

# Solutions for Water Scarcity

SAWEA Workshop June, 2006

Daoud Sliat, Business/ Projects Development  
GE Infrastructure/ Water & Process Technology



# **Water Scarcity**

## **Definition**

**The Demand for  
Freshwater  
that Exceeds**

**The Sustainable  
Supply of Freshwater**

## **Implications**

**Left unresolved Water Scarcity  
will:**

- Slow/Stop economic expansion
- Reduce agricultural output and food independence
- Degrade public health and quality of life

**Mandate – Sufficient, safe, reliable freshwater  
delivered at the lowest total cost**

# Regions of Water Scarcity

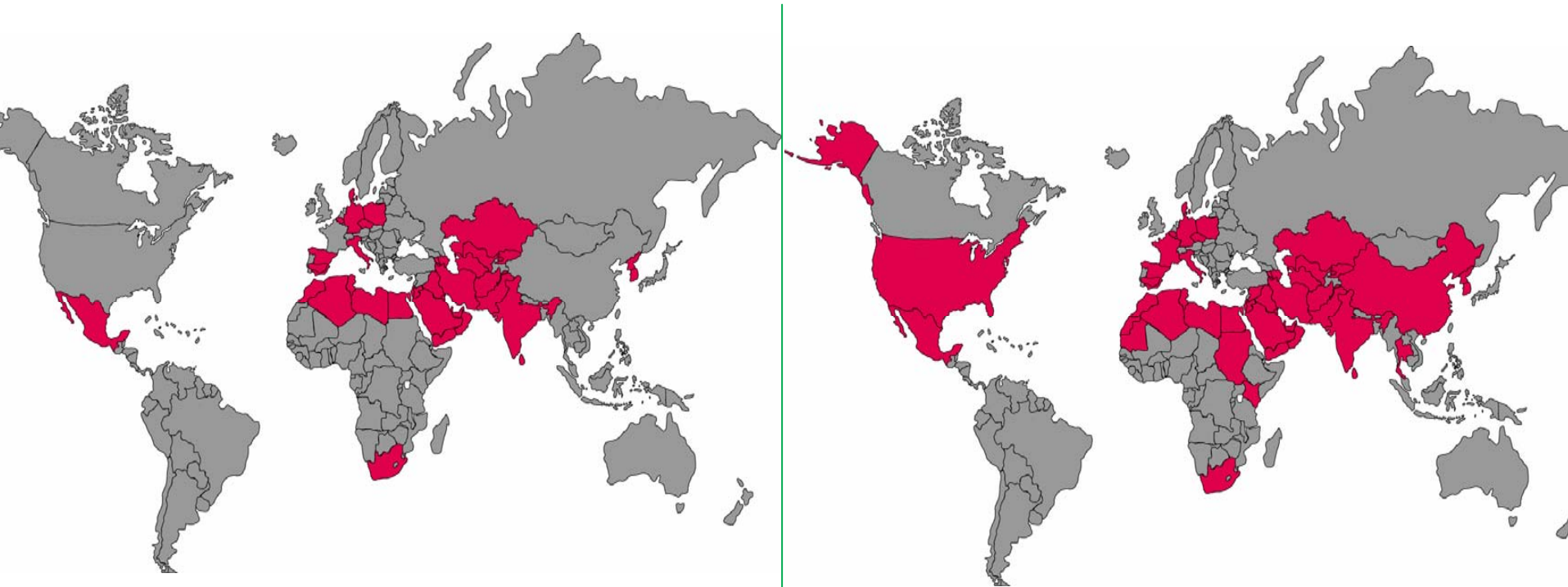
In 2001 the UN identified 18 countries that have a critical water shortage:

- Mainly in the Middle East and North Africa
- And a few countries in Europe, Asia and the Caribbean

In the year 2025 it is projected the number of water stressed countries will increase to 29:

- Population in current water scarce regions is expected to almost double
- Increasing demands of industry for high quality process water to sustain the region's economy

# Global Water Stress is Spreading



1995

**2.3 Billion People**

2025

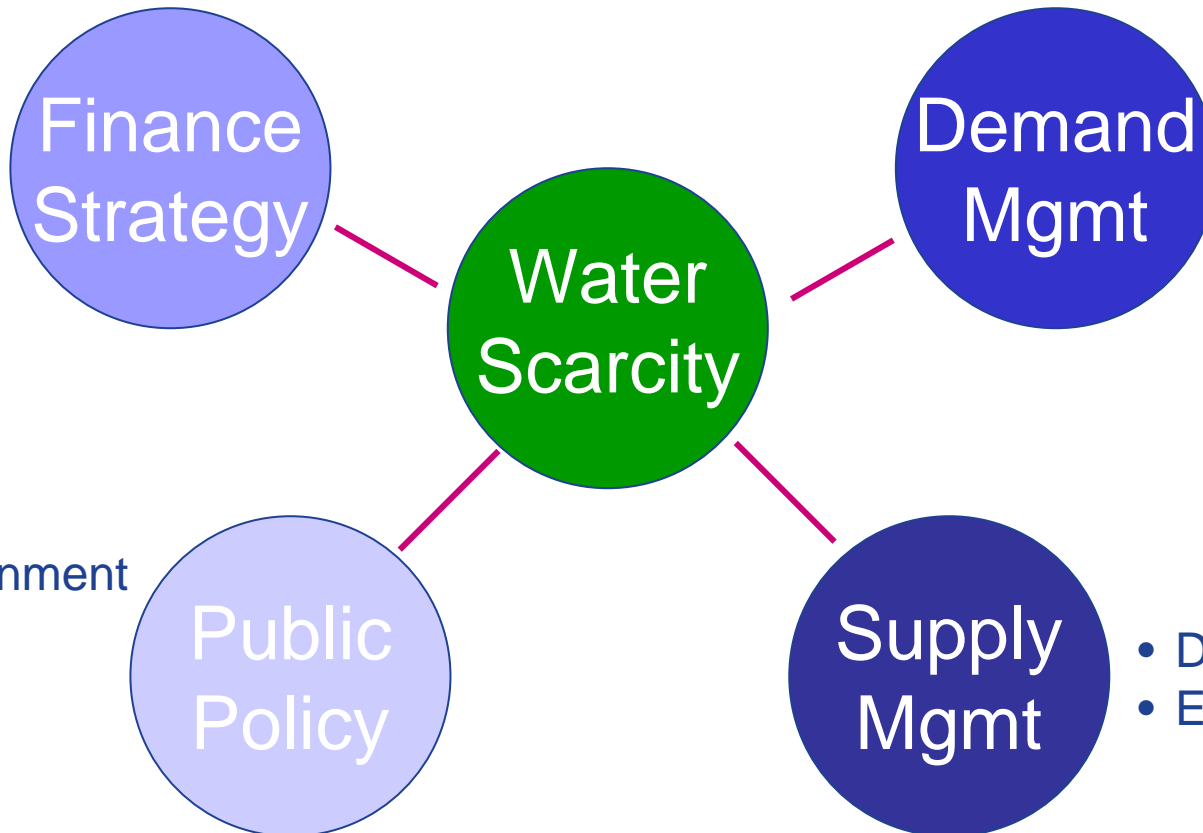
**3.5 Billion People**

Impact on Infrastructure of Industrial Growth is happening at a faster rate as Municipalities curtail scarce water for consumer use

# Components of an Integrated Strategy For Water scarcity

- Public Private Partnership
- Low Cost Finance

- Water conservation
- Education
- Water Re-use
- Distribution Integrity



- Environment
- Tariffs

- Desalination
- Emergency solutions

# Desal Driving Forces as a supply solution

- Scarcity of water in both the developing and the developed world.
- Demographics stressing existing water sources.
- Industry follows population growth and creates additional demand
- Technology is reducing treatment costs.
- Risk re-allocation via BOO/DBO models



# Desalination



**Seawater - RO & Thermal**



**Brackish Water - RO**



**Municipal Reuse**

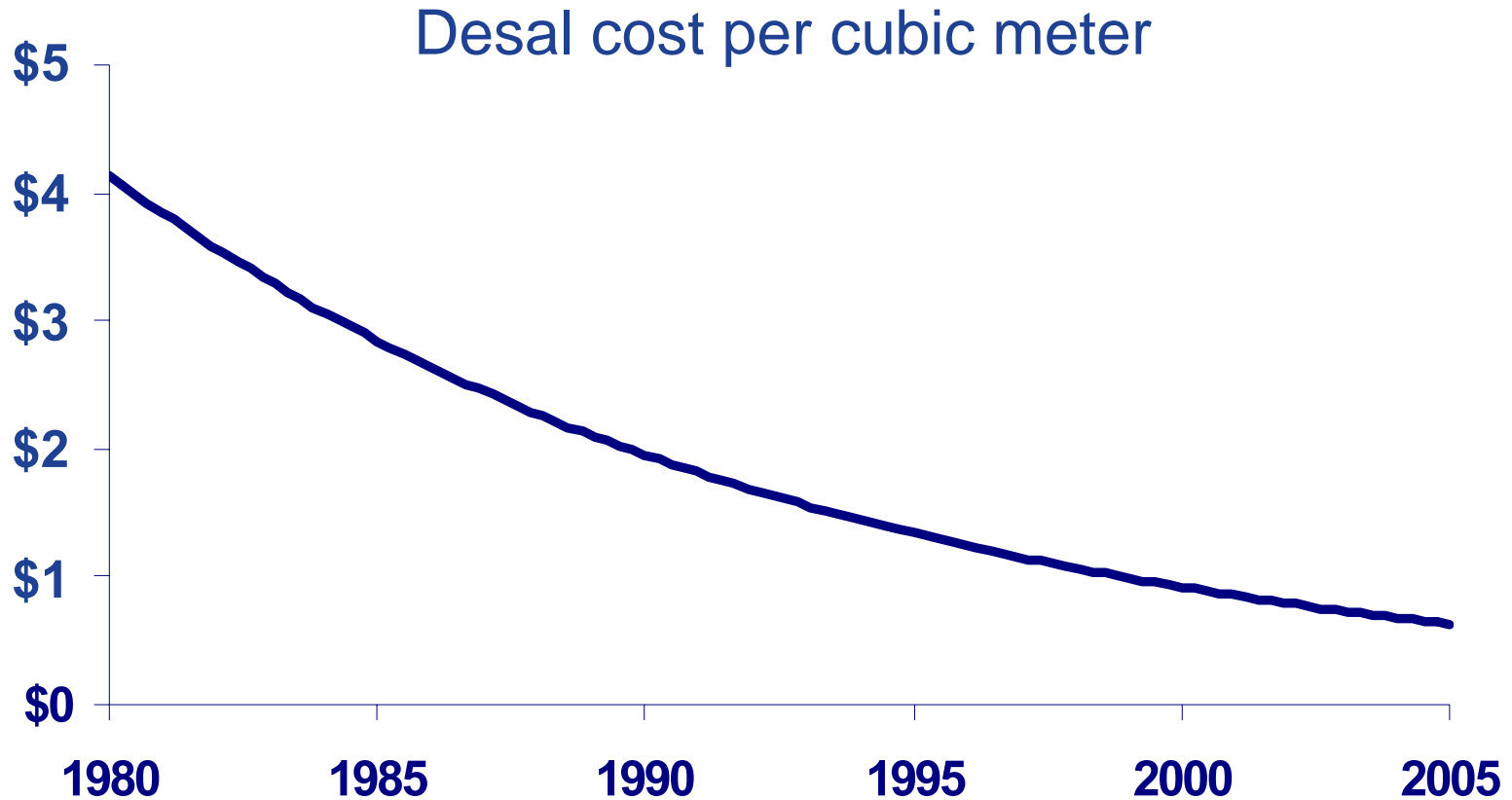


**Brackish Water – EDR**



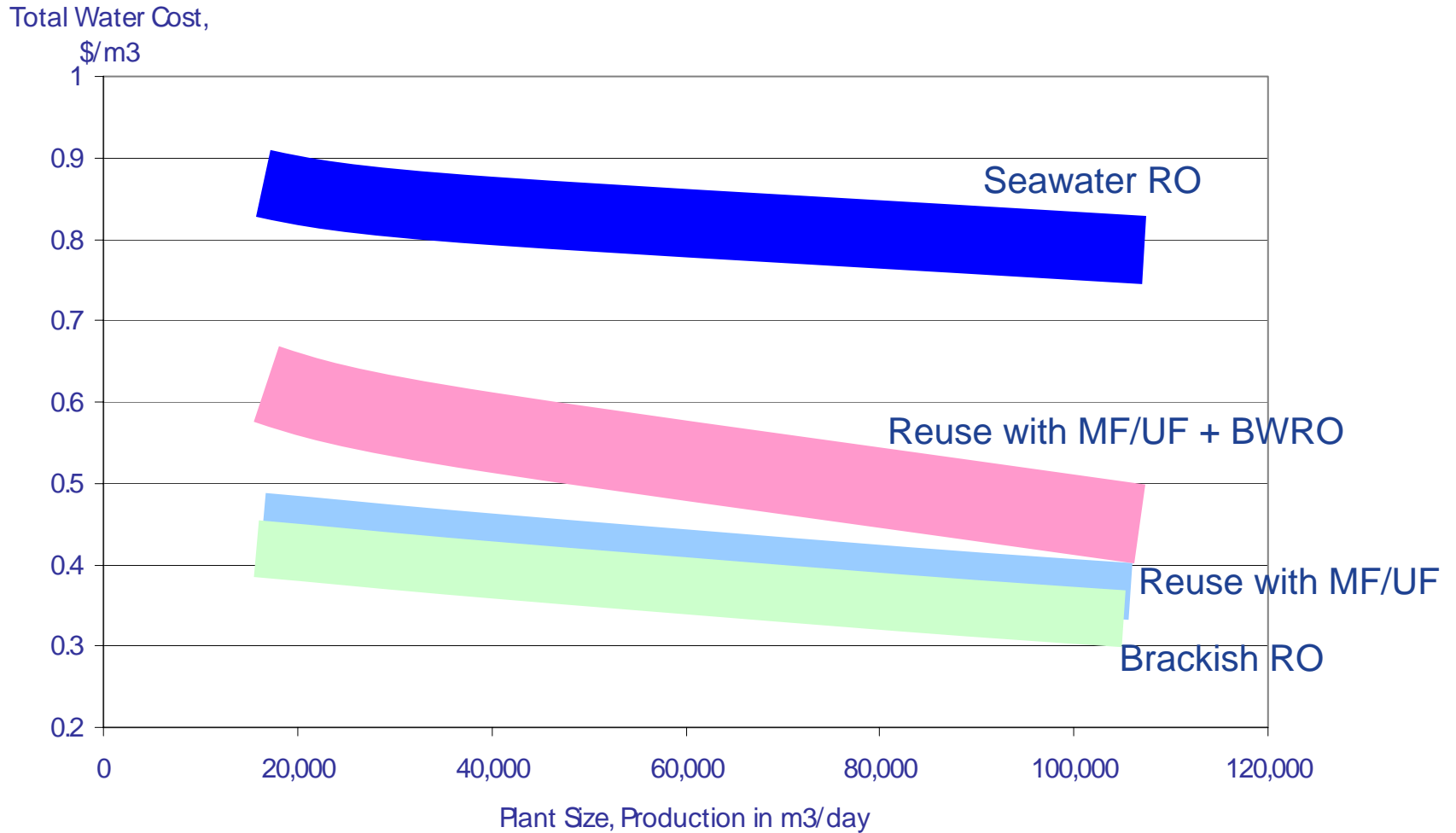
**Industrial Reuse - Thermal, RO, UF**

# Technology Driving Attractive Economics

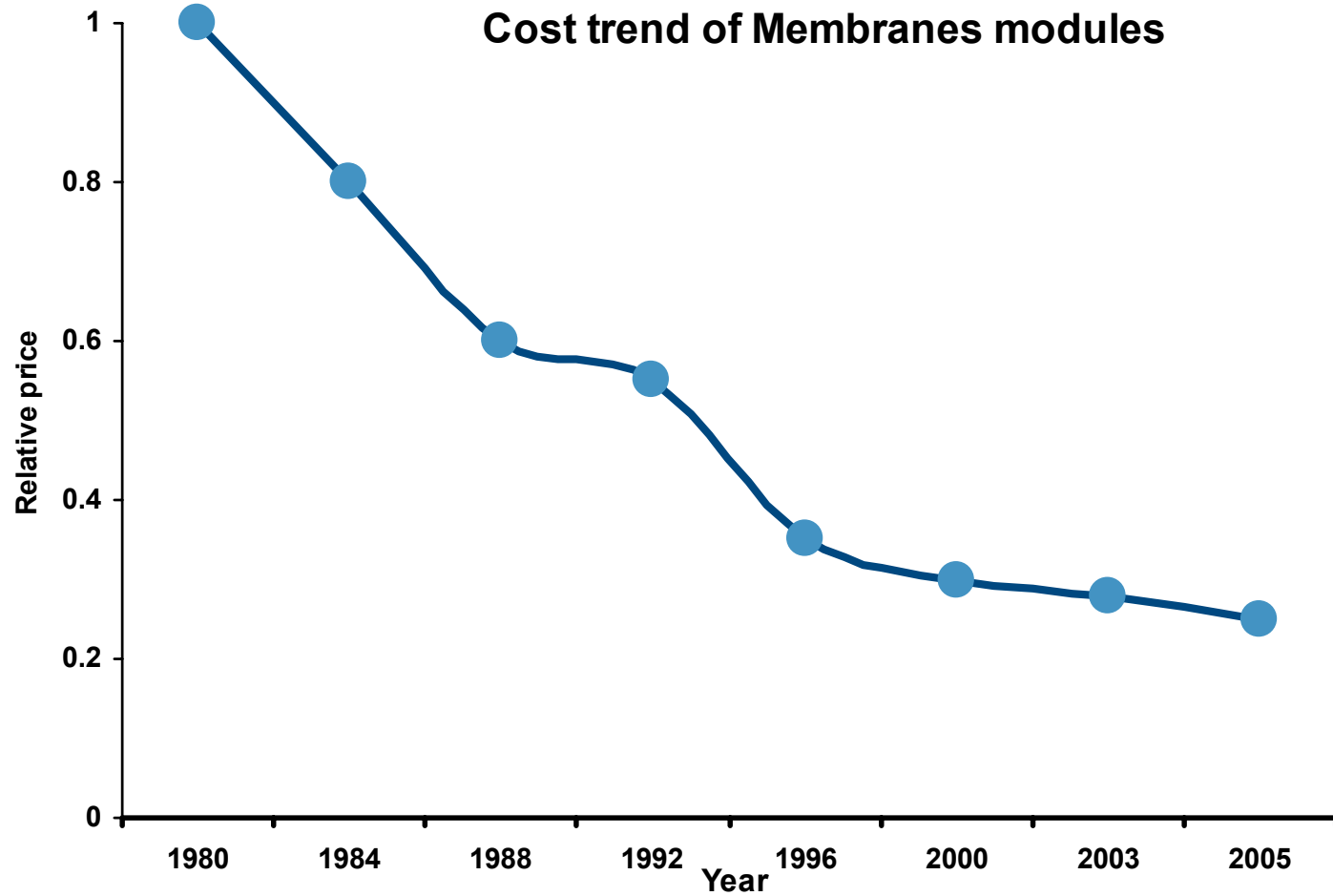




# Lifecycle costs for alternative water sources



# Cost of the Desalinated water is gone down by 80% in last 20 years



# Sulaibiya Wastewater Treatment And Reclamation Plant

## BOT Project - Kuwait



# Sulaibiya Water Reclamation Drivers

## Water Scarcity Challenges:

- Fresh water supplies limited and declining in Kuwait.
- A need to build a new wastewater treatment facility that would comply with the highest criteria for effluent discharge to the Gulf and away from residential Area
- To include an advanced Technology to meet the increasing demands of agriculture and other non-potable applications with a high quality reusable effluent
- Reduce the increasing demand on the existing and planned desalination plants in Kuwait for potable water
- Use Privatization “Public-Private-Partnership (PPP)” as a financial enabler and risk transfer vehicle to insure a predictable water tariff and project schedule
- It is reported that the above Water Management strategy will save the State of Kuwait some \$11 billion over the project concession period



UF Skids



RO Skids

# Development Steps

## Initial Data:

- Product requirements (m<sup>3</sup>/day)
- Customer business structure preference, if known
- Term of contract (BOO, DBO, O&M)
- Guarantor
- Project Status

# Structured Financed Projects Considerations

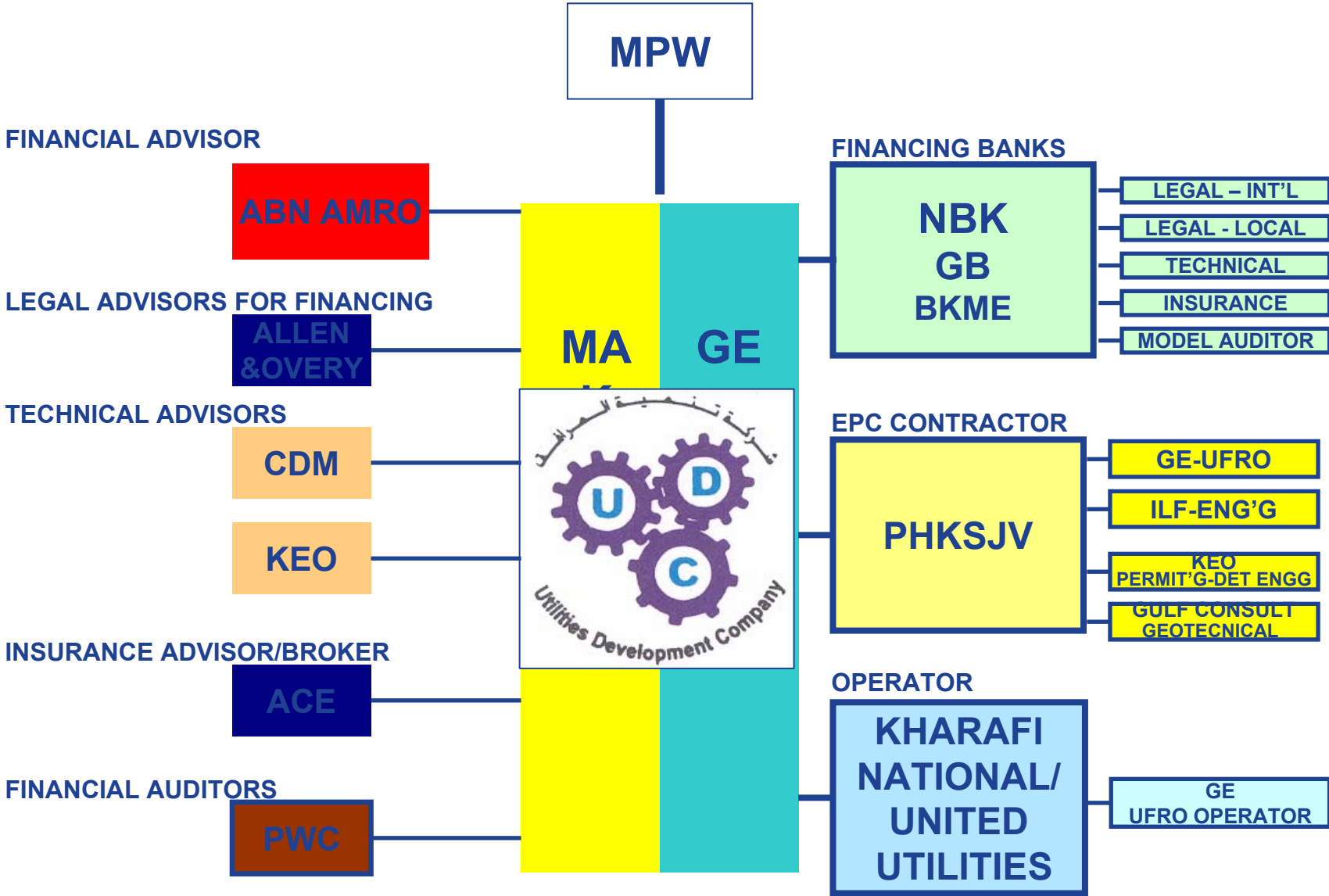
- **Project Definition** – Has the project been clearly defined with a bankable Water Sales Agreement?
- **Revenue Security** – Is the client providing a bankable “take-or-pay” feature in the contract with suitable sovereign guarantees?
- **Asset Security** – Is the credit rating of the client strong enough to assume the purchase of the project assets if required?
- **Tariff Adjustment** – Does the contract allow for fluctuations in economic indices?
- **Economic** – How strong is the economy of the host country, and what incentives (tax) exist between the host country and the country of the foreign investor.
- **Institutional** – How strong and proven are the relevant institutions (political, judicial, financial, etc.) in the host country.
- **Political** – How stable is the local politics and how strong is the government relationship between the host country and the foreign investor’s country.
- **Power guarantee**
- **Banking** – Is there sufficient demand in the payment currency of the contract to attract adequate competition for the debt financing.
- **Currency** – Ease of converting and transferring currency, hard currency on-shore bank accounts
- **Local Participation** – Consideration given to the need of local partner to participate in the equity and/or EPC construction.
- **Change in Law** – Allows tariff adjustment
- **Acceptable Site Lease**



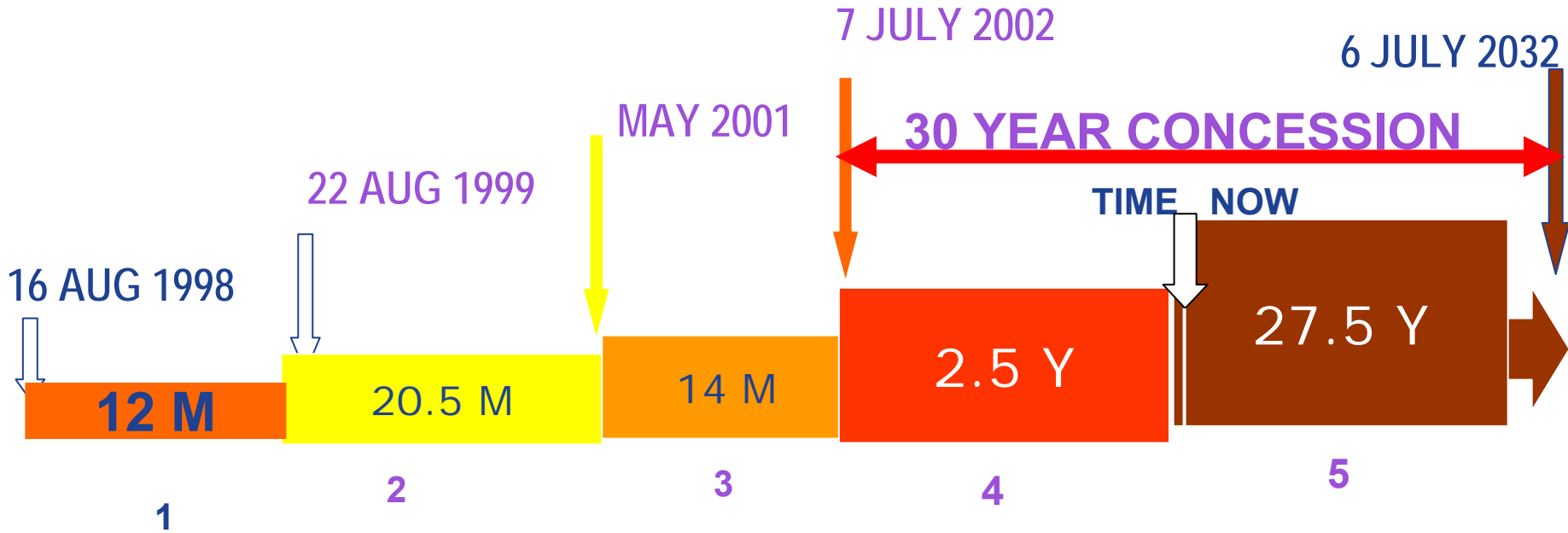
# Dedication Ceremony – March 8, 2005



# Sulybiah Loop –BOT Project



# Contract Timeline



**1. Pre-qualification Phase**

**2. Tendering Phase Until Contract Signing**

**3. Development Period**

**4. Engineering, Procurement & Construction (EPC ) Period**

**5. Operation & Maintenance Period**



# A global team for engineering, manufacturing and finance



# The Concession Contract

Treat Raw Municipal Wastewater to Reclaimed Water

Conforming to Quality Parameters

- 30 Year Concession
- Plant Capacity:
  - Initially: 375,000 M<sup>3</sup>/D
  - Expansion Capability: 600,000 M<sup>3</sup>/D
- Payment for Produced Effluent
  - Rate Per M<sup>3</sup>
- Guaranteed Minimum Inflow
- Guaranteed Off-taking of all Effluent.

# Major Features

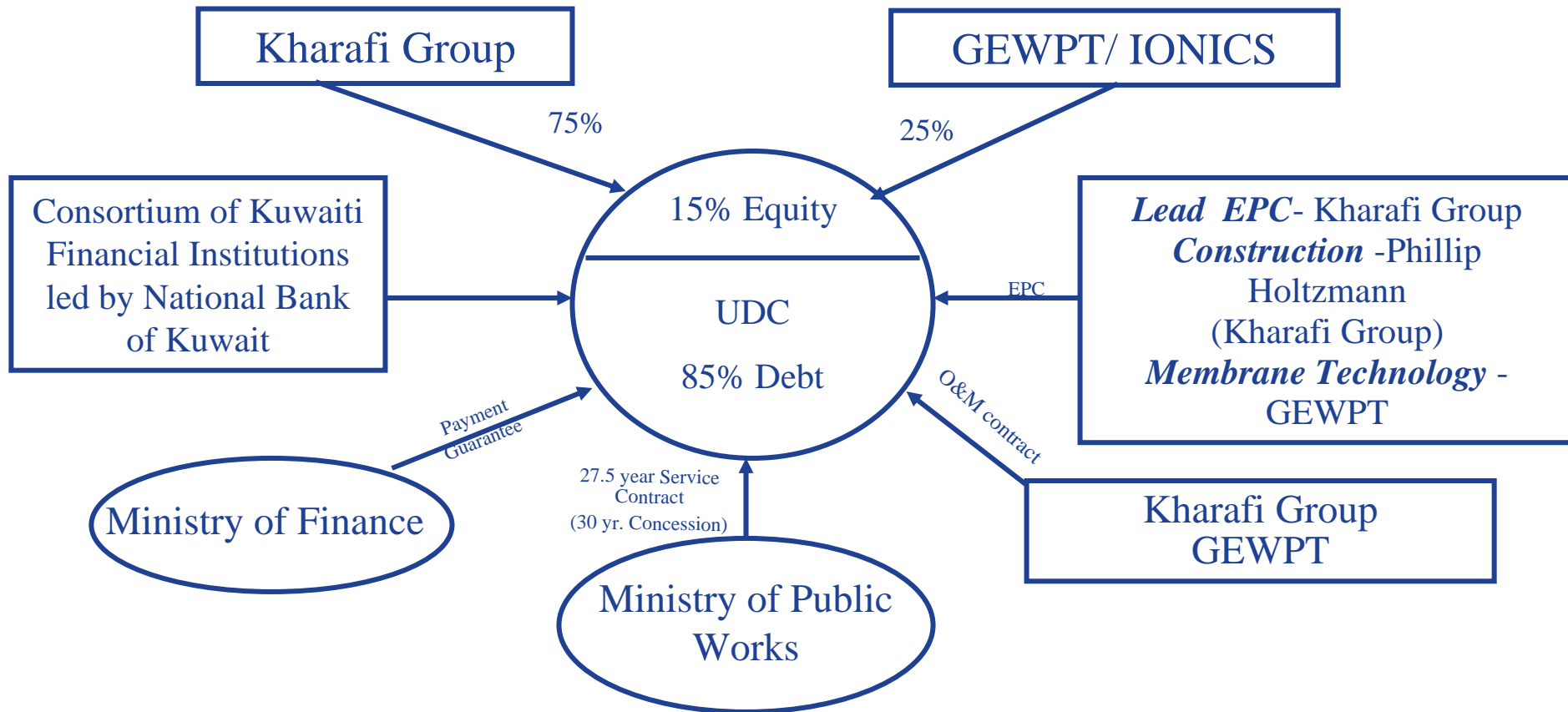
- **Strategic Asset:**

  - Handling 60% of Kuwait Domestic WW. > 375,00 M3/DAY**

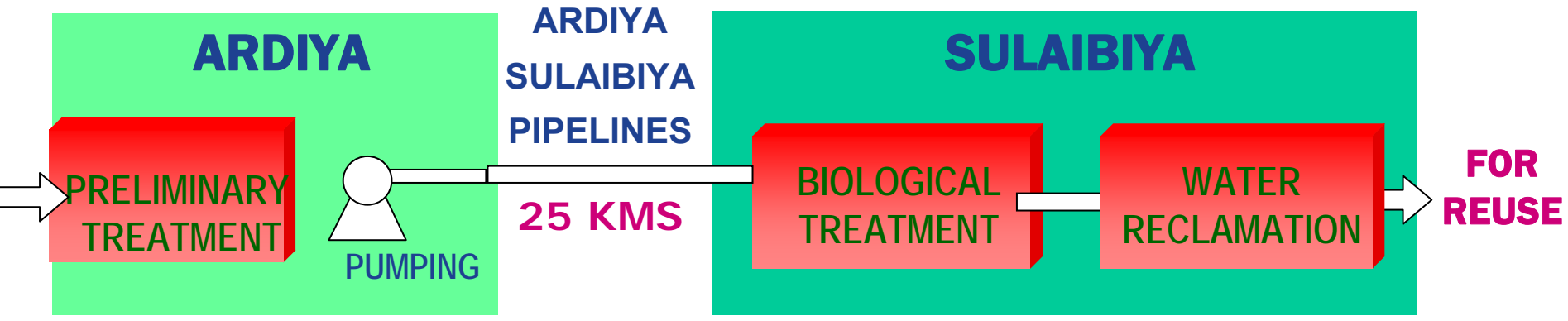
- **Government Guarantees Power Supply at Agreed Upon Rates.**
- **Protection of Concessionaire from Negative Effect of a New Law.**
- **Concessionaire Entitled to Claim Benefit from Any More Favorable New Law.**
- **Local Financing in KD**



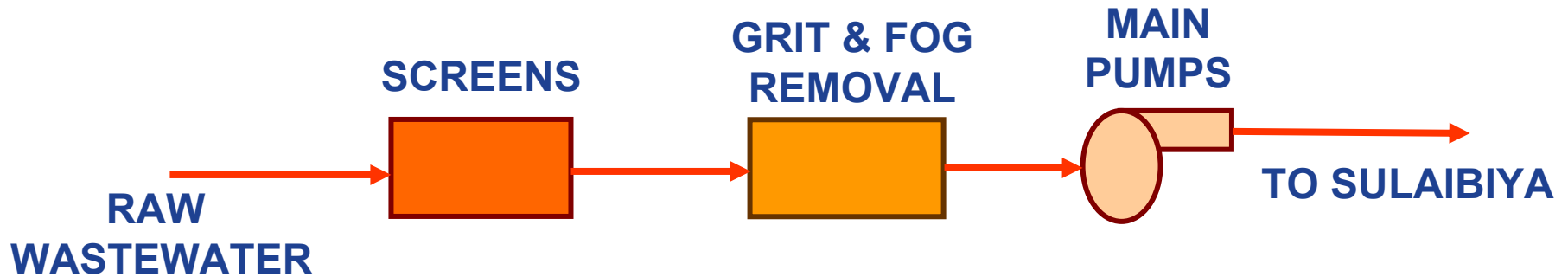
# Sulaibiya Project Structure - Kuwait



# PROJECT GENERAL DESCRIPTION



# Ardiya Operations



# Ardiya Preliminary Treatment and Pumping Station

Proposed Construction  
Future Extension

Incoming Force Mains

Operations Building

Odor Control Building

Green Belt

Screening and De-gritting

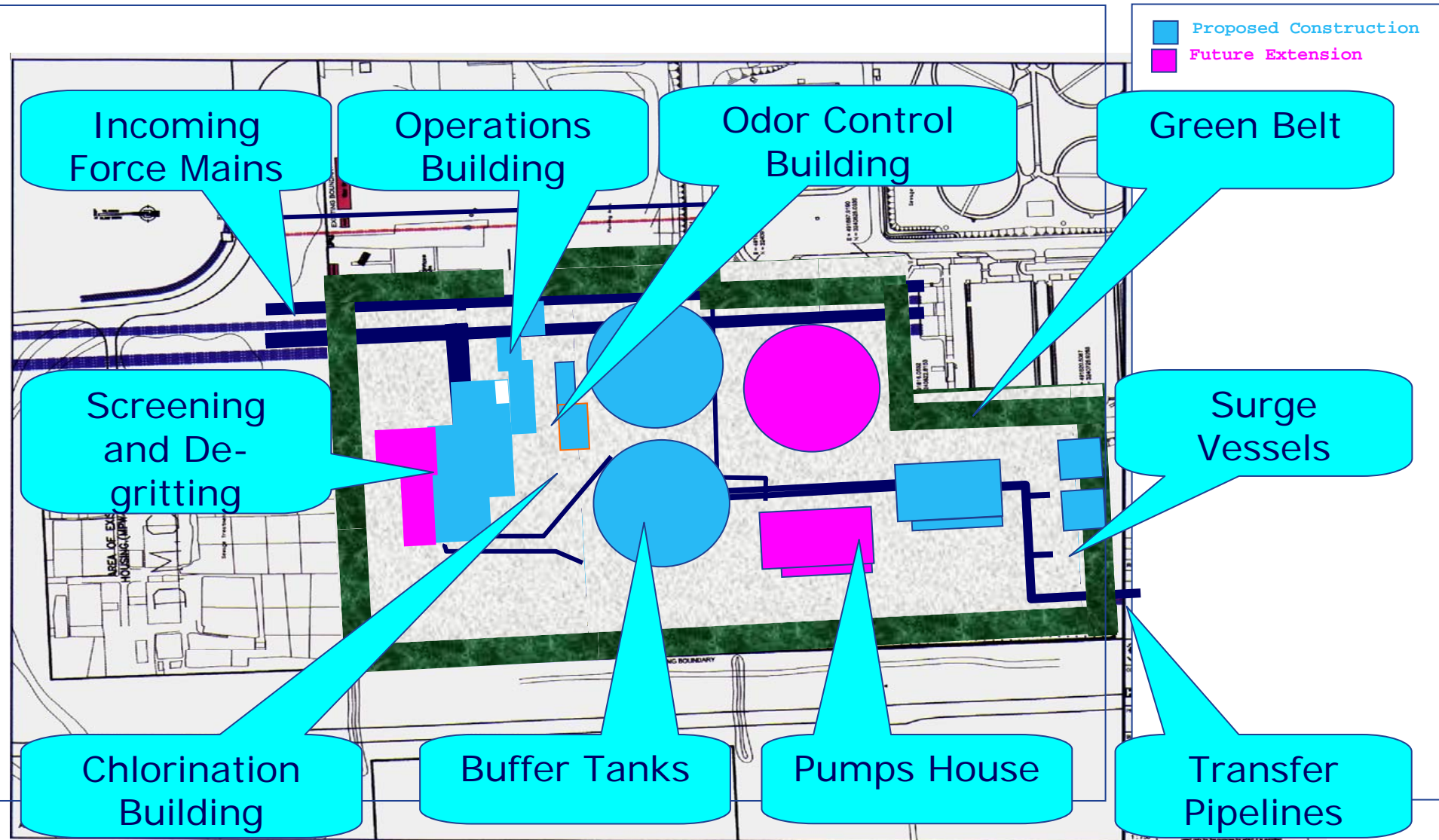
Surge Vessels

Chlorination Building

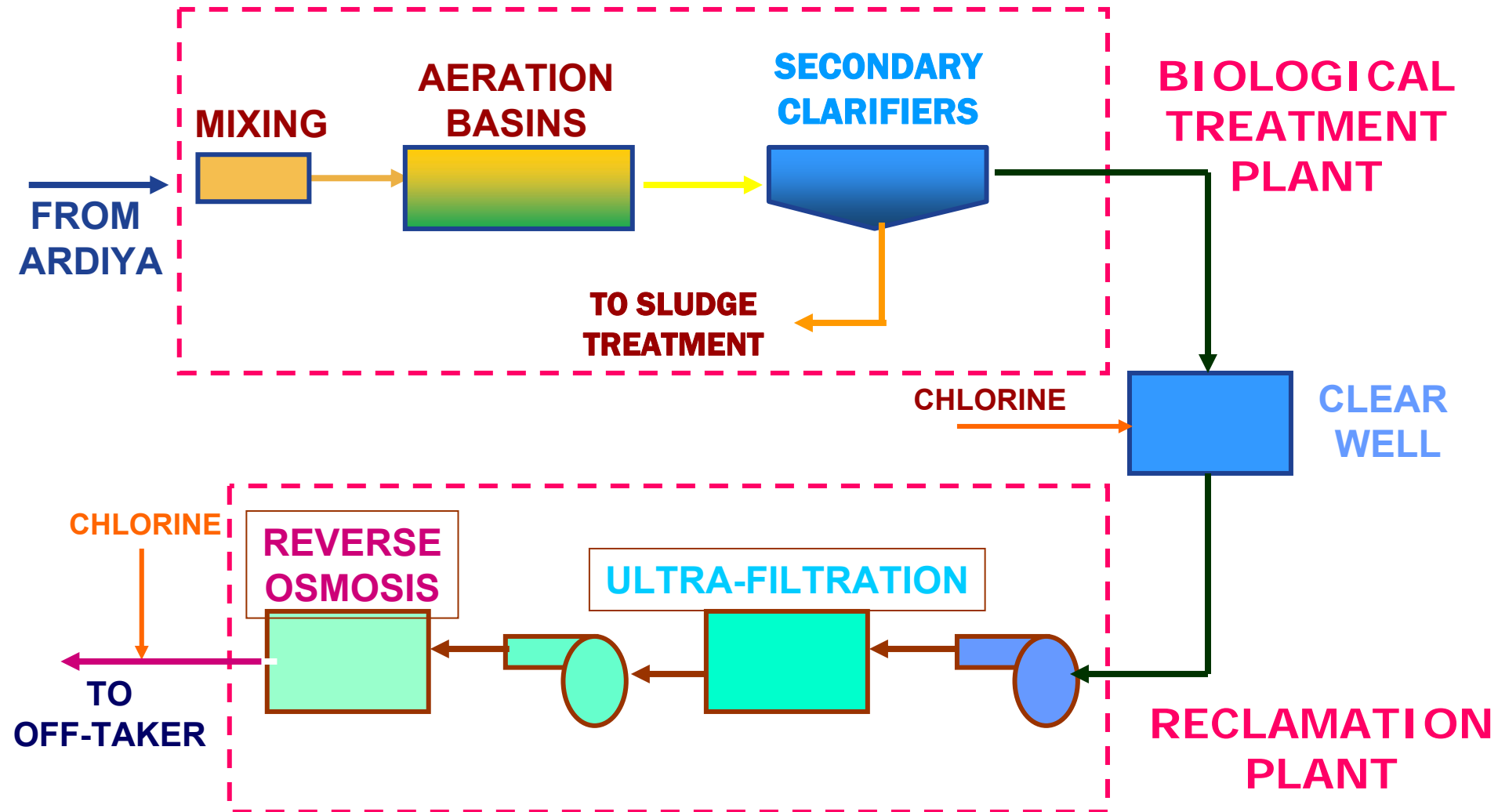
Buffer Tanks

Pumps House

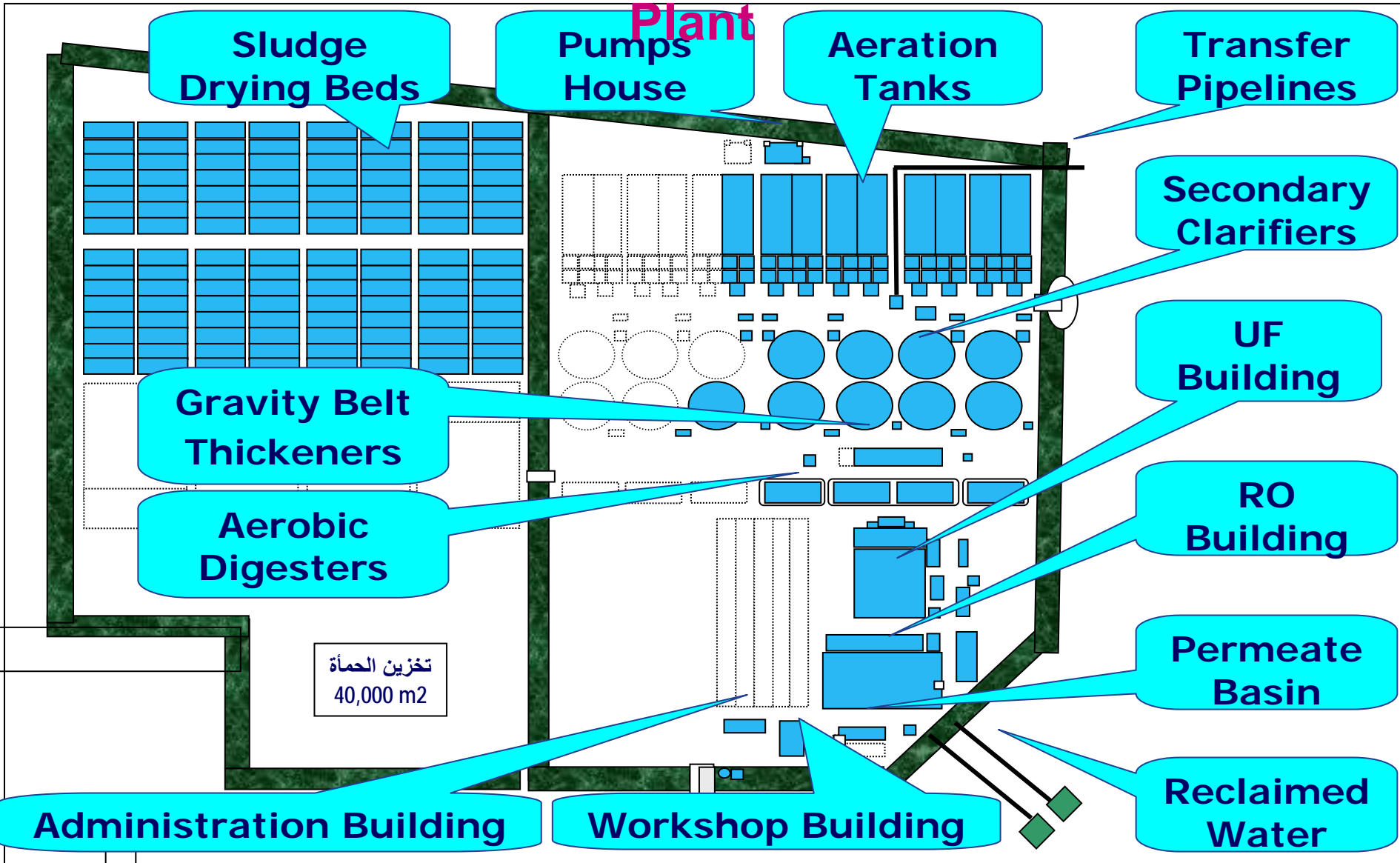
Transfer Pipelines



# Sulaibiya Operations



# Sulaibiya Wastewater Treatment and Reclamation Plant





# Ardiya Preliminary Treatment and Pumping Station

Ardiya



# Pump House

Ardiya

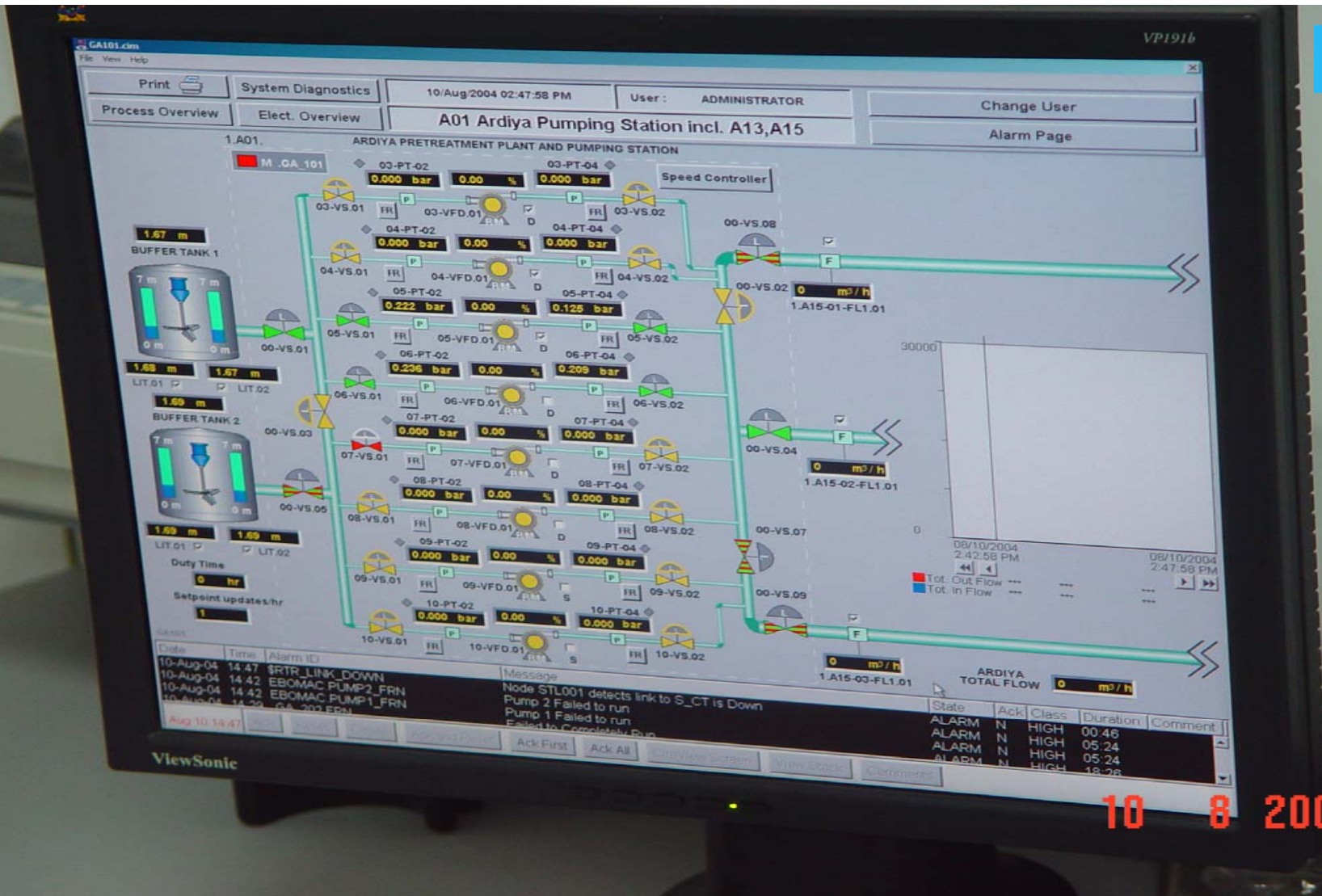


10 8 2004



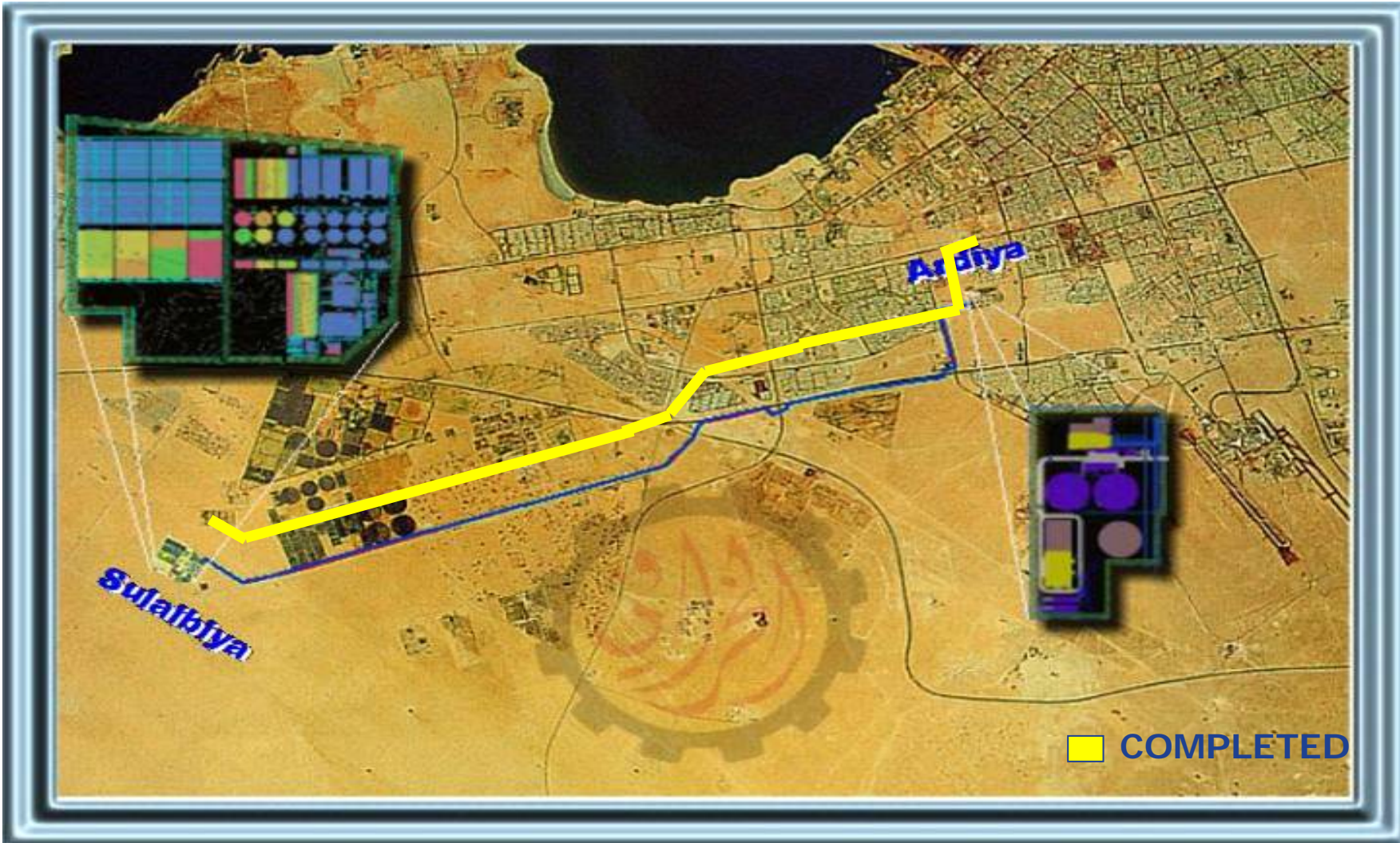
# SCADA System at Ardiya

Ardiya



10 8 2004

# Transfer Pipelines Between Ardiya and Sulaibiya





# Transfer Pipelines



# Aeration Tanks

Sulaibiya



26 10 2004



# Secondary Clarifiers

Sulaibiya



25 10 2004



# Aerobic Digesters

Sulaibiya



# Gravity Belt Thickeners





# UF Skids and Piping

Sulaibiya



13 10 2004

# Pumps at UF Building

Sulaibiya



13 10 2004



# RO Skids and Piping

Sulaibiya



13 10 2004

# RO Pump Room and Piping

Sulaibiya





# RO Building

Sulaibiya



# RO Building Control Room

Sulaibiya



# Why is Sulaibiya A Ground Breaking Project?

## ➤ WORLDWIDE:

- Largest Wastewater Treatment and Reclamation.
- Largest RO Plant.

## ➤ IN THE ME:

- First Major WWT BOT in the ME

## ➤ IN THE GULF:

- First Major Infrastructure BOT
- Fully Financed by Local National Banks.





imagination at work

**THANK YOU**

**[Daoud.sliat@ge.com](mailto:Daoud.sliat@ge.com)**