	**Title: Feasibility of Membrane Based Treatment Technologies for Brackish Water Desalination and Effluent Reclamation in the Jordan Valley**
	Prepared by: Jalal Bsharat
	Supervised by: Dr. Eng. Rashed Al-Sa'ed
	University: Birzeit University
	Funded by: Middle East Desalination Research Center (MEDRC)-
	Email: jalal_bsharrat@yahoo.com

Abstract:

This research study investigates the feasibility of applying the membrane based technologies for brackish water desalination and effluent reclamation for agricultural use in the Jordan Valley area. The purpose of this research is to identify and evaluate additional water resources to alleviate the water shortage in the Jordan Valley.

The ground water in the Jordan Valley is characterized as brackish water. about 10-12 MCM/Y of brackish water are extracted by the Palestinians from Jordan Valley wells and used for agriculture. This quantity is expected to be improved by additional 6 MCM/Y by developing the old existing wells. The PWA and the MoA estimated the shortage in water demand for both domestic and agriculture uses in the year 2030 of more than 60 MCM. On the other hand, an optimistic water quantities are still available for development such as the brackish water from Fashkha and Malih springs 81–101 MCM/Y and 4 MCM/Y of runoff water harvested from the wades. Furthermore and by the end of 2014, Jericho wastewater treatment plant (JWWTP) will be generating 2450 cubic meter per day (CM/D). This quantity will be gradually increasing to reach its maximum capacity by 2025 with 9900 CM/D which equals to 3.6 MCM/Y of treated effluent water from Jericho sewage collection and treatment system which can be considered as an alternative option to reduce the gap between available resources and the growing demand for Agricultural water in the Jordan Valley.

Currently 21800 ha of irrigated lands are used for agriculture whereas, 221 ha are still available for development.

The research methodology was based on evaluating the available brackish water quantities in the study area, collecting baseline data on existing desalination and wastewater treatment plants in the study area, evaluating beneficiary's awareness and perception to use desalinated brackish water and treated effluent, this was measured by designing, distributing and analyzing a questionnaire survey to the target beneficiaries. A total of 162 wells (annex 1), 4 desalination plants (annex 2) and 6 wastewater treatment plants have been surveyed (annex 3).

The research has investigated several alternatives for utilizing the brackish water and treated effluent in the Jordan Valley. The research proved that the use of reverse osmosis (RO) technology for treating brackish water wells in the Jordan Valley is the most competitive alternative comparing with other desalination technologies, RO will be more feasible when combined with other alternatives to minimize the cost and improve the efficiency such as blending the brackish water with treated effluent generated from wastewater treatment plants (WWTP) or blending with runoff water harvested from neighboring Wades and also by combining with off-grid Photo Voltaic power (PV) to minimize the energy cost produced by traditional power sources (Diesel generators or electricity grid). RO was selected for its low

energy consumption, market availability, and also for its simplicity in operation and maintenance and the ease of being coupled to off–grid solar PV.

Although the research has proven the economic feasibility of RO technology comparing

with other desalination technologies but still the cost is higher than being tackled by low-income farmers in the Jordan Valley, therefore, support of governmental and non-governmental organizations (NGO's) will be needed.

The feasibility of the Membrane Based Treatment Technology (MBTT) has been examined by evaluating the available resources for agricultural water in term of quantity and quality including the potential for future development whereas, financial feasibility has been evaluated by comparing the cost of R.O desalination using two different sources for power supply such as public electricity grid to the off-grid connected RO-PV, also to the cost when blending the brackish water with treated effluent or harvested run off water.

Comparison was tested on an operating desalination plant in Zbeidat village. The economic calculation has shown that the average produced water cost estimated to be $ 0.183 (USD)/CM for RO-PV desalination compared to 0.166 and $ 0.346 (USD)/CM estimated if power obtained from public electricity network or diesel generators.

By giving the fact that the baseline data for this research based on the assessment of farmer's and public perception for reusing of desalinated water and treated effluent, a field survey's has been conducted in order to analyze the existing situation, understand the needs and define gaps in the existing agricultural water management pattern. Several parameters has been measured and data were collected by means of questionnaire designed based on a set of predefined indicators related to the study. The survey analysis showed a low level of awareness on desalination and effluent reuse, high rejection to the treated effluent when used directly but less rejection when effluent blended with desalinated or run-off harvested water. Most farmers considered that the best affordable price for agricultural water should not exceed 0.2 – 0.4 NIS equals to $ 0.056 – 0.11 (USD) . The results showed that most of the farmers have average potential for land development between 2-6 hectares.

This research taken the wells in the Arab Development Society (ADS) as a case study. ADS is the biggest farmers associations in the Jordan Valley located to the east of Jericho city near the border with Jordan where the high salinity water exists. ADS extends on 7500 ha and owns 24 wells of licensed abstraction of 1.2 MCM/Y, however only 4 wells are operated with average abstraction of 0.631 MCM/Y, other wells are abandoned and requires rehabilitation.

The alternatives proposed for the Arab Development Society wells can be disseminated and applied on other 162 agricultural well in the Jordan Valley of different capacities and water quality in order to overcome the problem of salinity and stop the damage to the soil and crops.

By comparing the research results with the corresponding ones obtained from similar researches showed an acceptable agreement with strong proof that desalination cost has come down and the efficiency improved in the past twenty years.

The final conclusion of this research that the most feasible option to utilize the brackish water in the Jordan valley is by combining the RO technology by other alternatives such as blending with treated effluent or run-off water, Nevertheless, a further investigation on the desalination design capacity and efficiency is still needed as well as the environmental impact of RO, brine disposal and effluent reuse