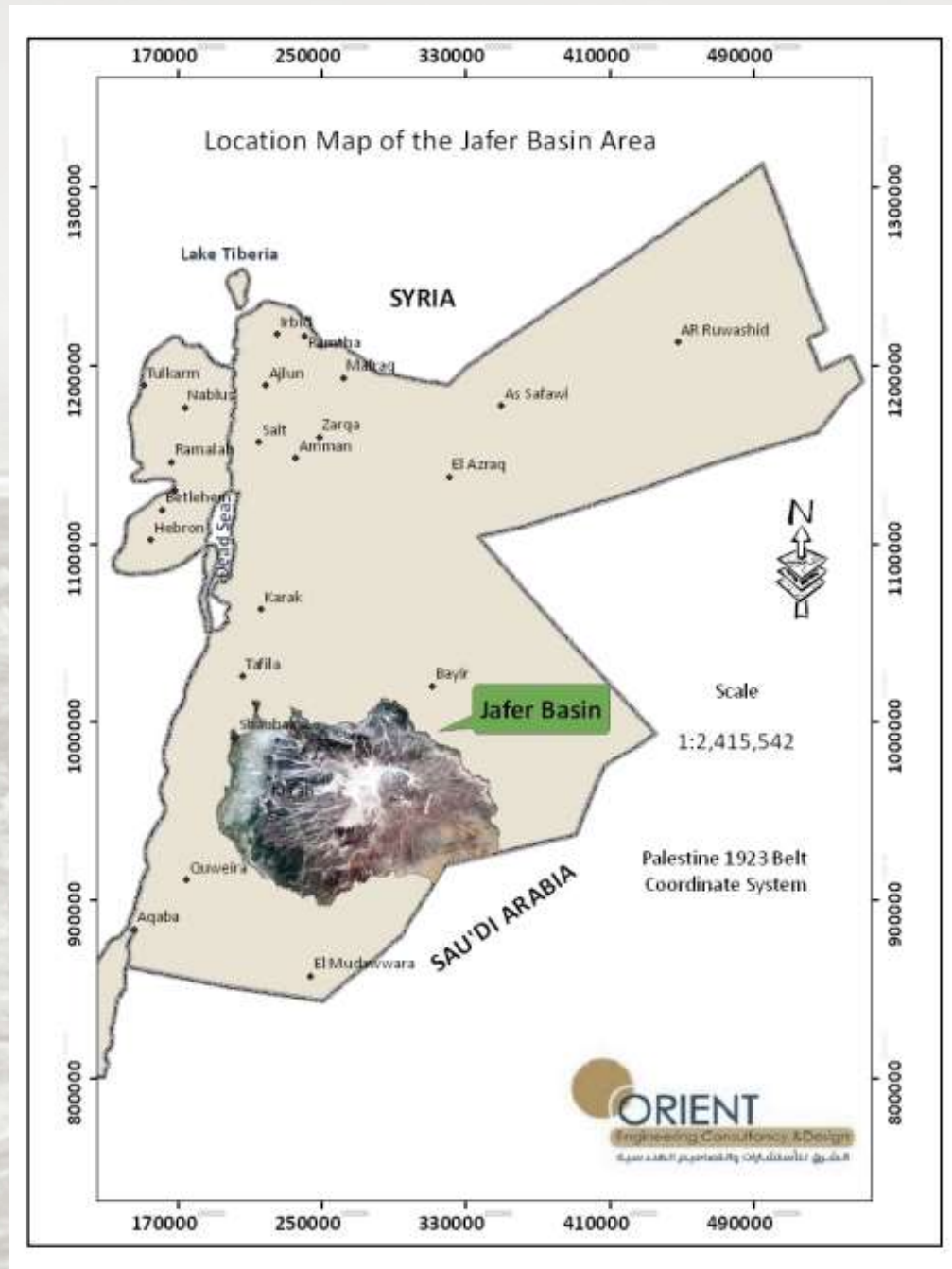


Al Jafer Basin

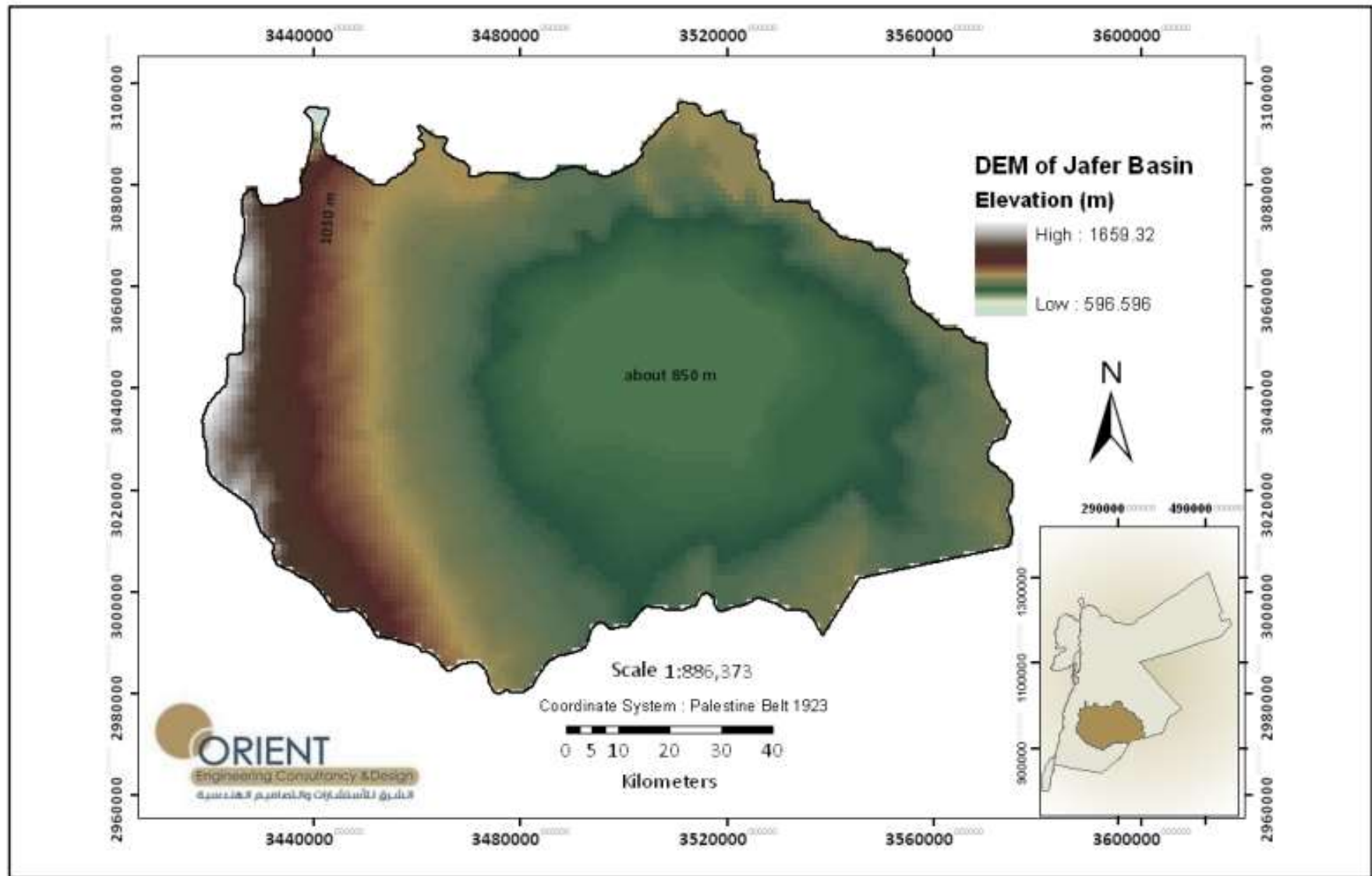
**"تقييم أثر تغير المناخ على
موارد المياه الجوفية"**

Geo Alaa ATIEH

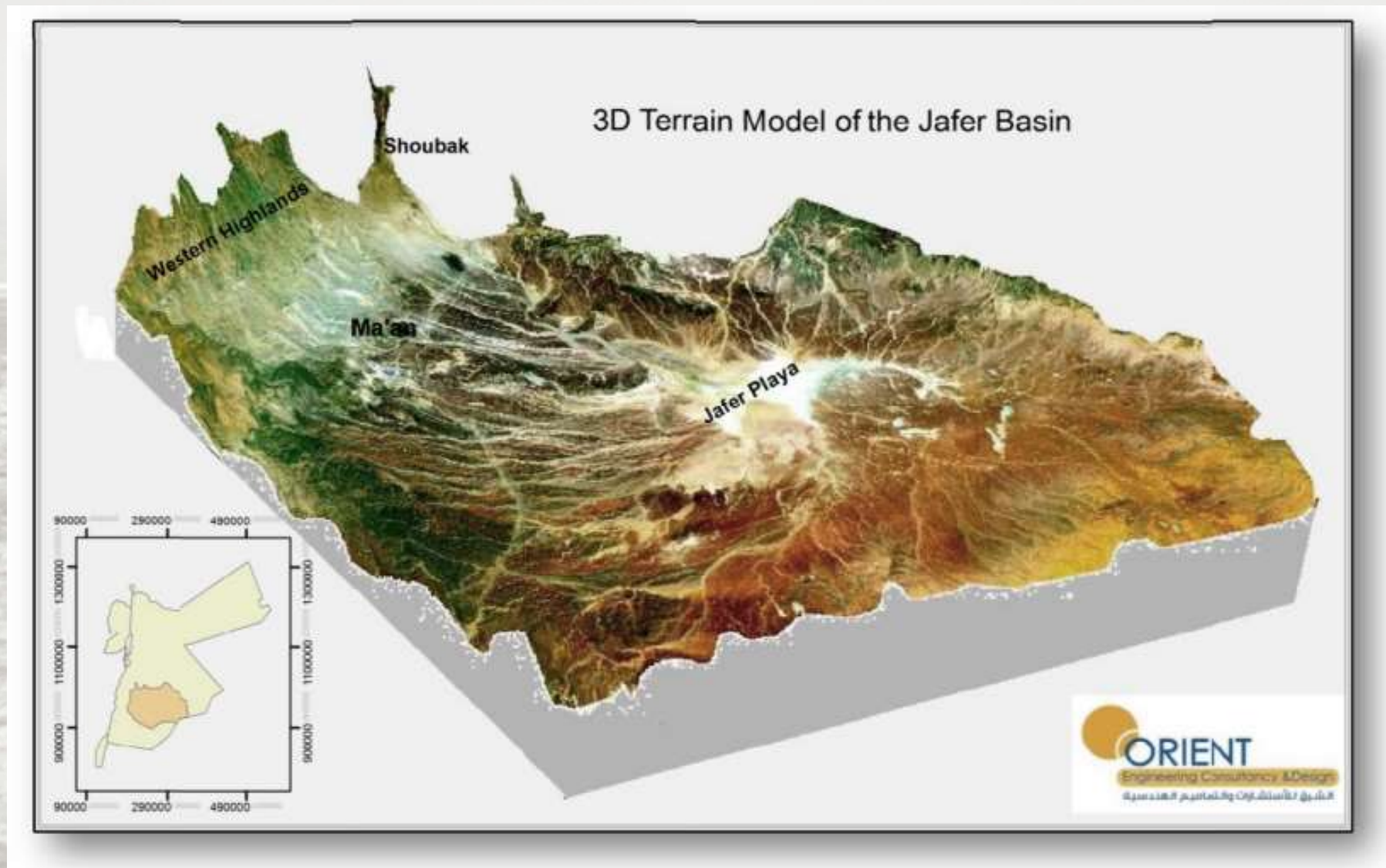
Location Map of Jafer Basin



Digital Elevation Model of Jafer Basin



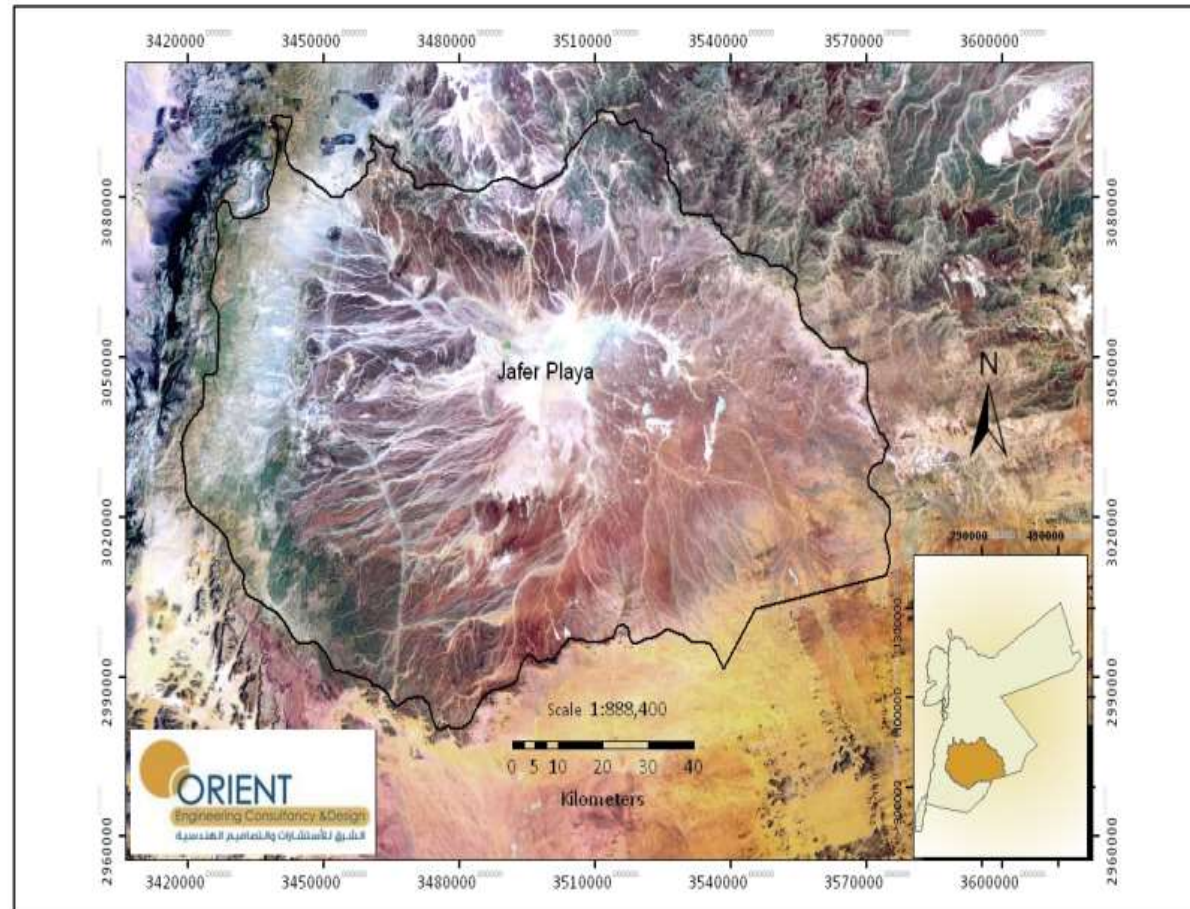
Digital Elevation Model (contour interval 20m) of Jafer Basin



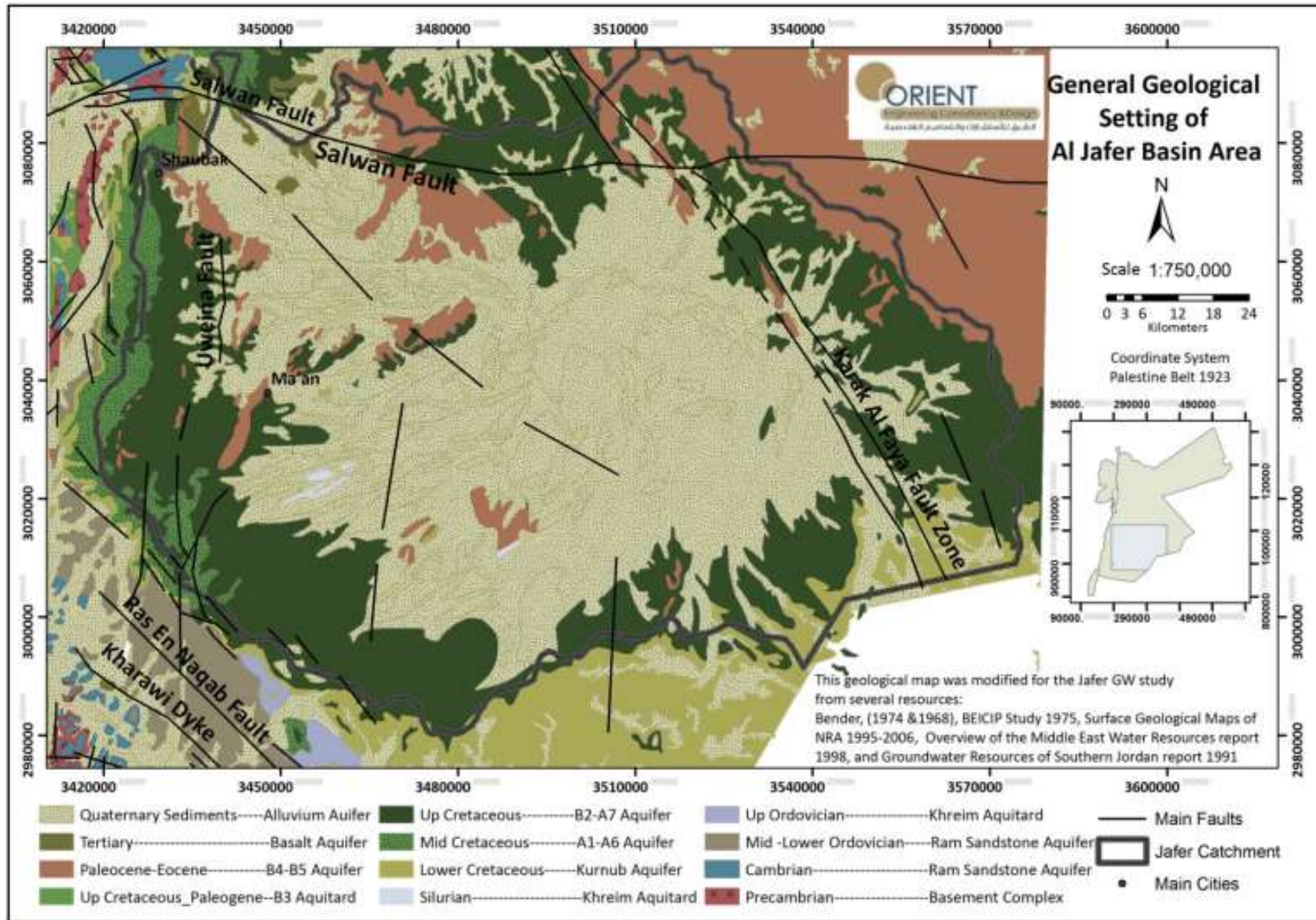
the largest concave in Jordan

Landsat TM image of the Geomorphology of Jafer Basin

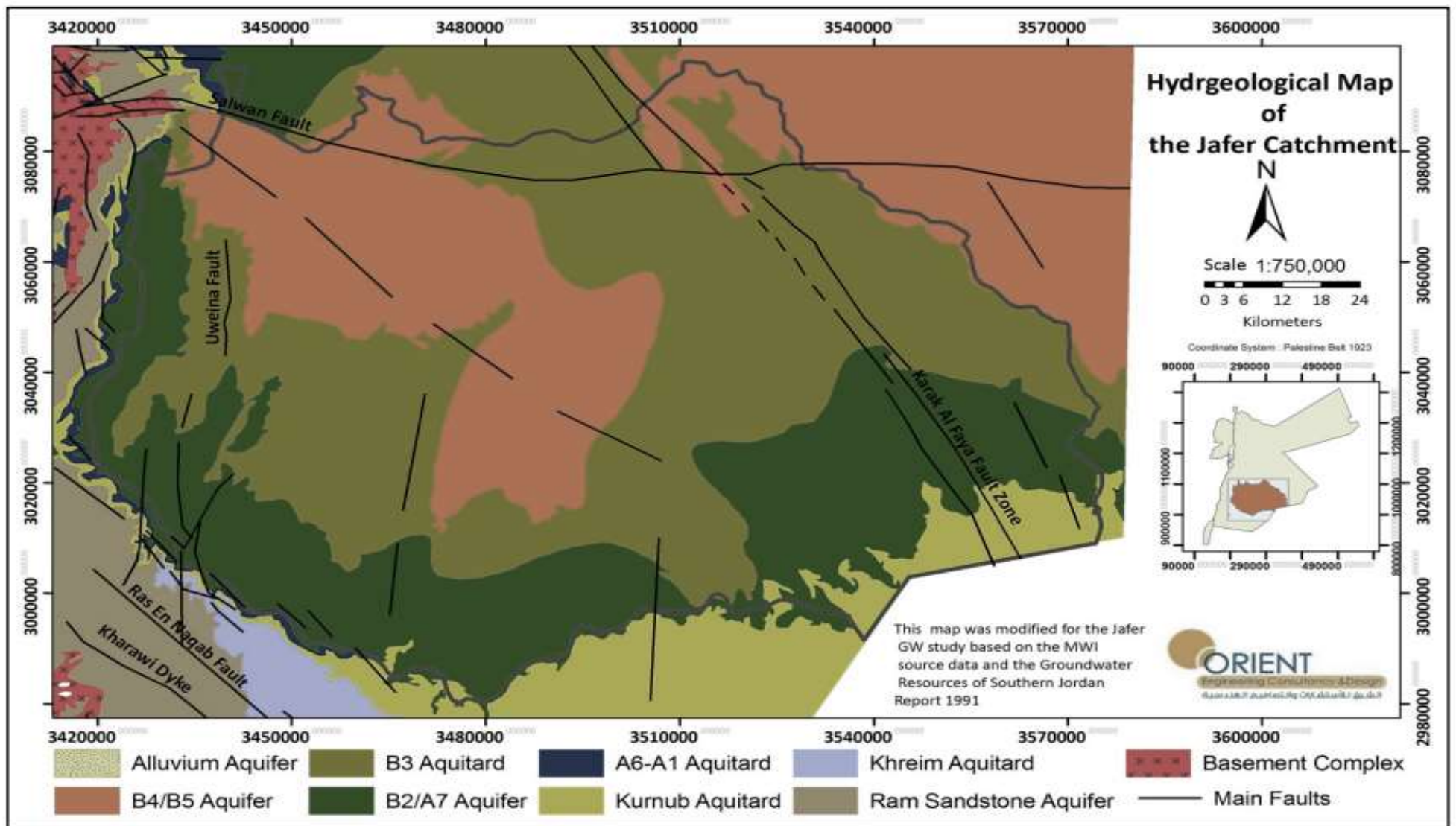
**Al Jafr basin is a large internally draining catchment area in southern Jordan
It has an EW extension of around 150 km
and a NS extension reaching 100km**



Geological setting of the Jafer Basin Area



General Hydrogeology of the Jafer Basin Area



The Shallow Aquifer System (The Um Rijam aquifer B4)

The Middle Aquifer System (The Amman Wadi Es Sir aquifer B2/A7) lower Ajlun (A1-6)

The Deep Aquifer System (Disi and Kurnub)

Model Objective

Develop a three-dimensional groundwater flow model for Jafer Basin using MODFLOW

Determine the sustainable yield for Jafer basin

Investigate different scenarios of groundwater management of Jafer including variation of abstraction and recharge rates

Model Design

GIS and Remote Sensing Data

Basin boundaries of the basin; Surface and ground boundaries

Rainfall stations and wells distribution

New modified isohyetal map

Aquifer contacts, GW Flow pattern, Thickness, Base, A1-A6, B2-A7, B3, and B4-B5

Geological Contacts and develop a new simplified geologic map for the basin and area surrounding

Major Geological structures framework

Hydrogeology map

Hydrological and Hydrogeological required layers: abstraction, boreholes, thickness of aquifers, isohyetal maps, transmissivity layers,...etc

Isopach maps for the aquifers

Drainage Pattern image

Landsat TM image of the basin

Topographic contour map at 20m and 50m interval

3D Digital Elevation Model

An aerial photograph of a desert landscape. In the center, there is a prominent, rounded rock formation. The terrain is arid, with sparse vegetation and visible erosion patterns. The background shows a flat expanse extending to the horizon under a clear sky.

Geological Data

Geological map

Hydro and Hydrogeological data

Abstraction Wells

Climate Stations

Rainfall Stations

Water level

Ground water wells

Lithological description wells

Formation description wells

model consists of

Criteria	Description
Model area	To cover the entire Jafer Basin area
Model Rows and Columns	129 ROWS 161 COLUMNS
Maps	Geological, hydrological, Hydrogeological, structural and other important features including water level and transmissivity contours has been digitised in suitable format to be imported into groundwater modelling software.
Boundary conditions	Refer to section 3.1, Figure 22 and Figure 23
Layers	4 layer case described in Figure 1 that includes the following: Layer 1 – Rijam B4/B5 aquifer Layer 2 – B3 Aquitard Layer 3 – B2/A7 aquifer Layer 4 – A1/A6 Top of layer 1 – use DEM with enhanced accuracy using topographical maps. Tops of layers 2 – 4 would use available litho-stratigraphic data, cross sections, maps and existing wells.
Grid size	Mesh size: 1 by 1 km,
Barriers to flow	No significant barriers to flow identified.
Units	Length: metres Time: day
Coordinate system	Palestine Belt Coordinate System
Model orientation	General West to East unless there is significant barrier to groundwater flow from fault system
Model grid spacing	1000m grid spacing.
Recharge	In general, a value of about 5 % of the rainfall was assumed for direct and indirect recharge. In areas where the rainfall was less than 50 mm per year, it was assumed as no recharge.
Discharge	Abstractions and other components of the outflow from the aquifer system.
Initial head conditions	BGR 1991 data and monitoring wells
Modelling software	The finite difference groundwater flow model "MODFLOW" with a pre/post processor Processing MODFLOW package.



Model Boundary

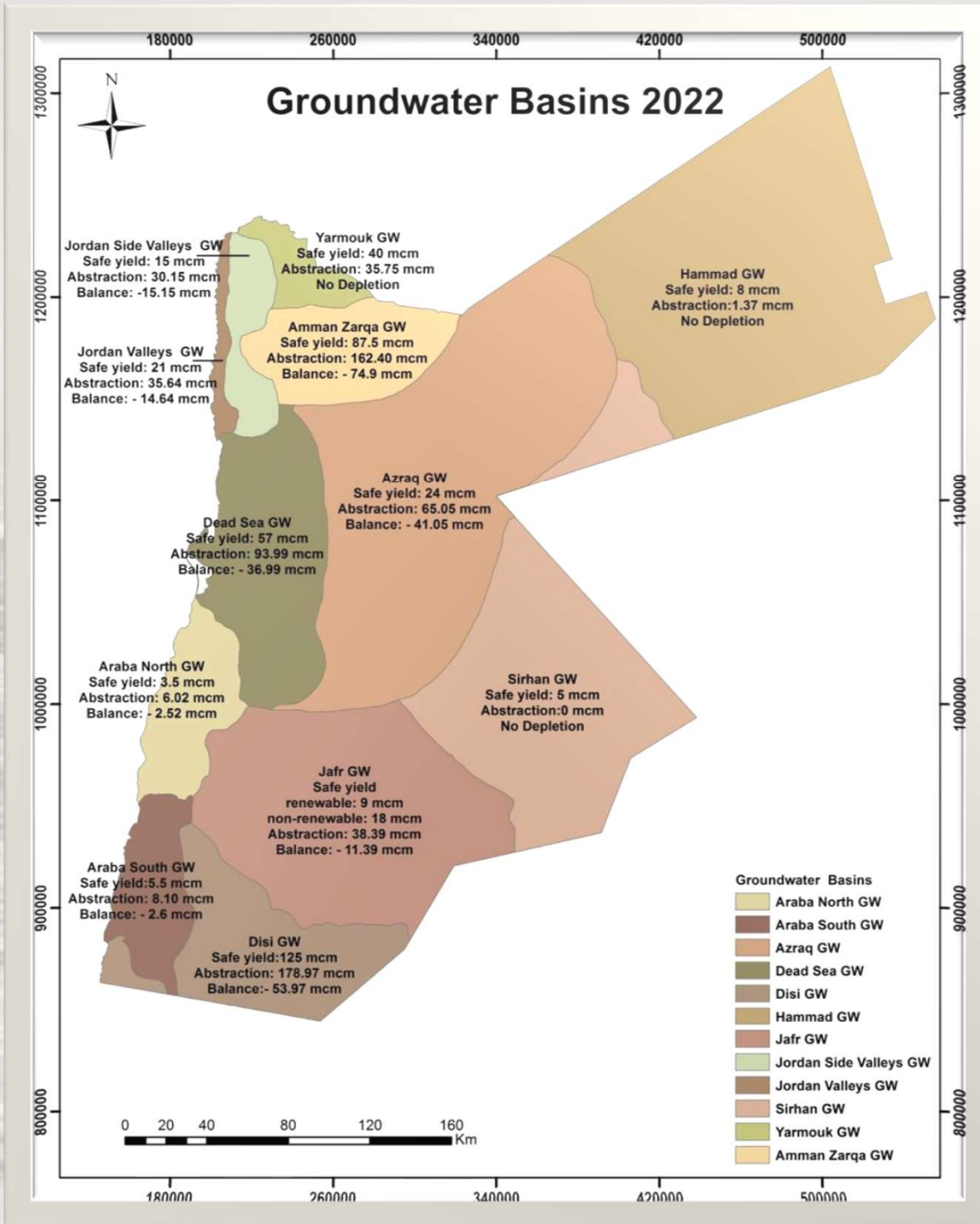
**physical boundaries that formed impermeable bodies or rocks (such as faults) or large water bodies (such as lakes),
Hydraulic boundaries that form as a result of hydrologic conditions such as groundwater divides or flow lines.**

Model Layers

Recharge and Discharge

Groundwater Through flow

Hydraulic Conductivity



Jafr GW
Safe yield
renewable: 9 mcm
non-renewable: 18 mcm
Abstraction: 38.39 mcm
Balance: - 11.39 mcm

Groundwater Basin	Safe Yield (MCM)	Abstraction (MCM)	Deficit (MCM)
Disi & Mudawara	125	178.97	-53.97
Amman-Zarqa	87.5	162.4	-74.9
Yarmouk	40	35.75	4.25
Jordan Side Valley	15	30.15	-15.15
Azraq	24	65.05	-41.05
Jafer	27	38.39	-11.39
Jordan Valley	21	35.64	-14.64
Dead Sea	57	93.99	-36.99
Araba South	5.5	8.1	-2.6
Hammad	8	1.37	6.63
Sirhan	5	0	5
Araba North	3.5	6.02	-2.52

Hydrological Surface water budget 2022 for Jafer Basin

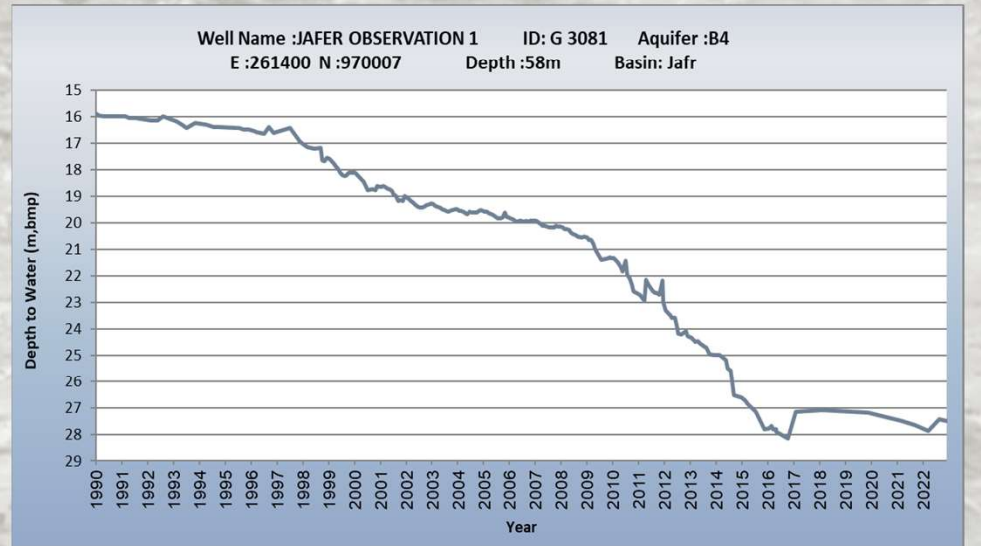
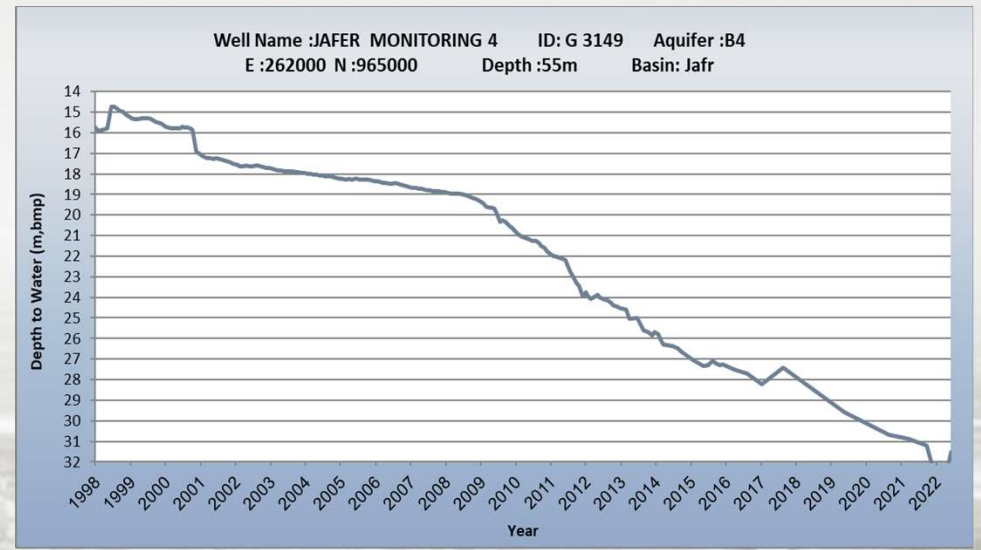
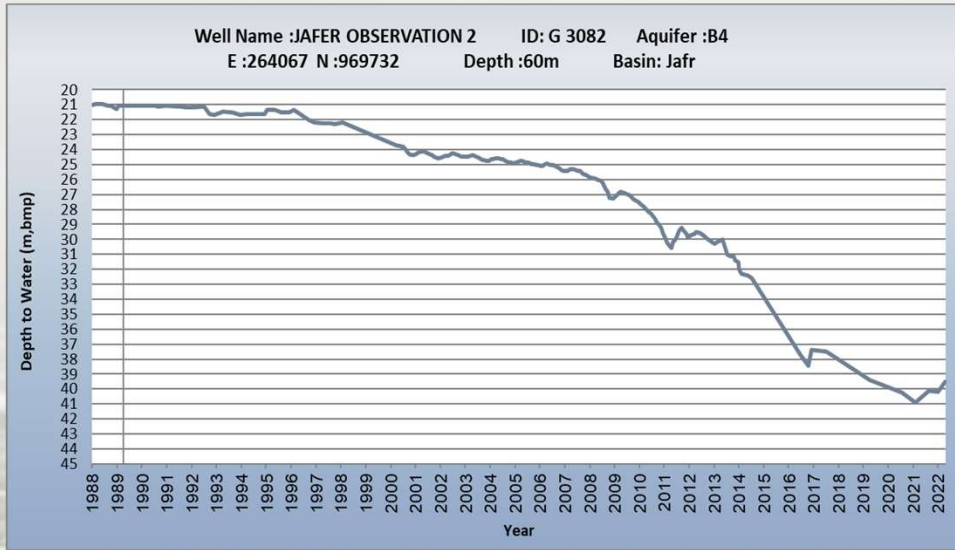
Recharge volume mm3	recharge Coefficient %	Evaporation volume mm3	Evaporation coefficient %	Flow volume mm3	Flow coefficient%	Rainfall volum mm3
8.49	2.29	359.69	97	2.63	0.71	370.81

Groundwater extracted from Jafer Basin and its uses 2022

Industrial		nomadic		Government domestic		private domestic	
wells	production	wells	production	wells	production	wells	production
25	12.87		0.00	66	13.93	8	0.49

Total		Government irrigation		tourism		private irrigation	
wells	production	wells	production	wells	production	wells	production
228	38.39	3	0.50	1	0.00	125	10.60

Behavior of Monitoring Wells



Thank you

