A Study on Domestic Water Consumption in LashKar Gah City, Helmand, Afghanistan

Ahmad Ansari, Ahmed Hussein El-Shafiee
Faculty of Civil Engineering, Helmand University, Lashkar Gah city, Afghanistan

Abstract— Water is vital natural resource and an essential component of life on earth. The availability of safe water and adequate sanitation is crucial not only for health reasons, but also for economic development (UNICEF & WHO, 2008). This study was conducted in district 1, 2 and 3 of Lashkar Gah city in Helmand province, Afghanistan, for the period of January 2014 to April 2014. The aim to assess various factors which affect domestic water consumption. Data from 100 households were collected from the three districts and analyzed using IBM SPSS (Statistical Package for Social Sciences) and Microsoft Excel (spreadsheet) software. Household water consumption was found to be correlated with socioeconomic aspects such as size of household, distance of water source, household head's age and educational and the household income. Statistical analysis has been done utilizing a Pearson correlation matrix between water being used as a socioeconomic factor with the objective of minimizing the complexity and simplifying the interpretation of data. Per capita consumption was found to vary from around 160 L/c.d in small households down to around 80 L/c.d in larger households. Per capita consumption also varied with household income with as little as 20 L/c.d being used in poor households .Only 8% of households surveyed had piped water whereas 76% of the households surveyed relied on private tube wells. It would be desirable to extend this work to cover different seasons and to also include investigation of water quality.

Keywords: Domestic water consumption; urban household; source of water; Lashkar Gah city; Helmand, Afghanistan

1 Introduction

Water is one of the vital and most fundamental natural resources and an essential component of life on earth. The availability of safe water and adequate sanitation is crucial not only for the health reasons, but also for economic development (WHO & UNICEF, 2008). Five critical requirements for the existence of human are air, water, food, heat, and light. Contamination of each of these elements may cause severe health hazards not merely to man but also to animals and plants life (Punmia et al., 1995). In nature the water is revival source and generate continuously. The water is available in various forms such wells, streams, lakes and rivers etc. It is the responsibility of any water supply utility engaged in the supplying of water is to provide water resources to the district, city or a country by creating certain water tube wells, pipelines and other resources so that people can get pure and clean water for drinking purposes.

Yet the pressures on freshwater are rising continuously, from the expanding requirements of agriculture, food production and energy consumption to pollution and the weaknesses of water management. Climate change is a real and growing danger. Without excellent planning and adaptation, hundreds of millions of people are at risk of hunger, disease, energy shortages, and poverty (WWDR, 2012). The United Nations Economic and Social Council (ECOSOC, 2003) states that water shall be available and accessible to all human beings. Within several of the UNs adopted documents, water shall additionally be sufficient, affordable, safe, and acceptable, and contain a certain standard of quality.

1.1 Afghanistan's Water Resources

Afghanistan is well endowed with water resources, both surface and underground. The recent estimates show that Afghanistan has 75 billion (annual) cubic meters of potential water resources of which 55 BCM is surface water and 20 BCM is underground water. The annual amount of water used for irrigation is measured to be 20 BCM, which is 99 % of all water used in the city. It clearly depicts that 20BCM is the 99% of water that is being used whereas 1% is wasted. The amount of groundwater extraction is to some 3 BCM (Qureshi, 2002). Approximately 15 % of the total water volume used annually derived from alluvial groundwater aquifers (9 %) and spring (7%) and about 85 % from rivers and streams. Groundwater consumed from tube wells counts for less than 0.5 %. Therefore, the annual per capita water availability is approximately 2500 cubic meters (Qureshi, 2002).

1.2 Water Supply in Lashkar Gah City

In the 1960s, the US government engaged in major projects like water management, water supply, major irrigation systems inside Lashkar Gah city and surrounding districts, and housing development along the Helmand River, indeed the city (Lashkar Gah) earned the nickname "Little America or New York of Afghanistan" (Cullather, 2002). But unfortunately all the water supply system and infrastructure had been damaged due to incident of conflict, war, and bombardment or remained out of maintenance.

The water supply department was initially established in 1960 in Lashkar Gah city. The Department of Helmand and Arghandab Valley Authority used to be the in charge of water supply services since 1960, and Lashkar Gah city municipality was in charge of sanitation services. But since 2013 the Lashkar Gah city municipality has become the incharge of both, water supply and sanitation services for the Lashkar Gah city. The municipality supposed to provide service in terms of cleaning the open drains, cleaning of streets, solid waste management, water supply services, and irrigation of trees.

A small part of the city which is located along the Helmand River had modern water supply and sewerage systems, but the past 30 years of conflict and war has damaged all public infrastructures including drinking water supply utilities and sewerage system, Hence the system is no longer in use. Now the Lashkar Gah city households collect water from tube

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

wells, shallow wells, fetch and collect water from neighboring houses, public hand pumps. A few numbers of households have access to piped water in district 1 of Lashkar Gah city. For the black water (toilet water or human excreta mixed with water) disposal, each house has private septic tanks which are excavated inside houses or, outside on the footpaths of the houses. The septic tanks are not designed, built, and run according to the sanitary and environmental engineering criteria. The land is just excavated (3 or 4 m in depth and 2 × 4 m, width and length) with simple pipe connections to toilet. When the black water flows into the septic tank the leachate penetrates to soil and from soil to groundwater. Therefore, the leachate contaminates the groundwater, which is the main source of drinking water in city.

As mentioned earlier, the area of this study is located in the governmental and residential region, namely district 1, 2 and 3 or (Lashkar Gah city, Shaheed Ghaltan and Karta-e-Lagan districts) respectively. The city community consists of approximately 297,200 population scattered over the area of approximately 984 km^2, the city is divided into 8 districts (Lashkar Gah Municipality. 2013). Lashkar Gah city municipality, International City/Country Management Association and Commercialization of Afghanistan water and sanitation activity ICMA CAWSA programs are working jointly to provide water supply and sanitation services to the residents of the city. But until now, they could not cover the mentioned area. The municipality just provides water for drinking purposes to a limited households and a limited time of the day through elevated water towers. These water towers are not available in the whole city and districts. These are available at some places only. Some of the water towers in district 1 were being designed and constructed at the beginnings of establishment of the city, and some others constructed by UN- HABITAT, UNICEF, MRRD and other NGOs in few past years. UN-Habitat had been carried out a preliminary assessment of water towers in Lashkar Gah city, which was just about the capacity and location of water towers. Afterward, no assessment or evaluation has been performed yet about the existing water towers and water supply networks.

This study was carried out in Lashkar Gah city of Helmand province, covering district 1, 2 and 3 of city and population of 201,546. The study was carried out at the period of January 2014 to April 2014 for assessing various factors which affect multiple uses of domestic water and their impact on the sustainability of traditional domestic water consumption. Data from 100 households were collected from three districts namely district 1, 2 and 3 or Lashkar Gah city, Shaheed Ghaltan respectively. We considered 70 households from which 35 were taken from district 2 while the remaining households belong to district 3. The factors that were supposed to affect household water consumption and were found to be correlated with socioeconomic aspects were size of household, distance of water source, household's head age, educational level of household and income.

The major objective of this study is to investigate and assess the domestic water supply system and water consumption, in Lashkar Gah City of Helmand province Afghanistan.

The below are the specific objectives of this study.

1. To assess and analyze the existing condition of shallow, tube, WCN and piped water supply system.
2. To investigate the factors influencing households' domestic water consumption and households' choice of water source.

2. Method of Data Collection

In this study primary as well as secondary data were collected. In order to find out the exact figures of the domestic water consumption in the Lashkar Gah city of Helmand province, Afghanistan, both the primary and secondary data were collected from selected areas during the study.

2.1 Primary data source (questionnaire survey)

The primary data source was the questionnaire survey and interviews. Since the establishment of the city it has been the first time the residents were asked about the domestic water consumption through a questionnaire survey. The data comprises of meetings with community elders, chief and officers, interview with local residents, discussion about sanitation with department of public health, interview with municipality staffs about the domestic water consumption. During the primary data collection on site it was observed that there was much difference in water consumption between high income families and low income families. The wealthier families were consuming much water than poor families. There were many poor families; even they did not have wells inside their house compounds, so they had to collect the water from their neighbors or from the public water towers.

The current situation of water supply system in the city depends on tube wells, shallow wells, public water towers, and piped water supply. The households which have piped water connection also possess a tube well in their house, because the pipe water is not regular and have many water shortages. Even some families they did not have any water collection source in their houses and some families, their water wells were contaminated or the taste of the water was salty due to the some mineral near to the water wells. Therefore, the mentioned families collect water from their neighbors, mosques, and public water towers and hand pumps. The water from tube wells was extracted by electric submersible water pumps, hand pumps and by buckets from shallow wells. There was no any wastewater treatment facility. The sewerage system of the city is in worse condition and sewage services were in very low level, even it was considered zero. Each household simply used to flow their wastewater to the ditches in front of their houses.

2.2 Secondary data sources

For secondary data, the study began with a review of the literature sources by reading library reference materials such as journal papers, maps, reports, dissertations, articles, and books. Review of the relevant material sources that have been

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

published in the same field, also the governmental departments and non-governmental organizations were requested for the data and figures. The secondary data were collected from the below sources specifically:

Governmental Departments:

- HAVA (Helmand Arghandab Valley Authority)
- Lashkar Gah City Municipality, Irrigation department
- Water Supply Department
- Department of Urban Development Affairs
- Department of Rural Rehabilitation and Development

Non-governmental Departments and NGOs:

- RAMP UP-SOUTH (Regional Afghanistan Municipality Program for Urban Population)
- UN- HABITAT (United Nations Human Settlements Program)
- ICMA CAWSA (International City / Country Management Association Commercialization of Afghanistan Water and Sanitation Activity).

2.3. Data Analysis of Initial Information

Data from the 100 households were collected from three districts and analyzed using IBM SPSS (Statistical Package for Social Sciences) and Excel software. Statistical analysis has been done utilizing Pearson correlation matrix between socio-economic aspects with the objective of minimizing the complexity and interpretation of large sets of data.

3. Results and Discussion

3.1. Existing Sources of Domestic Water in Lashkar Gah City

According to International City / Country Management and Commercialization of Afghanistan Water and Sanitation Activity
,(ICMA-CAWSA. 2013), they conducted a survey investigating number and condition of elevated water towers in Lashkar Gah city where they found about 20 water towers were under operation and providing domestic water to the households. The water towers are located at different spots in the Lashkar Gah city. Fig. 1 shows the exact locations of the water towers in the Lashkar Gah city. All of the towers are supplied by 20 public production wells. Some towers in district 1 are connected to the city water supply network, but not functioning regularly due to rusted pipes, lack of maintenance and operators, leakage of pipes and financial woes. Most of the water towers are not connected to the water supply networks, or the areas do not have a water supply network system. As mentioned earlier, most of the households had their own shallow or deep wells within their house's compound or some of the households were collecting water from neighbors' wells or public water utilities. The extraction of water was through hand pumps, buckets and electric submersible water pumps.

The public water utilities up to date covers only almost 8 percent of the whole residents of the city just for drinking water and the rest of (92%) population rely on their own other sources such as private tube well (PTW), shallow wells (SW), and water collection from neighbors (NWC). Fig. 2 shows the chart depicting percentage of residents relying on PTW, PHP and WCN. The depth of the tube wells varies from region to region between 18 to 75 meters and the depth of the shallow wells are between 15 to 30 meters.

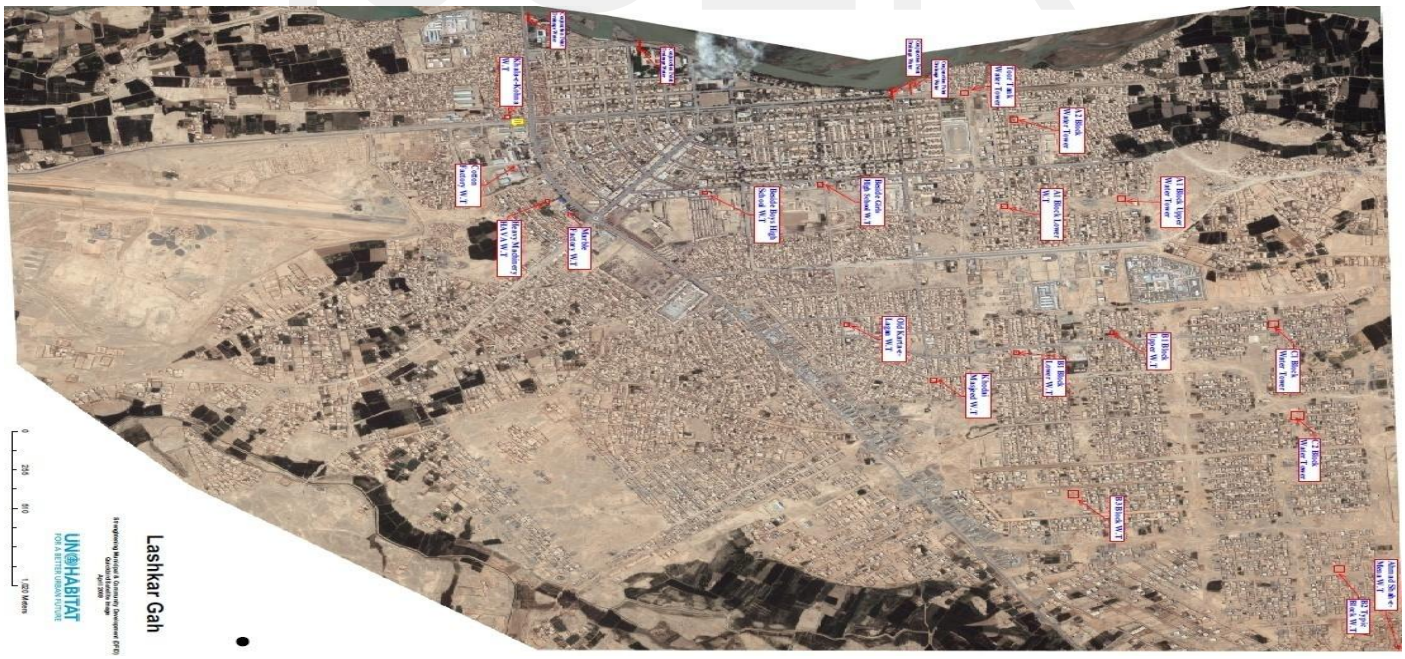

Fig. 1 Lashkar Gah city water towers map
Source: UN-HABITAT

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

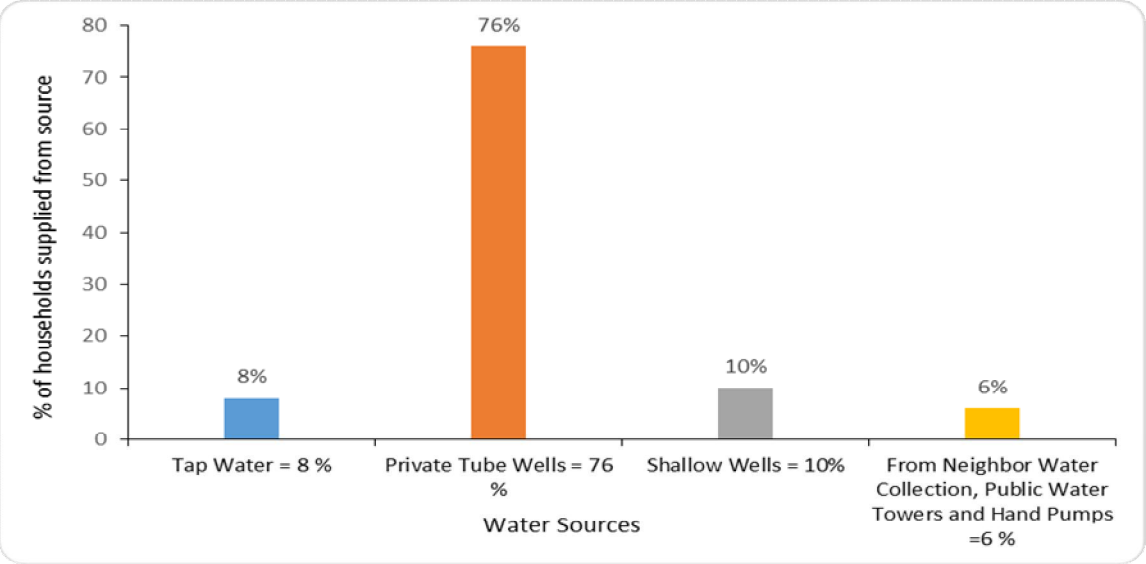

Fig. 2 Sources of Drinking Water in District 1, 2, and 3

3.2. Storage of water in Lashkar Gah city

Six steels and wooden water towers were built during the establishment of Lashkar Gah city, at different locations in district 1 and the remaining of water towers were constructed from RCC Concrete and steel rebar in the other eight districts of the city. Each water tower has the capacity of 35 cum and gets filled up twice a day, at 10 am and in the afternoon around 3 pm. The water towers provide 70,000 liters of clean water for only two hours in the morning and two hours in the afternoon (Lashkar Gah Municipality. 2014). Households with tube well have water tanks inside their home with different capacity. Fig. 3 and 4 show a public water storage tower and a storage tank at a house with tube well respectively. Groundwater quality varies slightly from one well to another, regardless of the well's depth, but the water of different wells exhibit a huge difference in quality due to the chemical composition of the underground and the presence of certain kinds of salts, gypsum, limestone minerals and rocks close to the source of groundwater.

3.3. Comparison of households' water consumption with household size

Family composition and size are related strongly with household water consumption in Afghanistan. Findings from the conducted questionnaire survey in district 1, 2 and 3 of the city indicate that, there are three types of households viewed from economic perspective: Low income, middle income, and high income households. It is better to include here that the categorization of income level is based on socioeconomic perspective and people are divided according to the population and survey made by me. So I consider these three household categories as Low, middle and high with the reference to economic point of view in Afghanistan. From the aspect of social composition of the household's structure in the city, there are two types of household structures, specifically the single, and multiple households. For the single household structure, only one family is living in a house while under the multiple household structures, more than one family is living in a house. According to the central statistics organization of Afghanistan, the national average household size is 6.3 persons in a single family but the finding from this study shows it is approximately 7.4 persons for a single family in the Lashkar Gah city. Most of the households are headed by male person, with very few households were headed by women. The questionnaire survey shows that out of 100 houses in all three districts, 62 are of single family and 38 are of multiple household structures. For single household it is found an average of 7.4 persons live in a single family with standard deviation of 2.09 and correspondingly an average of 20.63 persons are living in a multiple household with standard deviation of 5.15.

To produce a correlation between water consumption and size of household in the city, a combination of questionnaire and face-to-face interview was conducted among the PTW, SW and WCN+HP+PWT water consumers. The survey discovers that the per capita volume of water decreases with increasing household size. The finding also shows that the amount of water used for hygiene (bathing, laundry and cleaning) purposes grows slightly with an increase in household size. The consumption of water in a household for other purposes such as watering and cleaning the house, cooking, and dishwashing found to decrease with a larger household size.

Fig. 5 shows the average per capita consumption for each household size but at a smaller scale and expresses the possible impacts of the small sample size. It is reasonable to assume that the per capita consumption can decline more consistently with an increase in household size. This decline of water consumption per capita suggests household's uses of water for dish washing, clothes washing and water used for making bread, cooking, and cleaning the house are minimized per capita basis in larger households. In the graph illustrated below, we take 1 data point as 10 scales which means that point 1 on x-axis show 10 households and similarly this goes on for

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

the others.

Fig. 3 Public water tower

Fig. 4 Household storage tank

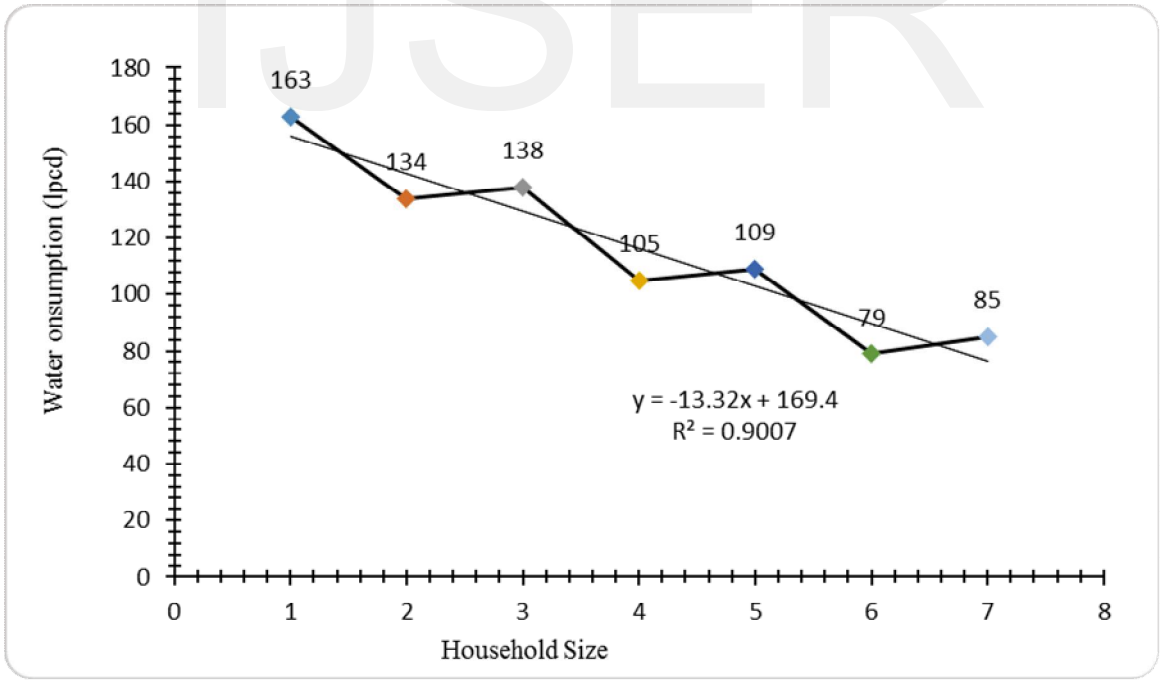

Fig. 5 Household size vs water consumption

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

3.4. HOUSEHOLD INCOME VS WATER USE

The key findings from the questionnaire survey show that the household income is a strong determinant of the supply and consumption of domestic water. Tshikolomo et al. (2012) states, "It was argued that people could be water poor not because of there is no safe water in their area but because they are income poor''. In the other words, despite of water being available in their region, the people might fail to get access to safe drinking water due to they cannot afford the cost of doing so (Dungumaro. 2007).

The household characteristics that include the number of people in the family (adults and children), residence size, highest education background, and household income all have a statistically important and positive impact on household water consumption. A firm relationship has been conceived during a questionnaire survey in the study area between household income and water use. To conceive such a relationship between the income of the households and the water consumption among the residents in the Lashkar Gah city, the respondents are divided into four categories proportioned to their occupation: labor, government employee, private business employee and jobless or unemployed. Among the mentioned categories of the occupants there were low income, middle income, and high income households under each. Out of 100 respondents 33 are labors, 23 are government employees, 21 are private business employees, and 23 are jobless.

It is found that the greater household income, the higher average amount of domestic water usage and the number of indoor amenities. The household with low income has only one pit/hole toilet, washing clothes by hand, and using buckets for bathing and with no green area (backyard) unlike the high income households which have more than two flush toilets, washing clothes with washing machine, using the shower for bathing and having green area inside their houses.

Throughout the survey among households, we classified that the average household monthly income ranges from $1 to $200 for low income, from $201 to $400 for middle income and $401 and above for high income household, as shown in Table 1.

Table 1 depicts the three categories of households according to their monthly average income in the entire district 1, 2 and 3 of Lashkar Gah city. Out of 100 households in the district 1, 2 and 3 in Lashkar Gah city, 42 households are of high-income, with most of them have their own source of water inside their houses. Twenty households are of middle-income while the remaining 38 are of low-income households. The size of average household in the study area is 7.4 persons with monthly income of ($1 to $200), The upper limit equates to a per capital daily income of $0.9 compared to the United Nations poverty line which is US$1.25 per capita per day (World Bank. 2008).

The plot of water consumption data against income of household as depicted in Fig. 6 exhibits a rather high correlation (R^2 = 0.791). As revealed by the regression line (y = 0.3295x - 13.143), the quantity of consumed water increases with an increase in the average household income in the studied area.

Table 1 Household monthly income and access to water sources

Income of Households	Tap Water	Tube well	Shallow Well	WCN + Public Water Towers & Hand Pumps	Total
Low-Income ($1 to $200 US)	2	26	6	4	38
Middle-Income ($201 to $400 US)	2	14	2	2	20
High-Income ($401 US and Above)	4	36	2	0	42
Total	8	76	10	6	100

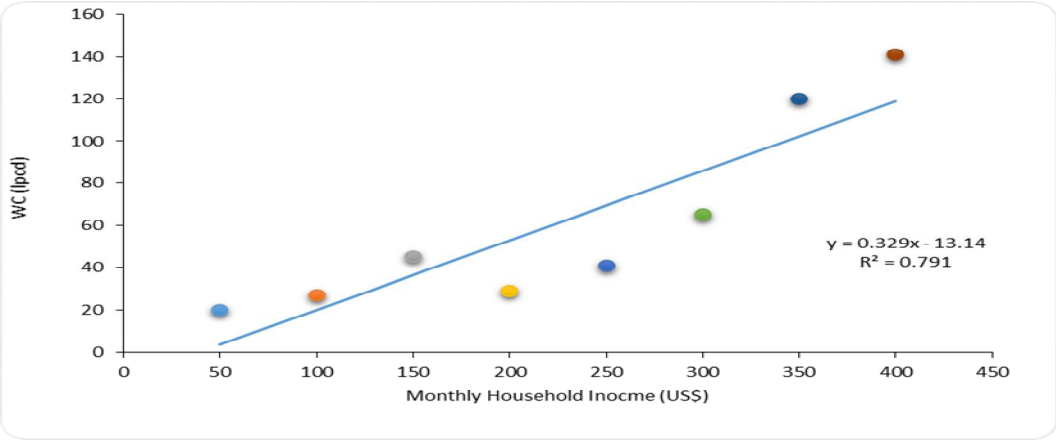

Fig. 6 Average W.C. against household income

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

3.5. Distance of water source from residential site and HH water use

Regarding the findings from the studied area, a decrease in the distance to the water source is found to be correlated with an increase in per capita water use. In order to support the findings; (Stefanie et al. 2005), and (Gazzinelli et al. 1998) also noted that the further away a water source is located from the house and the longer one must queue, the less water from that source will be used. It is very important to determine how long it takes for water fetching, because fetching of water is often the responsibility of teenagers and children under the age of 16. The water collection frequency as mentioned previously is twice daily, in the morning around 9 to 11am and afternoon around 2 to 5pm, in the district 1, 2 and 3 of city. These are the hours where children and teenagers should be at school. According to my opinion I think most of the children don't come to schools because they spent their time mostly to collect water for household purposes. Therefore, the task of collecting water sacrifices students' (teenagers and children) precious school hours. The other dangerous impact of the water fetching by children can also cause conflict leading to violence with other children during water collection. Very hot and very cold weathers may also affect the health of the children.

Water sources such as WCN, public water towers and hand pumps are located within 15-200 meters from residential sites. The households would normally travel long distance to collect water due to absence of water sources at home or having shallow well which by then dries up given long drought or contaminated by unsanitary septic tanks. The average time for fetching water is at minimum 34.7 minutes, which includes both time taken traveling to and fro between home and water source and queuing time .This indicates that the average time for collecting water was significantly dependent on the water source whereby among those who depended on free water source (WCN+ Public Water Towers & Hand Pumps).In comparison to the water collection system of houses which have their own tube well inside their house's compound and those who do not have water source inside their house, is five times higher. This means, water fetching time is just between 2 to 7 minutes for houses with tube well in inside their compound.

Fig. 7 shows the influence of distance of water source from residential sites on the amounts of water fetched in the study area. There is a considerably strong correlation ($R^2 = 0.6878$) between the distance of water source from residential area and the quantity of water fetched. The regression line ($y = -0.1839x + 26.131$), projects the quantity of water gathered increases with a decrease in the distance between water sources and residential areas. This also affirms Katsi's report that water sources near to residential sites provide households with a quick access to water supply (Katsi et. al 2007).

3.6. Price Estimation for New Water Source and Water Cost

The total cost estimation for digging a new water tube well with fixtures (submersible water pump or hand pump, pipes and casing, wire, power generator, concrete slab) together with the estimated monthly fuel and maintenance cost is estimated in Table 2. Allow income household with a monthly income of $200/US. One would have to spend 7-month's income in order to own a water source. Findings from the questionnaire survey show that, out of 38 low-income households, 18 households own their houses, while the remaining 20 families are living in rental house because in many houses where water wells are available results in high rents and costs and the residents need to pay the landlords for availing the facility of water.

The socioeconomic conditions of the households in the study area imply the households which are in the income groups of (>US$401 and US$201 to US$400) per month, are spending (US$0.65 – US$1.25) for collection of 1000 liters water per day from tube wells. This spending comprises of the price of fuel and maintenance cost for the power generator and submersible water pump. The households with monthly income of (US$1 to US$200) are collecting water from free sources (SW + WCN + PWT + HP). Therefore, the water price for the middle and high-income households are affordable. But for the low-income households, whose monthly income is between (US$1 to US$200), the water price is not affordable, because they are living under the poverty line.

3.7. Educational Background of Household's Head

It is anticipated that a higher level of education of household members corresponds to a higher level of awareness of health benefits in using water (in terms of both quantity and quality) (Keshavarzi et al. 2006; Sandiford et al. 1990).We hypothesized then the level of education would positively affect the choice of water consumption. As a proxy for level of education, this study is also used to determine the relationship between educational background of the head of household and the household's domestic water consumption. From the completed survey questionnaire and the conducted in depth interview we obtained the education background of each respondent. In the questionnaire, it was asked from the respondents their highest attained education level: primary, secondary, high school, or university. These variables account for not only the educated household's head, but also those of other who are illiterate head of households. The educated people in the surveyed area are found to be more concerned about the hygiene of the consumed water. Specifically educated people tend to be more well-informed of potential health problems associated with the use of contaminated water. Thus, most of the households of surveyed educated head are relying on tube wells and with even some of them use water filter to purify water.

Highest levels of educational attained are divided into four categories, with most of the respondents are only high school graduates and 10 respondents are illiterate. The correlation between education background of household head and water used for drinking and cooking is not significant, but correlation between highest education level attained and hygiene (bathing, laundry, and cleaning) is computed to be r= 0.31 which is a significant positive correlation, as shown in Table 3. It means that the education level increases, the level of awareness of household about the hygiene and health benefits of water consumption also increase.

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

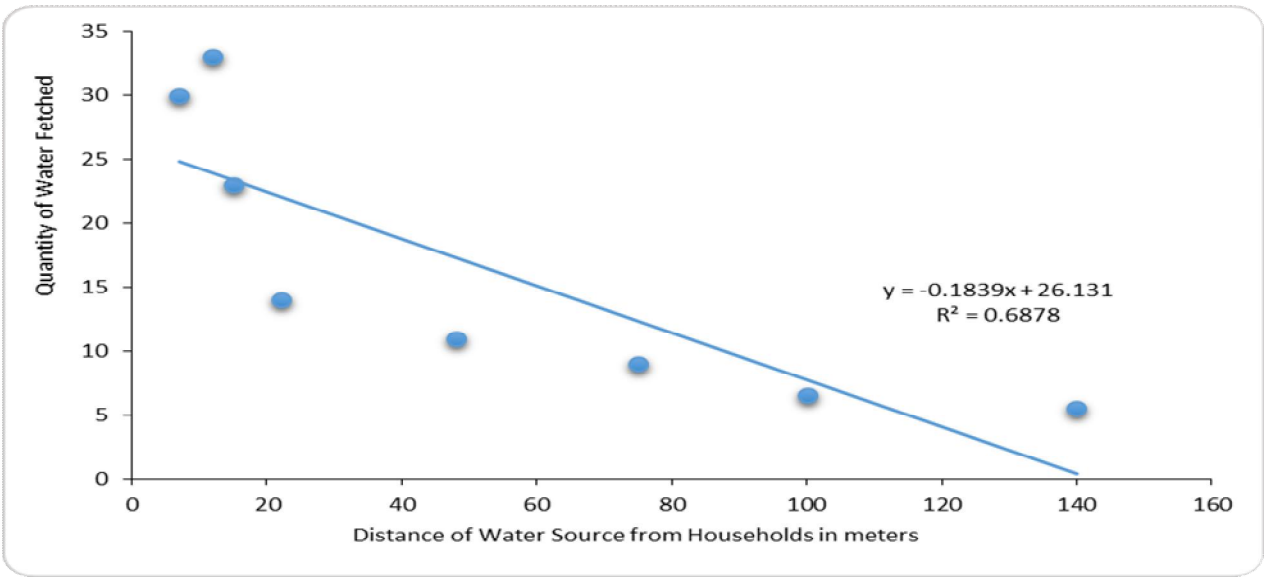

Fig. 7 Influence of water source distance from residential area on quantity

Table 2 Estimated price of a tube well in Helmand province

Estimation Price for Tube well (Dia 6 Inch) and Depth 75m					
S/N	Item Name	Unit	Quantity	Unit Cost (UD$)	Total Cost (UD$)
1	Boring Cost	m	75	5	375
2	Pipe	m	75	4	300
3	Casing Pipe	m	60	6.5	390
4	Submersible Water Pump or H.P	each	1	120	120
5	Concrete Work (Slab and Ditch) L/S)	L/S	1	70	70
6	Electricity Wiring	L/S	1	20	20
7	Power Generator	each	1	110	110
Total Cost For One Tube well Monthly fuel and maintenance cost: 20$ Here L/S stands for Lump sum value Here H.P stands for hand pump					US$1385

Table 3 Correlation matrix between household WC and 4 in-dependent variables

	[variable:1]	[variable:2]	[variable:3]	[variable:4]
WC /person/day	1			
Head of household age	-0.035[a]	1		
Education Level	-0.047	-0.051	1	
Hygiene (bathing, laundry, cleaning)	-0.025[a]	0.00	0.31[b]	1

$p < 0.05$
[a] Significant at $p < 0.01$
[b] Significant at $p < 0.05$

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

3.8. AGE OF HOUSEHOLD'S HEAD

A range of socioeconomic and demographic variables determines a household's quantity of water demand. An obvious one is occupancy and a more subtle one is occupant's age (Fox et al. 2009). Keshavarzi et al. (2006) reported that there is a positive significant correlation ($r=0.17$, $p<0.05$) between the head of household's age and the amount of water used by the household. This is probably the result of indifferent attitudes towards environmental issues, where an older head of a house has less grasp of the need for water preservation. Therefore, they hardly scrutinize their household's water consumption. Nevertheless, it is found from the study area that elders are thriftier concerning the amount of water consumption especially during the winter and do make it a priority the conservation of water. This implies instead a negative correlation between age of household head and the amount of water used. The factors may be the religious obligations or climate condition.

3.9. WATER AND SANITATION

The finding shows that the type and usage of toilet depends on the income of households in district 1, 2 and 3 of Lashkar Gah city. 10. 66% of household are using hand flush toilets, coincide with the middle income household. The 11% of the high-income households were utilizing flushed toilets and 23% of low-income households are using pit / hole latrine.

4. CONCLUSION AND FUTURE RECOMMENDATION

4.1. CONCLUSIONS

It is obvious that understanding domestic water consumption and factors which affect residential water demand and choice of water source are vital for some planning purposes in the Afghanistan's water supply sector. The main objective of this study is to investigate and assess the current condition of domestic water supply system and drinking water consumption in district 1, 2 and 3 of Lashkar Gah city.

In order to achieve the objectives and know the condition of existing domestic water supply system and water consumption in district 1, 2 and 3 of Lashkar Gah city, combination of distribution of questionnaire and in-depth interview conducted with water consumers in the three districts.

Currently the public water utilities constitute only 8 percent of drinking water supply in Lashkar Gah city. The remaining 92 percent drinking water supply is being relayed through other water sources like private tube wells (PTW), shallow well (SW), and collection of water from neighbors (NWC). A small percentage of poor households travel between 20 to 140 meters a day for clean water collection therefore, the wealthier households have greater access to clean water vice versa

Therefore, a medium correlation ($R^2 = 0.6878$) was found between the distance of water source and quantity of water fetched, and a significant positive correlation was found between household monthly income and water consumption. Two types of households were found during the study in the area, single and multiple households. The study discovers that the per capita volume of water consumed decreases with an increase of household's size. Digging a new water source like tube well normally costs US$1405, which is unaffordable for households living under the poverty line, i.e. with per capita per day US$ 1.25. Another pair of variables of interest to this study is between education level of the leader of household and the households' domestic water consumption. Households' whose heads are highly educated, are more careful about the use of water for hygiene. Specifically educated people tend to be better informed of potential health problems associated with the use of unimproved water.

The findings show that the type and usage of toilet depends on the income of households in district 1, 2 and 3 of Lashkar Gah city. Out of 100 surveyed households, 66 households fall under the category of middle income use hand flush toilet. All 11 high-income respondents utilize flushed toilet and 23 households of low-income rely on pit / hole latrine

4.2. FUTURE STUDY AND RECOMMENDATIONS

This study was carried out in district 1, 2 and 3 of Lashkar Gah city of Helmand province. It will be great if in the future, a similar study (survey for water consumption) can be carried out covering the remaining 5 districts of the city. The survey was conducted in the period of January 2014 to April 2014, while the water consumption can change in the other months of the year; therefore, it is also strongly suggested if the survey could be conducted on periodic basis throughout the year. This study covers just the domestic water consumption patterns; it could be helpful if the quality of water for chemical and physical parameters are also analyzed in the area.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude and owe my deepest appreciation to the guidance and advice I have benefited from my supervisor, Dr. Muhammad Mukhlisin and my other lecturer, Assoc. Prof. Dr. Ahmed Hussein El-Shafiee since the beginning of the project. It is an honor for me to express my gratitude to the Ministry of Higher Education of Afghanistan for their scholarship that has supported me financially. I also would like to thank the leadership of Helmand University for their encouragement and academic support during this study. I would like to thank the people of district 1, 2 and 3 of Lashkar Gah city of Helmand province for their assistance regarding to participating in the questionnaire survey and giving their precious time for answering the questions and face to face interview. This study would not worth without their cooperation.

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

1. References

2. Cullather, N. 2002. Damming Afghanistan: modernization in a buffer state.The Journal of American History, 89(2), 512-537.
3. DFID 1998. Guidance Manual on Water Supply and Sanitation Programs. Farrington, J., Carney, D., Ashley, C. and Turton, C. (1999) Sustainable Livelihoods in Practice: Early Applications of Concepts in Rural Areas.
4. Dharmaratna, D. and E. Harris. 2010. Estimating Residential Water Demand Using the Stone-Geary Functional Form: the Case of Sri Lanka
5. Dungumaro, E.W. (2007). Socioeconomic Differentials and Availability of Domestic Water in South Africa. Physics and Chemistry of the Earth 32, 1141 – 1147
6. Fox, C., McIntosh, B.S. & and Jeffrey, P. 2009. Classifying Households for Water Demand Forecasting Using Physical Property Characteristics
7. Gazzinelli A, Souza MCC, Nascimento I et al 1998. Domestic water use in a rural village in Minas Gerais, Brazil, with an emphasis on spatial patterns, sharing of water, and factors in water use
8. ICMA CAWSA. (International City/County Management Association Commercialization of Afghanistan Water and Sanitation Activity
9. Katsi, L., Siwadi, J., Guzha, E., Makoni, F.S. & Smits, S. 2007. Assessment of Factors which Affect Multiple Uses of Water Sources at Household Level in Rural Zimbabwe – A Case Study of Marondera, Murehwa and Uzumba Maramba Pfungwe Districts
10. Keshavarzi AR, Sharifzadeh M, Haghighi AAK et al (2006). Rural domestic water consumption behavior: a case study in Ramjerd, Fars province, I.R. Iran.
11. Kohlmann. 2003. What Is Ph, and How Is It Measured (A Technical Handbook for Industry
12. Lashkar Gah Municipality 2014. Hard Copy of annual report
13. Nyong AO, Kanaroglou PS. 1999. Domestic water use in rural semiarid Africa: a case study of Katarko village in the Northeastern Nigeria. Hum Ecol 27(4):537-555
14. Parliamentary Commissioner for the Environment. 2000. Ageing Pipes and Murky Waters-Urban water system issues for the 21st century. Wellington, Parliamentary commissioner for the Environment, June 2000
15. Punmia et al. 1995. Water supply engineering, second edition, 1995, ISBN: 978-81-318-0703-3
16. Qureshi, 2002. Water Resources Management in Afghanistan: The Issues and Options Yamane (1973). Taro Yamane formula (1973) calculation of sample size.
17. Sandiford P, Gorter AC, Orozco JG, Pauw JP 1990. Determinants of domestic water use in rural Nicaragua.
18. Stefanie, E, Iskandarani, M, and Useche, M.P (2005) Improved Water Supply in the Ghanaian Volta Basin:Who Uses it and Who Participates in Community Decision-Making
19. Tshikolomo et al. 2012. Water Supply and Requirements of Households in the Luvuvhu-Letaba Water Management Area of South Africa, 2012
20. UNICEF AND World Health Organizaiton, 2008. Progress on drinking water and sanitation. ISBN 978 92 806 4313 8
21. United Nations Economic and Social Council. 2003. General Document E/C.12/2002/11, Committee on economic, social and cultural rights, Geneva, 11-29 Nov. 2002.
22. WHO (World Health Organization)/UNICEF (United Nations Children's Fund). 2010. Progress on Sanitation and Drinking-Water: 2010 Update. Joint Monitoring Programmer for Water Supply and Sanitation.
23. World Bank. 2008. World Development Indicators. World Bank Key Development Data and Statistics
24. WWAP (World Water Assessment Programme). 2012. The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk. Paris, UNESCO.