

WWCH 2017 PROBLEM DESCRIPTION

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| Problem Title | |
| Drainage water reuse in Egypt | |
| Contact Information | |
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| Country | Egypt |
| 1. Basic information | |
| <p>Egypt, mainly delta region, Egypt has a total population of 83,387,000 inhabitants (2014 according to the FAO)</p> <p>The majority of the country area is desert land. Most of the cultivated land is located close to the banks of the Nile river, its main branches and canals, and in the Nile Delta. Rangeland is restricted to a narrow strip, only a few km wide, along the Mediterranean coast and its bearing capacity is quite low. There is no forest land. The total cultivated area (arable land plus permanent crops) is 3.8 million ha in 2013, or about 4 percent of the total area of the country. Arable land is about 2.7 million ha, or 73 percent of the total cultivated area, and permanent crops occupy the remaining 1 million ha. (please refer to attached table (1))</p> <p>Hot dry summers from May to October and mild winters from November to April characterize Egypt’s climate. Rainfall is very low, irregular and unpredictable. Annual rainfall ranges between a maximum of about 200 mm in the northern coastal region to a minimum of nearly zero in the south, with an annual average of 51 mm.</p> | |
| 2. Water Circumstances (Optional) | |
| <p>Egypt main water resource is the Nile River with a percentage exceeding 72% of its water budget while the remaining percentage is obtained from other different water resources that will be discussed later.</p> <p>How the water input is distributed among different sectors in Egypt is defined in table (2) and illustrated in charts (1) and (2).</p> <p>Please refer to figure(1) that shows the water supply per capita in the past, now and the expected water capita in the future.</p> | |
| 3. Problem description | |
| <p>Egypt is expected to face a real water problem in the upcoming years, but what about now?! What about its current resources and how do we deal with them?!</p> <p>The main water resource in Egypt is the Nile river which contributes to the total share of water by 55.5 billion cubic metres. Rainwater, floods, and groundwater, as well as agricultural drainage water that has been recycled and desalinated seawater, collectively add up to about 20.75 billion cubic metres in 2015/2016, compared to 20.9 billion cubic metres in 2014/2015—a decrease of 0.7%!</p> <p>82% of the Egyptian share of water is consumed by the agriculture sector; plants absorb only a small percentage of this value while the remaining is distributed among deep percolation and evapotranspiration.</p> <p>Since Egypt has a gap between the fresh supplied water and the required water the approach</p> | |

of reusing agriculture drainage water became a national policy due to its great potentials; as it provides a reliable supply of irrigation water rich nutrients to cropped fields.

In the meanwhile Egypt's share of water from Nile River is about 55 BCM per year, as mentioned before more than 80% of this percentage goes for irrigation but only 6.58 BCM of the drained water, with an average salinity 1.65 ds/m is reused each year.

In 1975, the government was planning to increase the percentage of water reuse by using marginal water, drainage water mixed with fresh water, for irrigation. But here the problem reaches its peak! The government was unable to implement this project. What threatened the approach is that the supply of the fresh irrigation water is becoming low in quantity and quality as well. Also the degradation of the drainage water quality is affecting the mixing process adversely. Consider the following hypothetical example; the mixing process requires 1 cubic metre of fresh water and 0.5 cubic metres of agriculture drainage water free of biological and chemical loads to produce 1.5 cubic metres of water that can be reused in the irrigation process once more. However the actual case is far from that, apart from being in shortage of fresh water the drainage water is actually saturated in chemical and biological loads as well as the industrial waste effluent that is being illegally discharged into drains in a regular manner. Figure (2) attached shows the regions affected by toxic pollution of drainage water.

Beside not being able to increase the percentage of reused water, they were convinced to entirely or periodically close drainage water pump stations due to the increasing degradation of drainage water quality such as :

- 1) Mahsama Pump Station in the Eastern Nile Delta was pumping approximately 200 million m³ of drainage water annually.
- 2) Upper Pump Station No 1 in the Middle Delta was constructed to pump approximately 100 million m³ annually.
- 3) In the Western Delta, the Umoum Reuse Project construction was finished during 1995. The project anticipated 1000 million m³ reuse annually of the drainage water.

Thus, now we are facing a problem that keeps on getting worse from two directions; from one side, Egypt's water share of Nile River is expected to decrease because of the construction of the GERD while the water needs are continuously increasing and on the other hand we cannot reuse drainage water as the quality of water in the drains are continuously decreasing.

So we are left with two approaches; the first is to use drainage water with its poor quality as fresh water is already scarce and this will have some serious negative effects on the soil by increasing its salinity which in turn decreases the permeability of the soil and decreases the ability of the roots of the plant to absorb water stop reusing. This untreated water is full of chlorides and sodium that reduce the rate of growth and productivity of the crops. Also the biological waste, sewerage water, with high concentrations of BOD and COD enhances the population of bacteria that harms humans, farmers, and animals health.

The second approach is to stop using drainage water at all, and that's the decision the Egyptian government started applying by closing the pump stations, as mentioned above, but this will no more be applicable as Egypt is already facing a water scarcity which is

expected to escalate as mentioned above. So no matter the quality of this marginal water there will be no option other than using it regardless its quality as one day Egypt will not have the luxury to choose between the two approaches. Unfortunately this day has already come as farmers started to illegally utilize drainage water in irrigation processes; by pumping directly from drains straight into the farm land.

By the time you finish reading this paper, a significant number of Egyptian babies would have been born, each of them in need for water and proper food that has to be fulfilled and proper reusing of drainage water is our hope to help stop the approaching water deficiency.