



HASHEMITE KINGDOM OF JORDAN
Ministry of Water and Irrigation
(MWI)
Jordan

Project Concept

**Augmentation of Water Supply for Central and Northern
Jordan from Deep Aquifer (Sheediyya – Al Hasa)**

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1. Introduction

This project proposal describes water supply infrastructures urgently needed to cope with the increased water demand and scarcity in Jordan. The influx of around 1.3 million Syrian refugees and the low amounts of rainfall in recent years have exerted tremendous pressure on the government of Jordan to respond to the water supply challenges. Due to the presence of Syrian refugees mainly in the northern and central parts of Jordan, water supply in the entire country had to be rearranged. Although water supply from the Disi wellfield (100 MCM/a) became operational in 07/2013, part of this amount will now be diverted to the middle and northern governorates. Wellfields previously supplying Amman, like Qatrana, Siwaqa, Lajjun, Hidan and Corridor, have now been modified in order to provide water to other cities not able to meet their demand, like Irbid, Zarqa, Kerak and Madaba. A quick solution is needed to cover water supply deficits for the northern and central parts of Jordan in the near future.

2. Project Objectives

The northern and central parts of Jordan urgently need an additional 50 MCM/a (58,000 m³/d) in 2018. Such a high amount can only be provided from the Deep Aquifer (Ram Group) as the main aquifer (A7/B2) is highly overused, showing high groundwater level declines and consequently has already fallen dry in some parts of the country. Therefore there is no alternative to this proposed solution.

3. Project Concept

Water in the Deep Aquifer flows from the south (Disi) to the Dead Sea (Figure 1). Previous studies showed that this aquifer can be intercepted and tapped at depths of between around 1,200 to 2,000 m below ground level (bgl) near the already existing Disi-Amman pipeline (Orient, 2014; Figure 2). Water levels in this area are expected to be at 380-500 m bgl. Water temperatures will be between 52-65°C, requiring stainless steel installations, due to high corrosivity. Drilling diameters have to be large enough to accommodate a 20" pump chamber. Wells need to penetrate at least 300 m into the Deep Aquifer in order to provide a high enough yield.

MWI has started drilling a number of deep wells reaching this aquifer in 1999 (Lajjun wellfield). Operation of the Lajjun wellfield showed that yield in the upper part (where Kurnub and Ram Group aquifers are combined) is less than in the deeper part, therefore drilling of the new proposed wells will target mainly the deeper part of the deep aquifer system. Drilling of exploration wells by MWI (one well in each proposed zone; Figure 3) along the Disi pipeline will start this year. Salinity (TDS) is expected to range between less than 1,000 and 2,500 mg/L (Figure 4).

Water conveyance from Jurf ed Darawish to Damikhi requires only few pumping stations (ca. 5). A pipeline between Damikhi and Amman already exists so that only a small section of pipeline between Damikhi and Jurf ed Darawish is required (80 km). The elevated salinity may require treatment (desalination). Therefore a desalination plant has to be built near Damikhi. Two reservoirs, functioning as buffers, are required, each with a capacity of 100,000 m³, one located before the treatment plant, one after.

4. Proposed Components

The proposed water supply infrastructure will require the following components (Figure 1; Table 1):

- 44 wells (37 production wells, 7 stand-by wells)
- 5 pumping stations
- pipeline (Jurf ed Darawish - Damikhi, 80 km) and connections to wells
- 1 treatment plant
- 2 reservoirs

Table 1: Estimated costs of proposed water supply infrastructure

Item	number	Unit cost	Cost per item
Production wells	37	6 Mio USD	222 Mio USD
Stand-by wells	7	6 Mio USD	42 Mio USD
Pumping stations	5	1 Mio USD	5 Mio USD
Pipeline 1400 mm, 80 km	1	1.5 Mio USD/km	120 Mio USD
Treatment plant	1	50 Mio USD	50 Mio USD
Reservoirs, 100,000 m ³	2	8 Mio USD	16 Mio USD
Total cost of project			455 Mio USD

5. Implementation Schedule

Based on current demand estimations, the proposed project needs to be operational in 2018, leaving only 4 years for implementation.

Item	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
	2015	2015	2015	2015	2016	2016	2016	2016	2017	2017	2017	2017	2018	2018	2018	2018
Drilling of production and stand-by wells	█				█				█							
Construction of pipeline									█							
Construction of treatment plant									█							
Construction of reservoirs									█				█			
Testing of system													█		█	
Start of operation																█



Figure 1: Proposed water supply infrastructures

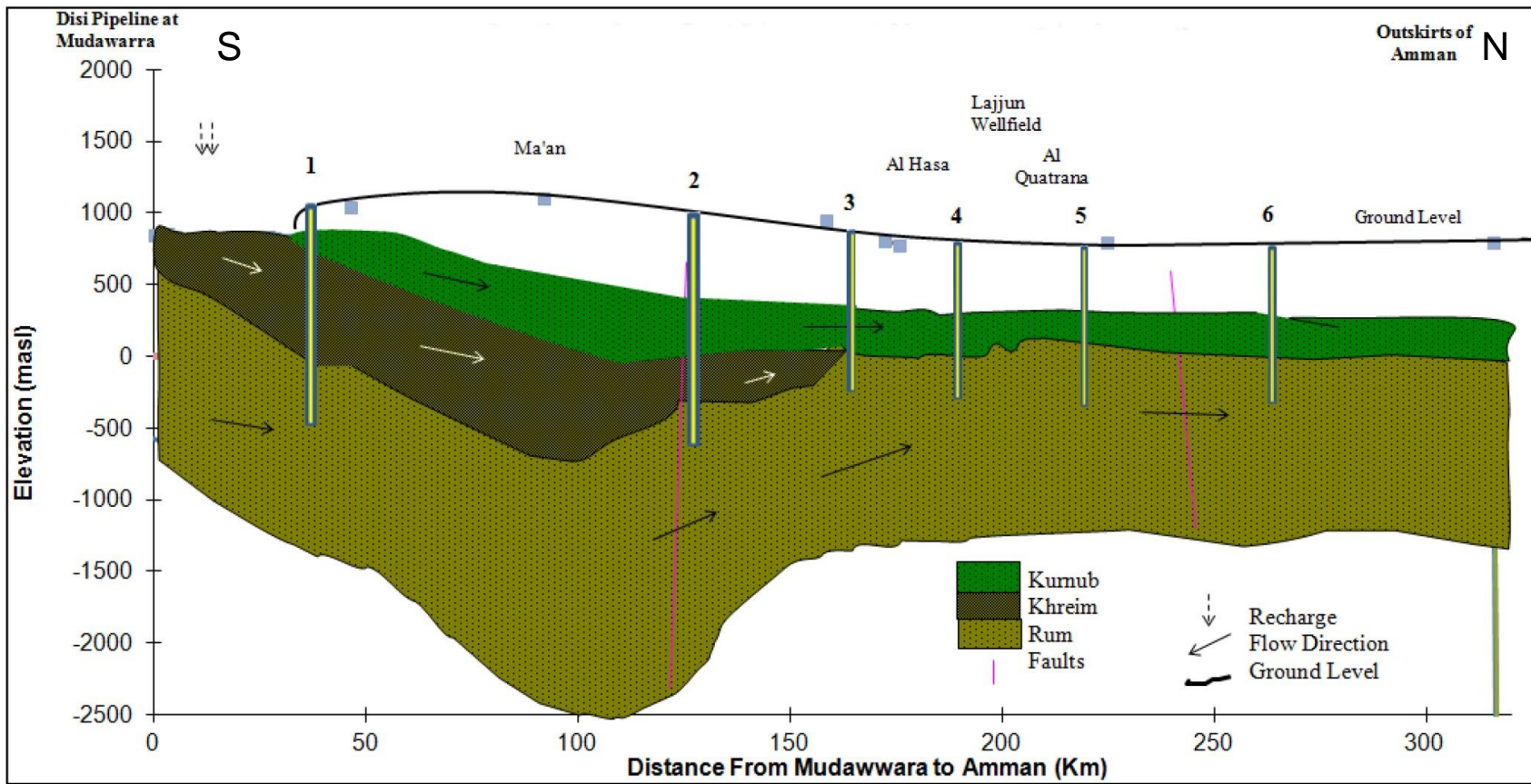


Figure 2: Geology along Disi/Mudawwara - Amman pipeline and proposed exploitation areas (drilling zones)

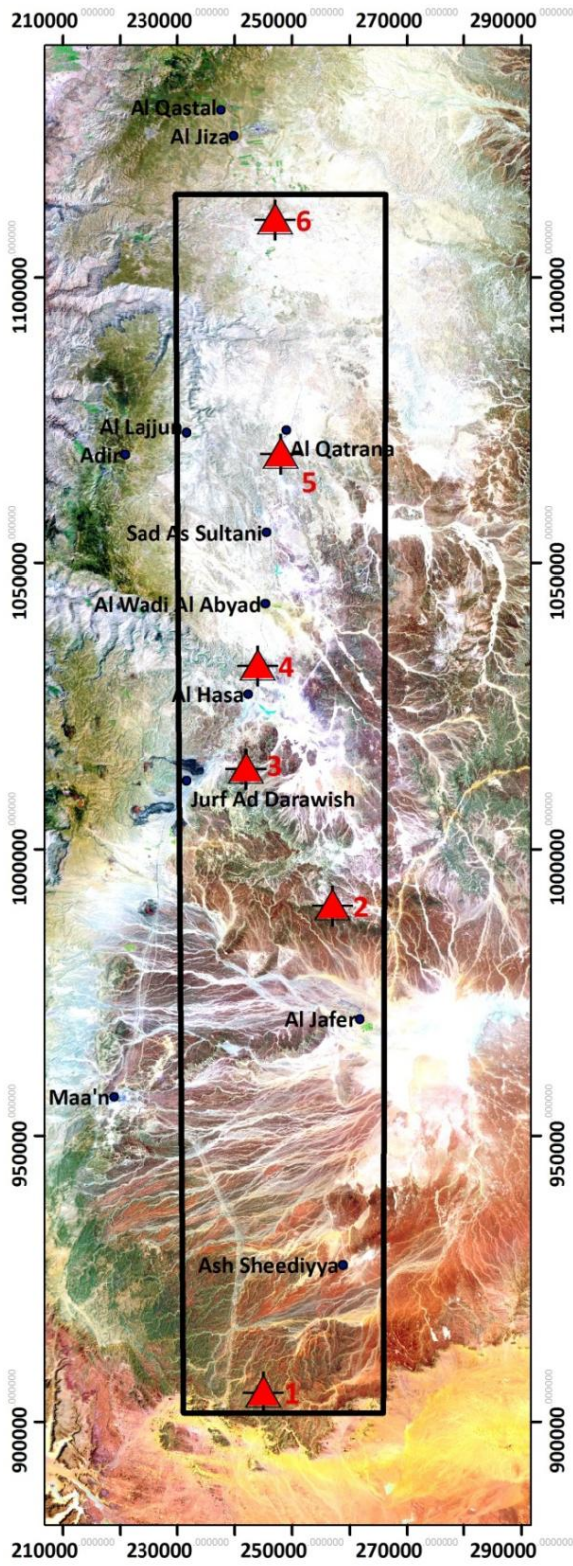


Figure 3: Proposed drilling zones (location of exploration wells)

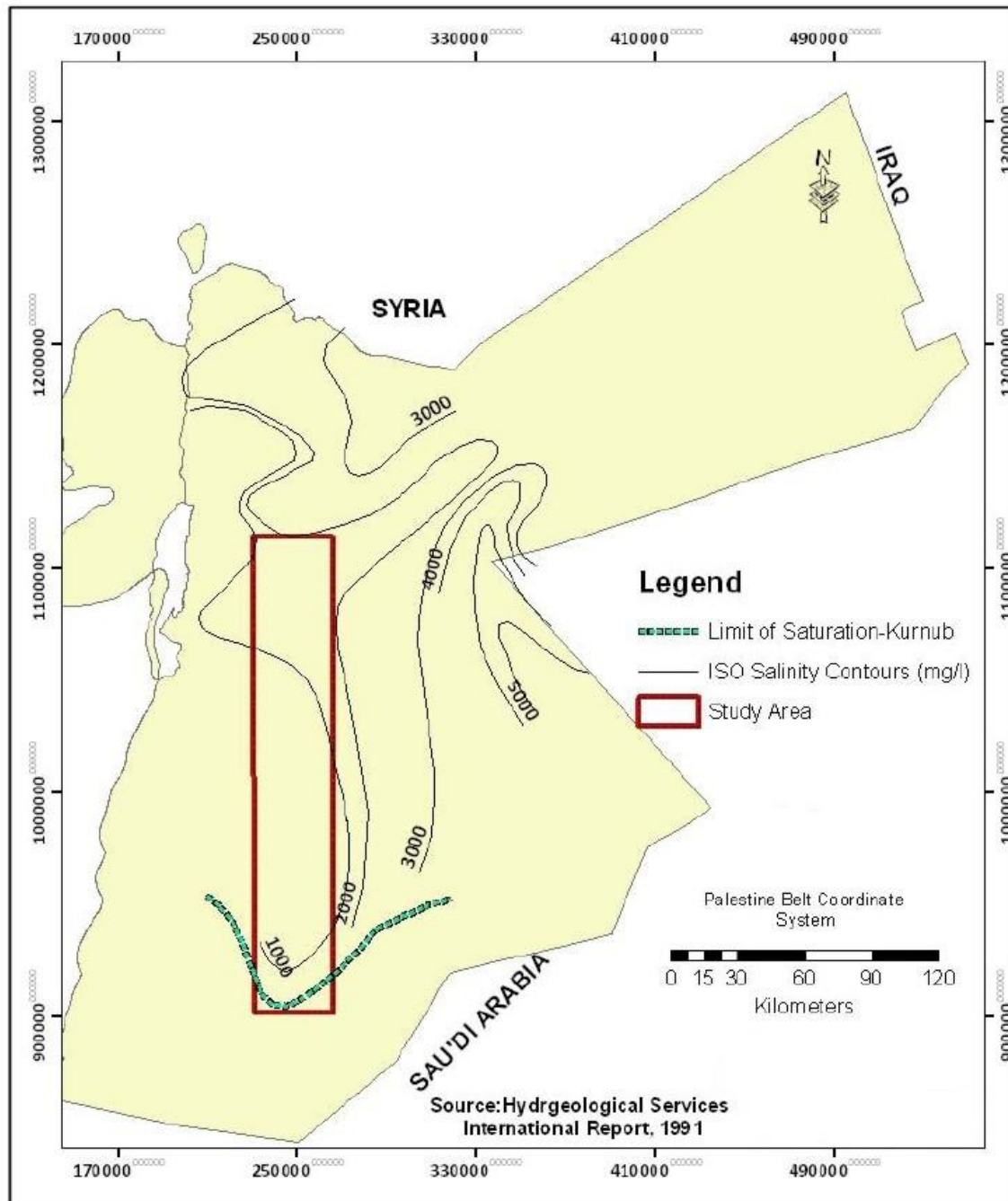


Figure 4: Expected salinity in proposed groundwater exploitation area