

## **Abstract**

Proper Wastewater management in Palestine is still very limited. About 59.8 % of the West Bank households have cesspit sanitation system where almost 3% are left without any sanitation systems (PCBS, 2011). Cesspits are known to be one of the major sources of soil and groundwater pollution.

The main goal of the research was to assess the pollution load in terms of total nitrogen and heavy metals from cesspits in Beit Dajan and Beit Fourik villages in Nablus East. This was achieved through meeting the following specific objectives:

- Characterizing septage in terms of TN and HM from various cesspits of different desludging frequencies
- Determining the pollution load fluxes from cesspits both in infiltrated and desludged septage in terms of TN and HM.

This research was accomplished by integrating a comprehensive data collection and analysis with a technical field work. 150 household were surveyed to obtain data about drinking water consumption and wastewater generation and disposal. In addition, 50 different random septage samples were collected from different cesspits. 5 samples were collected from infiltrated septage accumulated in a monitoring well installed for this study at around 1.0 m distance from a cesspit , and 5 drinking water samples were also collected from the water supply network and water supply wells.

The data collection survey revealed that the average daily consumption of drinking water in Beit Dajan and Beit Fourik is 58 l/cap.day, while the average daily wastewater generated per capita is 49 l/cap.day and the daily average septage infiltrated from cesspits per capita is 19

l/cap.day. 70% of the drinking water needs is covered from the public water network, while 25% from the rain water harvesting, and 5% purchased through truck tanks.

Cesspits are the only final wastewater disposal method in the study area where 22% of the surveyed houses empty their cesspits once in a month or less, 20% every two or three months, 15% every 4-7 months, 14% every 8-11 months, 8% every 12-24 months, 6% every 25-36 months and 15% never emptied their cesspits.

The technical study revealed that the average TN concentration in septage cesspits in Beit Dajan and Beit Fourik is 297 mg/l, where the lowest concentration was found to be 171 mg/l and the highest value was found to be 516 mg/l. The specific TN in cesspit septage was 8.53 g/cap.day.

On the other hand, the average TN concentration in the infiltrated septage was 159 mg/l, where the lowest concentration was found to be 91 mg/l and the highest value was found to be 277 mg/l and the specific TN in infiltrated septage was 3.27 g/cap.day. Accordingly, it was found that 46.4% of the total nitrogen concentration in the septage was removed during the movement of infiltrates from the cesspit to the sampling and monitoring well.

The average heavy metals (Cu, Ni, Pb, Mn, Fe, Cr, Zn) concentration in the cesspit septage are Cu (0.24 mg/l), Ni (0.03 mg/l), Pb (0.01 mg/l), Mn (0.47 mg/l), Fe (12.56 mg/l), Cr (0.04 mg/l), and Zn (1.23 mg/l). Iron (Fe) and Zinc (Zn) have the highest concentration.

Heavy metals concentrations in the infiltrated septage have been reduced after being moved through soil particles. Copper, nickel and chromium that was detected in the septage have not been detected in the infiltrates, while other metals such as manganese, iron and zinc have been reduced dramatically where Mn was detected at 0.008 mg/l, Fe (0.32 mg/l) and Zn (0.02 mg/l).

The heavy metal concentration have witnessed a vast reduction during the infiltration process

though soil.

The total infiltrated septage calculated as recharge to groundwater was 134,835 m<sup>3</sup>/year (13.9 m<sup>3</sup>/dunum.yr), while the total annual recharge from rainfall was calculated as 910,061m<sup>3</sup>/yr (63.1 m<sup>3</sup>/dunum.yr). Therefore, septage infiltrated from cesspits contributes to as much as 15% of total recharge from precipitation, making cesspits a significant source of recharge. On the same context, TN that is infiltrated from cesspits from both villages was 27,694 kg per year, which is equal to 2.87 kg TN/dunum.yr.