EVALUATING ADDITIONAL SOURCES OF WATER IN THE DRY SEASON IN HAGAJERER AREA OF BALAMBALA SUB-COUNTY, GARISSA COUNTY, KENYA

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Abstract

In many arid areas of Kenya like Garissa County, potable piped water does not exist in rural areas. Thus, in an area like Hagarjerer in Balambala Sub-County, residents rely heavily on water tankers to bring water from River Tana for their daily survival. The study aimed to establish the viable water supply option. The research methodology involved interviews as well as observations of the existing water situation. The ranking of options showed that additional trips of water tanks trucks was ranked first followed by drilling of borehole, and last was pumping of water from earthpan. Therefore, the current water crisis can be solved by increasing the number of trips made by water tank trucks while exploring the option of drilling a borehole.

1.0 Introduction

Hagarjerer village is located in Danyere location of Balambala Sub-county of Garissa County. It is situated 180 Kilometres west of Garissa town. The road connecting Garissa town and Garbatulla town cuts the village into two. Hagarjerer community faces acute water shortage for around six months despite intensive research and implementations of water projects over the past five years in the area. This is not acceptable since access of water is a human right issue as per the declaration by United Nations (USAID, 2009). However, blame cannot be apportioned to anyone because the study area lies in an arid area that experiences droughts every 3-4 years and has rainfall which is erratic (UNDP, 2010).

Access to water by the rural communities in Kenya is less than 50% (Elimelech *et al*., 2009) and this could be the reason why Kenya aims to conserve water resources and start new ways of harvesting and using rain and underground water (GOK, 2007). Therefore, there was need for a study focusing on water supply in such a remote community in Northern Kenya because this part of the world lay claim of the world's greatest water and sanitation challenges (WHO/UNICE, 2008). This study was justified because it is apparent that the Millennium Development Goal (MDG) of halving the 1990 figures, the proportion without access to water and sanitation by 2015 (UN, 2000) will not be achieved if nothing is done to fast track the process of the goal attainment. The project proposal was initiated by the community when the researcher was working on a road project in the area, therefore, ownership and maintenance by the community will not be a problem (RELMA in ICRAF, 2005).

In designing water supply schemes in such areas there is need for information on water consumption. RELMA in ICRAF, 2005 suggests the following values of consumption in litres per day: People (20), camels (15), cattle (15), and donkeys (15). Delivery of water from one point to another requires some form of energy and for a place like Garissa which has an average of 250 hours of sunshine per month solar energy can be used (www.weather-and-climate.com, 2015). When it comes to pumps, there is need to use solar pumps as they are environmental friendly. In this study the water demand was restricted to the current demand as it helps to understand the challenges that are still there for Kenya in trying to meet the Millennium Development Goals. Such a study is useful to the County Government of Garissa as it gives additional information to aid in prioritizing of County projects. The study aimed at determining the best option for water source in the study area with the following specific objectives: to determine the water demand, and to estimate the cost of the current available water supply options.

2.0 Methodology

The research involved interviewing the local leaders to get the population of people and animals. It also entailed observing the existing situation of supply of water.

3.0 Results and Discussions

3.1 Population

It was found from a survey done on 24th September, 2014 that the village had 300 inhabitants living in 80 households. There are 30 camels, 12 donkeys and 500 goats.

3.2 Assessment of existing situation

The village receives two trips of water tank in one month equal to 30 000 litres of water. The water is off loaded into ten water tanks situated in strategic places in the village. Each tank has a capacity of 10, 000 litres. The time between the two trips can take too long resulting in shortage of water. During this period, residents of the area have to travel 40 kms to Libhalo to look for water using donkeys.

In addition to water tank residents get water from an earthpan. Pans are excavated water storage structures without a constructed wall and stores runoff and for community water supply. The pan was constructed by National Water Conservation and Pipeline on behalf of Northern Water Services Board and funded by Kenya Government in 2010. The pan measures 100 m by 70 m by 2.5m and has a capacity of 17, 500m^3 of water which is more than the 10 000 m^3 earth pan suggested by RELMA in ICRAF, 2005. The water in the pan last only one month due to high consumption by livestock that migrate to the area during that time. The water in the pan is lost through evaporation, runoff and infiltration. Rapid runoff during the rainy season observed in this region often results in a high proportion going to waste or even being destructive (RELMA in ICRAF, 2005) and hence the construction and maintenance of the earth-pan in the area (Plate 3.1).

Plate 3.1: Photo of water pan

The capacity of the pan reduces due to silt accumulation at the bottom. The pan was rehabilitated by desilting in 2013. The rehabilitation was done by CARE-KENYA through Millenium Water Alliance in collaboration with the Ministry of Environment, Water And Natural Resources. Rehabilitation involved digging a trapezoidal trench of 500m^3. In addition to trench digging a handpump with a channel and a trough was installed. The hand pump was broken at the time of observation Plate 3.2.

Plate 3.2 :Photo of hand pump

3.3 Water demand

Table 3.1 Water demand calculation in litres/day

Category	**Calculation**	**Total (litres/day)**
People	300 x 20litres/day = 6,000	6000
Camels	30 x 15litres/day = 450	450
Sheep/goats	500 x 3.5litres/day = 1750	1750
Donkeys	12 x 15 litres/day = 180	180
		8380
	Others and losses 10%	838
	Grand total	9218

Using the estimates of RELMA in ICRAF, 2005 the current water demand (Table 3.1) is 9218 litres/day for people and animals. The flow rate is 6.4 litres/ minute. In a month the consumption is 276,540 litres, this is approximately ten times the water supplied by water tank trucks. The longest dry season in the area lasts six months and hence the current water demand to last for six months is 1, 659, 240 litres which can be provided by the earthpan of capacity 17, 500,000 litres. The total water delivered by the water tank trucks in 6 months is 6 x 2 x 15,000 = 180 000. So there is need for additional 1,479,240 litres/ six months to meet the current demand.

3.4 Way Forward

Since the water demand is ten times the water supply there is need for additional water supply. The additional water supply can come from boreholes which was the wish of the community. The details of installing a borehole are shown in Table 3.2.

Table 3.2 Cost estimates for borehole installation

S/N	**DESCRIPTION**	**UNITS**	**QUANTITY**	**UNIT PRICE**	**AMOUNT**
1	Exploration for water	SUM			300,000
2	Equipping a borehole with solar pumps	SUM			1,000,000
3	*Administration*	*SUM*			*250,000*
4	Platform for water tanks concrete	CM	20	35,000	750,000
	Sub total				2,300,000
5	Add 5% contingencies of sub total				115,000
	Grand total				2,415,000

For such an area with a water-pan, extra supply of water can come from pumping the water from 17,500m^3 pan into an underground tank located near the earthpan. Since the excavation of the earthpan a lot of money has been used in excavation, expansion and provision of ancillary facilities. Therefore it is good for such a facility to be improved in operation and maintenance if Kenya is to meet or surpass the MDG target (Elimelech, 2009).

The details of pumping water into the tank are shown Table 3.3.

Table 3.3 Cost estimates for pumping and storing water from pan in the rainy season

S/N	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	AMOUNT
1	Constructing underground tank with capacity of 1,479,240 litres whose size will be 22 metres by 22 metres by 3metres and thickness of 300 mm	CM	225	35,000	7,875,000
2	Solar Water pump with head of 100m	NO	1	300,000	300,000
3	2” pvc pipes	NO	20	1000	20,000
	Sub total				8,195,000
4	Contingencies 5% of the total	SUM			409,750
	Grand total				8,604,750

Furthermore, additional water can come from additional trips of water trucks. The details of a truck bringing water are shown in Table 3.4. The required additional trips of trucks are 16.4 per month so for six months, there is need for 99 trips.

Table 3.4: Cost estimates for increasing the number of trips of water tanks tracks

S/N	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	AMOUNT
1	Water tank trips	NO	99	10,000	990,000

Another option is roof catchment. There are five buildings with iron sheet roofs. They are a mosque, two shops, one homestead and a school. They have a combined catchment of 320 m^2. The number of rainy days between June and October in Garissa are 9 with 50 mm of rain for the entire period (Weather-and-Climate.com). For the calculation of runoff from roof cathment was done by assuming a conservative value of 5.6 mm of rain per hour in a rainy day. The amount of water collected by the roof in the area was then calculated using the empirical formula below (Greeno and Chudley, 2008):

$$C = \frac{AR}{3} = \frac{320 \times 0.0056}{3} = \frac{0.6m^3}{rainy}day$$

Where C is the capacity in m^3, A is the area on plan of the drained roof in m^2 and R is rainfall in m/h.

Therefore, for 9 rainy days a total of 5.4 m^3 of water can be harvested from roof catchment in the entire dry period. This is far much less than the additional demand of 1,479.24 m^3 and hence roof catchment is not an option when it comes to meeting the additional demand in the dry season.

Apart from the cost estimates it was necessary to evaluate the three feasible options by ranking them on some features as shown in Table 3.5.

Table 3.5 Ranking of the water supply options based on five parameters

Feature	Drilling of a borehole	Pumping water from earthpan	Additional trips of water tank trucks

Cheap in cost	2	3	1
Cheap technology	3	2	1
No uncertainty in exploration	3	2	1
No sophisticated treatment of water	1	3	2
Community preference	1	3	2
Average rank	2	2.6	1.4

From Table 3.5 it is apparent that the most suitable option of water during the dry season is additional trips of water followed by drilling a borehole and lastly pumping water from earthpan into underground water tank.

Conclusion

Initially four options of additional water supply sources were considered. The option of roof catchment was found not feasible. The ranking of options showed that additional trips of water tanks trucks was ranked first followed by drilling of borehole, and last was pumping of water from earthpan. Therefore, the current water crisis can be solved by increasing the number of trips made by water tank trucks while exploring the option of drilling a borehole.

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