

WATER SUPPLY AND SANITATION FOR A GROUP OF PALESTINIAN VILLAGES IN THE SOUTHERN WEST BANK

*David J. Scarpa, Alfred Abed Rabbo, Reem Zeitoun
Water and Soil Environmental Research Unit,
Bethlehem University, P. O. Box 9, Bethlehem, P. A.
email: dscarpa@bethlehem.edu*

ABSTRACT

The selected hill villages in the southern West Bank traditionally depended on springs issuing from the surrounding hillsides. The eastern basin of the Mountain Aquifer, south of Jerusalem, is now the principal source of drinking and domestic water for the Palestinians in this area. Implementation of provisions contained in Article 40 of the Bilateral Interim Accords (1995) allowed 16 new wells to be drilled into this part of the Eastern Aquifer. An increased allocation of groundwater resources extracted from deep wells should meet present demand. However supply systems are inadequate and the sustainability of this aquifer is in question. Provision also comes from PWA and private tanker operators. Rainwater is collected in household cisterns. Management of water quality through conservation measures and the appropriate use of treated wastewater are important priorities. No wastewater treatment plant exists to serve these communities. Thus, as well as being denied the valuable resource of appropriately treated wastewater, the environment and health of the people under study are threatened by this lack. Consideration must also be given to food security that is not dependent on local water supplies but on access to world markets. This in turn is dependent on developing livelihoods that encourage economic growth in a safe and secure socio-political climate.

KEYWORDS: Livelihoods, Palestinian hill villages, sustainable water supply, treated wastewater, West Bank aquifers.

INTRODUCTION

A paper was delivered at the Zurich conference in December 1992 on groundwater flow in the Eastern Aquifer (Scarpa, 1994). Seven years later, at an international conference in Bethlehem University another

paper (Scarpa, 2000) dealt with a study of the hill villages that form the subject of this present paper. There has been considerable development in the Eastern Aquifer since 1992 and the water stress suffered by the villagers has worsened since 1999.

The Israeli network supplied domestic water to some of the larger communities in the study area from the early 1970s. However the hill villagers, living a subsistence agricultural existence, have been denied an adequate supply of domestic water, with little available locally for irrigation. Rain-fed crops have been grown for millennia in this area, but in recent years attempts to irrigate have met with mixed results. Schemes funded by the World Bank and others to provide necessary water supplies to these villagers have not been implemented in the volatile climate of these opening years of the new millennium.

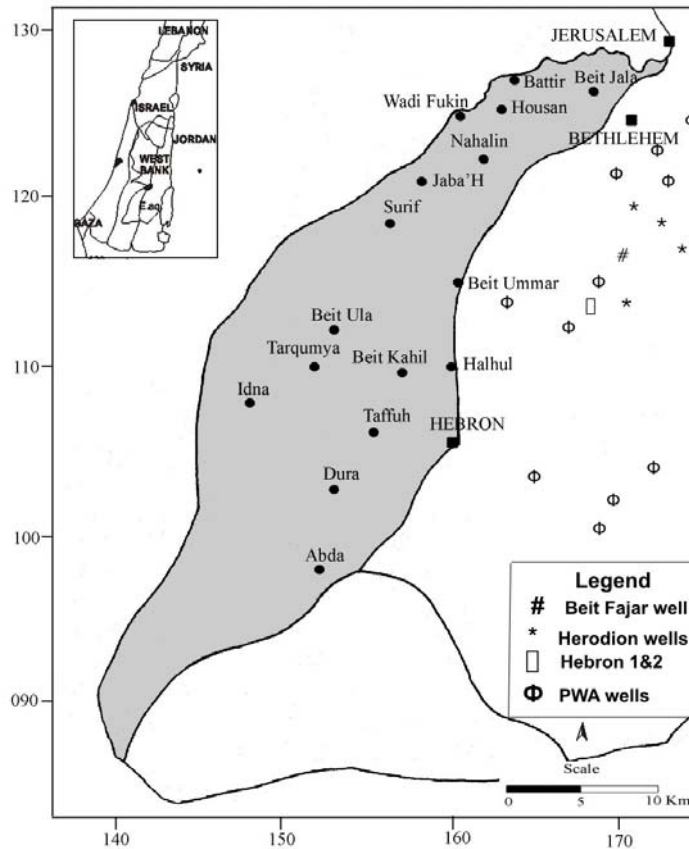


Figure 1 Location map showing selected area of study.

The severe water stress could be alleviated if access to supply from the water well field of the eastern basins of the Mountain Aquifer were available. Population growth and local expectations for development have increased water demand. However the political situation has prevented alleviation of this water crisis. The economy has been in continual decline and future prospects look bleak.

This paper seeks to determine the extent to which these Palestinians from a group of towns and villages (Figure 1) can deal with a water crisis that threatens their existence. It attempts to evaluate the levels of environmental, economic and social, sustainability in considering water allocation and provision. Unemployment remains very high (between 25 - 80%) depending on location, with greatest hardship in the hill villages. Most village economies used to be sustained by employment in Israel, which, for the most part, is no longer available. Livelihoods and food security remain, therefore, within the confines of each town and village.

The area to the south of Jerusalem has two distinct regions separated by the northeast to southwest axis of the anticlinal structure forming the Hebron Mountains that contains the southern part of the Mountain Aquifer. To the east the land descends from elevations exceeding 1000 m to the Dead Sea, more than 400 m below sea level. Prevailing moist westerly airstreams deposit most of their load on the windward side of the Hebron Mountains. To the east a rain-shadow desert results from the descending air mass. To the west springs have been the main source of water until recent times. For the Palestinian population, the eastern basins of the Mountain Aquifer are now the principal source of high quality drinking water. The various procedures adopted by current water management in the selected area and the impact this has on the local population are considered within the wider context of an emergent state within a region of political conflict.

METHODS

Data were collected delimiting the population areas with their agricultural hinterland. The economy of these people is agriculturally based. Rain-fed agriculture has been the traditional livelihood and source of food for these Palestinians. Although inadequate to provide

the needs of the communities under study, spring discharge remained important.

Water samples were collected and analysed from the local springs and other sources for their biological and chemical parameters. The results of the data collected are discussed herein.

The principal source of high quality drinking and domestic water is the southern part of the eastern basin of the Mountain Aquifer between Bethlehem and Hebron (Figure 1). Five deep wells, Herodion 1 – 5, were drilled between 1971 and 1993 by the Israeli water company, Mekorot, near the site of the Jordanian drilled Beit Fajjar well of 1963. This latter was deepened in 1988 by Mekorot. These wells provided water supply to both Israelis and Palestinians up to the late 1990s. In accordance with the requirements of Article 40 of the Interim Accords (1995), Mekorot, drilled two wells, Hebron 1 and 2, in 1996 for the Palestinian population of Hebron. The Palestinian Water Authority (PWA), with foreign funding, completed a further 14 production wells. The water from each of these wells was analysed and assessment of safe yield determined. Details of these data are considered herein.

RESULTS AND DISCUSSION

The results of the chemical analyses were processed through a series of computer programmes that allowed assessment of the suitability of the water for the purposes to which it is put. Health and environmental hazards and their possible alleviation are considered. These assessments are based on internationally accepted chemical and biological standards for drinking water and other uses as published in WHO (1993). These results may be found in Abed Rabbo and Scarpa (2000, 2001).

The relative importance of the spring water for different groups depends on alternative sources of supply. Some communities are supplied with water derived from the deep aquifer provided either by Israeli or Palestinian water authorities. Those not so accommodated use local spring discharge, or, if they can afford it, buy water from privately owned or the PWA water tankers. A few villages in this study have neither network provision nor direct access to any spring and cannot afford the expensive tanker water. Collection of rainwater

in household cisterns depends on an uncertain winter rainfall season. Rainfall in the 2001-2002 seasons seemed to return to the 1961-1990 averages (Scarpa, *et al.*, 2002). However, the very low rainfall of the previous three seasons brought considerable hardship to the villages covered in this study. Allan (1997, 1999) noted that drought is often the incentive for changes of water policy and practice. Official publications sponsored by the PNA, (PECDAR, 2001; MOPIC, 1998a,b,c; MenA, 2000, 2001) tend not to address the implications of seasonal and annual uncertainties that threaten drought and its consequences nor how to develop a coherent strategy. The fact that major policy decisions and control of much of the water available to Palestinians is still in the hands of the occupying power acted as a disincentive to develop effective pricing policies, as, indeed, did the poor state of the Palestinian economy.

The shortages evident at the beginning of the study period became considerably more precarious at the end of the study period during which crops were destroyed, fenced off or became inaccessible due to Israeli military action.

Of the 61 springs sampled in each of the three seasons (end of the dry, middle of the wet and end of the wet seasons) nine, i.e. 14.75 %, with high nitrate concentrations were selected and are listed in Table 1.

Table 1. Key to selected springs shown in Figures 2 and 3.

Spring	Name	Location
A	Arab	Hebron City
B	Balad	Housan
C	Balad	Idna
D	Imran 2	Dura
E	Mussallam	Tarqumia
F	Nabil Sharif	Dura
G	Quf East	Beit Kahil
H	Sukhuneh	Housan
I	Za'bud	Halhul

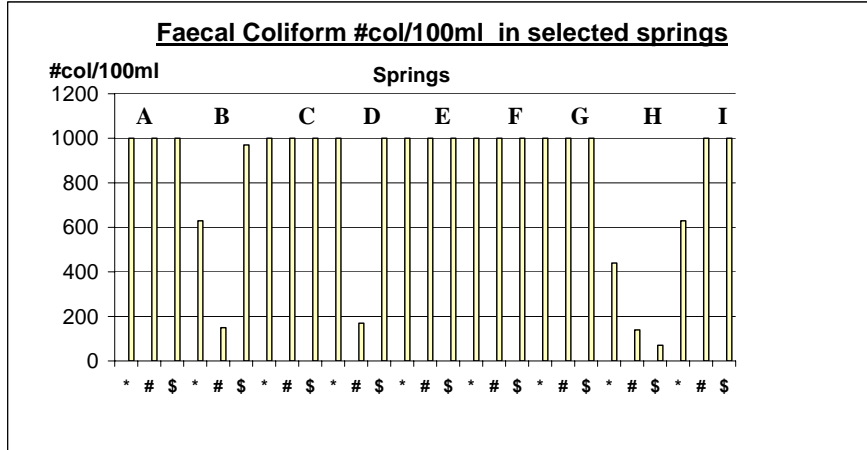


Figure 2. Incidence of faecal coliform bacteria in selected springs (see Tables 1 & 2) showing the number of colonies per 100 ml of water.

Table 2. Key to seasonal sampling of selected springs shown in Figures 2 & 3.

Season	Description
*	end of the dry season (1998)
#	middle of the wet season (1999)
\$	end of the wet season (1999)

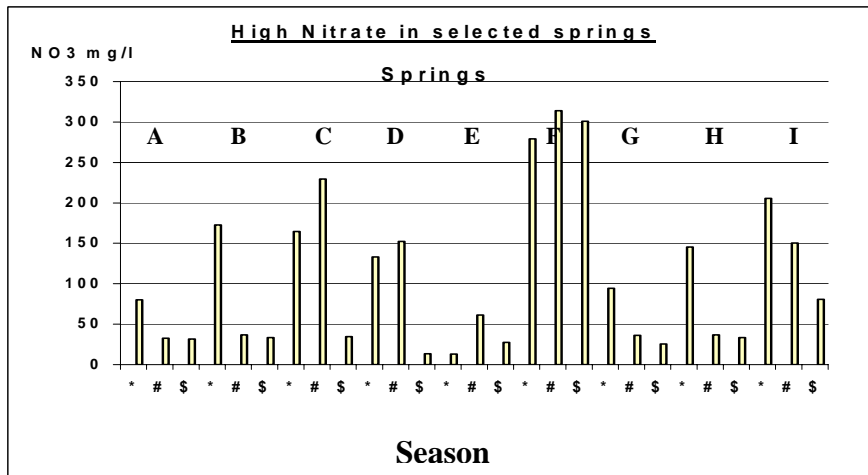


Figure 3. Selected springs (see Tables 1 & 2) showing high nitrate concentrations.

All springs sampled are contaminated with coliform bacteria. Those in the selected springs (Figure 2) show samples with colonies so prolific that they are too numerous to count on the medium plate, even though illustrated in Figure 2 as 1000 colonies/100ml. Rainfall dilutes the concentration of the nitrate. Only Sukhuneih in Housan had faecal coliform colonies throughout the year that were few enough to count

The analysed samples from this selected group of springs in the southern West Bank, showed highest concentration of NO₃ in those collected at the end of the dry season. However, the Nabil Sharif spring in Dura discharges at field level in an intensively farmed area, resulting in NO₃ readings of about 300 mg/ l throughout the year. The Za'bud spring is located in the centre of the busy market town of Halhul and high concentrations of NO₃ could be expected. There is a downward trend from the end of the summer dry season >200 mg/ l to the end of the wet season, > 80 mg/ l. Ein Arab is in the centre of the city of Hebron, but its highest concentration is 80 mg/ l diluted in the wet season to just above 30 mg/ l. The differences may be accounted for in better sewage control in the city and fewer sheep and goats polluting the spring site than in the town. The Municipal spring in Housan has nearly twice the nitrate concentrations as Ein Arab at the end of the dry season, but comparable wet-season readings. The main spring in the town of Idna, on the other hand, has highest concentrations in the middle of the wet season, as does Imran 2 in Dura and the shallow well of Mussallam in Tarqumiya. This latter may be explained by the fact that the olive press, dependent on this spring, is located nearby. Quf East is at the edge of the experimental farming plots above the road into Beit Kahil and this would account for the nearly 100 mg/ l concentration at the end of the dry season, diluted to acceptable levels during the wet season.

Most springs have very high readings for hardness, as would be expected in carbonate rich aquifers. The springs of Gharabi, with 852 mg/l, Nabil Sharif 750 mg/l, and Saqiah 710 mg/l, all from Dura had particularly high readings. Water is defined by Sawyer & McCarty (1967) as *very hard* if the concentration is above 300 mg/l.

During the relatively dry period of this study, the basic economy of these villages and towns, dependent on the sale of mainly market garden produce, was massively reduced. In turn less fruit and vegetables were available to the villagers and townspeople themselves. The quantity of drinking water available from all sources, springs, rain-fed cisterns and the network, had been reduced to levels that represented a danger to health. Lack of water from springs in villages dependent on them for drinking water also reduced the quality of the drinking water. This presented a serious health hazard, especially for the children. Significant incidence of amoebic dysentery among both children and adults were reported in most of the villages of this study (Scarpa, 2000).

Treated wastewater could alleviate some of the water stress. The larger towns, in particular, the city of Hebron had an industrial base with huge demands on this diminishing resource, but, at the same time, produced a considerable amount of wastewater. This potential resource was lost. The tanning, dyeing, glass and ceramic industries were the main polluters but claimed that removal of hazardous waste material from the water was too expensive. Political problems were overcome and plans for a large wastewater treatment plant to the south of Hebron were underway but proved impossible of implementation because of the volatile situation from autumn 2000.

There seems to be no clear policy with respect to local water markets and no framework for promoting and regulating these markets. Similarly, property rights over wells and springs remain unclear in certain areas, leading to uncontrolled use and to possible conflicts among competing users. Finally, the lack of water-user associations and the limited capacity of existing farmer organizations do not allow farmers to initiate cooperative arrangements to implement and/or maintain local water projects such as water harvesting or spring rehabilitation (Isaac & Saade, 1999:23).

The water supply from the springs and shallow wells in the study area could not accommodate even the basic domestic needs of the population. Further exploitation of the aquifers beneath the southern West Bank was recognized as the principal means of alleviating the water stress suffered by the Palestinian population under study. Ensuring adequate water supplies was seen as an important part of the

peace process. Article 40 of the Oslo Accords of 1995 sought alleviation of the problem by increased borehole extraction from the eastern basin of the Mountain Aquifer. This was recognized as the principal source of potable water available to the Palestinian communities under study.

Studies conducted for the PWA (Alewiwa & Jarra, 2000) and by the PHG (De Bruijn, *et al.*, 2000) as well as independent researchers (Selby, 2002) raised serious doubts concerning the amount of water available in the aquifer and the sustainability of extraction rates proposed.

The Palestinian Legislative Council of Ministers (PLC) ratified the Water Law in 2002. This law is designed to preserve and protect water sources from pollution and overuse (Art.2). The enforcement of legal provision in the towns and villages under study is impossible in the volatile situation that exists in the southern West Bank. The PLC hopes that, in the long term, provided that Palestinians have access to the water under the West Bank, there would be a surplus, that is, discharge and extraction from the aquifers would be less than recharge. (Abu Ju'ub, 1998:47). Israeli policy, on the other hand, supported by the USA, seemed to disregard the principles of international law with respect to basic resources exploited by an occupying power to the detriment of the indigenous population. Instead of returning the aquifer to Palestinian control, Israel planned to supply desalinated water from Mediterranean shore plants to the West Bank Palestinians. The flawed nature of such a plan is discussed in Pearce (2004).

CONCLUSION

Palestine has a low capacity to adapt to the economic and political problems that it faces. This results in very serious negative impacts generally and on water insecurity in particular (see Figure 8.4a, Allan 2001). It is within this context, of a fragile economy, dependent, in large part on foreign aid, with a weak government striving for a statehood which can have only very limited sovereignty, that fundamental decisions concerning the diminishing water resources have to be made. Agriculture is not only an important source of livelihood; it is, for the villages in this study, an essential provider of food. Diversification is therefore not an easy option.

Population growth has been increasing at a rate of between 4% -5% since the 1996 census (PCBS, 1997, PASSIA, 2003). Local expectations for development increase water demand. An attempt to meet this demand is to increase allocation of groundwater resources extracted from deep wells that would further endanger the sustainability of an already vulnerable resource (Scarpa, 2004).

The present subsistence farming cannot be sustainable. The diminishing water resources may mean that the water extracted from the aquifer by borehole should only be allocated for drinking water and for other domestic uses. Appropriately treated waste water, rain harvesting and spring water will help alleviate the stress. However, sustainability demands better returns to water than agriculture can provide. It requires an economy that provides livelihoods and earns sufficient money from exportable goods on the world markets to allow food security to be assured in imports from countries with a food surplus. Environmental sustainability must be seen within the context of social and economic sustainability (Allan, 2001:1).

The Palestinian Development Plan (PDP) for 1999-2003 allocated 27% of the productive sector total investment budget to agriculture. Land reclamation projects were allotted about 44% of the agricultural sector investment budget in the three years (2000-2002) and 27% was allocated for food security projects (Isaac & Saade, 1999:16). Agriculture was expected to continue to play an important role as a refuge for thousands of workers in times of Israeli closures and to absorb a significant share of anticipated future increases in the labour force. The PDP also aimed at providing infrastructure and social service development in the rural areas in order to reduce inequalities in income and standard of living between rural and urban areas. It is especially the case among the rural areas of the Hebron District that access is denied between the city of Hebron and its satellite towns and villages, thus increasing the poverty of the rural areas that form the subject of this study.

The PNA is faced with a massive problem in the provision of employment. There are few feasible alternative occupations to farming for many of the Palestinian villagers in the study area. Although foodstuffs, particularly grain and its manufactured

derivatives, are imported, fruit and vegetables are still produced locally and at low cost.

If it is the case that Palestinian political discourse would engage in a consideration of a solution to the water crisis in the increased importation of food, it thereby engages in global political considerations. The validity of the *virtual water* solution is dependent on cheap food being available on the world market and accessible to relatively poor countries like Palestine. This food for export may be subsidised in those countries that can grow an abundance of food, only possible where there is adequate round-the-year soil moisture. Palestine therefore should diversify its economy away from irrigated agriculture towards industry, particularly service industry that provides much better returns to the water resources, making it possible to import the bulk of its foodstuffs. It is clear that a comfortable existence that may allow sustainable development for the village communities discussed herein requires a stable, secure socio-political-economic milieu, not so far apparent in the foreseeable future (Scarpa, 2003, 2004).

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