

DESALINATION ROLE IN KUWAIT'S WATER SECTOR



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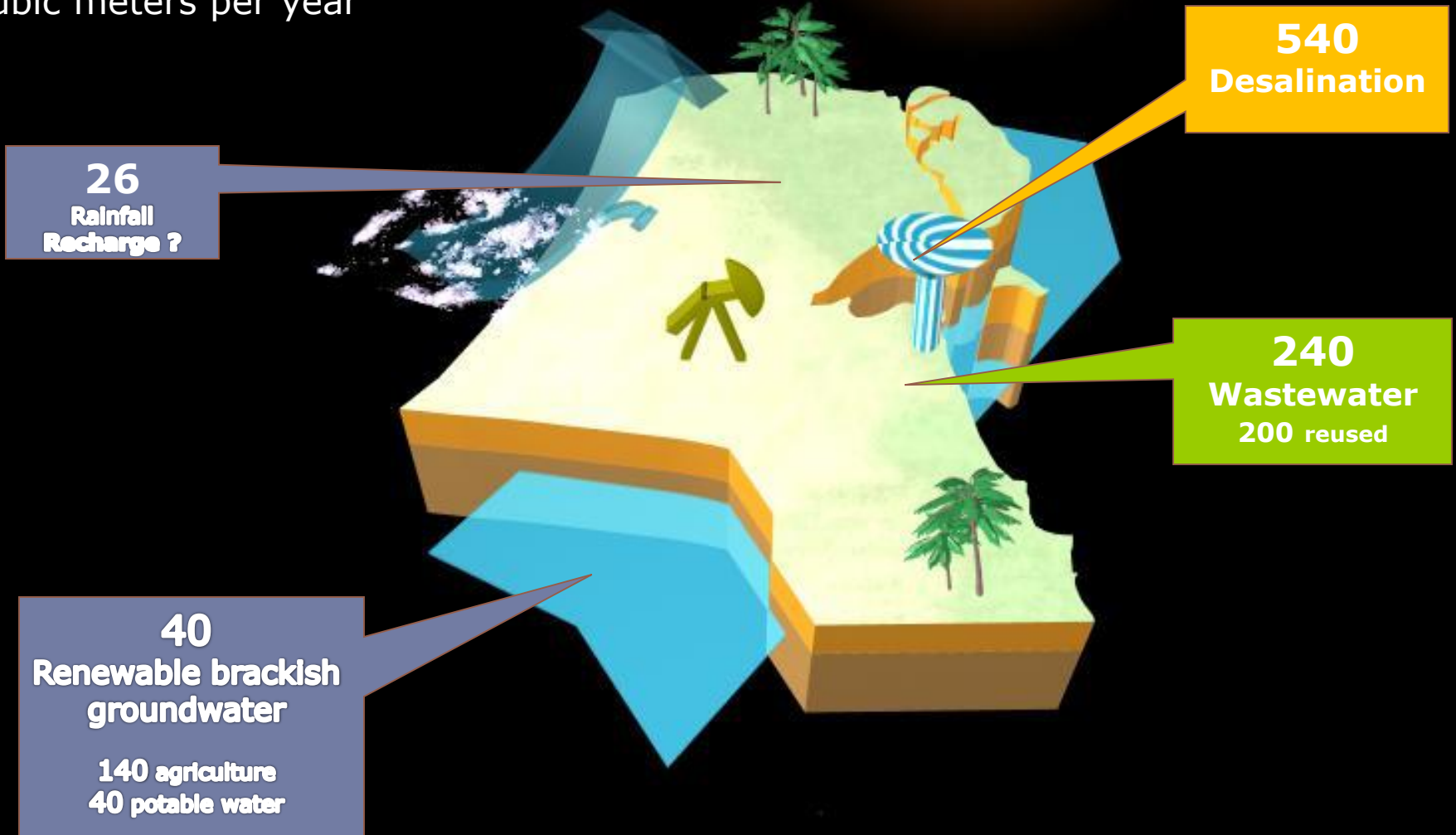
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- Components of the water balance of Kuwait
- Desalination industry in Kuwait
- Challenges facing the water sector in Kuwait
- How to face the challenges
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Water Balance of Kuwait

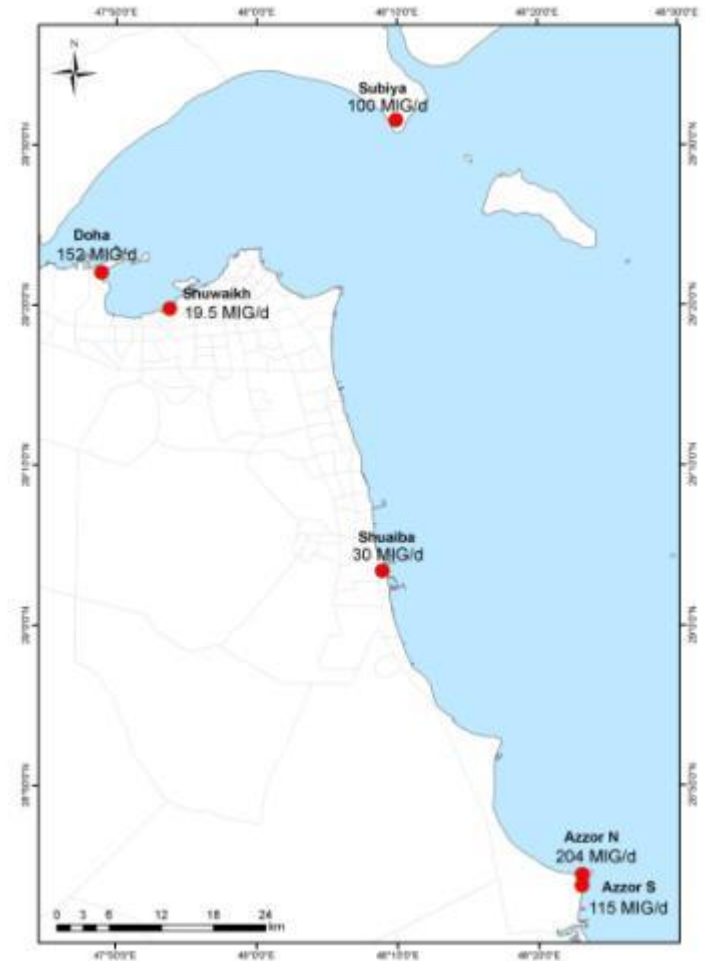
All quantities in million cubic meters per year



Desalination Industry of Kuwait



- Historical Background
- Backbone of the water sector (92% of domestic and industrial needs, 60% of all water use)
- Kuwait has 6 plants (620 MIG/d at $\approx 1\$/m^3$)
- Multi stage flash distillation and power cogeneration
- Reverse Osmosis (brackish water, remote locations, 1.3 MIG/d)



Challenges Facing the Water Sector in Kuwait



- Overall challenge: Meeting the ever increasing development needs
 - Immediate term:
 - ✦ Increasing demand (population and per capita increases)
 - ✦ Summer shortages (due to inaccuracy in prediction, struggle between government and parliament)
 - Medium and long term development goals
 - ✦ Non-oil revenue/private sector boosting (90% oil- 28% salaries)
 - ✦ Development of new urban areas

Challenges Facing the Water Sector in Kuwait



- Modernization of desalination industry
 - Business as usual attitude
 - The high sensitivity of the industry
 - Vast investments in current infrastructure
- Improving water utilization efficiency
 - Reducing the high per capita consumption
 - Better water allocation (e.g. RO wastewater in AR rather than irrigation)
 - Preserving the natural water resources
 - Revisiting agriculture and food sufficiency strategy

Challenges Facing the Water Sector in Kuwait



- Securing a water strategic reserve
 - Uniqueness of the water sector in Kuwait and its implications
- Environmental challenges
 - Adaptation to climatic impacts
 - Impacts of desalination intakes and brine disposal on marine life
 - Greenhouse gases (desalination)
 - Reduced air quality in the vicinity of urban areas
 - Soil and groundwater pollution problems (produced water-oil industry)

How to Face These Challenges



- Modernization of desalination industry
 - Adopting a hybrid desalination model (staged introduction of RO to the operators, less risk to the industry, arguably better performance)
 - Modernization should be based on replacement or amending aging MSF units
 - Improving the dialogue between the research and executing agencies (mostly KISR and MEW)
 - Desalination (i.e. RO/brackish groundwater) should be utilized in agriculture and creation of strategic reserve

How to Face These Challenges



- Establishing an independent entity to be responsible for water management at the national level
 - Optimization of water allocation (e.g. RO in AR rather than agriculture)
 - Awareness campaigns at the political and public levels
 - Campaigning for regulatory reforms (**restructuring of water tariff, reducing water-related subsidies, mandating water saving fixtures, penalizing water wastage, restructuring of agriculture sector, etc.**)
 - Advocating for more private sector involvement in desalination plants management

How to Face These Challenges



- Environmental protection
 - Prediction of climate change impacts on groundwater should be conducted as the initial step to adaptation (country and trans-boundary)
 - Simple and effective engineering solutions are available and should be adapted for brine disposal and green house gases capturing
 - Initiating research on zero liquid discharge for inland desalination (mostly related to oil production)
 - Natural gas maybe considered for plants within urban zones

Opportunities



- Build up of public pressure/dissatisfaction
 - Opportunity to pass the stalling desalination projects at the parliament
 - More acceptance of water tariff restructuring
- Many of the MSF units are approaching their design age with vast investments needed anyway
- The success of the first BOT project in the water sector (wastewater treatment) may open doors for more involvement of the private sector in the water industry

Opportunities



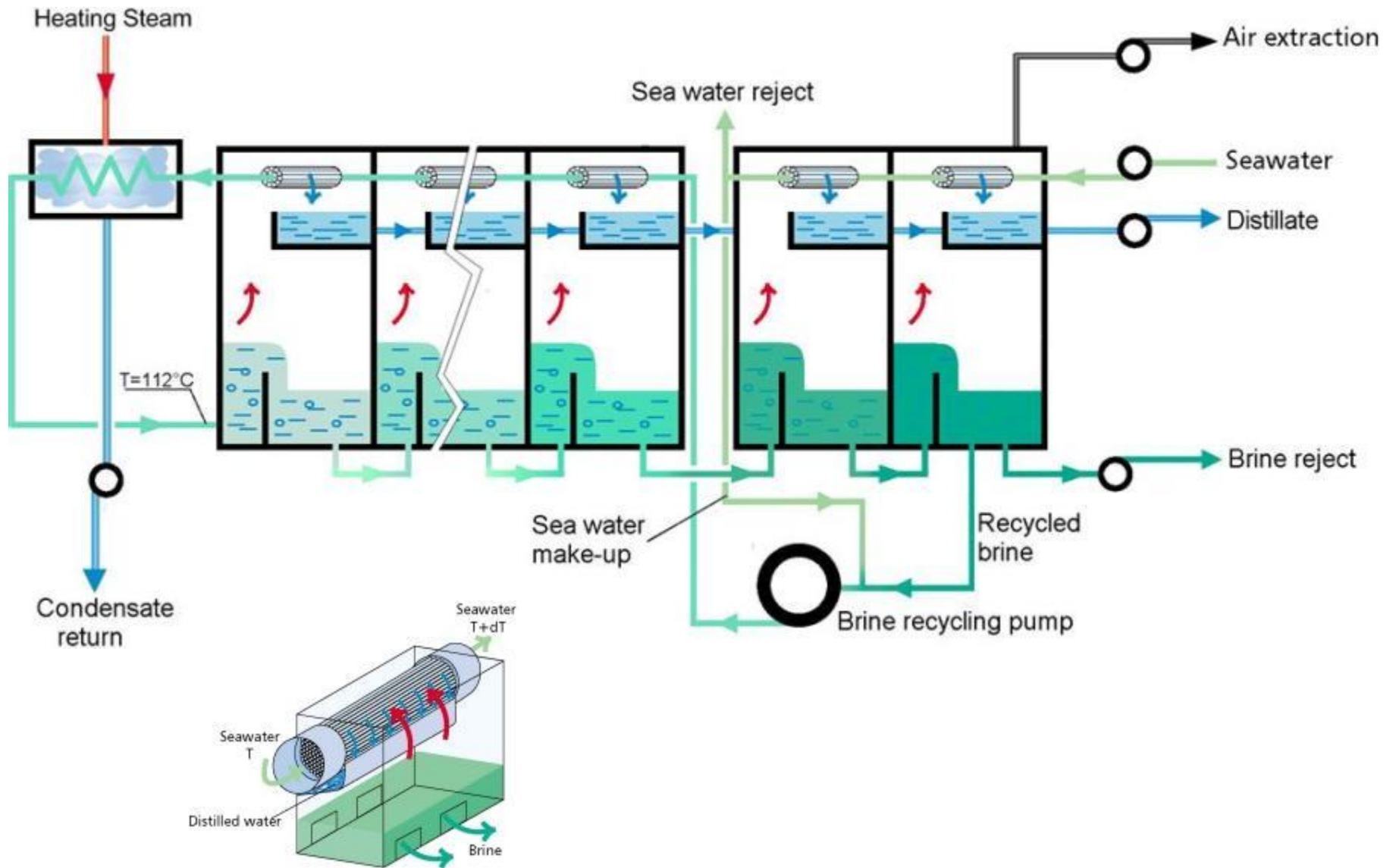
- High level political support of research foundations
 - Funds have been mobilized to build state-of-the-art water research center, with desalination modernization on the top of its list
 - Cooperation between KISR and water related implementing organizations is being encouraged at the highest level

Conclusions

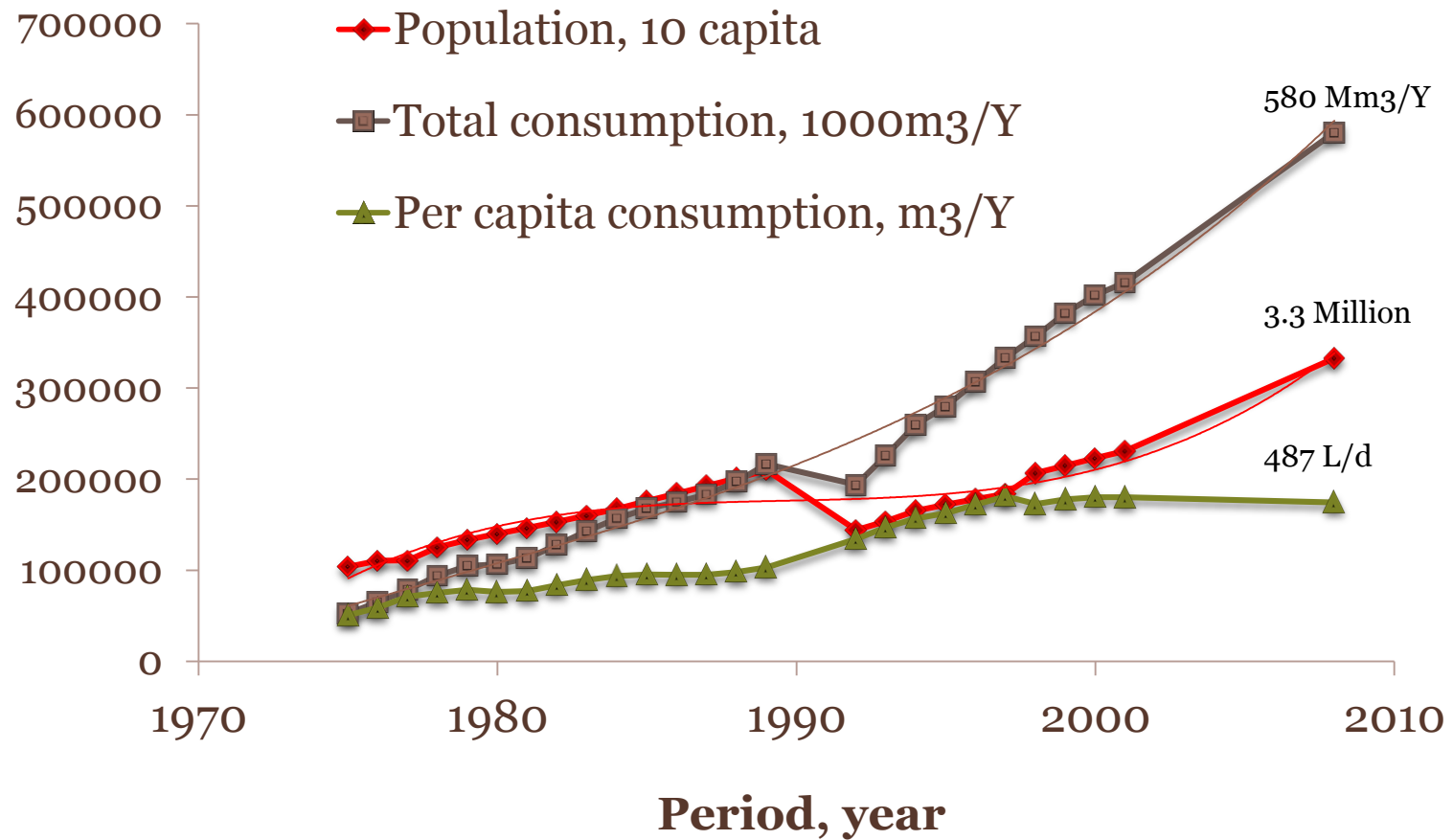


- The desalination industry is the backbone of the water sector in Kuwait and will continue being so in the foreseeable future.
- The resilience of this industry to climate change is expected to shield Kuwait and many other Gulf countries against climatic change impacts on water availability.
- Regulatory and technical reforms of the water sector are needed for improving the feasibility of the sector
- Modernization through adopting RO and hybrid methods is essential to elevate the economical burden.

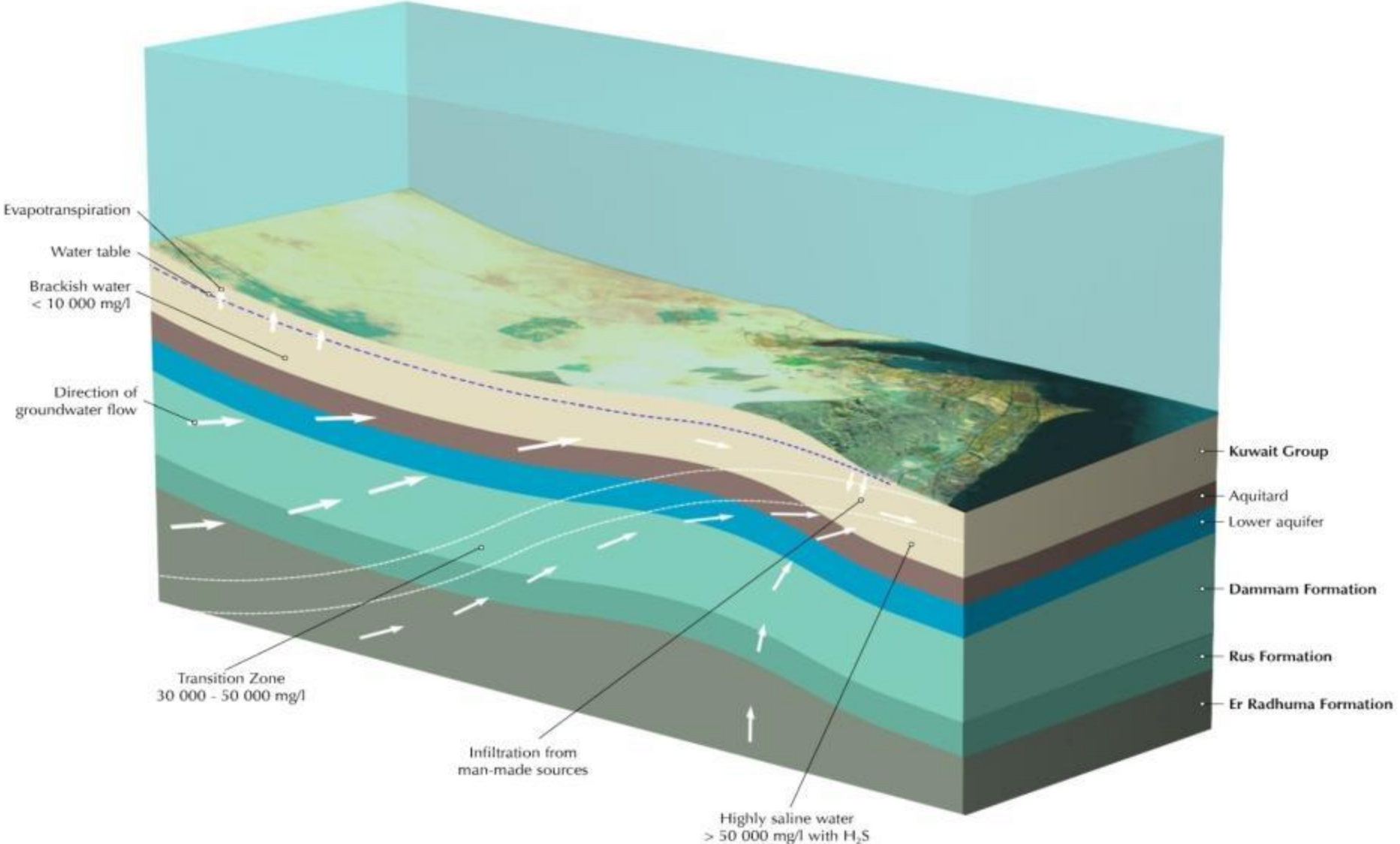




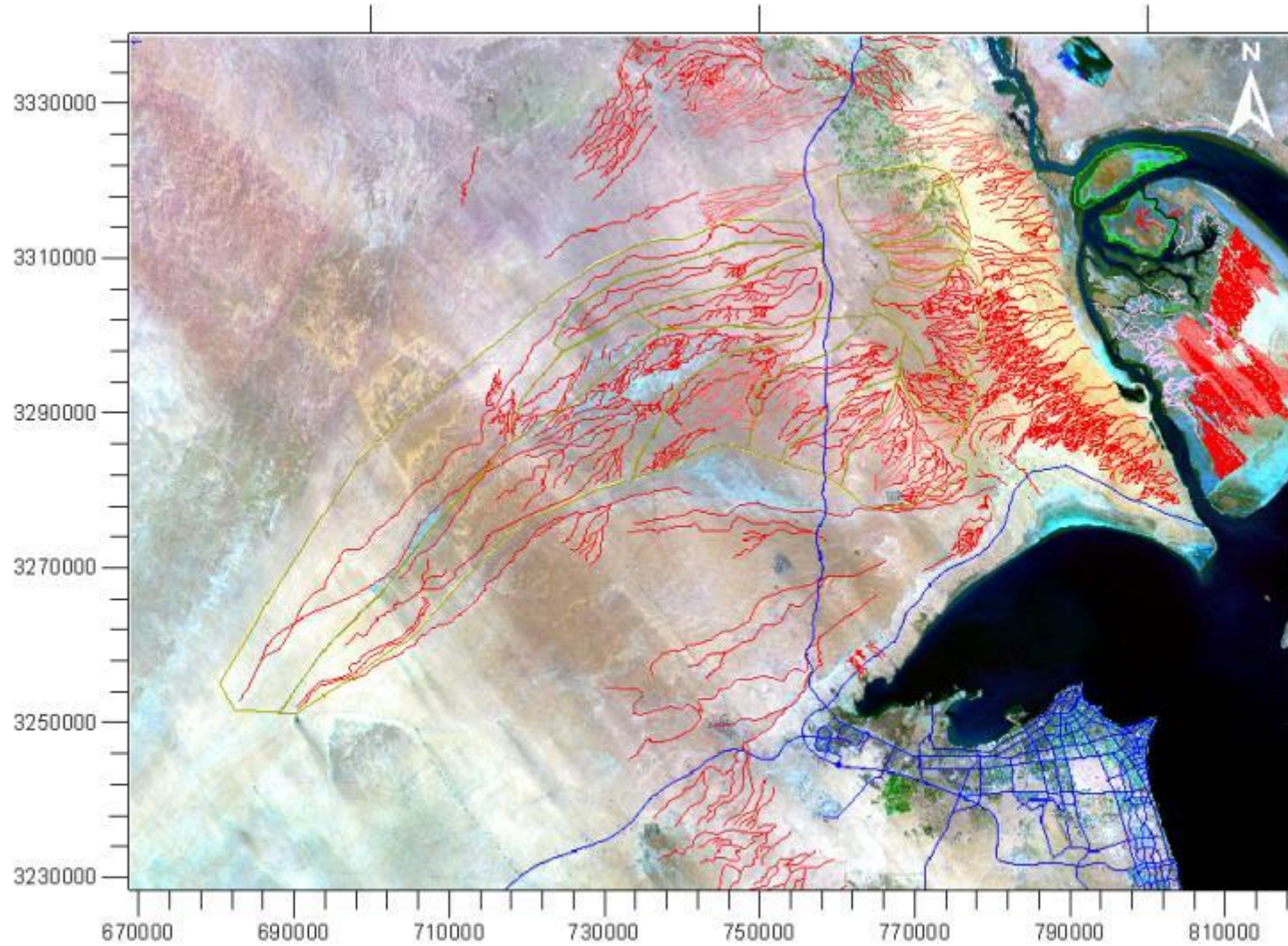
Freshwater Consumption in Kuwait






Main Aquifer System




Watersheds of Northern Kuwait



Legend

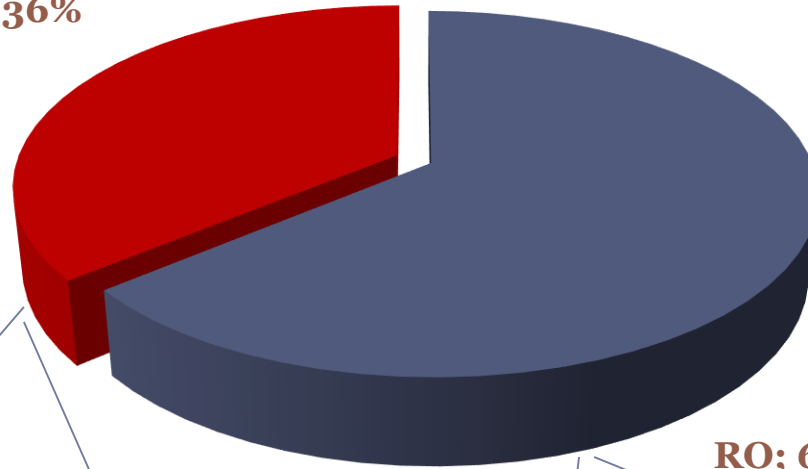
-  Drainage channels
-  Raudatain Basin
-  Road

0 20 kilometer



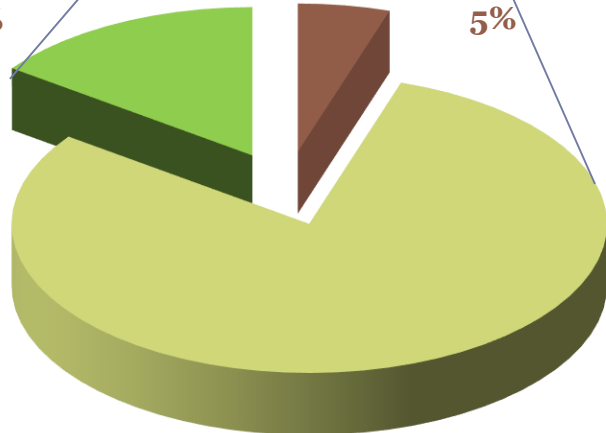
Wastewater Reuse

**Tertiary,
36%**



RO; 64%

**Agricultur
15%**

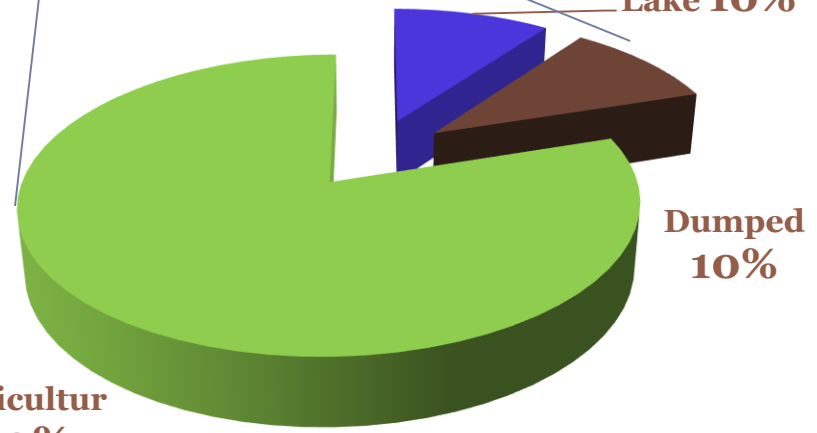


**Dumped
5%**

**Greening
80%**

Lake 10%

**Agricultur
80%**



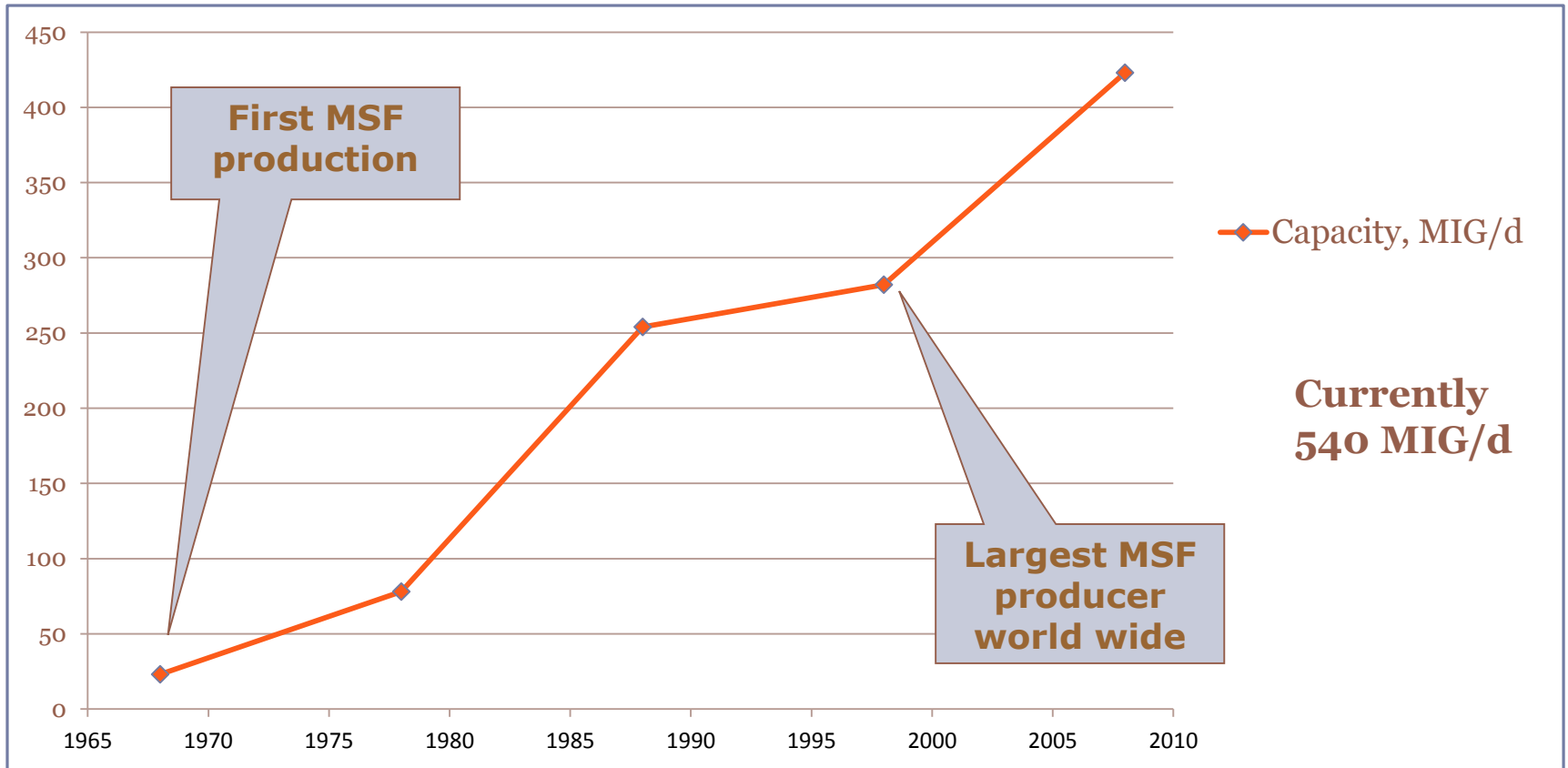
**Dumped
10%**

Climate Change and Kuwait Water Resources



- Groundwater resources
 - Northern watersheds: severe and immediate impact
 - Brackish water aquifers: intermediate delayed impact
- Desalination
 - Easily manageable minor to no impacts
- Wastewater
 - No impacts
- Overall:
 - The resilience of the desalination industry to climate changes will enable Kuwait and other places in the Gulf to continue with their development plans without significant mitigations

Desalination in Kuwait



Issues related to cost estimation



- **Factors include: size, method, feed water, labor, capital cost, and disposal of concentrate**
- **Cost = capital (30%-based on 5% interest and 25 years lifetime) + Operation and main. (50-70% energy, 20-35% maint., 10-15% labor)**
- **\$0.96/m³ based on 2006 oil prices**
- **\$1.13/m³ based on imported gas prices**
- **\$2.62/m³ based on water only production (also, overstaffed, old plant, limited scale)**
- **Internationally: UAE \$0.6/m³ (hybrid system), Singapore \$0.49/m³ (RO),**

Suggestions for the region



- **Limited scale RO of brackish groundwater units could be used for remote areas for drinking water and agriculture. However, the ag. Industry should adopt to the economics of the water**
- **Large scale desalination plants for major coastal cities could be used for drinking water to free the natural water for use in ag.**
- **Privatization of the desalination industry is key**