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Water management and conservation practices in Aird Zone: A case study of Bahawalpur, Pakistan

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Abstract: Water is the basic and vital source of life. Water Resource Management has become a key factor regarding a sustainable use of this resource. It is not only a matter of providing potable water. It is an imminent ecological, economic and social factor. Population of regions across the world suffers from acute water shortage. This situation will intensify due to climatic change and increasing population growth rate that caused a significant higher demand of potable water especially in arid regions. The precipitation is negligible to countervail the extraction of groundwater. The research study focuses on water resource and its management in arid region of Bahawalpur, Pakistan. The objective of the research is to find out the major source of water in the city and the method of water supply through city administration. It is also in focus to analyze the demand of water management through taxation in two research areas of different supply situation, because it is an immense issue regarding the sustainability of demand and supply system of water in Arid Zone. Findings of the paper reveal ground water as a major source of potable water that not only use domestically but also in agriculture. The water management composition of the city reflects huge gap of ground water management and its demand in Bahawalpur City, where as conservation practices of water are in practice.

Keyword: Water use practices and policy, Water resources, Water management, Bahawalpur

1. INTRODUCTION

The stress on water resources is from multiple sources and can take many diverse forms. The growth of urban cities, increased industrial activity, and dependence of agriculture sectors on chemicals and fertilizers has led to overcharging of carrying capacity of water bodies to assimilate and decompose wastes. (State of environment, 2005). www.environment.gov.pk/pub-pdf/StateER2005/Title%20&%20TOC.pdf http://www.environment.gov.pk/Publications.htm

Integrated Water Resource Management has become a key factor regarding a sustainable treatment of the resource water. It is not only a matter of providing potable water. It is an imminent ecological, economical and social factor. Potable water supports the efforts of containing Diarrhea (still cause of death to 1.5 Million people every year (cit. POPULATION REFERENCE BUREAU; 2008; p.8). In 2004, Pakistan stated a population growth rate of 1.9% while the projected figures 173 million in by 2010 and 221 million by 2025. These estimates suggests that the country would slip below the limit of 1000 cubic of water per capita per year from 2010 onwards. The situation could get worse in areas situated outside Indus basin where annual average is already below 1000 cubic meter per head **(Table 1)**.

Table 1: Availability of water in cubic meter (Pak. Env. report, 2005)

Year	Population (million)	Availability (m^3)
1951	34	5300
1961	46	3950
1971	65	2700
1981	84	2100
1991	115	1600
2000	148	1200
2013	207	850
2025	267	659

The study focuses to show a clear management lack and a gap that has to be closed on the supply side as well as on the demand side. The study focuses on water sources and management of arid region of Pakistan i.e. the objective of the research is to find out the major source of water in the city and water supply through administration authorities. Moreover demand management through taxation rates is analyzed in two areas having different supply situation, because it is a big issue regarding the sustainability of demand and supply working system of water in Arid Zone.

2. INVESTIGATED AREAS OF STUDY

Bahawalpur is located at 29° N and 71° E beneath the Cholistan desert, a western extension of the Thar Desert. The Climate of Bahawalpur can be

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defined as arid. With an annual growth rate of 4.93 percent, Bahawalpur ranks second place within Pak (first place: Islamabad with over 5 percent). The planning behavior of water infrastructure authorities is usually to assume an increased water demand in the future. Therefore the strategy is to develop the waterworks infrastructure accordingly. The costs should be recovered by taxes and when there is plenty of water (and even if there is not) a conservation of the resource water will not be promoted by them (c.f. UNEP; 2004). For the research study 5 areas of Bahawalpur are taken who are representative for the city regarding research work.

***Shahdra*:** Due to an increase of Migrants from India the Nawab[1] of Bahawalpur planned some schemes for poor, low income people including Shahdra.

Shahdra represents a slum area in Bahawalpur but due to the near of more developed areas (Model Town) it shows developing movements. The house sizes are small and the population density is high. Streets are almost tarred nut narrow.

Model Town (A, B and C)

Because of high pressure on the Wall City due to growing population in 1943 an architect from Hyderabad prepared a comprehensive town plan for Bahawalpur "Model Town". In the 1950's the residential scheme was under construction. Especially for high class businessman, Land Lords and high rank Officers it was build on Grid iron pattern with wide roads, open spaces and a low density.

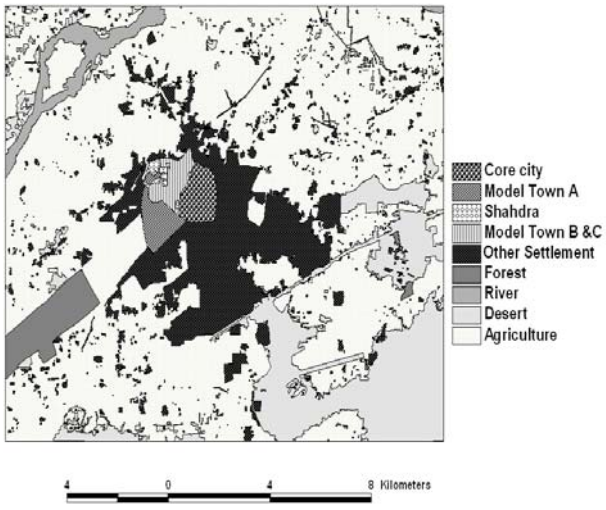

Fig. 1: land use of Bahawalpur (ANWAR, 2010)

A "Nawab" or "Nawaab" was the title for a province governor or viceroy in the Mogul empire. (www.wissen.de)

Model Town was chosen because of the diversity inside the area. While Model Town A reflects the original residential scheme, the high standard of this area decreases from A to C. Model Town A is a Defence Housing Area protected and organized by the military. The people who use to live there have high income and are working mostly in the tertiary sector (private and public services). In Model Town B and C the inhabitants are working in the secondary sector (industry, handcraft etc.) as labors in govt. offices and at the agricultural market.

Shahdra represents a slum area in Bahawalpur but due to the near of more developed areas (Model Town), it shows developing movements. The house sizes are small and the population density is high. Streets are almost tarred nut

3. Methods and techniques of water management

Water Supply includes administration authorities, production (quality standards), distribution, carry-off, treatment of sewerage and bringing this treated sewerage to a new purpose. Furthermore demand management through taxation or rates are closely connected to the supply side since recovering the costs is a big issue regarding the sustainability of a working system. The demand side means the inhabitants source of potable water (official supply net, private/ bottled water companies, self-extraction of groundwater). Additional aspects are the use and the carry-off (if the needed infrastructure provided by the administration is not working properly or doesn't exist). Last but not least the price of the good is important, e.g. for influencing the consumption behavior.

GRAMBOW (2008) points out, that the worldwide state of knowledge is, that a proper management of the water infrastructure is the biggest weakness and uncertainty talking about making a progress in developing the water sector.

1. RESULTS

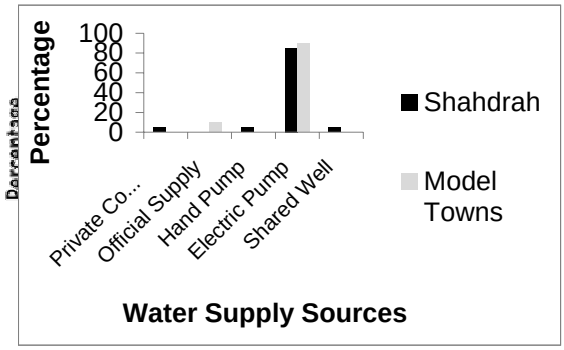

Fig. 2: Potable water source (ANWAR, 2010)

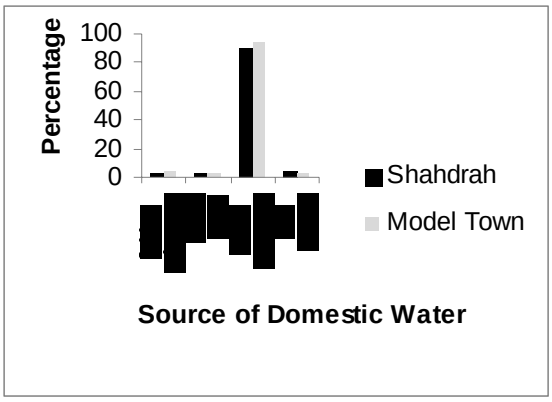

Fig. 3 : Source of domestic water (ANWAR, 2010)

The results of interviews from inhabitants show that 93% people in Model Town and 80% inhabitants of shahdra uses ground water as a potable water source through electric pump **(Fig. 2)**. While there is 17% official water supply in Model Town, there is no official supply of water in Shahdra. In the same way Domestic water source in the both areas is also Ground water as 96% and 94% people in both areas are extracting ground water through electric pump **(Fig. 3)**.

40% people in model town and 13% people in shahdra are using purifying methods for the drinking water. 60% people are not Purifying water for drinking purpose. Out of 13% people who are purifying the water for use in shahdra, almost 3 % people are using the electric filters for purification while more than 8% are boiling the water. 30% people are using electric filters to purify the water. People boil water to be used for drinking purpose in Model town. **(Fig. 4)**

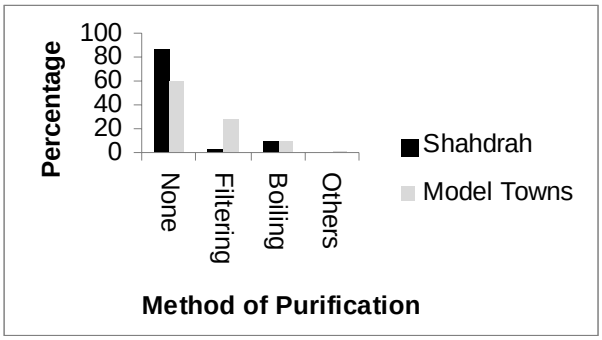

Fig. 4: Method of Purification (ANWAR, 2010)

There is no taxation rule in shahdra because of low socio economics and not availability of official water supply. In the Model Town A.B and C. 3% people pay the water tax 600Rs per year. 4% people pay the water tax 840Rs per years. 9 % people pay water tax 1200Rs per year. 4% people pay the water tax 1800Rs per year. 80% people are not paying any tax on water they consume. **(Fig. 5)** The reason for not paying taxes is due to no water pipe line present in model town C and the other variation in taxes is due to income differences of the inhabitants. The amount of tax in rupees is fixed by TMA (Tehsil Municipal Administration) of city Bahawalpur and Model town B and C Cantonment board for model town A. The results clearly show a difference in water quality of two areas having different socio economic conditions.

4. DISCUSSION

The available water sources for Bahawalpur are mainly groundwater and surface water. The **(Fig.5)** supply of water for Bahawalpur derives from the Sutlej and Chenab River. In 1947 the water availability was approximately 5000 m^3 per capita, in 2002 the availability decreases to 1200 m^3 per capita and is estimated to fall under 1000 m^3 per capita in 2010. An acute water shortage is expected in 10 – 15 years. Bahawalpur uses a daily amount of 8-10 m^3 per capita ground waters for domestic and private purposes. The main purposes surface water is used for is the agricultural sector (95%).

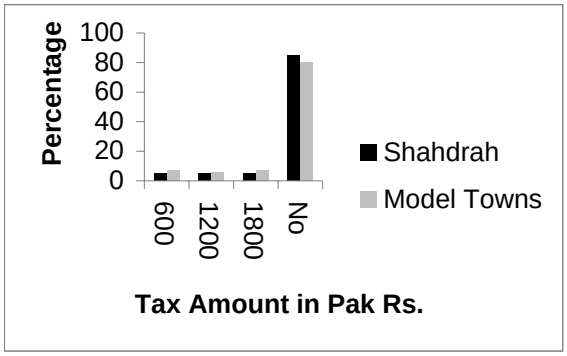

Fig.5: Tax on water supply (ANWAR, 2010)9%

Water Quality Standards

The basic purpose for making guidelines or standards is to prove safe drinking water to the citizen of the country. For the quality of Bahawalpur's water resource the city uses mainly WHO (World Health Organization) standards which are advisory in nature and are based on scientific research and epidemiological findings. These are general guidelines. Pakistan have established their own water quality standards to meet their national priorities taking into account their economic, technical, social, cultural and political requirements. PCRWR (Pakistan Council of Research in Water Resources) and PSI (Pakistani Standards Institute) have drafted drinking water quality standards. Others which are in use for the quality of water in Pak. are standards from EPA (Environment Protection Agency) and IBWA (International bottled water association).

Ground Water

Groundwater as one water resource for Bahawalpur is mainly managed by the government and by private persons. This case faces a big issue in Bahawalpur, because in fact there is no organization or body who feels responsible for developing or implementing groundwater policies. There are no approvals from any authority needed to drill for groundwater and installing pumps.

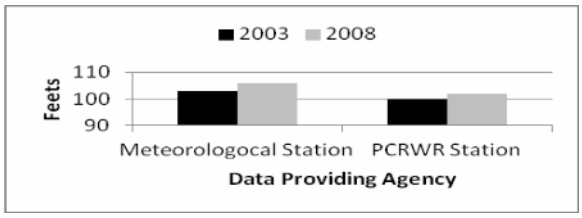

Fig. 6: Changes of the groundwater level from 2003 to 2008. (Data: PCRWR) Design: ANWAR,2010)

The quality of groundwater ranges from sweet to brackish. About the quantity of groundwater there is no information provided by the departments. Ground water quality measured on specific scale is represented in map.

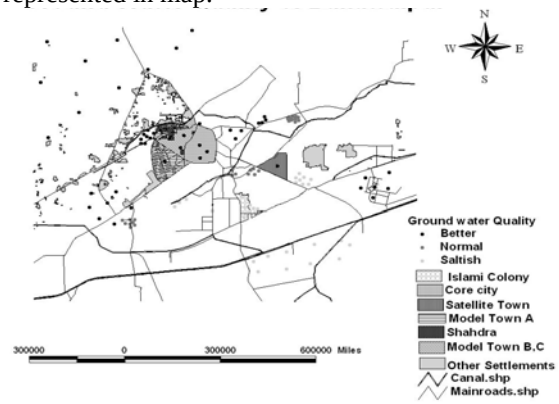

Fig. 7: Ground water of city Bahawalpur (Anwar, 2010)

5. CONCLUSION

The various aspects have been taken under consideration in the study shows that Bahawalpur is leading towards a situation of acute water shortage in future. The planning and management for the distribution of quality water is not working properly. Majority of potable water is extracted through ground with electric pumps. It shows the local bodies are not providing adequate supply of drinking water that can fulfill the demands of increasing population. Therefore inhabitants of the city are spending their money to buy the bottled water from various private companies, but as the results shows a small percentage of inhabitants are purchasing the bottled water from the area of good socio economic condition but on the other side inhabitants of Shahdrah (low socio economic area) are consuming the direct water from ground with the help of hand and electric pumps. Therefore this area is more threatened for epidemic diseases such as malaria, hepatitis, skin diseases etc. This shows a clear demarcation in the prevailing situation of Bahawalpur City.

Strategies to deal with water shortages, depends on local conditions including topography, the extent of water scarcity, available financial resources and technological and institutional capacities. As local govt. is gaining the revenue through taxes for water supply but the amount is not sufficient for good water management in the semi arid region. Therefore it is quite necessary that Pak. Govt. should provide funds to the semi arid regions of the country for water management that will not only fulfill the increasing population demands but as well as will solve the agricultural problems.

Moreover the most important of all are water conservation and water use efficiency improvement in existing water supply through water management reforms, policy reforms, and investment in the advanced technology and infrastructure and improving crop production and land potential through integrated efforts in water management and agricultural research and policy. Sound governmental policies regarding water allocations, distributions and use can help the city authorities to adopt better strategies to manage the scarce water resources.

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