced Tertiary | TOC, Traces Compounds, Pathogens |     |
| | Quaternary | Salinity (TDS), Ions, Pathogens |   |

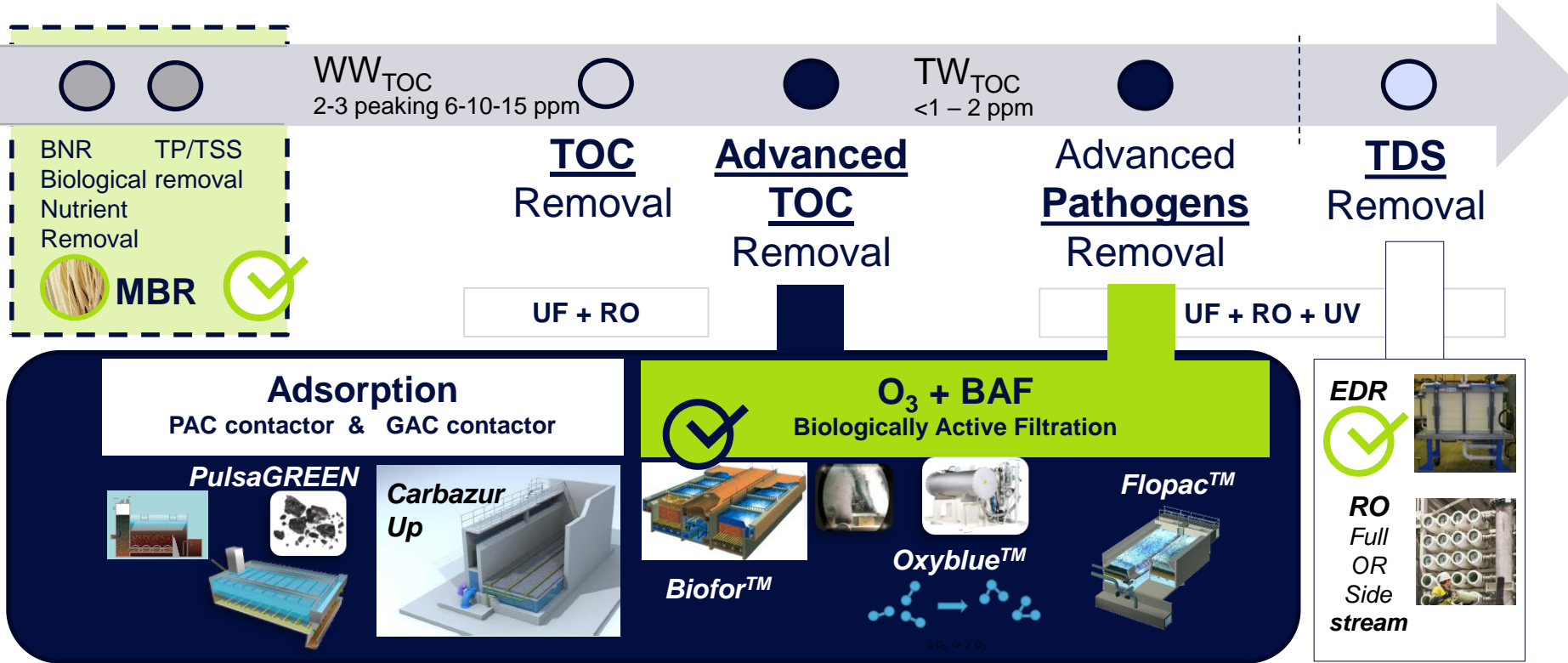


Systematically include MAR at conceptual & feasibility stages in Water Management plans & Infrastructure projects



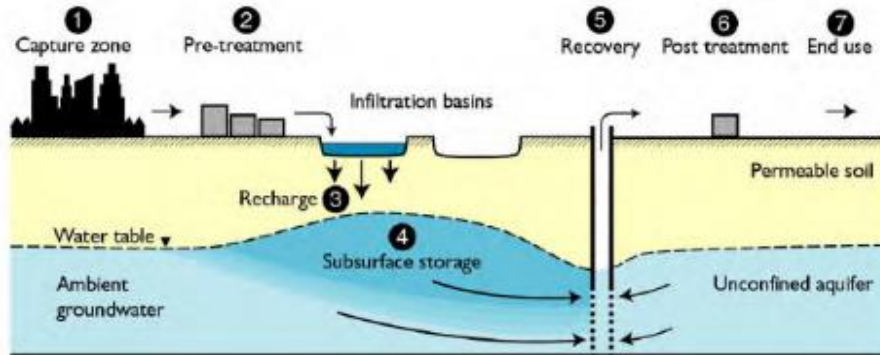
Treatment technologies for aquifer recharge

WW Reuse → Potable Reuse compliance (low TOC) & Micropollutant/CECs removal

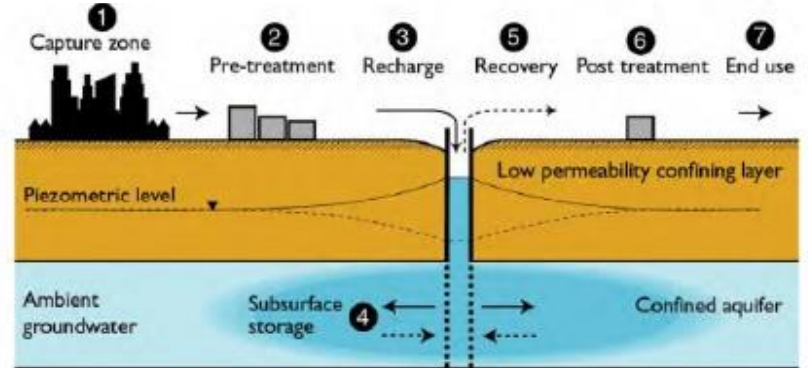


making the best of the available aquifers

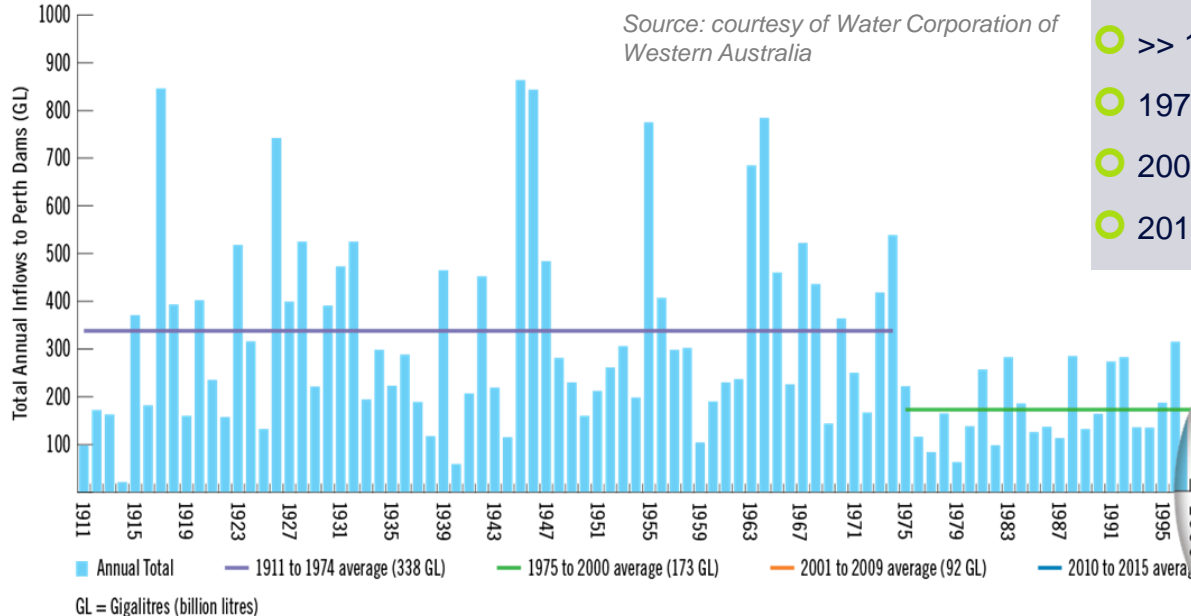
Unconfined Aquifer



Confined Aquifer



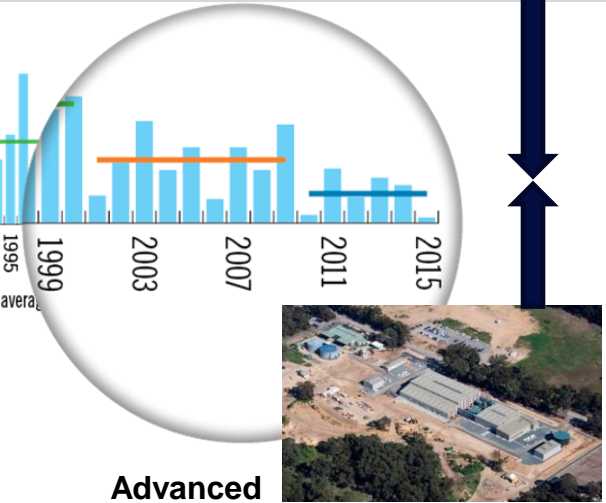
IPR groundwater replenishment Perth Beenyup, Australia



- >> 1975 Dams only supply
- 1975 – 2000 Increasing groundwater
- 2001 to 2010 2 new desal plants
- 2010 >> **Groundwater replenishment**

Why Groundwater Replenishment?

- 30-40% reduction in rainfall over 50-year period
- Constant Inflows depletion to Perth Dams

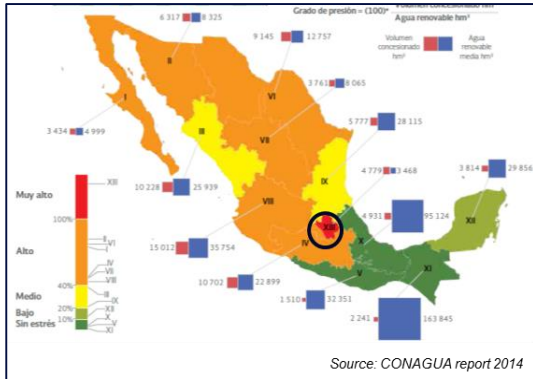


Advanced Treatment Plant

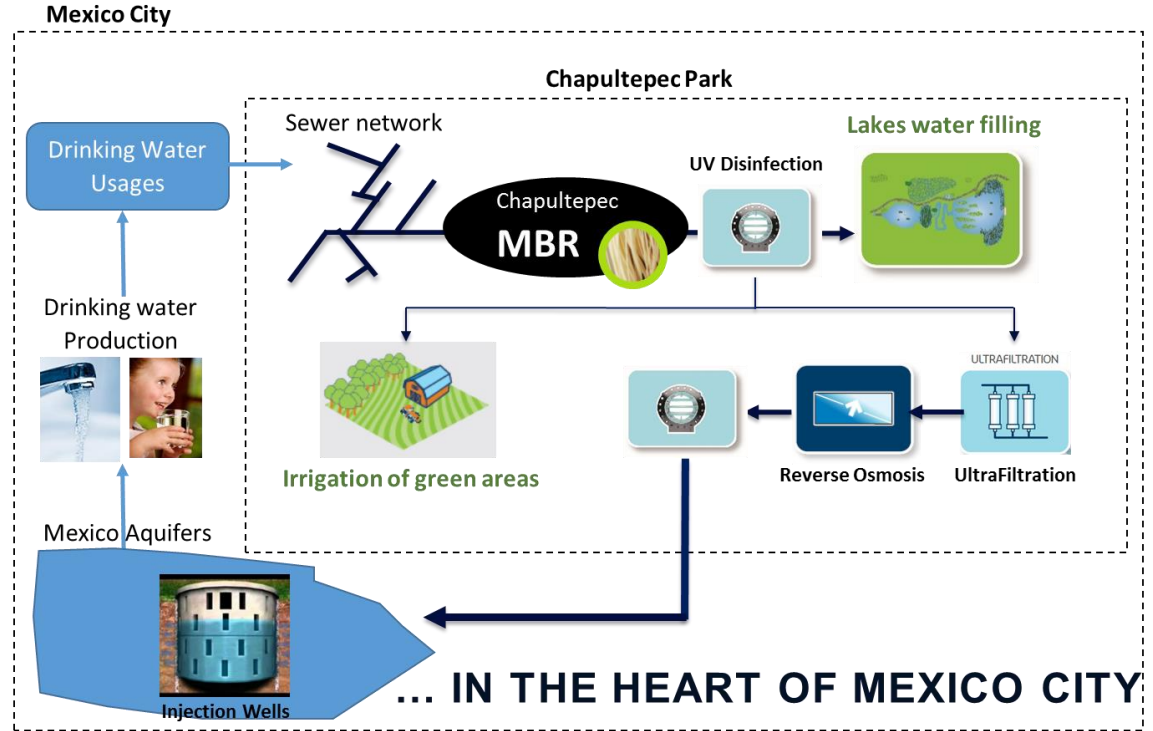


water reuse & aquifer recharge (IPR)

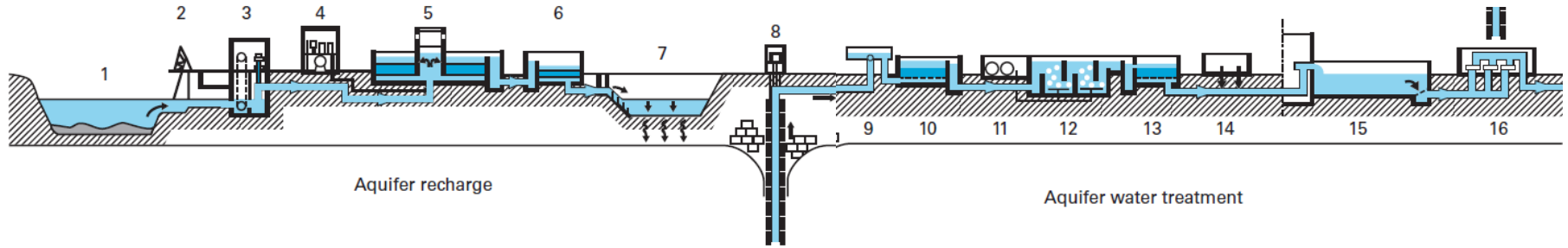
Mexico City, Mexico



INDIRECT REUSE SYSTEM...



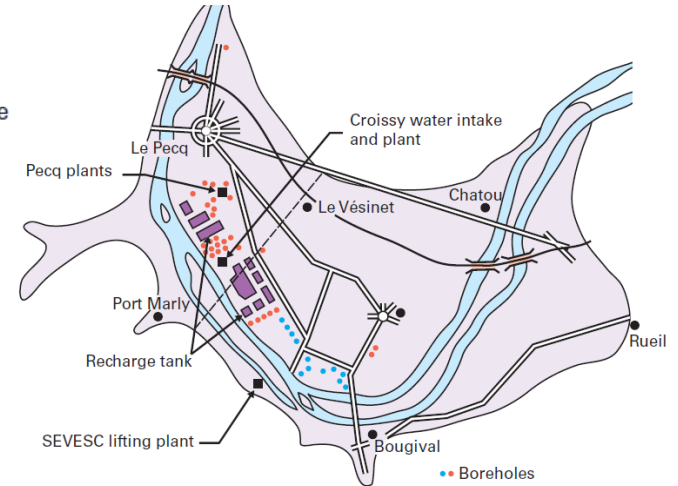
Croissy-sur-Seine aquifer recharge plant and aquifer water polishing



- | | | |
|------------------------------------|---|---------------------------------------|
| 1. The Seine river | 7. Infiltration basins (1m·d ⁻¹) | 12. Ozonation |
| 2. Water intake and bar screen | 8. Borehole pumping | 13. GAC filters |
| 3. Raw water screening and pumping | 9. Aeration and distribution | 14. Chlorination |
| 4. Reagent buildings | 10. Iron removal and nitrification using Nitrazur | 15. Treated water storage |
| 5. Pulsator clarifiers | 11. Ozone generator building | 16. Pumping towards distribution main |
| 6. Aquazur filters (sand) | | |

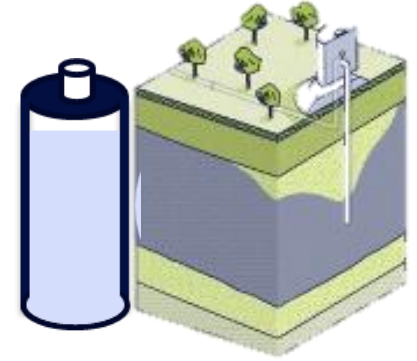
Croissy-sur-Seine recharging plant (capacity: 136,800 m³· d⁻¹)

and polishing of aquifer water (Pecq plant – Capacity: 146,400 m³· d⁻¹) - Fe, Mn and NH₄ in pumped groundwater



water reuse for Managed Aquifer Recharge deriving full value

- Key for the Management of Local Water Resource
- Strong contribution to Local Water Cycle
 - Replenish Water Reserve
 - Act as Hydraulic Fence/Barrier
 - Decrease Water Losses by Evaporation
 - Agricultural sufficiency, food security
- Solution for Crisis Situations / Water Scarcity with significant costs benefits
- Treatment needs for
 - “Environmental and Sanitary” Safety
 - Advanced WW Treatment Plant up to Potable Standards
 - Recharge/Treatment technics function of hydrogeological characteristics
- Regulatory framework: regional, national, local



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Thank you!

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ready for the resource revolution

