



## The Marsaba-Feshcha groundwater basin and Ein Feshcha spring group: vulnerabilities, risks, water resources potential

### Key findings

The understanding of the hydrogeological setting of the Marsaba-Feshcha groundwater basin was refined by the construction of new geological cross sections based on the integration of a comprehensive and heterogeneous data pool.

The Marsaba-Feshcha groundwater basin, which discharges to the Dead Sea is considered to have one of the highest potential for future water development with an average annual discharge of 45 - 80 MCM.

Vulnerability and risk maps were developed based on both, the improved understanding of the hydrogeological setting and the water quality analyses in the upstream aquifer and the Feshcha springs.

The Marsaba-Feshcha (M-F) groundwater basin is considered as one of the most potential future resource to be developed for the Palestinians in the Eastern Aquifer basin. In order to include



Figure 1 Göttingen University and Hydro-Engineering Consultancy team installing water quality sensors

this resource in the Palestinian Water Strategy several requirements must be considered. Two of the most important goals that largely determined the work flow are the assessment of the current and the expected water quality in the future as well as the development of a sustainable exploitation concept as part of an overall IWRM strategy.

Both, the refinement of the understanding of the structural and hydrogeological setting of the E-F groundwater basin and an appropriate risk and vulnerability assessment were the identified key elements of a sustainable water resources development concept

for the M-F groundwater basin.

Main products and a synthesis of the conducted research are the risk and vulnerability maps, which are required by the different decision makers and stakeholders and fundamental for the planning process.

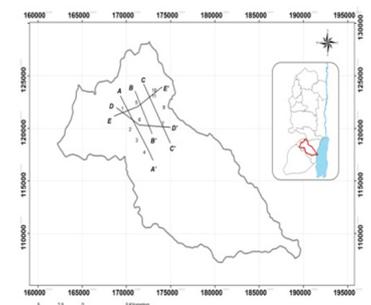


Figure 2 Map illustrate geological cross section in Catchment from Bethlehem to the Dead Sea.

**Developing Hydrogeological cross sections**

The work program to develop a refined understanding of the E-F groundwater basin covered a broad study and evaluation of a comprehensive, heterogeneous data pool including well logs, recharge zone geometry, the hydrogeological characteristics of the various geological layers, and more.

As a result new hydrogeological cross sections were constructed that are essential for an improved understanding of the hydrostratigraphy especially for the lower parts of the M-F groundwater basin and to evaluate the characteristics of groundwater movement and aquifer recharge.

It could be shown that the groundwater flow is directed to the southeast, towards the central part of the Feshcha spring group and that water in the Hundaza and Shdaima well fields is abstracted from

the lower aquifer before the mixing happens. Groundwater flow in the M-F groundwater basin is structurally constrained by the strike directions of the main anticlines and synclines.

According to the 3D model of Flexer et al. (2001), Bensabat et al. (2004), and our own findings the sustainable pumping potential in the Mizpe Jericho well field is around 8 MCM/year. The pumping today is half of it. Enlarging the well field by adding new wells is therefore one measure to be considered in the Palestinian Water Strategy and future actions plans. The site is well-suited for capturing the fresh water before salinity increases significantly southward.

**Construction of risk and vulnerability maps**

To support the development of alternative planning and management options for a sustainable implementation of the IWRM concept in the western part of the

Lower Jordan Valley the refined understanding of the structural and hydrogeological setting was merged with the relevant geographical information like topography, soil distribution, and drainage maps, as well as with the geochemical characterization of the water quality in space and time. As a result of superimposing all layers of information helps in identifying existing and potential point and none point pollution sources.

The synthesis of this convergence process are vulnerability and risks maps, which are essential tools for water resources development and to define groundwater protection measures. The new interpretation level will be used by decision makers and stakeholders like the Palestinian Water Authority to optimize their integrated water resources planning and management processes and to identify priority actions and measures.

The risk assessment scheme used for the risk map of the M-F

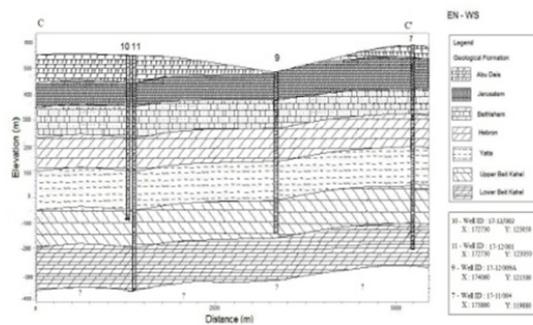


Figure 3 Geological cross section C-C', illustrate the geological formations within Shdaimah well No. 1 and 2, Ras Al Wad well and El Eizariya well No.2.

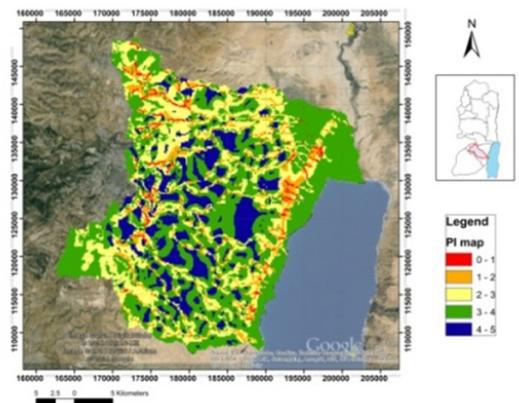


Figure 4 Vulnerability Map of M-F.

groundwater basin is based on the intrinsic vulnerability map constructed using the PI method and the hazard map.

**Summary**

Increasing water demand for domestic, touristic, agricultural and industry purposes is a major driver for water scarcity and competition for water resources. This potentially leads to real economical, social, or political crises taking into account the required per capita minimum demand, the sanitary conditions, and a constrained economical and social development.

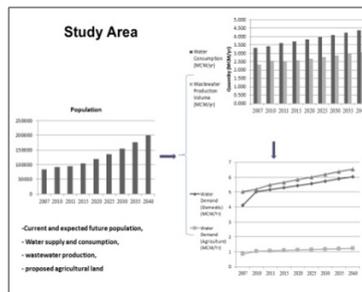


Figure 5 Water demand and supply in the upper part of the study area (2007-2040).

The produced risk and vulnerability maps are ready to be applied in the water resources planning and management process framed

and conducted by the higher and subordinate Palestinian Water, Agricultural, and Environmental Authorities.

Our recommendation is to construct new wells within the western flank of the Nabi Musa syncline and the flanks of the Marsaba anticline, where the thickness of the saturated zone is maximal. The drilling upstream should be accompanied with monitoring of the water level and water quality at the downstream.



**References and further Reading**

- Burg, A., Yechieli, Y., Galili, U. (2016): Response of a coastal hydrogeological system to a rapid decline in sea level; the case of Zuqim springs - The largest discharge area along the Dead Sea Coast. Journal of Hydrology 536, 222-235.
- Palestinian water authority(2011) Annual Status Report on water resources, Water Supply, and Wastewater in the Occupied State of Palestine.
- Shoqeir, J. (2014) Tracing Groundwater in Karstic Aquifer: IWRM Components Implications and Challenges. 1stedn. Lambert academic Publishing, ISBN:978-3-659-27211-0.
- Further detailed information about the different studies can be found on the project website [www.iwrm-smart-move.de](http://www.iwrm-smart-move.de)