Strategic Water Reserve using Aquifer Recharge and Recovery with Desalinated Water

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Overview

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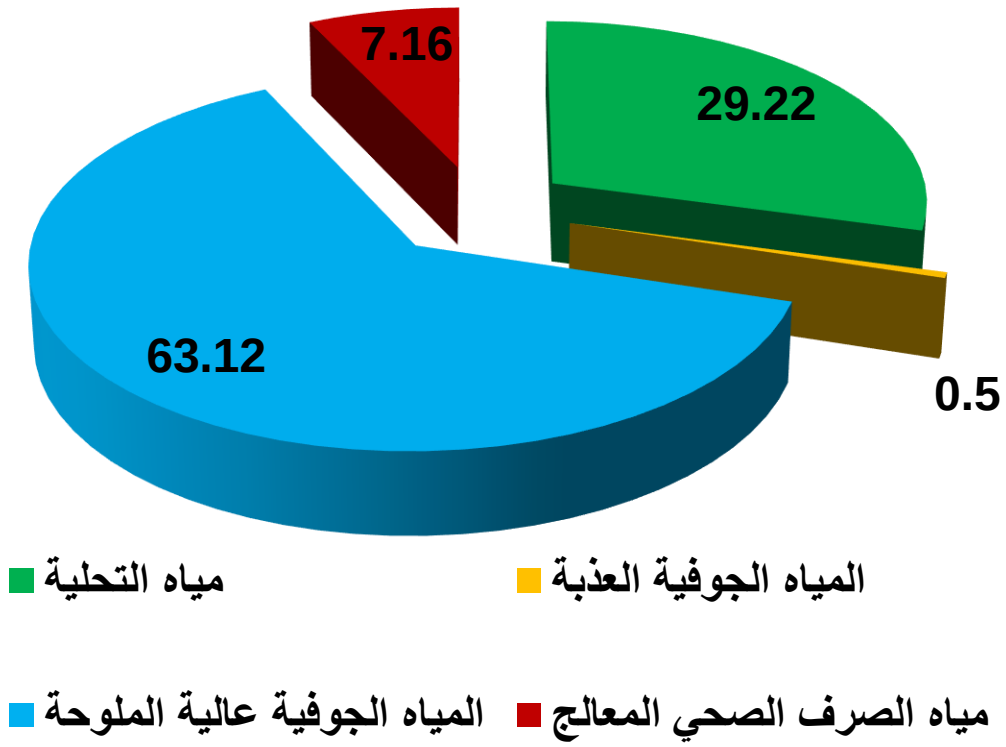
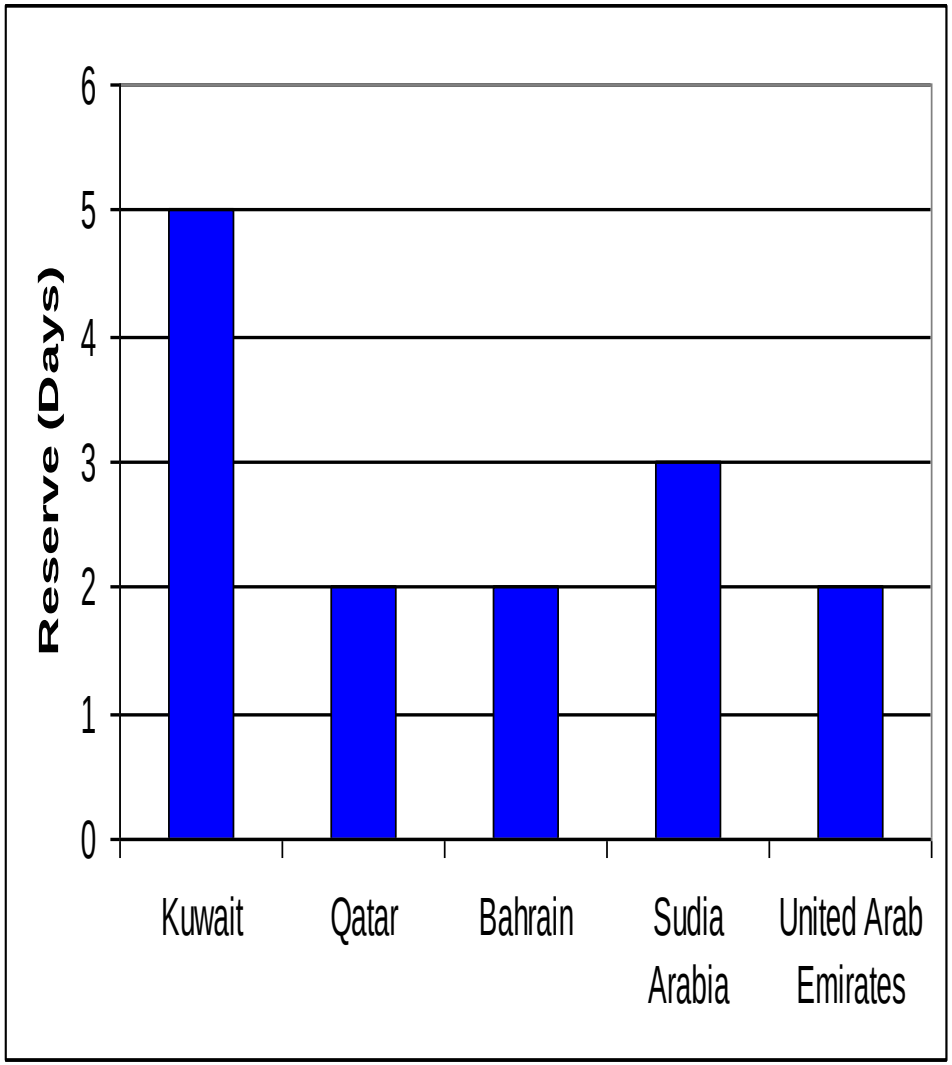
- Strategic Water Reserve
- Groundwater Assessment
- Factors Affecting Groundwater Recharge
- Suitability/Site Selection Criteria
- Site Selection
- Pilot Project
- Full Scheme Project
- Final Remarks

Introduction



Strategic Water Reserve



Strategic Water Reserve Options/Alternatives

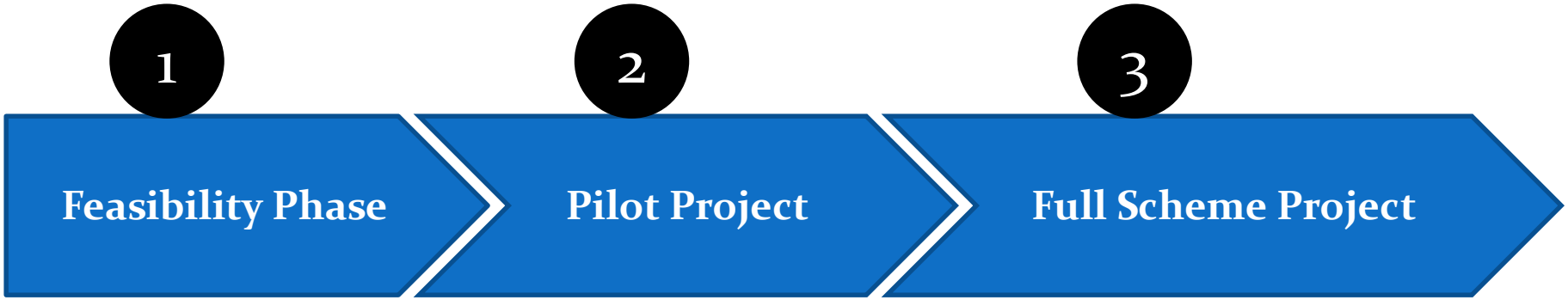
INPUT				
Recharge Rate			Duration	Total Volume
5.0 MIGD	0.21 MIGH		2 a	3,650 MIG
22,730 m³/d	947 m³/h	0.263 m³/s	24 months	16.6 Mio.m³

OUTPUT					Supply Rate
Recovery Rate			Duration	Total Volume	1 Mio. Residents
40.0 MIGD	1.67 MIGH		up to 90 d	3,600 MIG	40 IGD/cap.
181,844 m³/d	7,577 m³/h	2.105 m³/s	3 months	16.4 Mio.m³	182 litres/d/cap.

Recharge / Recovery Flow Volume Ratio:	1 : 8
Recharge / Recovery Time Ratio:	8 : 1

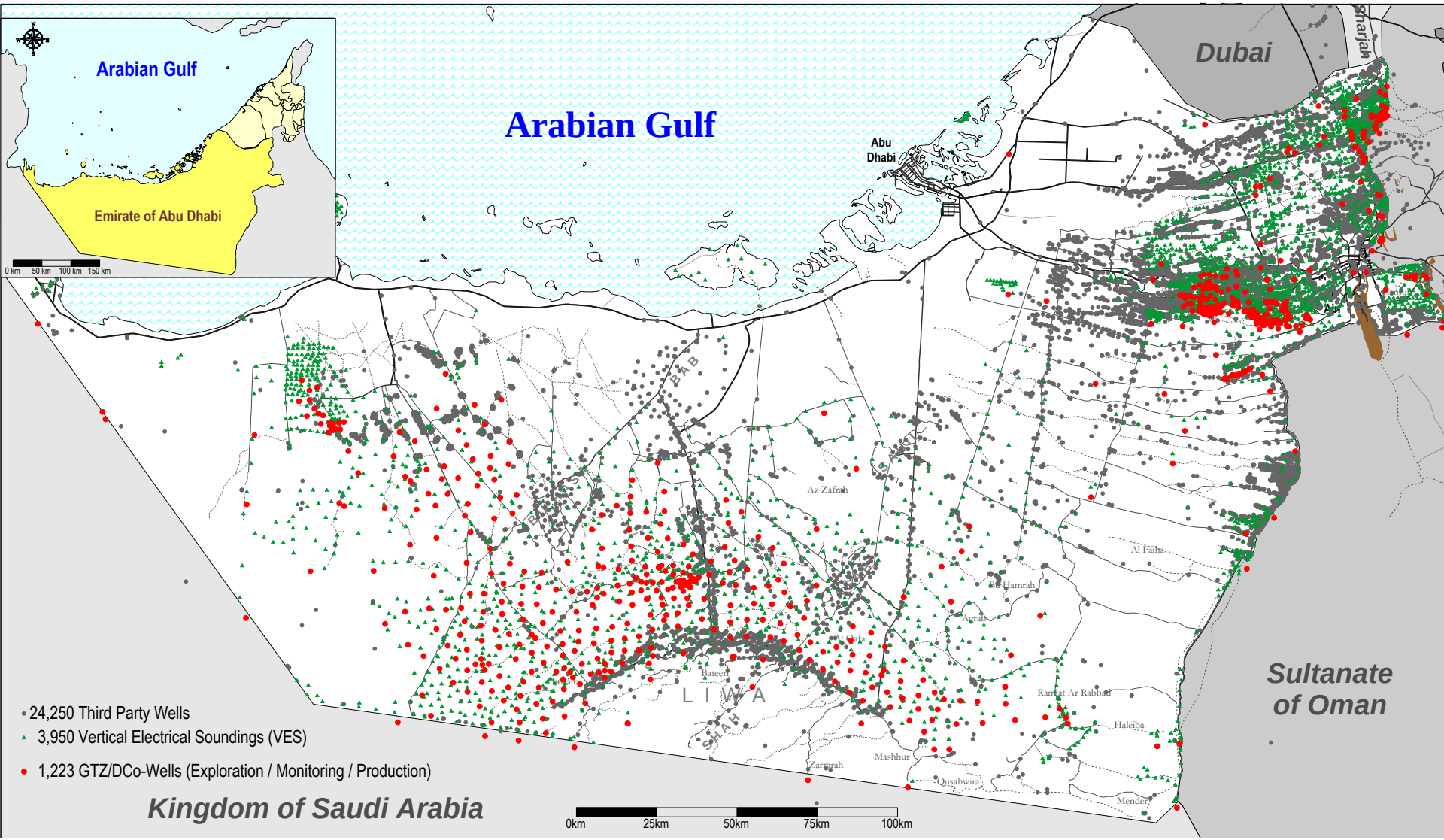
Individual Tank Volume			# Tanks
2,500 m³	550,000 IG	(ASR-Pilot Plant)	6,640
10,000 m³	2,200,000 IG		1,660
25,000 m³	5,500,000 IG		664
45,000 m³	9,900,000 IG	(Mussafah)	369

Project Phases

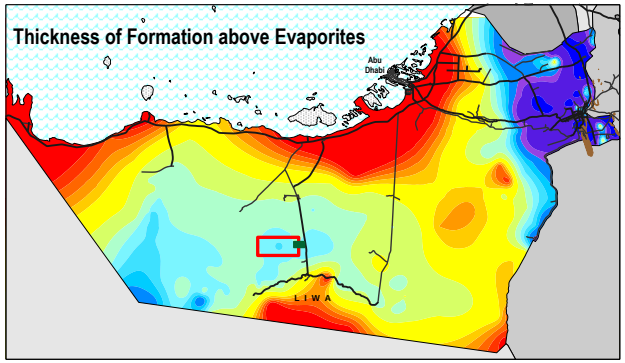


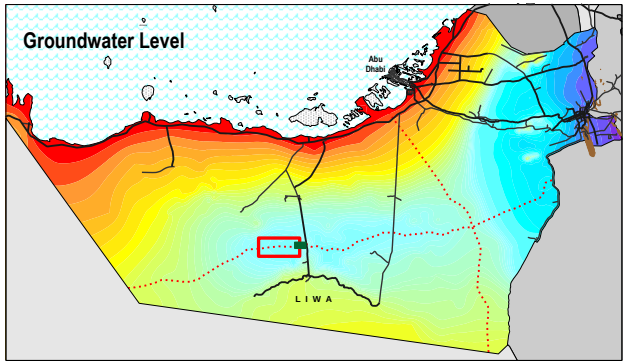
Feasibility Phase	Pilot Project	Full Scheme Project
• Data Collection • Strategic water reserve options • GW Assessment • Factors affecting aquifer recharge • Modeling • Feasibility study	• Pilot project design • Injection cycles • Recovery ratio • Recovered GW quality and quantity	• Preliminary design • Construction of the: • Injection system • Recovery system • GW monitoring system • Pumping stations • Pipes and networks
1.5 Years	2 Years	5 Years

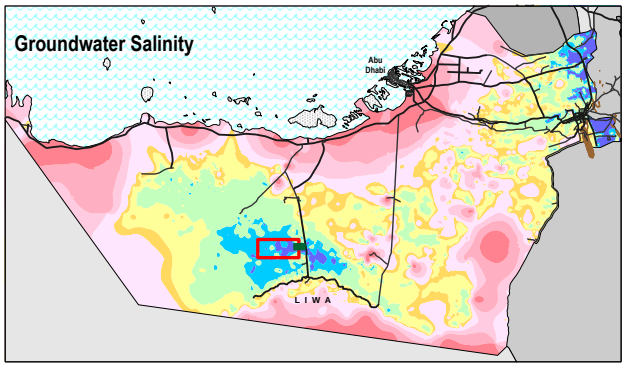
Groundwater Assessment

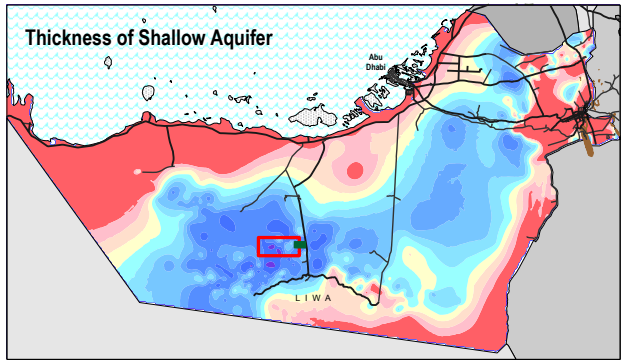


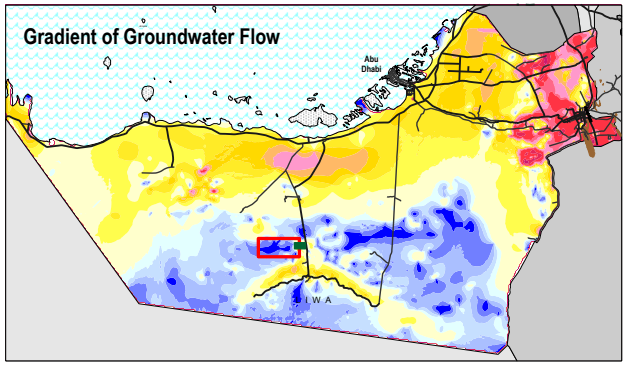
Factors Affecting Groundwater Recharge

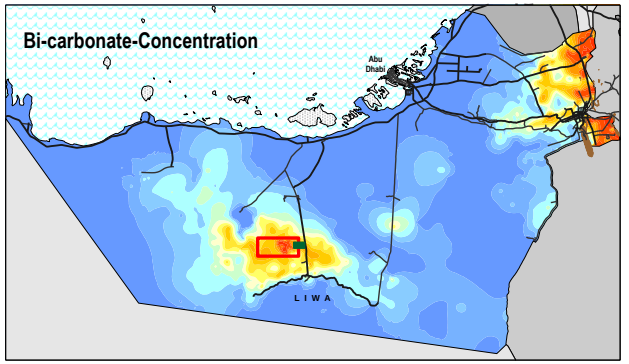


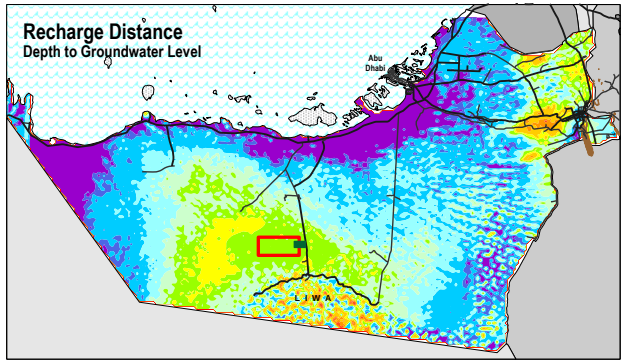


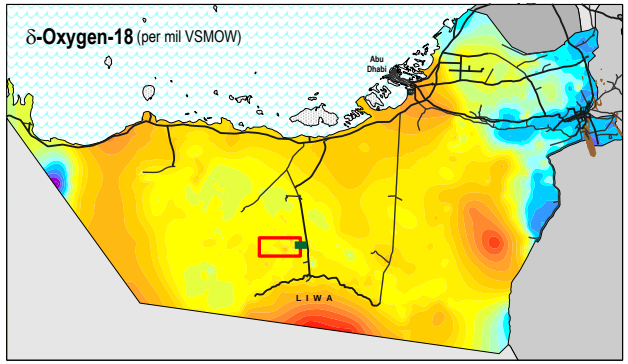


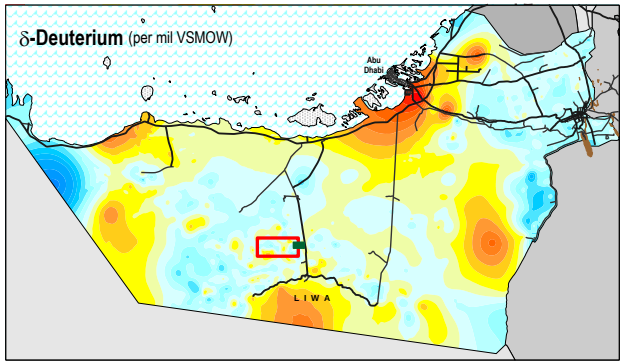




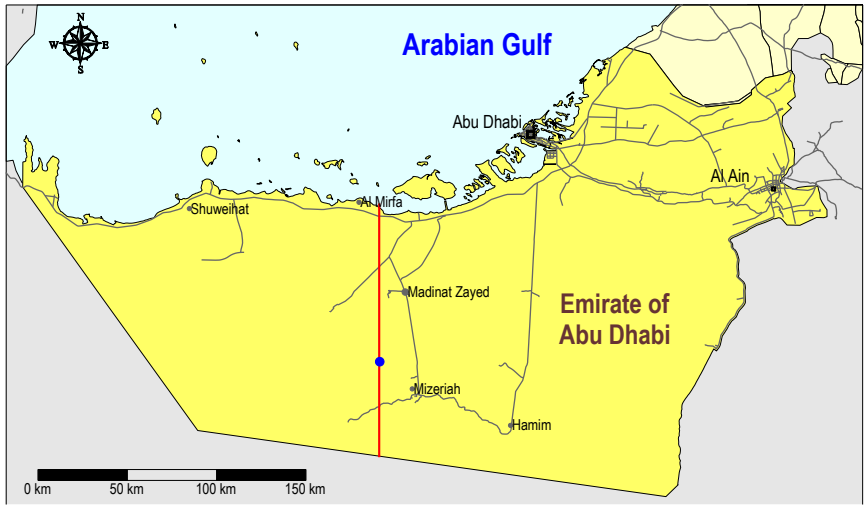


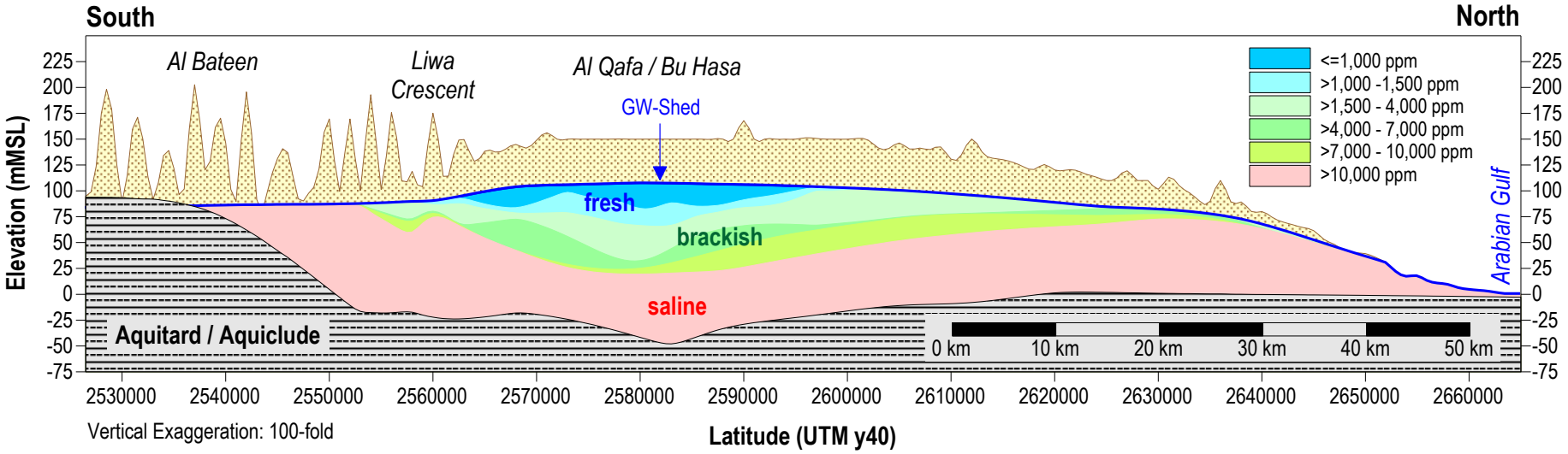






Hydrogeologic Cross Section





Suitability / Site Selection Criteria

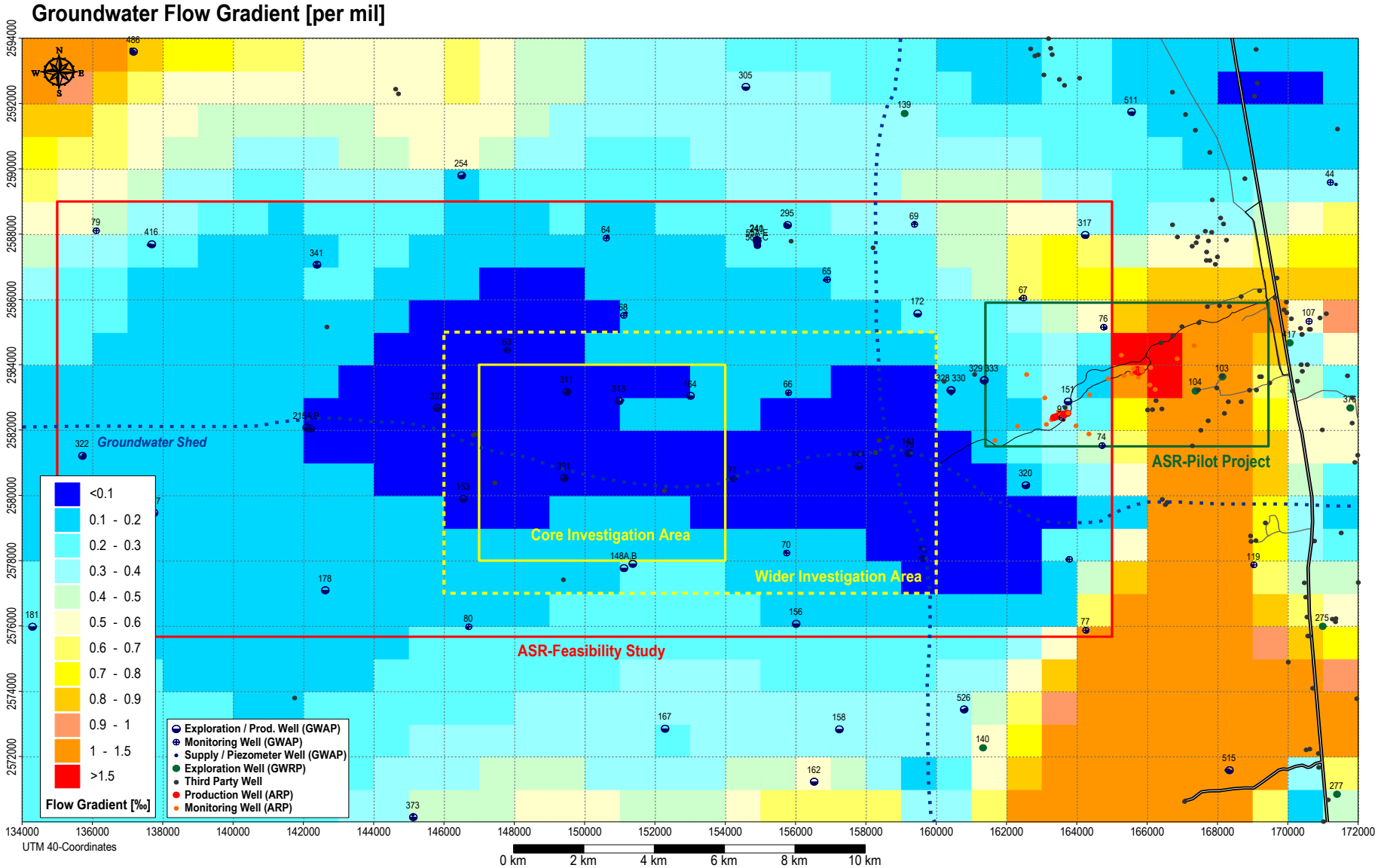
HYDROGEOLOGY

- Available thickness of the aquifer system
- Thickness of the vadose zone (vertical distance surface to groundwater table)
- Aquifer confinement
- Quality / salinity of the native groundwater
- Aquifer transmissivity and storativity
- Groundwater flow gradient and velocity
- Present and future use of the aquifer by third parties (agriculture, municipal, forestry, etc.)
- …….

OTHERS

- Distance to nearest border / coastline
- General infrastructure
- Present and future land utilisation / development (urban, industrial, agriculture, etc.)
- Environmental aspects, regulations
- Concessions (oil, gas, mining, etc.)
- …….

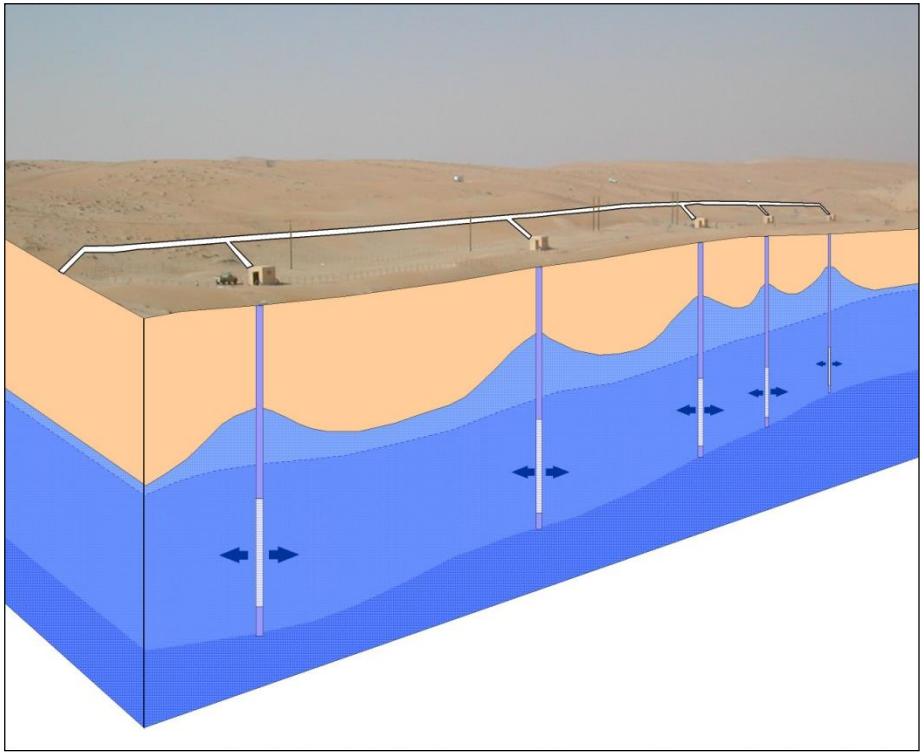
Site Selection



Pilot Project Design

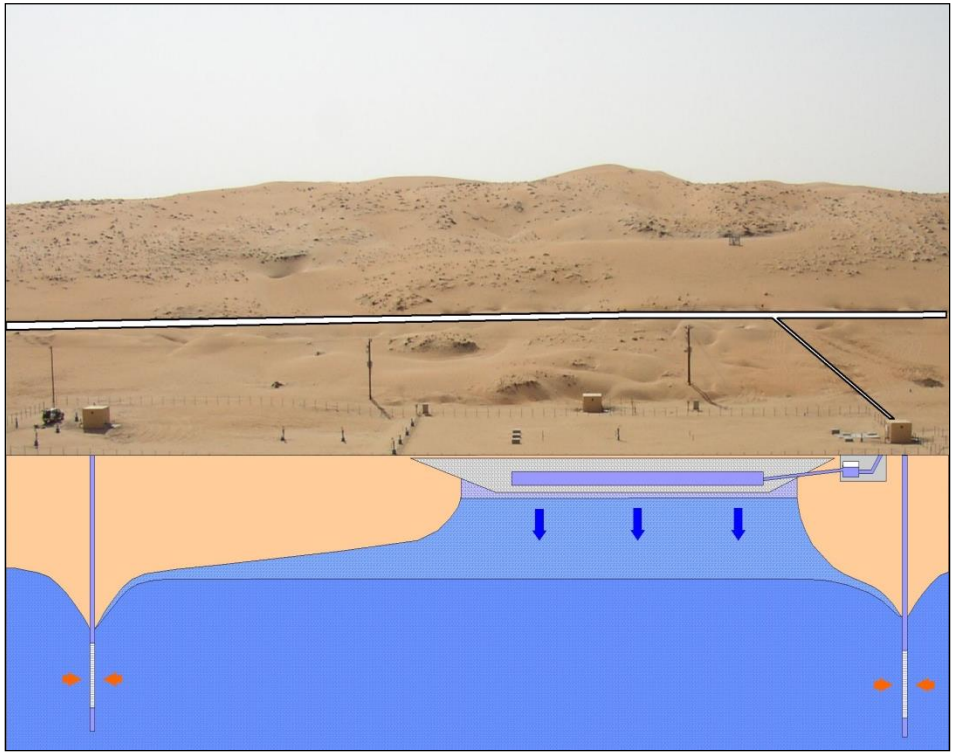
Dual Purpose Well Concept

(Combined Recharge and Recovery)

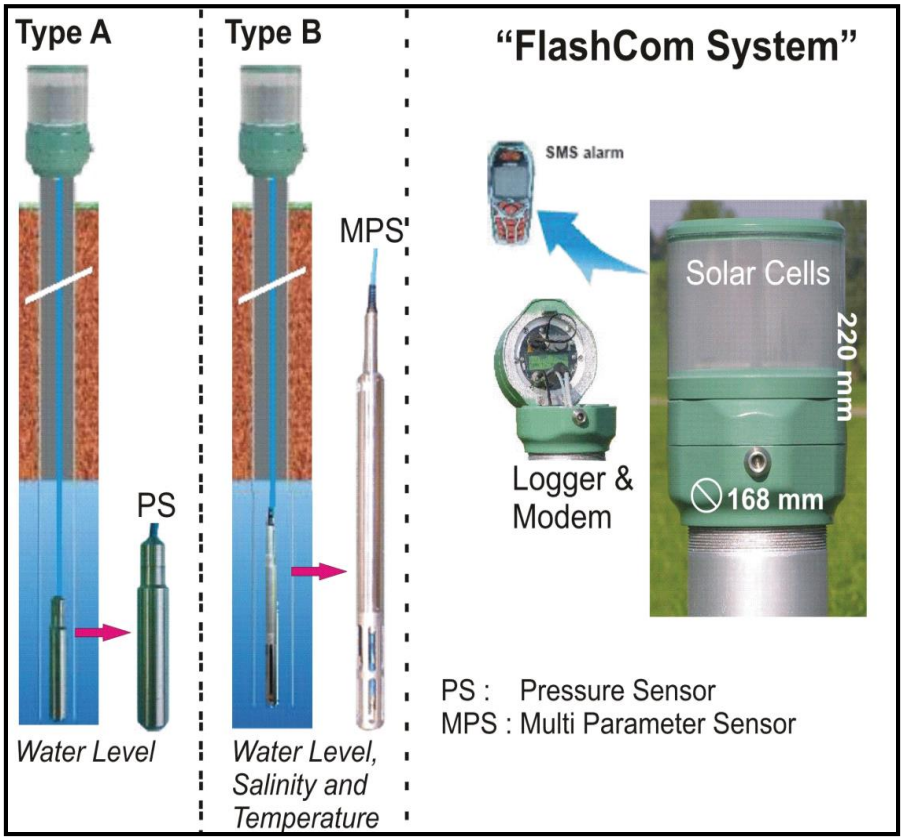


Infiltration Basin Concept

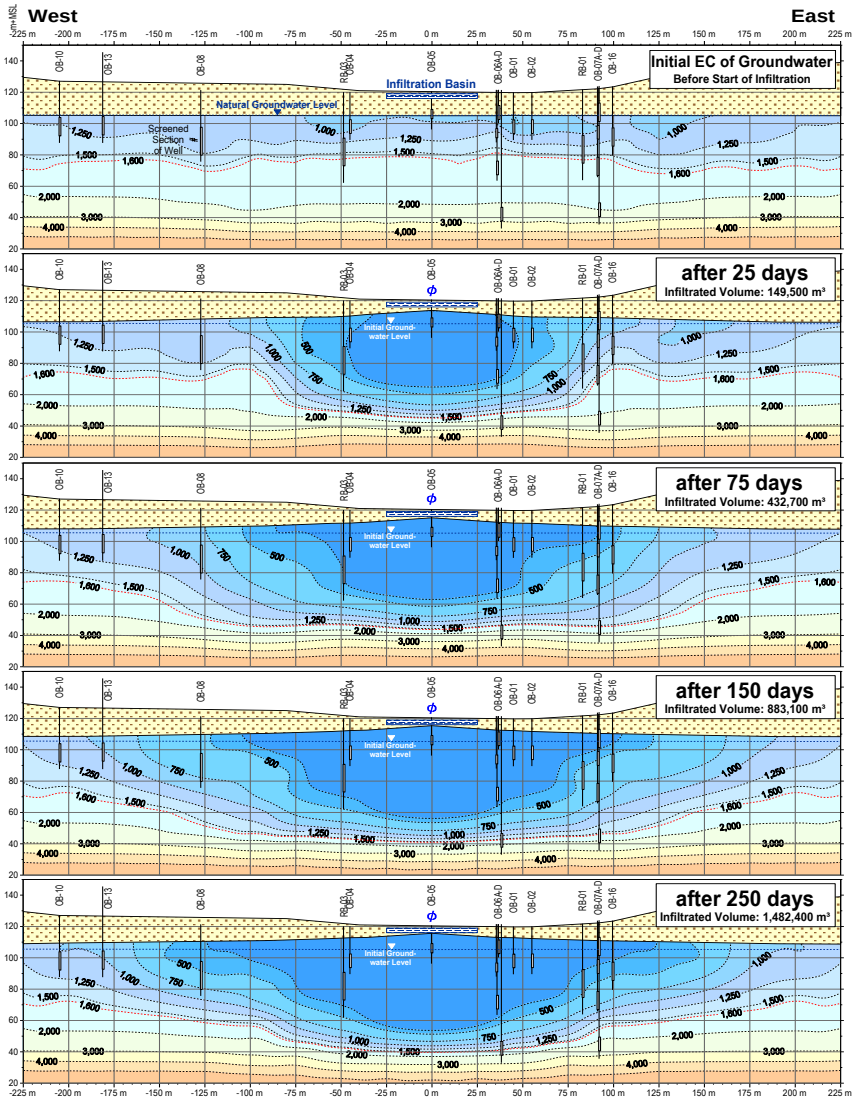
(Infiltration Basin and Recovery Wells)

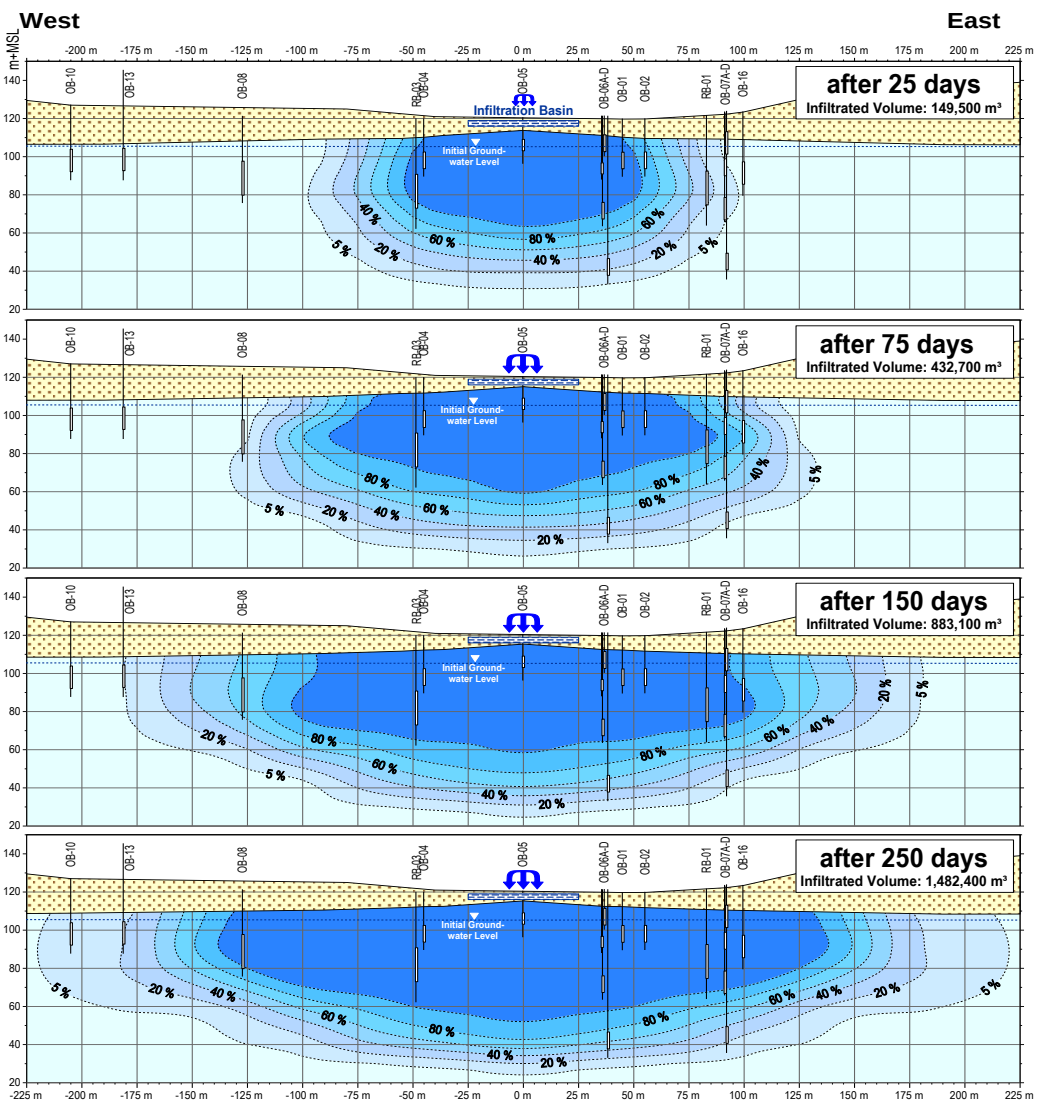


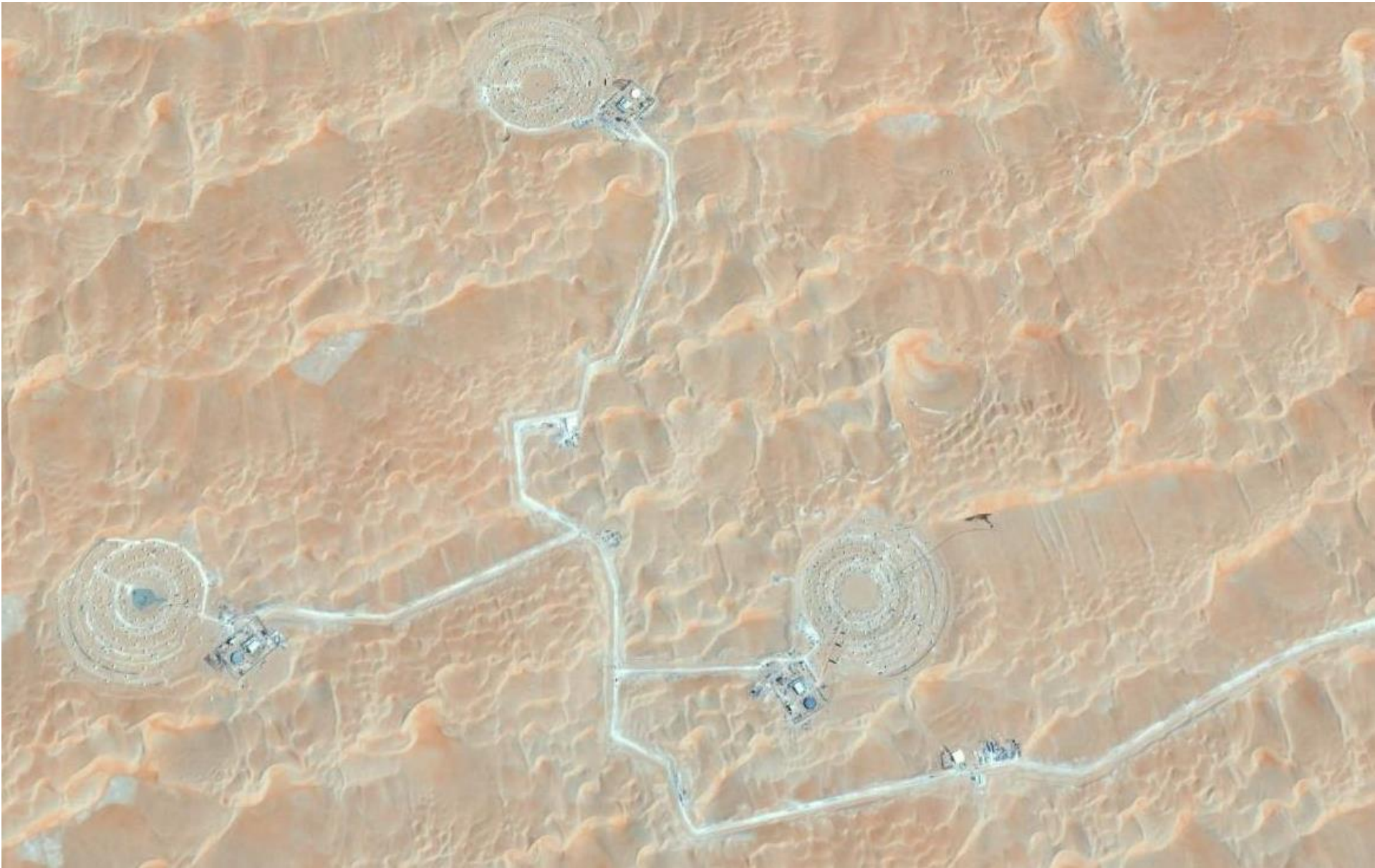
Groundwater Monitoring System



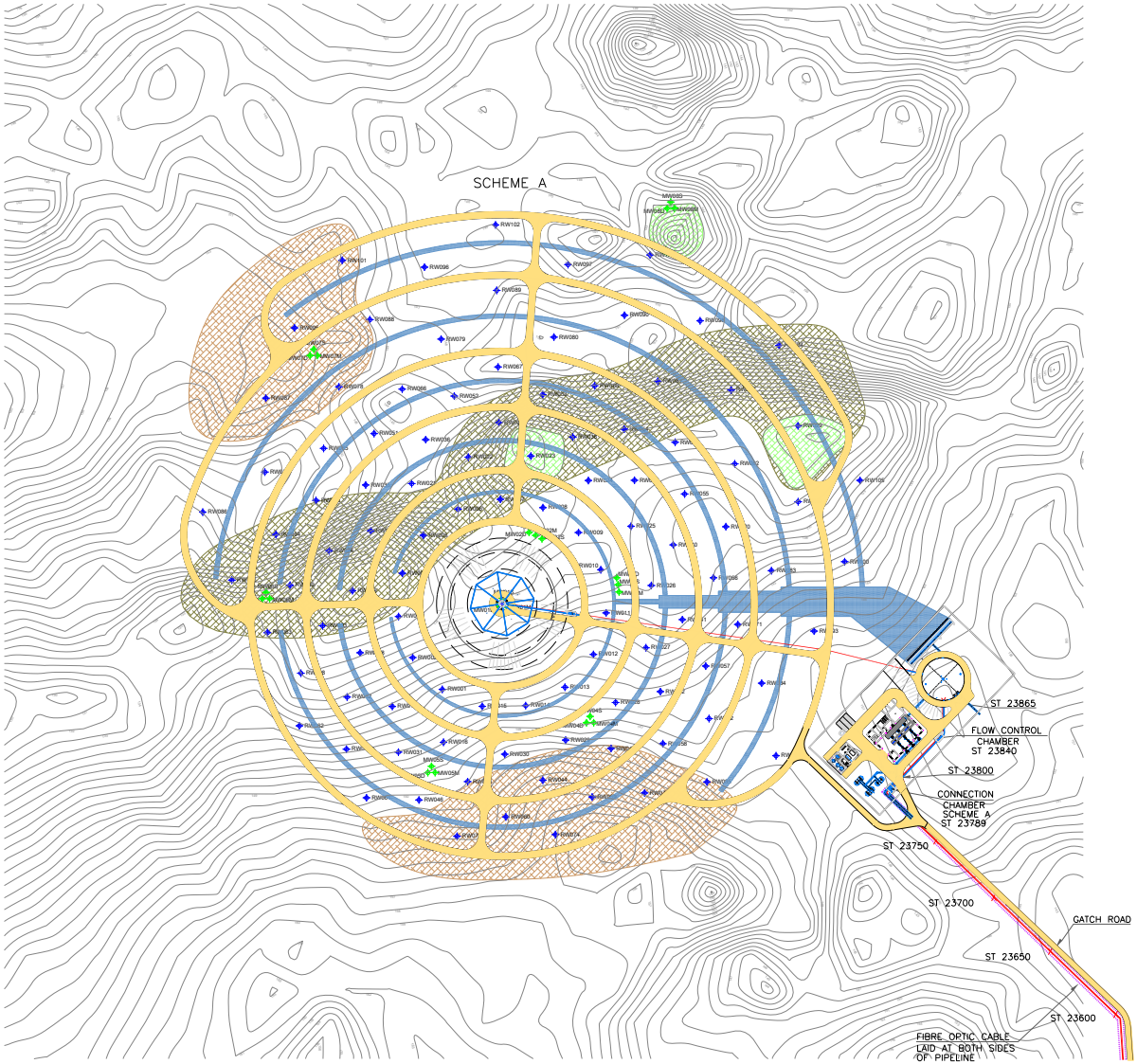
Assessment of Recharge







System Design



Final Remarks

In Abu Dhabi emirate two recharge schemes using injection wells and infiltration basins for were used for injecting the desalinated water into the shallow groundwater aquifer system. Recovery cycles results indicated that under the given conditions the recovery ratios ranged between 85% and 90% were physically recovered. At the end of 250 days lasting period of constant recharge, the lateral migration of the outer injected freshwater body was only 0.2 m/d. For 75 % recovery ratio, the recovered water salinity will be up to 430 ppm, and for 85 % recovery ratio, the recovered water salinity will be up to 485 ppm. Both schemes proved to function perfectly. However, in contrast to the infiltration basin scheme, for the dual-purpose wells of the well gallery scheme there are indications of reducing injection and abstraction capacity over time due to clogging effects. Moreover, considering the local hydrogeological conditions, the infiltration basin conception is advantageous as it is easier to operate and maintain. It was recommended to use recharge basin in the full scheme project.