WATER CRISIS IN BETHLEHEM GOVERNORATE

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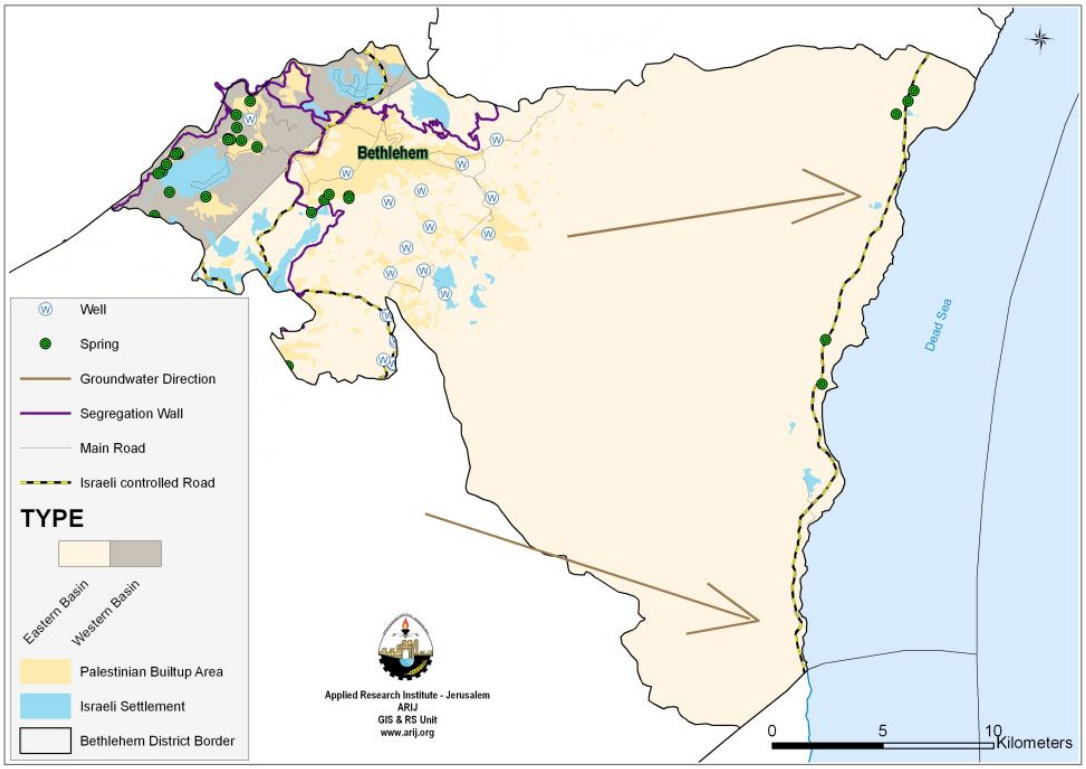
Recently, Bethlehem governorate suffers from a real crisis of water and stifling due to insufficient supply of drinking water which results in a continuous water disconnection in some governorate areas and residential communities for long periods. The reason for this discontinuity in water supply is due to the limited drinking water resources in addition to some disabled pumping stations due to unavailability of money required to cover the operation and maintenance cost. Another important reason for this water crisis in Bethlehem governorate is the Israeli control over water resources and quantities supplied to the governorate by preventing the governorate from water which also increase the Palestinian citizens suffering.

The renewable water resources in Bethlehem governorate mainly consist of groundwater. Bethlehem governorate is considered as the richest area of groundwater in the West Bank, where parts of both the eastern and the western groundwater aquifer basins extending within the governorate area (Map 1). In addition to the groundwater, the rainwater also considered an important water resource in the Bethlehem Governorate where the estimated amount of water that can be collected from household roofs is about 1.8 MCM /year. 65% of the households in the governorate collect rainwater from their household roofs and store it in the household collection well, where the estimated amount of rainwater collected and stored in household collection wells is 1.16 MCM/year (PHG, 2007). But the fluctuation and the shortage in the average annual rainfall restrict the benefits from this source. The estimated rainfall quantity that fall on the governorate during winter season 2007/2008 reached about 360 mm according to the air quality and meteorology station in the applied research institute-Jerusalem (ARIJ) north to Bethlehem city. This quantity doesn’t exceeded 59% and 67% from the rainfall quantity that fall on the governorate in 2006/2007 and 2005/2006 seasons where it reached about 612 and 536 mm, respectively.



Map 1: Water Resources in Bethlehem Governorate

Drinking water resources in the Bethlehem governorate are divided into two main resources, namely; (**1**) Local resources from the groundwater wells and springs, (**2**) purchased resources from the Israeli Water Company "Mekerot" that is distributed through the West Bank Water Department (WBWD) (Figure 1). Local domestic water supply resources in Bethlehem are consists of 1) Palestinian Water Authority (PWA) wells which supplies Bethlehem and Hebron governorates, and 2) Beit fajjar wells which is owned by the Water Supply and Sewerage Authority WSSA. Whereas, the purchased-water from Mekerot are obtained from 3 different resources namely: (1) WBWD wells, (2) Mekerot wells inside the West Bank, and (3) Mekerot wells outside the West Bank (PWA, 2006). The total number of the spring and groundwater wells in the Bethlehem Governorate is 31 and 32 respectively as shown in map 1. These groundwater wells include the 8 wells which drilled by the PWA to supply the Bethlehem and Hebron governorates with water, in addition to Beit fajjar well. Also there are 5 main reservoirs with a storage capacity of about 20 thousand CM of water.

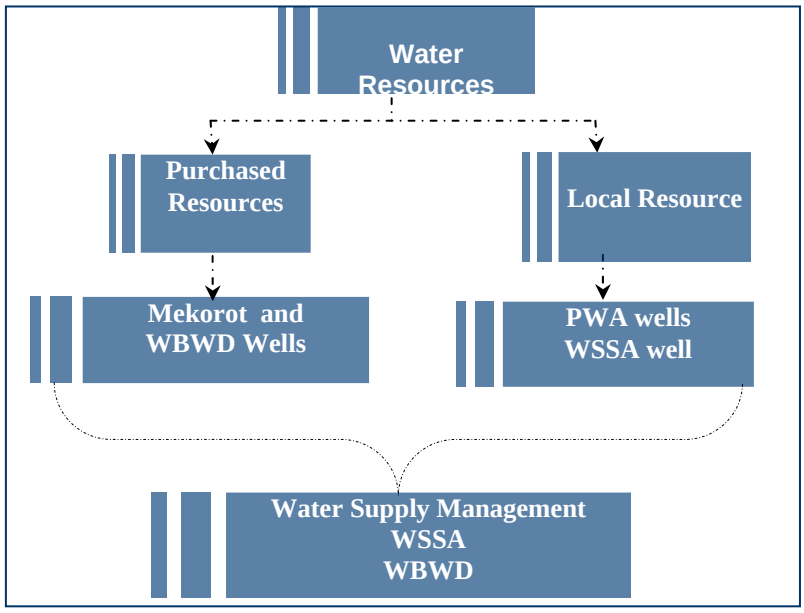


Figure 1: Domestic Water Supply Resources in Bethlehem Governorate

Water Supply and Sewerage Authority (WSSA) in Bethlehem is considered the main body that manages the distribution of water in the governorate. WSSA supplies water to approximately 120 thousand people (65% from the total governorate population), live in Bethlehem, Beit Jala and Beit Sahour, the refugee camps (Al-Duheisha camp, Aida camp and Al-A'zza camp) and some urban communities. The remaining communities in the Governorate depend on the purchased resources from 'Mekerot' which supplies the Palestinian communities through the WBWD (Table 1). Although most of the communities in the Bethlehem governorate are connected to the water network, still 14 communities with a total population of approximately 45200 are not served by the water network (PWA, 2008). These communities rely entirely on cisterns, water tankers and rainwater harvesting for their domestic water uses. Table 1 shows all the served communities with water network in the Bethlehem governorate according to the supplier.

Table1 : Served communities with water network according to the supplier

Supply Utility	Served Communities
WSSA	Al Walaja, 'Ayda camp, Al 'eza camp, Beit Jala, Bethlehem, Beit Sahur, Al Dawha, Al Khader, Al Duhaysha camp, Irtas, Rakhma, Al Firidis
WBWD	Bateer, Al 'Ubaeidia, Khalet Al Nu'man, Al Khas, Al Hadadia, Wadi Al 'Arayis, Al Hujeila, Dar Salah, Husan, Wadi Fukeen, Jahdam, Umm Al Quseis, Umm 'Asla, Hindaza, Al Shawawra, Ras Al wad, Fakht Al Jol, Dhuhrat Al Nada, Bareed'a, Nahaleen, Al Khisna, Beit Ta'mar, Kherbet Al Nahla, Khalet Allawza, Za'tara, Al Beida, Beit Faluh, Wadi Rahhal, Harmala, Abu Nujaem, Khalet Al Haddad, Al Ma'sara, Wadi Al nees, Jura Al Sham'a, Marah Ma'la, Al Hulqoom, Umm Salamona, Al Manshia, Taqu', Marah Rabah, Beit Fajjar, Al Munia, Kisan, 'Arab Al Rashayda, Al Rawa'ein

Source : PWA 2006

According to the data published by PWA (PWA 2006), the amount of water supplied to Palestinian communities residing in the Bethlehem governorate from the local resources reached 3.518 MCM in the year 2005, while the amount of water purchased from the Mekorot Company and supplied to the Palestinian through WBWD reached 5.566 MCM. Table 2 shows the amount of available water that's supplied to Bethlehem governorate according to the source, knowing that the needed water quantities in the governorate is amounted to 9.560 MCM which means that the Governorate suffers from drinking water deficit reach about 5.02% (PWA, 2006).

Table 2: Available Water and Supplied Quantities according to the sources

Resources		**Supplied Quantities MCM**
Local Resources	Beit Fajjar well	1.438
	PWA wells (1, 3, and 11), Al 'izariya wells (1 and 2), JWC well (4), and Hundaza well	2.080
Purchased Resources	Mekerot well inside West Bank (Shidma well 1, and 2)	2.978
	WBWD Wells (Herodion wells 1, 2, 3,4, 5)	2.588

Source PWA 2006

As a conclusion, Bethlehem governorate do not depends completely on the self-water resources in supplying the governorate with the required quantities of drinking water due to insufficient water quantities abstracted from groundwater wells in addition to the absence of other supplying resources. For that reason the WSSA resort to purchase additional water quantities from Mekerot to overcome the deficit in water quantities that must be supplied to the authority participants, where the purchased-water from Mekerot constitutes more than 60% from the total water supplied to Bethlehem governorate (Figure 2).

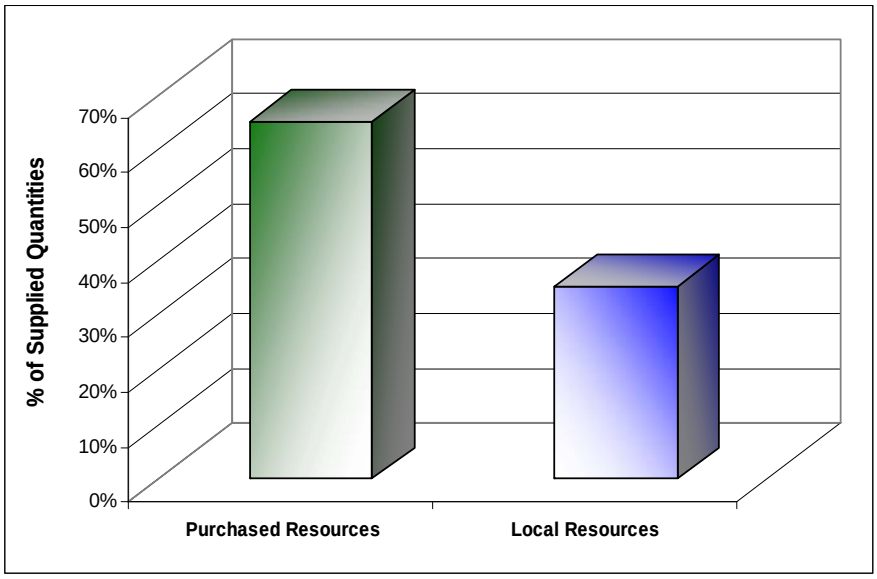


Figure 2: Percentage of Supplied Quantities according to the sources

According to WSSA reports, the Bethlehem governorate requires 30 thousand cubic meters of water per day for domestic use only, while it's supplied by less than half of this quantity with about 13600 CM/d (Table 3). Thus, most residential communities in the governorate suffer from large deficit in the supplied water especially those communities that depend mainly on the purchased water resources from Mekerot. In addition to that, most areas with an elevation more than 800 m above sea level in the governorate suffers from sharp deficit in water delivery especially in summer season when the demand on water consumption increased that decrease the pressure on the network and cause the crisis such cases are in Ra's Beit Jala, Al Dohha and Al Walja.

Table 3: Water Supplied quantity per day

Connection	Supply rate m^3
PWA	3,700
Jerusalem well	4,150
Batn Al-Ghul wells (Mekort)	4,120
Beit Jala	1000
Mekerot connections	600
Total	**13,570**

Source PWA 2008

The rate of water supply in Bethlehem governorate is varying from one community to another and according to the supplier, where it reaches 114 litres per capita per day in the communities served by WSSA, while it reaches 112 litres per capita per day in the communities served by WBWD and Mekerot. However, it is worth mentioned here that the citizen in these communities doesn't actually consume this amount of water due to the loses in the main resource and in the water network before it is actually accessible for consumption. Where according to the PWA, the average loss rate in the water network is estimated to be approximately 31%. These are either physical loss in the main resource and/or in the localities' networks and/or losses due to inaccurate readings by water meters and unregistered connections. Therefore, the per capita water consumption in the Bethlehem governorate does not exceed 79 liters per capita per day (L/c/d) (PWA, 2006). If this per capita figure is taken into consideration, it will be easily noticed that this figure forms only about ¼ of what is recommended by the World health Organization (WHO). This is based on the fact that the WHO recommends the minimum water requirements to sustain a healthy life is 100 l/c/d.

At the governorate level, the per capita water supply rate was increased distinctively during the years 2003; 2004 and 2005 due to the increased productivity of the new PWA wells, where its productivity reached about 7.8 MCM in 2005 with an increase of about 1.3 MCM from 2004. Figure 3 shows a comparison for the average water supply per capita at the Governorate level for the years from 1999 to 2005 (PWA, 2006). Even

though, there are still many communities in the Bethlehem governorate especially those having rural habits in which the average supply do not exceed 50 l/c/d.

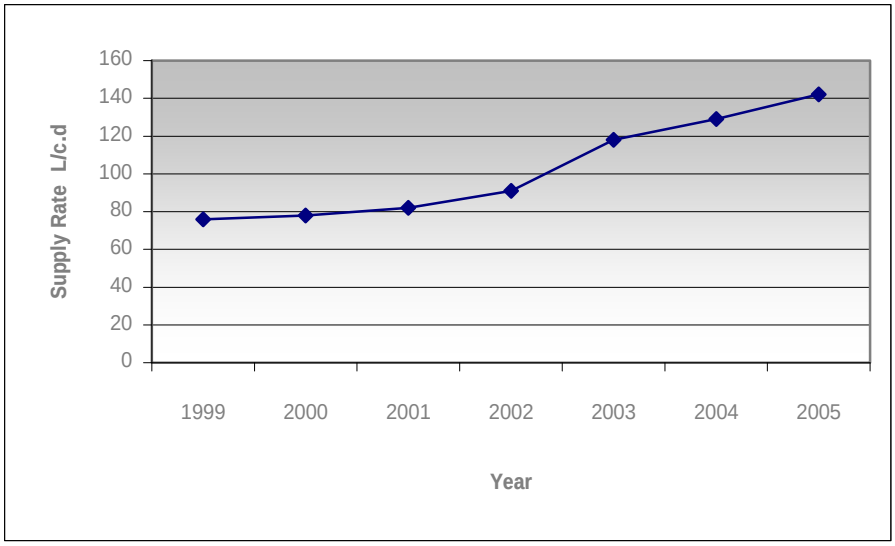


Figure 3: compares between the average of water supply for the years from 1999 to 2005

Considering the water quality for the various drinking water resources in the Bethlehem governorate, the results of the PWA analysis of the well's water for domestic use is considered with high quality and within the permitted limits of the Palestinian drinking water standards (table 4). Also the Palestinian central bureau of statistics pointed that 98.8% of the households in Bethlehem governorate use safe drinking water.

Table 4: The results Rate of the chemical tests of some of the wells supplying water to the population of Bethlehem governorate, 2006

Well	NO_3	SO_4	Cl	HCO_3	K	Na	Mg	Ca	EC	pH	T
'Beit Fajjar	13	8	32	238	1	16	33	38	560	7.5	21.4
Pwa No.1	8	10	43	246	2	14	29	49	582	7.5	21.8
Hundaza	13	4	29	231	2	9	32	50	535	7.4	
Herodion (Butn El Ghul) No. 1	14	8	29	209	1	15	26	45	507	7.4	20.7
Herodion (Butn El Ghul No.2a	15	5	28	221	1	15	24	40	506	7.6	20
Herodion (Butn El Ghul) No. 2	8	11	26	223	2	14	31	34	537	7.4	22.4
Herodion (Butn El Ghul) No. 3	6	10	27	250	2	13	33	40	574	7.4	23.6
Herodion No.4	6	10	27	250	2	13	33	40	574	7.4	23.6
Herodion No.5	14	7	36	234	2	20	31	43	546	7.4	21.1
Al 'Eizariya No.2	5	14	43	227	4	17	31	66	548	7.5	24
Pwa No.3	8	9	30	229	2	14	29	49	517	7.4	19
JWC-4	11	17	32	208	2	14	24	61	505	7.5	22

The water crisis in Bethlehem governorate arises from the deficit in water quantity to be discharged to it from the main resources where the governorate suffers from water breaks for long period of time in summer and winter seasons due to many reasons which are:

1. The Israeli control over the Palestinian resources which force the Water Supply and Sewerage Authority (WSSA) to purchase water from Mekerot in order to supply the communities of the governorate which it served. This causes restrictions in organizing water discharge and distribution among the residential communities, that's why it distribute water to the different areas periodically since the available water quantities are not enough to overcome the population requirements.

2. Increased the average loss rate in the water networks even that the WSSA made rehabilitation and restoration parts of the water network and build new reservoirs and changes the participant meters, but the citizens practices characterized by stealing water and illegal pipelines and damaging the water meters in the households increases the lose percentage.

3. The disabled wells also contributed in the decreasing of the water quantities supplying the Bethlehem governorate, from these wells there is 3 main wells which are: PWA 1, PWA 3, and Beit Fajjar well. It is worth noting here that Beit Fajjar well which is owned by WSSA doesn't supply the communities served by WSSA due to its connection with the Mekerot network which claimed that the water in this well is polluted, but according to PWA the water in this well is not polluted, recently the PWA is trying to solve this problem. In addition to the disabled wells, the Arab Al-Rashaida well that was excavated by PWA is still not operated until this moment; which was supposed to start discharging water before 8 months, due to technical reasons.

Water crises in the Bethlehem governorate can be solved by Increasing the water quantities supplied to the governorate by the PWA, decreasing the loss percentage from the water networks, rehabilitation of the disabled wells and re-operates them, and building new water reservoir.