Feasibility of Using Treated Wastewater in Groundwater Aquifer Recharge in Abu Dhabi Emirate, UAE

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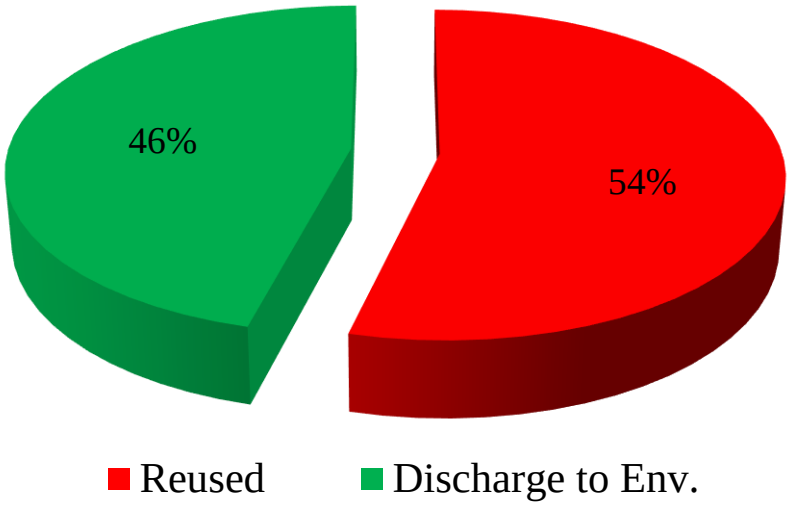
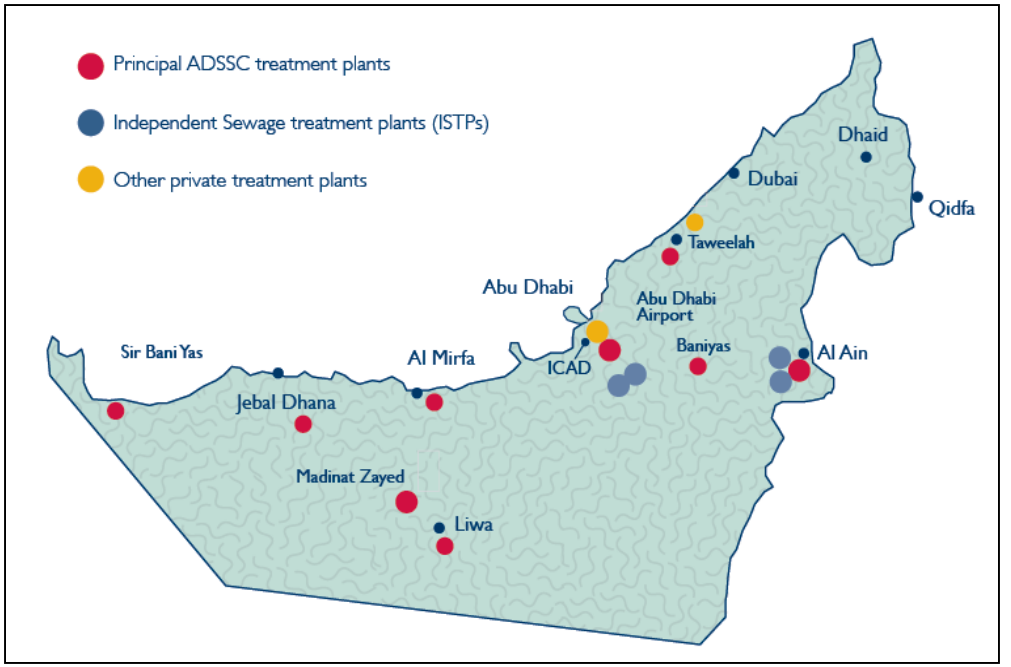
Introduction

- Depletion of freshwater supplies for potable and irrigation uses is a major challenge in Abu Dhabi.
- Wastewater reclamation and reuse has been recognized as a promising strategy to alleviating water scarcity and reducing the impacts on the environment
- Reuse of treated wastewater started in Abu Dhabi 20 years back
- Advanced wastewater treatment is required in order to maintain adequate levels of sustainable reuse.
- In Abu Dhabi all wastewater treated up to tertiary levels.

Treated Wastewater Production in Abu Dhabi

Present Status

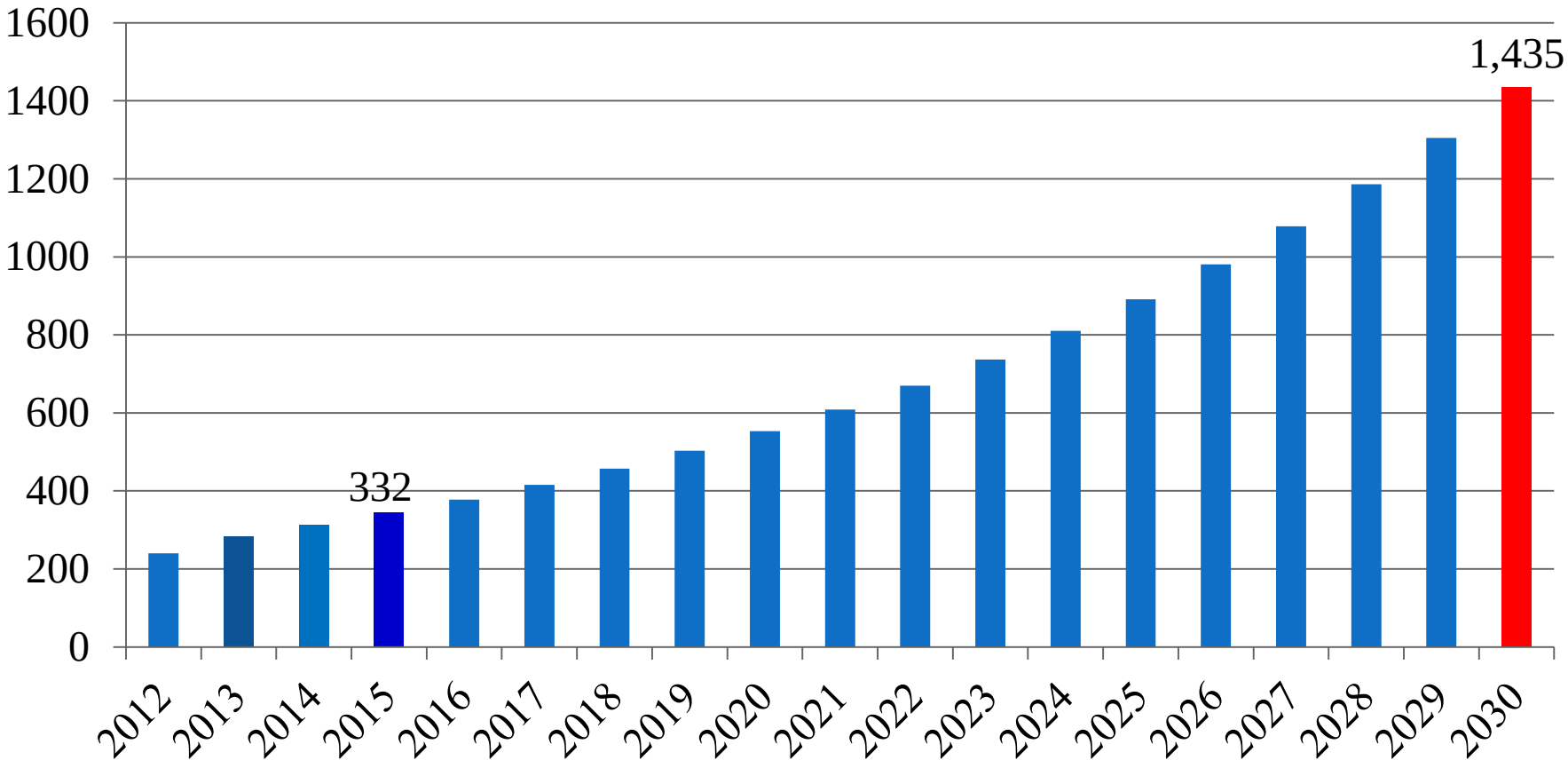




Region	Daily Production (m³)	Daily Reuse (m³)	Daily Discharge to Environment (m³)
Abu Dhabi	٦٨٩,٤٦١	٢٦٢,٢١٢	٤٢٧,٢٤٩
Eastern Region	١٨٥,١٦٦	١٧٦,٩٥٧	٨,٢٠٨
Western Region	٣٥,٦٧٢	٢٨,٧٠١	٦,٩٧١
Total	٢٩٩,٩١٠	٤٦٧,٨٧٠	٤٤١,٤٢٨

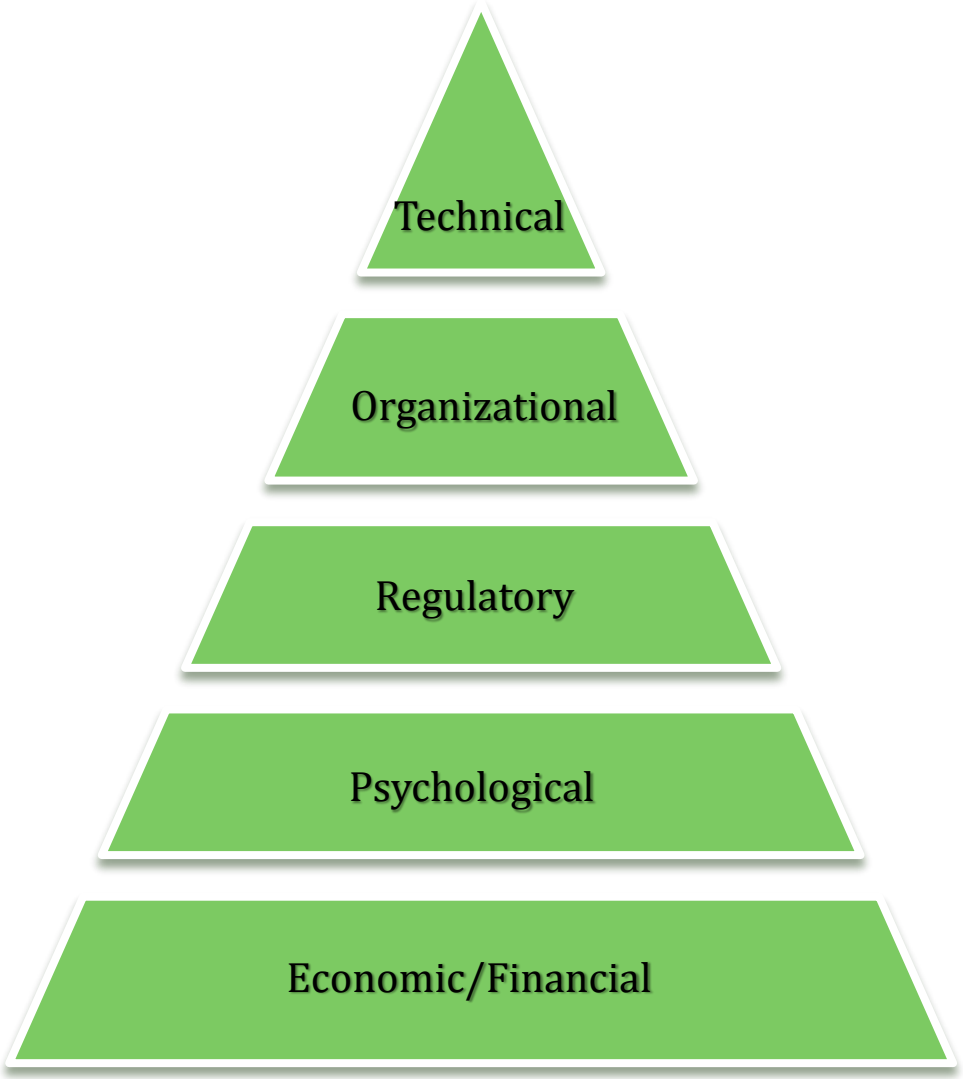
Treated Wastewater Production in Abu Dhabi

Future Predicted Production



Treated Wastewater Reuse Options

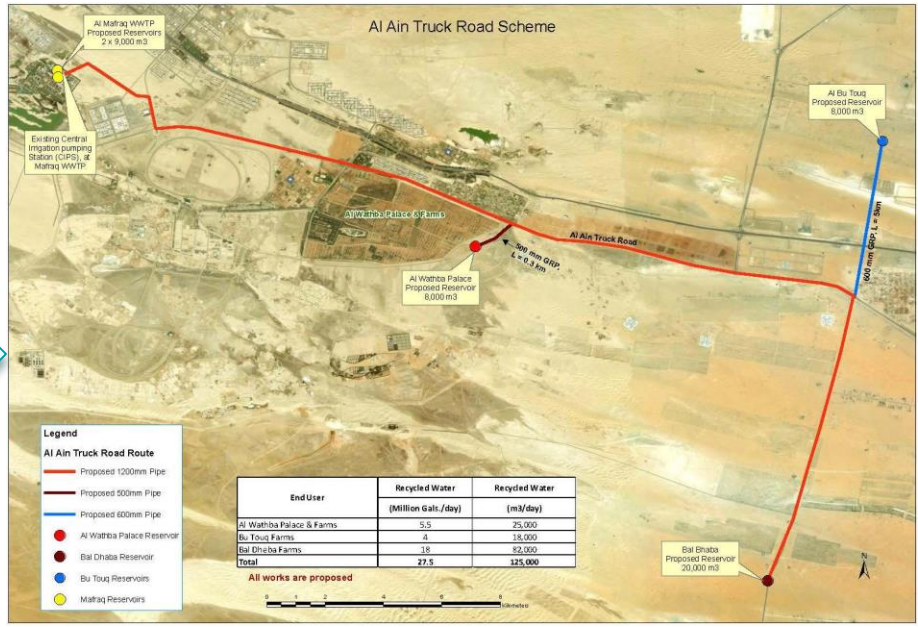
Six key factors with gradual importance contribute to the success of a water reuse project: economic, financial, regulatory, psychological, organizational and technical factors as shown in Figure (4). The economic, financial and psychological factors depend on two main groups of parameters: (1) the internal motivation of the local water agencies and authorities to rapidly establish a meaningful economic analysis and a rigorous financial plan and to gain public acceptance and (2) external non-controlled parameters such as slow and heavy institutional decision-making process, politicians' subjectivity, stakeholders' personality.



(1) Reuse for Irrigation

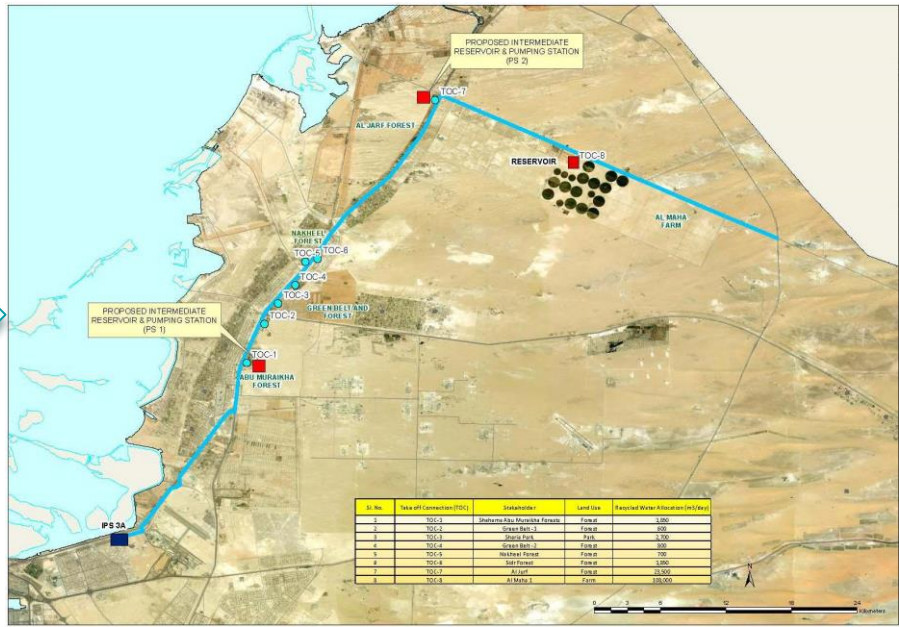
Dubai road Project:

- Length is 45 Km
- Daily capacity of 140,000 cubic meters
- Cost estimate 220 Million Dirham

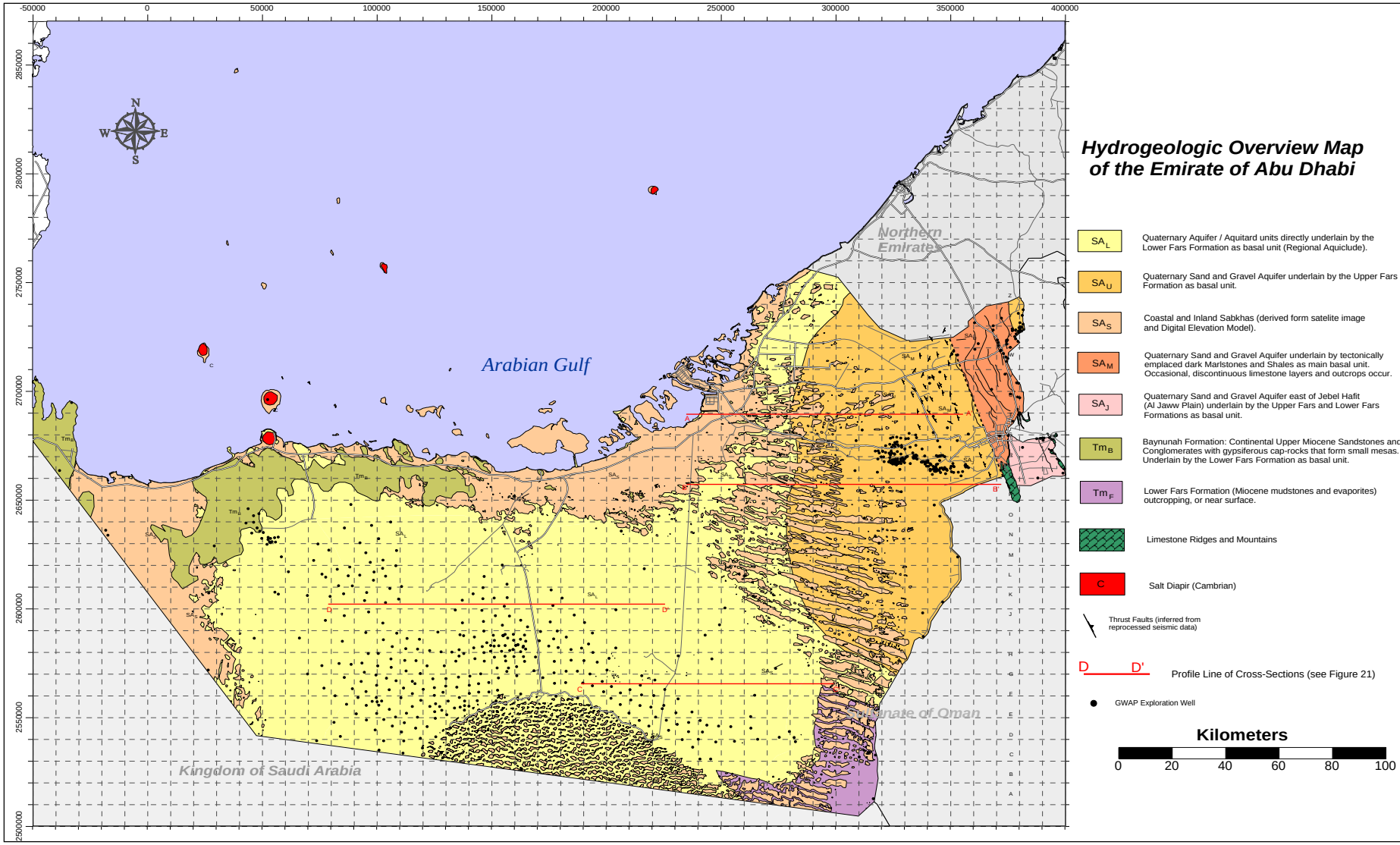


Al Ain road Project:

- Length is 70 Km
- Daily capacity of 270,000 cubic meters
- Cost estimate 720 Million Dirham



(2) Reuse for Groundwater Aquifer Recharge



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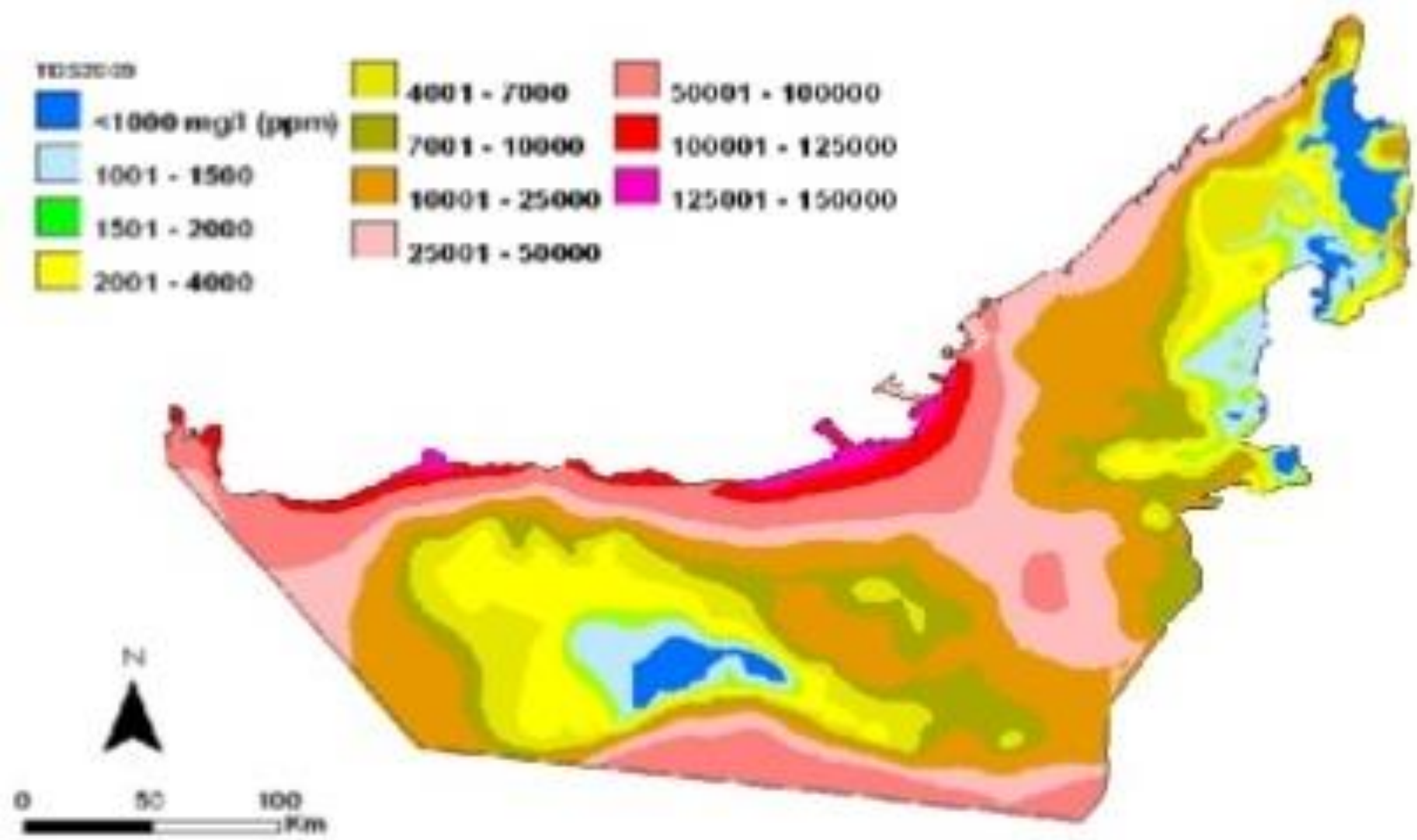

(3) Reuse for Industrial and District Cooling

The industrial and district cooling demands are very limited with a capacity of 25,000 m^3/day. So covering these demands will not be enough to utilize all discharged treated wastewater to the environment. So, partially these demands can be covered with no impacts on the other two alternatives/options. Three factors are affecting the reuse of treated wastewater in industrial sector and district cooling including quantities, quality, regulations and the feasibility. Additional treatment facilities maybe needed which will be additional cost and affect the feasibility.

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Cost Benefit Analysis

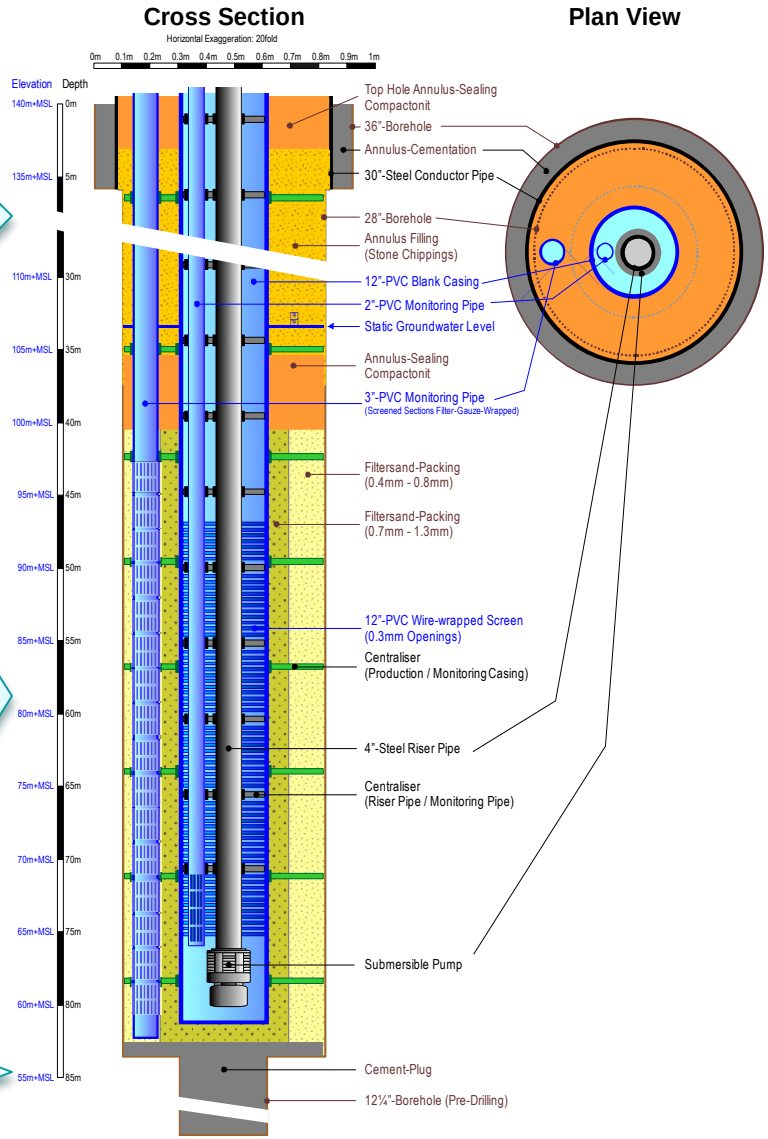
Estimation of Wastewater Treatment Costs:

The results indicating that the cost per unit treated wastewater ranges between 3 to 5 AED due to many factors affecting this cost

Estimation of Conveyance Costs:

- High-density polyethylene pipe (HDPE)
- Diameters
- The average elevation change in
- Al Ain road project is estimated to be about 70 m and head losses due to pipe friction limit the overall head loss to no greater than 120 m.

Injection, recovery and Monitoring Costs:



Results and Discussion

Estimation of Conveyance Costs:

- High-density polyethylene pipe (HDPE)
- Diameters
- The average elevation change in
- Al Ain road project is estimated to be about 70 m and head losses due to pipe friction limit the overall head loss to no greater than 120 m.

- The market value for tertiary treated wastewater is set between \$0.65 and \$1.1 /m^3 without pumping and between \$0.95 and \$1.31 /m^3 with pumping
- Operation and maintenance cost for producing and transmission of the wastewater to the demand centers is about \$0.16/m^3 without pumping and \$0.16/m^3 with pumping.
- Reusing treated wastewater will reduce nutrient concentration which may detriment agricultural crops fertilization, although the negative economic impact figures vary from different studies between \$-0.07/m^3 and \$0.01/m^3.

•Aquifer recharge system with treated wastewater is inexpensive, efficient for pathogen removal, and is not highly technical to operate. Most of the cost associated with an SAT is for pumping the water from the recovery wells, which is usually \$0.2-0.5 USD per m3. In terms of reductions, SAT systems typically remove all BOD, TSS, and pathogenic organisms from the waste and tend to treat wastewater to a standard that would generally allow unrestricted irrigation.

Conclusion & Recommendations

- Treated wastewater can successfully replace potable desalinated water in district energy/power applications. However the present demands will not cover the available non-utilized and discharged treated wastewater.
- So their demands can be covered without impact on the other alternatives.
- Treated wastewater analyses over extended time frames indicated that the quality is suitable and no additional treatment is needed.
- The critical parameters of the treated wastewater include Cl, PO_4, NH_3, TOC, and TSS. There are some factors which should be taken into consideration for this option including design, materials, chemical, and the operational.
- Monitoring and control systems should be added.


Thanks