Water Security and the Challenges of Water Reuse in the MENA Zone

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A Quick Outline

- The concept of water security
- How water security is defined by water scarcity.
- Water scarcity in the MENA region.
- The need for water reuse to address scarcity.
- Direct and Indirect Potable Water Reuse (DPR and IPR).
- Is potable water reuse in your future?

Water Security, a Definition

- **Water Security:**

  The Capacity to safeguard sustainable access to sufficient quantities of water at acceptable quality for the livelihood, socio-economic development, and ensure public health and well-being.

- **In a larger sense:**

  Water security is part of a complex and interconnected web of security, sustainability, public health (well-being), and economic development.

Water Security, a Definition …

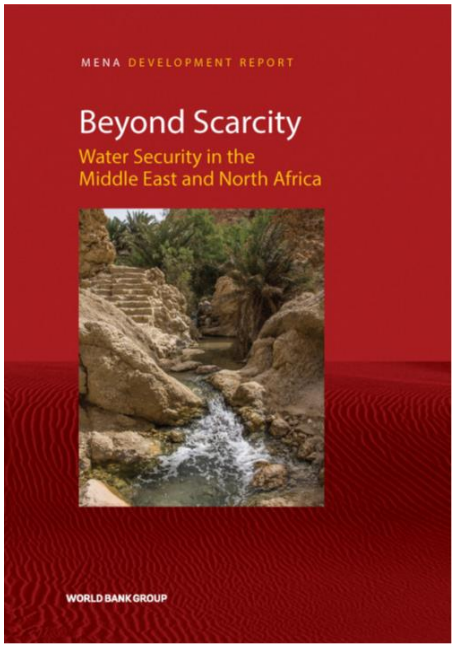
- **Additional complex factors:**
  - Competition for resources (Water and Energy) among countries and regions with implications for peace, political stability, and geo-political alliances.
  - Ability of countries to manage trans-boundary water systems (watersheds and/or aquifer systems).
  - Effective resource governing institutions that can envision and implement integrated and cross-cutting solutions to water provision issues.
  - Climate change and the shifting and variability of the global water cycle.

Key Elements in Water Security

- Access to safe and sufficient and affordable water quantities.
- Protection of the livelihood and socio-economic development of the user community.
- Protection of the ecosystem to maintain sustainability of the water resource.
- Resource management keyed into conservation, wise use, reclamation, and reuse.
- Ability to cope with, and manage risk and uncertainties.
- Forward looking system of management that provides for effective governance.

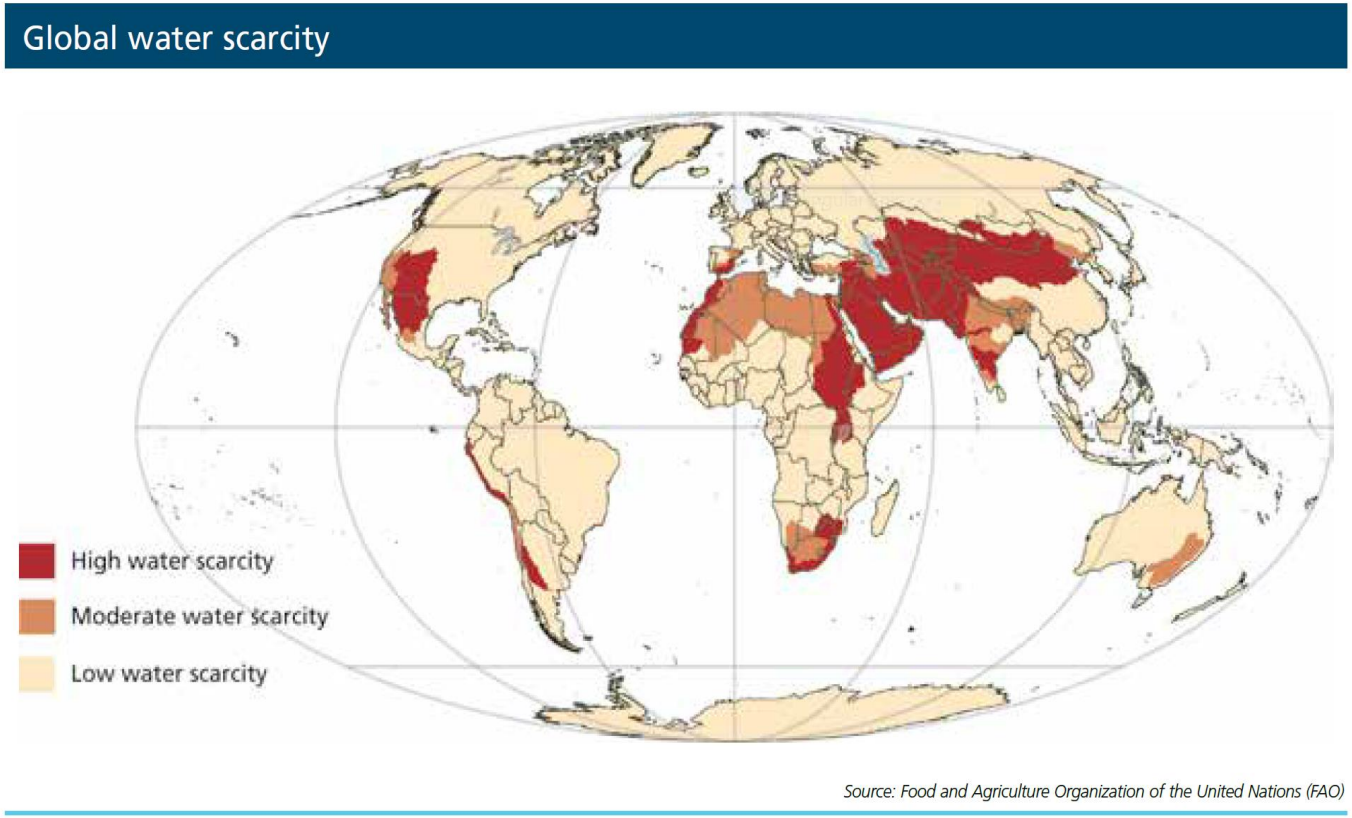
Access to Water in the MENA Region

- Access to water in the MENA region is defined by extreme and chronic scarcity.
- The region is home to 6 % of the world's population, and only 1 % of the world's freshwater resources*.
- Chronic scarcity coupled with growing demand, increasing hydrological extremes and
- Climate change must shape water policies now and into the future



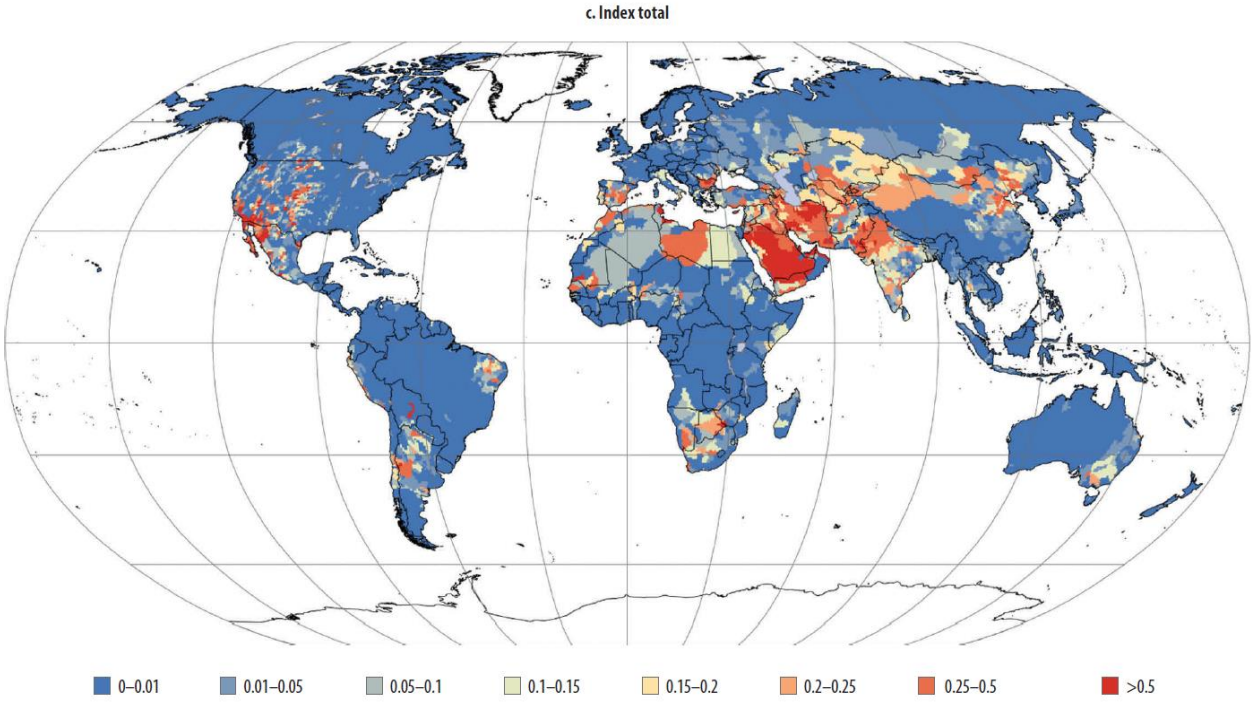
* Beyond Scarcity: Water Security in the MENA, World Bank, 2018

Global Total Water Scarcity



Global Total Water Scarcity Index (SW+GW)

Blue Water Sustainability Index (BWSI)

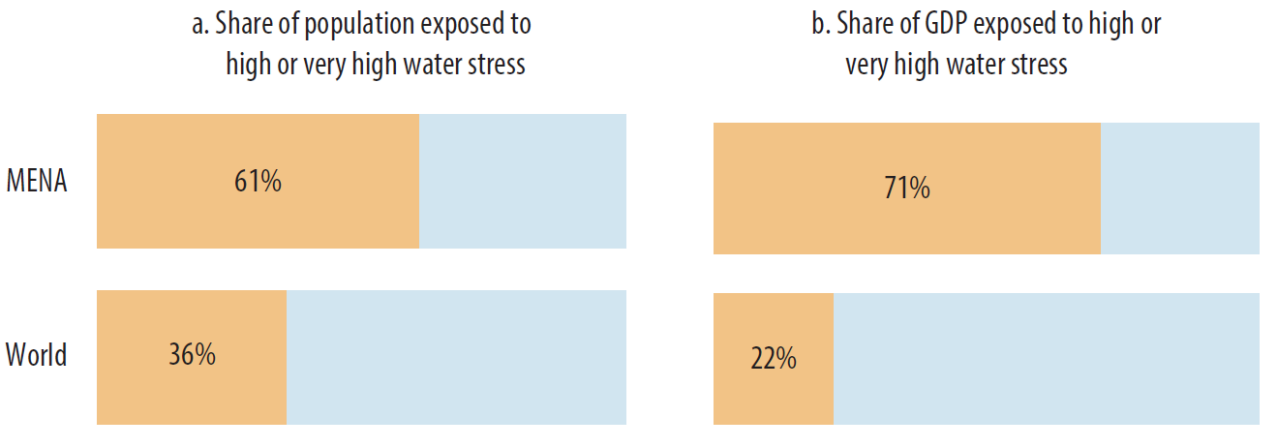


Source: Wada and Bierkens 2014.
Note: The Blue Water Sustainability Index (BIWSI) is a dimensionless quantity ranging from 0 to 1 that expresses the portion of consumptive water use that is met from nonsustainable water sources. Blue = sustainable; red = unsustainable. BIWSI measures the portion of water use that is unsustainable. Nonsustainable surface water use is estimated as the amount of environmental flow requirements not satisfied due to surface water overabstraction. Nonsustainable groundwater use is estimated as the difference between groundwater abstraction and natural groundwater recharge plus recharge from irrigation return flows. The Middle East and North Africa stand out as a global hotspot for unsustainable surface water and groundwater use.

Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

Water Scarcity Drives Economic Productivity

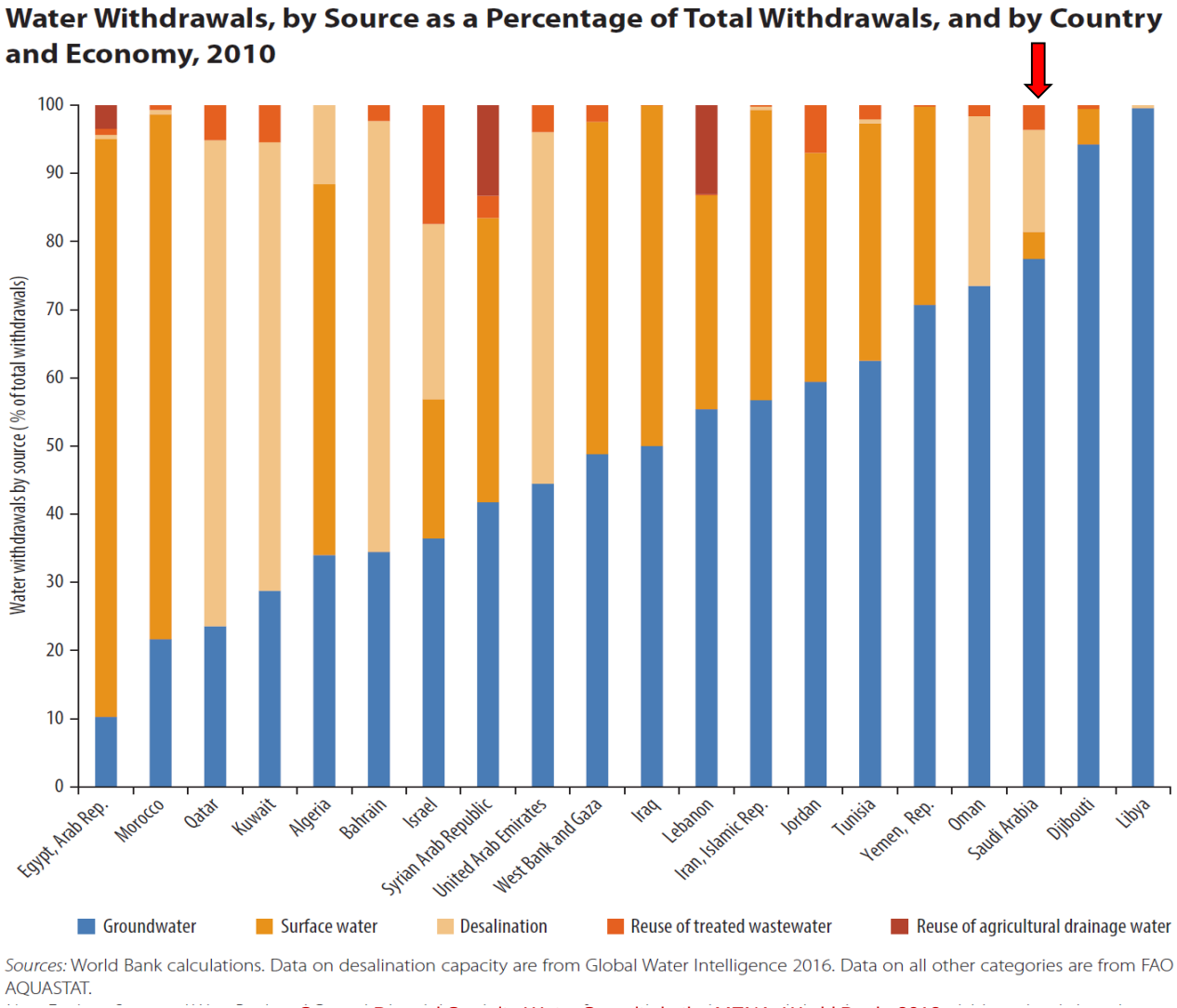
Share of GDP Produced and Population Living in Areas of High or Very High Water Stress in the Middle East and North Africa Compared with World Averages



Source: Estimates for the Middle East and North Africa are from World Resources Institute Aqueduct data. World averages are from Veolia Water and IFPRI 2011.
Note: High or very high water stress imply that water withdrawals are 40 percent or more of surface water resources availability.

Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

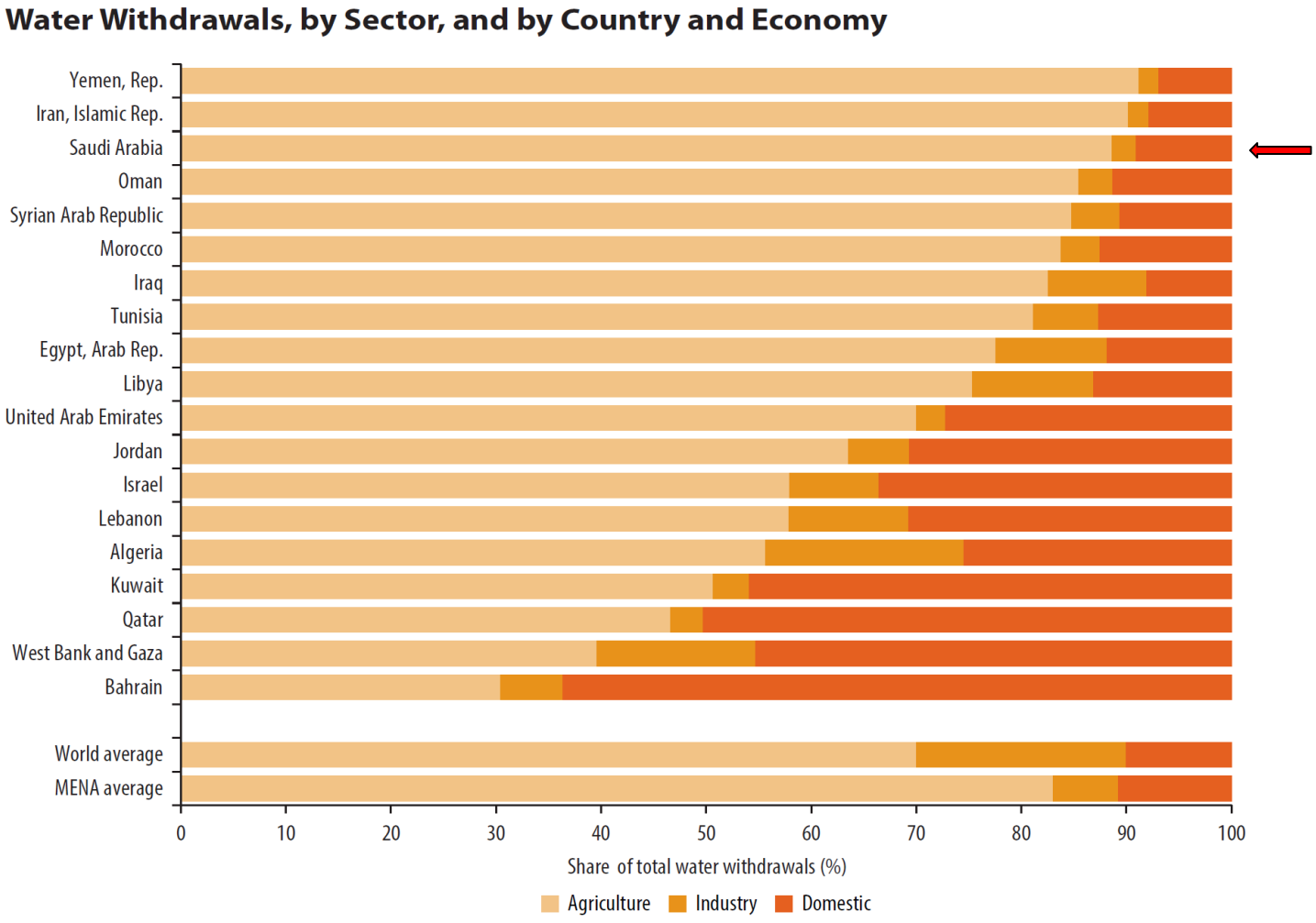
Where Does Our Water Come From?



Sources: World Bank calculations. Data on desalination capacity are from Global Water Intelligence 2016. Data on all other categories are from FAO AQUASTAT.

Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

Where Does Our Water Go?

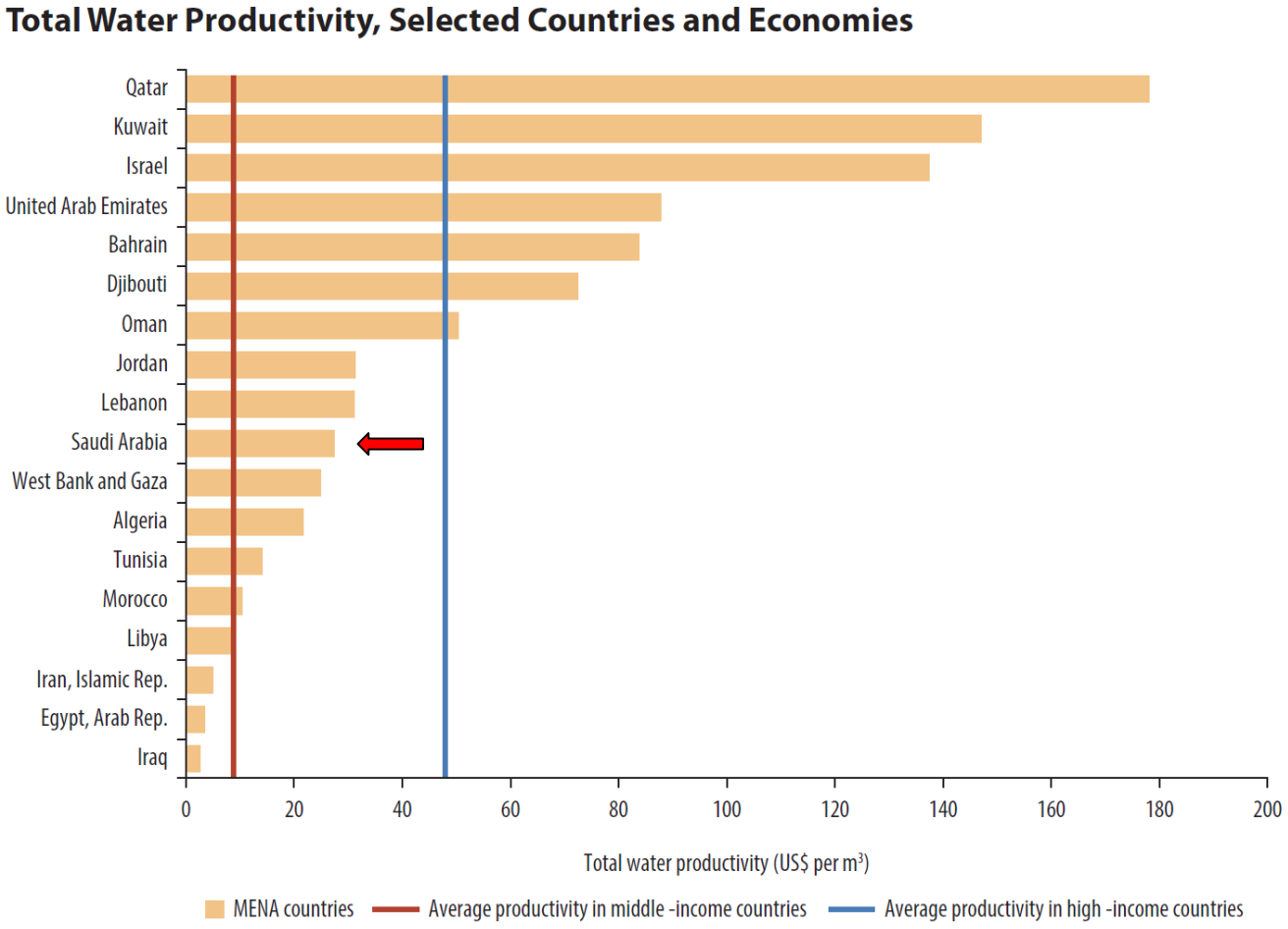


Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

Shifting the Paradigm in Water Use

- **Water management:** Water conservation and efficiency
  - Guarding public health and well being
  - Water use policies that reward conservation and penalize excess use
  - Promoting water productivity
- **Diversifying water resource portfolio:**
  - Unconventional water production – Desalination
  - Investment in modern arid land agriculture
  - Serious water reuse:
    - **No "wastewater disposal"**
    - **Investment in future water supplies**

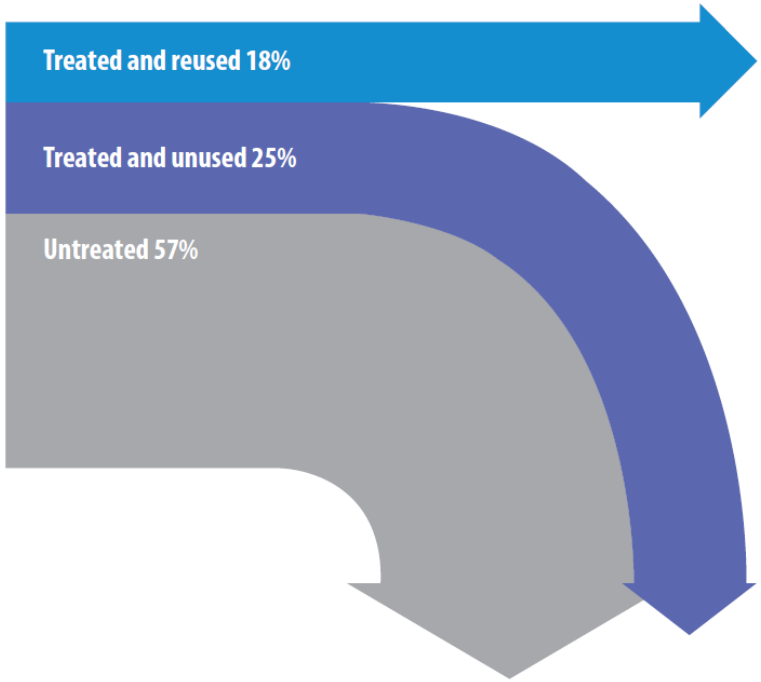
Water Productivity in the MENA Region



Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

The Need for Serious Water Reuse

Percentage of Collected Wastewater That Is Untreated, Treated, and Reused in Irrigation



Source: World Bank, using data from FAO AQUASTAT (database).
Note: The figure was generated by summing country-level data on wastewater treated and reused from FAO AQUASTAT. Country-level data are based on estimates provided by the governments and are subject to variations in estimation methods and year of collection.

Source: Beyond Scarcity-Water Security in the MENA, World Bank, 2018

Water Reuse Categories

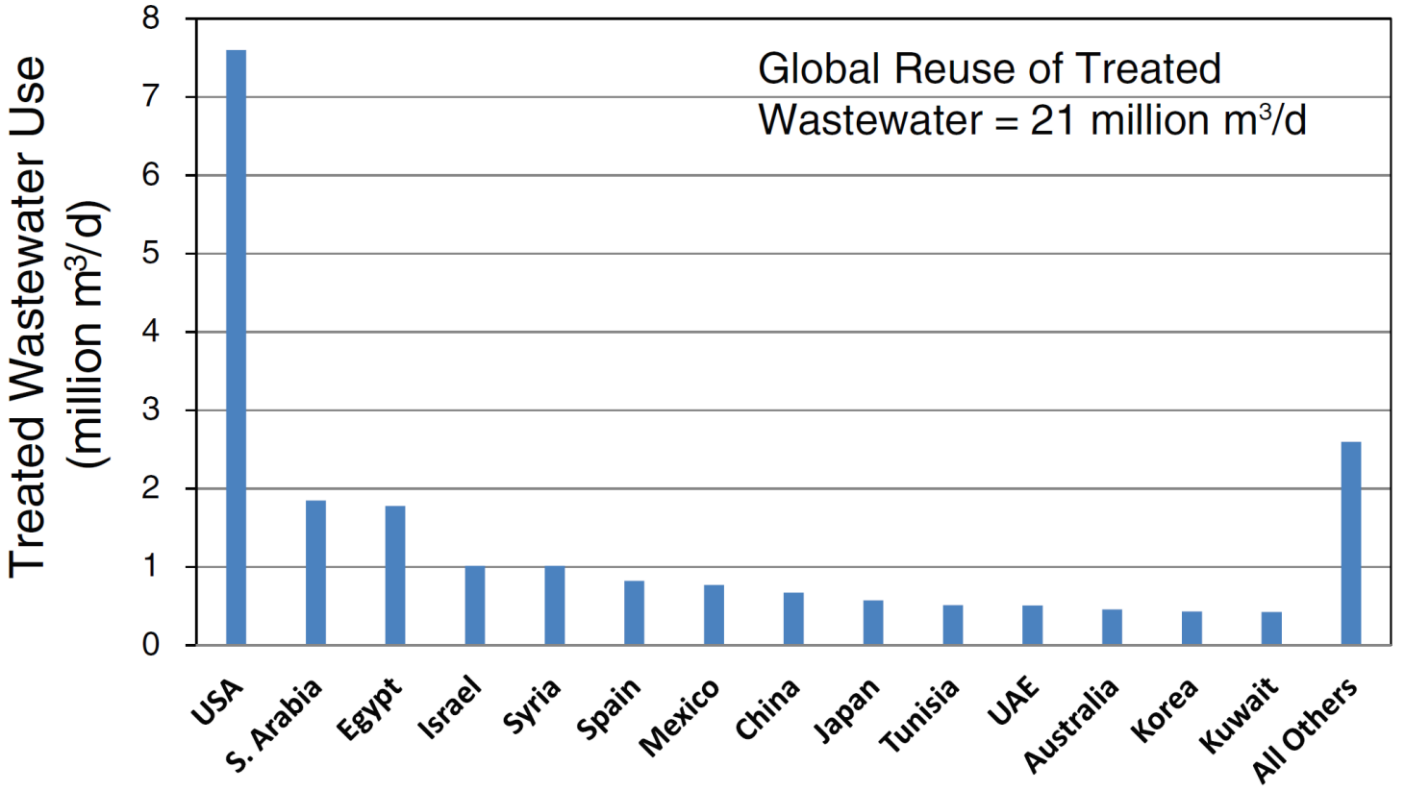
- **Planned Reuse**
  - **Potable Ruse**
    - Wastewater is treated in advanced treatment systems and returned into the potable water supply system
  - **Non-potable Reuse**
    - Wastewater is treated (usually using advanced treatment) and then used in agriculture and/or landscape irrigation
- **Unplanned Reuse**
  - Often referred to as “De Facto Reuse”
  - Wastewater is treated and discharged into receiving water bodies where it is reused by water system downstream.

Water Reuse Categories

- **Non-Potable Reuse**
  - Most common reuse category

    Wastewater is treated (often in advanced treatment) and used for landscape and/or agricultural irrigation.

Countries With the Most Water Reuse (2008)



Source: NRC, US National Academies

De Facto Water Reuse (Trinity River Basin, Texas)

Trinity River Basin, showing Dallas/Fort Worth in the headwaters of the water supply for the city of Houston.

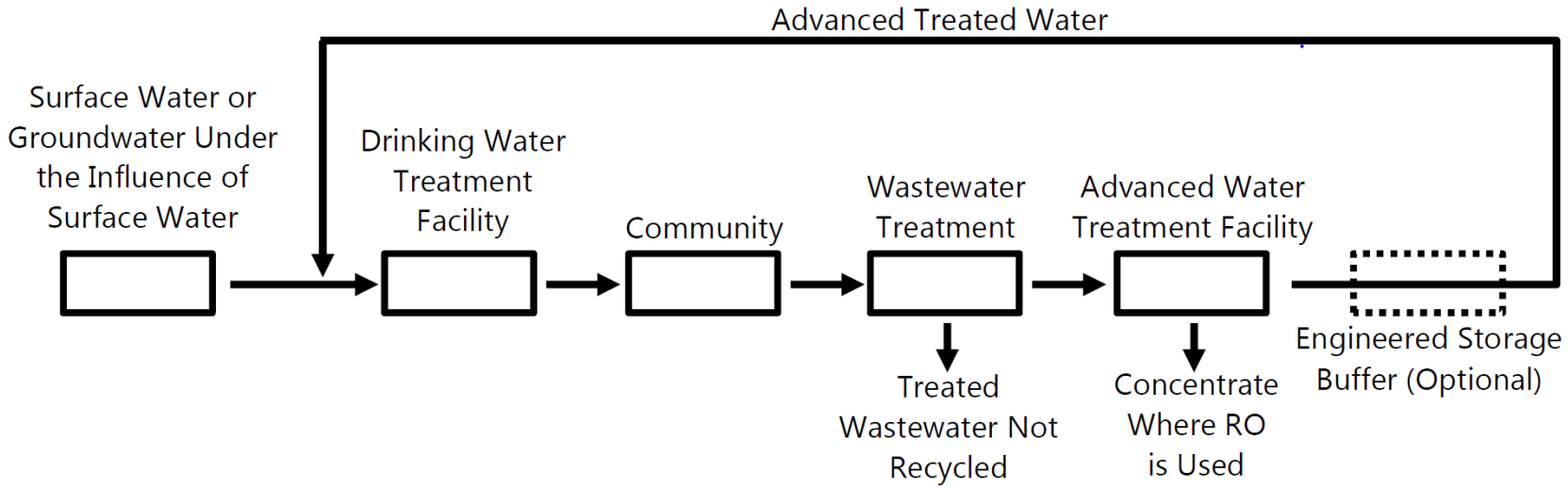
Source: NRC, US National Academies

Planned Water Reuse

Planned Potable Water Reuse

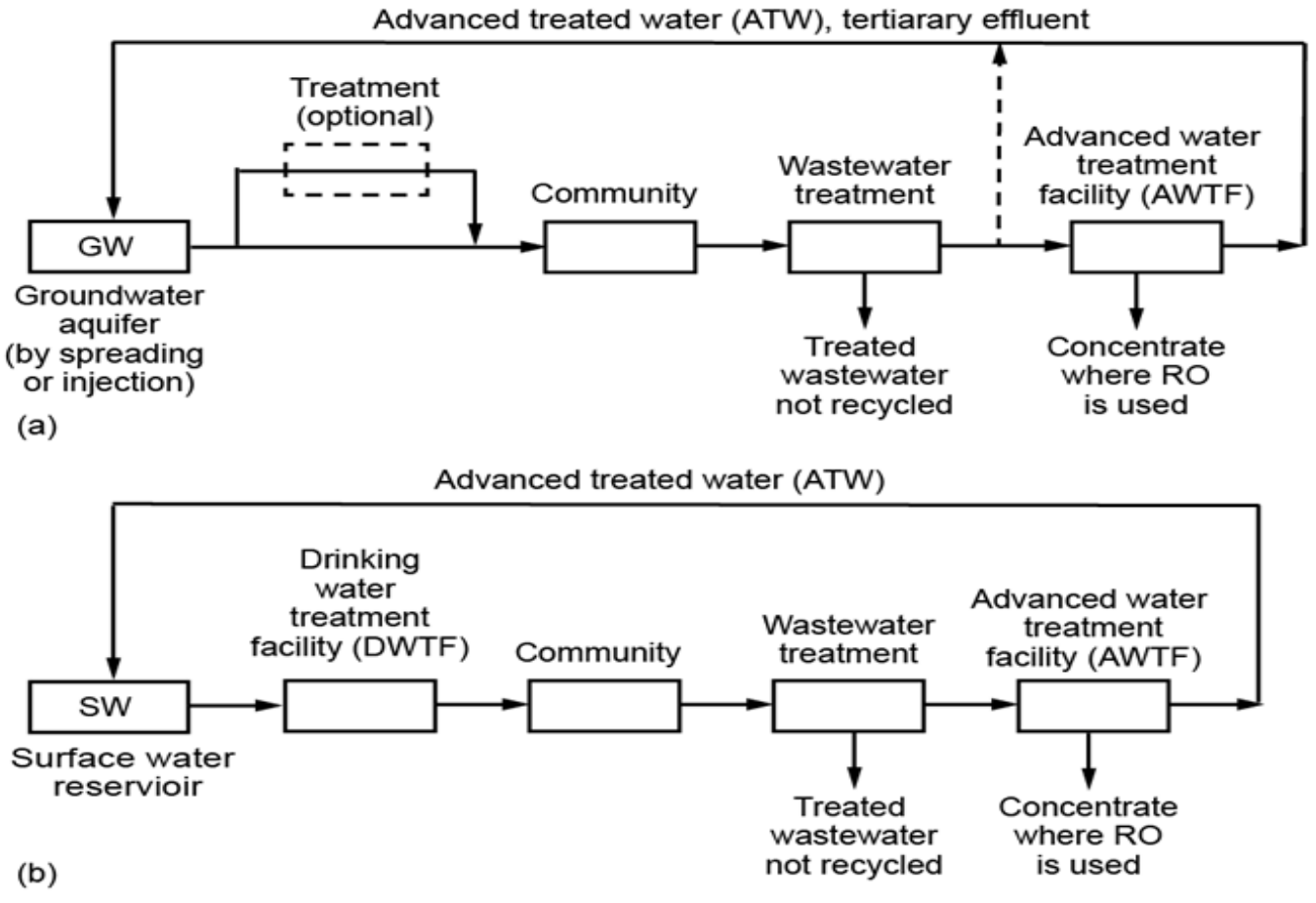
- **Direct Potable Reuse (DPR)**
  - Wastewater is treated using advanced treatment systems and then blended with (directly or indirectly) with the potable water supply system
  - A few examples of this water reuse method around the world
- **Indirect Potable Water Reuse (IPR)**
  - In this case the wastewater is treated using advanced treatment systems and then stored into an **environmental storage buffer (ESB)** before in enters back into the water supply system.
  - This a widely used reclamation schemes.
  - Environmental storage buffers include:
    - **Natural or man-made lake (Reservoirs).**
    - **Aquifer systems (Groundwater Recharge Systems)**

Direct Potable Reuse (DPR)



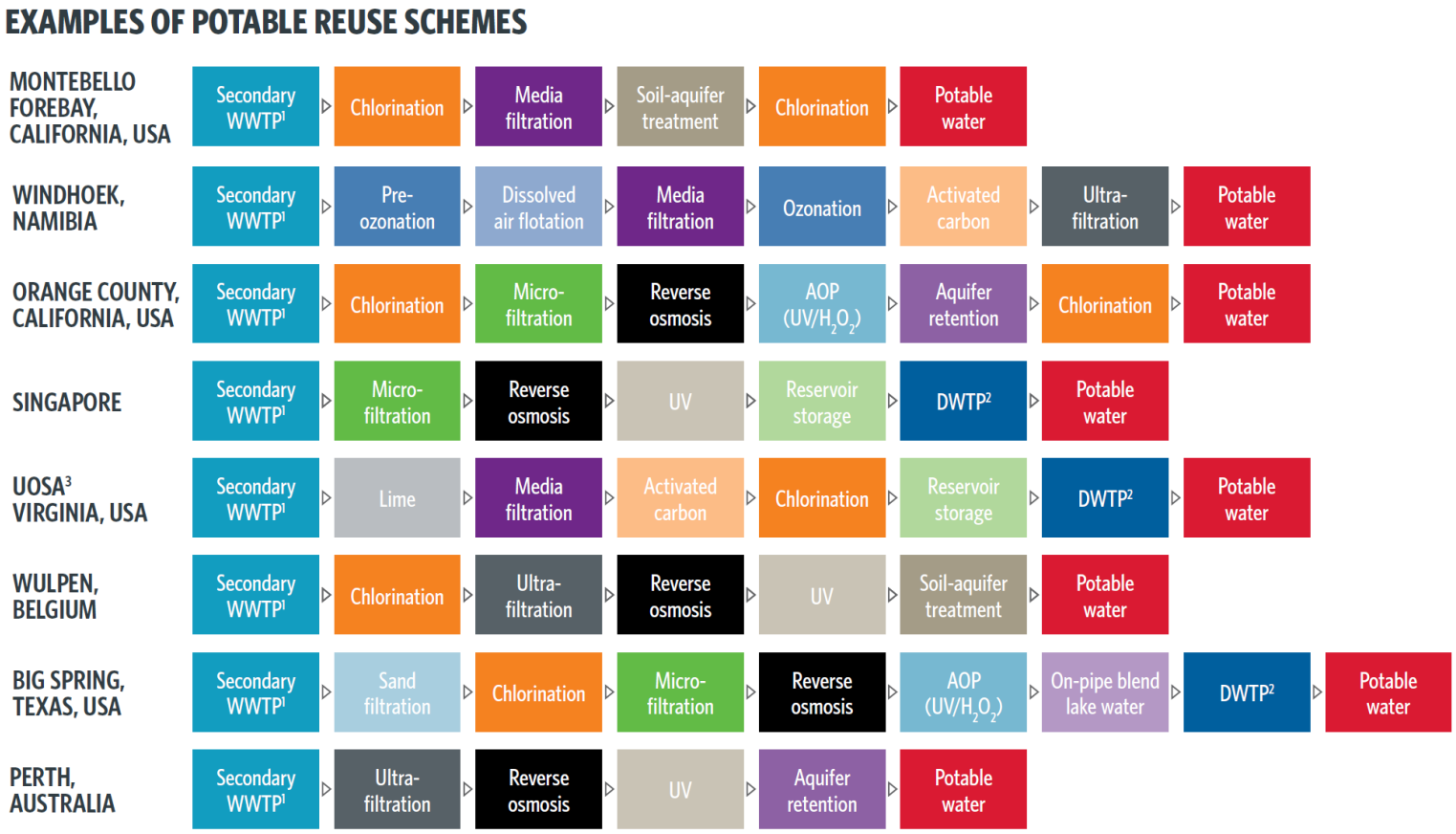
Source: Potable Reuse Compendium, USEPA, 2017

Indirect Potable Reuse (IPR)



Source: Potable Reuse Compendium, USEPA, 2017

Examples of Potable Reuse



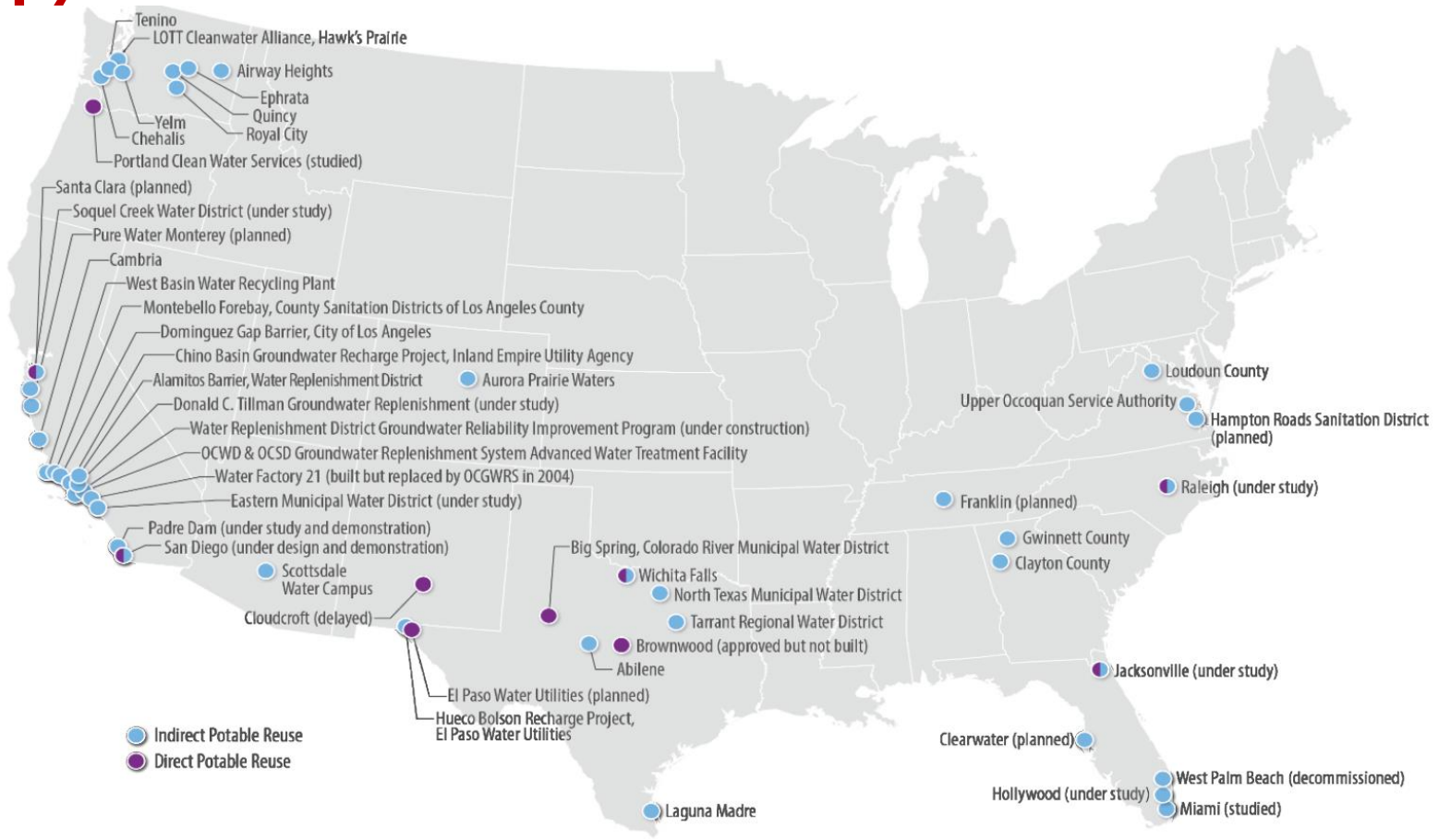
[1] Secondary treatment usually based on activated sludge and in most examples includes nutrient reduction.
[2] DWTP= Drinking-Water Treatment Plant.
[3] UOSA= Upper Occoquan Service Authority.

Source: HDR Engineering. 2018

Examples of Potable Reuse

Singapore PUB Newater Facility

Planned and Built US DPR and IPR Plants, 2017



Source: Potable Reuse Compendium, USEPA, 2017

Major Barrier to Potable Water Reuse

- **Public Acceptance:**

  The most important barrier to potable water reuse.

  – Recognize that water reuse can be controversial – especially theses days with (ill-informed) free press, and social media.

  – Recognize that in many cases, people do not understand water treatment and/or even where their water comes from.

  – Public education must start early – at the inception of the project.

  – Public education must start early – in elementary schools.

  – Include the clergy (the Ulama and religious scholars).

Development Issues

- **Basic Elements:**
  - Public understands water supply needs and resources and have confidence in quality of the water service.
  - Gain the support of community leaders and decision makers.
  - Have a consistent and proactive communications plan.
  - Employees understand the mission of the utility.
- **Technology and Water Quality:**
  - Demonstrated and effective technology solutions based on pilot studies.
  - Action plan to deal with contamination issues including emerging contaminants.

Is Potable Water Reuse in Your Future?

- “Potable water reuse” is unavoidable in the MENA Region – at least as Indirect Potable reuse.
- Indirect potable reuse needs to be a component of future water policies and water supply management toolkits.
- Indirect potable reuse needs to be viewed as a crucial investment in the future of water systems.
- Technological innovations will help chart sustainable pathways for water systems and utilities

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If your actions inspire others to
dream more, learn more, do more, and become more,
you are a leader!

University of Nebraska Lincoln