MAJI UHAI

Rain Water Harvesting Solution for ASAL Areas: Leveraging Rooftop and Shallow Wells Collections to Widen Rural Catchment Areas in Kenya

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Executive Summary

The Maji Uhai project proposal, is a revolutionary water harvesting solution targeted at Arid and Semi-Arid Lands (ASAL) areas in Kenya. It bridges the capacity gap and ensures households harvest and store water when it rains and access it during periods of drought.

Maji Uhai is an innovative but simple model that households can easily adopt to improve their access to clean and adequate water for domestic and farm use. In turn, this will have knock-on effects in other areas such as food security, education, and health.

The Maji Uhai model is based on the premise that ASAL areas in sub-Saharan Africa including Kenya cumulatively receive sizable amounts of rain during the year. However, due to lack of effective water harvesting mechanisms, most of the rain water flows away either as surface run off into rivers, seeps into the ground or evaporates into the atmosphere.

Equipping households and institutions with water harvesting tanks and underground-borehole like storage cisterns will help maximize on water harvesting. Part of the water harvested though roof catchments into tanks will be regularly evacuated to create more space for harvesting.

The evacuation model links to a central treatment and storage facility. Here, water is stored according to account numbers of the households it has been evacuated from. There will be a small village-based management team that oversees the proper evacuation and recording of the liters of water per household.

During the dry season or when the rains stop, households will have access to the water stored in their cisterns for watering their animals and irrigation as well as the clean water from the central storage facility for dinking.

Accessing the water from the central storage facility will be through credit points which are assigned at the point of evacuation and reviewed regularly to control the water resource usage and ensure it serves the community throughout the dry season. Community members without enough credit can offer to buy water at a very affordable price or combine monetary purchase and credit points redemption.

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1. Introduction

Maji Uhai is a contracted Swahili phrase which means ‘Water is Life’. This project proposal title aptly captures the importance of water resource management in Kenya and especially the Arid and Semi-Arid Lands (ASAL) which make up about 80 percent of the country. The central argument of our proposal lies in enhancing the rain water harvesting capacity of ASAL households through shallow wells (cisterns) and roof catchments into tanks.

This proposal is feasible because it works with mechanisms already acceptable within the community which, therefore, enhances adoption rates. The shallow wells will be dug through community initiatives while donor and government funding will be sought to finance the lining of the shallow wells with non-porous materials to prevent seepage of water into the ground and purchase of 10,000-liter tanks.

The use of credit system and short message service (SMS) is an innovative way of ensuring water evacuation from households is done efficiently, recorded accurately, and retrieved appropriately.

The proposal starts by giving a general overview of the impact of climate change at the global level, regional level (Africa), and local level (Kenya). It then looks at the specific impact of climate change on water resources and the effect this has on livelihoods.

The reviewed research work is appropriately cited to acknowledge source and give an insight into areas academicians have studied at and offered suggestions. Also, we have summarily reviewed select water harvesting initiatives in Kenya. This serves to position our project as an innovative solution in a space that has not been thought of before.

The Maji Uhai project is then analyzed in detail to show how we intend to operationalize it and the value addition it brings to the community and the water harvesting space in ASAL areas.

2. Background of The Problem

Theories on global climate and practical experiences all converge at one undeniable conclusion that indeed the global climatic pattern is changing. Trends in atmospheric gases such as carbon dioxide (CO_2), temperature, and sea-level rise are tracking the upper limit of model-projected sequences as elaborated by the Fourth Assessment (AR 4) undertaken by the International Panel on Climate Change (IPCC), (FAO, 2003).

2.1 The Global Purview of Climate Change

Global atmospheric temperature is projected to increase by approximately 4˚ C by 2080, consistent with a doubling of CO2 concentration in the atmosphere. Mean temperatures are predicted to increase at a faster rate in the upper latitudes, with equatorial regions being at a slower rate. Average altitude temperature is expected to rise higher more than at the sea level, resulting in intensification of convective precipitation and acceleration of snowmelt and glacier retreat, (Fischer et al., 2007; Nelson et al., 2009).

Estimates of global incremental water requirement to meet future demand for food production under climate change vary from 40–100 percent of the extra water needed without global warming.

The amount required for irrigation from ground or surface water depends on the modelling assumptions on the expansion of irrigated area – between 45 and 125 million ha. One consequence of greater future water demand and likely reductions in supply is that the emerging competition between the environment and agriculture for raw water will be much greater, and the matching of supply and demand consequently harder to reconcile, (Climate Adaptation Working Group, 2009; Padgham, 2009).

The future availability of water to match crop water requirements is confounded in areas with lower rainfall – those that are presently arid or semi-arid, in addition to the southern, drier parts of Europe and North America (FAO, 2003; CA, 2007).

Runoff and groundwater recharge are both likely to decline dramatically in these areas. Where rainfall volume increases and becomes more intense (Indian monsoon, humid tropics), a greater proportion of runoff will occur as flood flow that should be captured in dams or groundwater to be useable (CA, 2007, Faures et al., 2007).

Consequently, aquifers are exhausted in many parts of the globe where they are most valuable such as China, India and United States. This was occasioned by readily available cheap pumps, power and well-constructed methods, taking off in the year 1980s in India, China and much of Southeast Asia. Not only did the areas which were irrigated continue to produce food crops, but canal irrigation had become the least player in India by the year 2000, as access to ground water services expanded (Molden et al.,2010).

According to medium growth projections, the world population heads to more than nine billion people by 2050. Food preferences are changing to reflect this, with reducing patterns in the consumption rate of staple food, and the rise in demand for leisure products such as milk, meat, fruits and vegetables, that are heavily dependents on irrigation in many parts of the global.

Future world food demand by the ever-increasing population is projected to rise to 70 percent in 2050, but will roughly double in the developing countries. Cetaris paribus (that is a world without climate change), the amount of water that will be required to sustain the population is projected to rise by 11 percent to match the demand for biomass production (FAO, 2007).

Food security and agricultural livelihoods have regained importance in development planning, although some countries such as China seem ever more likely to balance further agricultural development and investment with imports.

The world has a large stock of under-performing canal irrigation infrastructure, and a vibrant groundwater sector. However, both create significant environmental externalities, which need to be managed. Not only that, there are calls for water to be preserved to maintain environmental flows in rapidly developing river basins and restored to ecosystems in over-exploited ones (Huntingford et al., 2005).

In response to global warming, the hydrological cycle is expected to accelerate as rising temperatures increase the rate of evaporation from land and sea. Thus, rainfall is predicted to rise in the tropics and higher latitudes, but decrease in the already dry semi-arid to arid mid-latitudes and in the interior of large continents (CA, 2007).

Water-scarce areas of the world will generally become drier and hotter. Both rainfall and temperatures are predicted to become more variable, with a consequent higher incidence of droughts and floods, sometimes in the same place (Rebetzke et al., 2008).

2.2 Climate Change -The African Perspective

The effects of climate change, though global, are more severe in Africa. This is notwithstanding the fact that the continent contributes the least towards climate change causing factors. Temperature changes have affected livelihoods, health, water availability, food productivity, and overall security. Furthermore, the number of weather-related disasters such as droughts and floods have doubled over the past 25 years, contributing to the rising mortality rate in Africa (Maplecroft).

Seven out of ten countries most at risk from climate change, are in Africa (Climate Change Vulnerability Index (CCVI), 2015). A unifying characteristic among the seven countries is their dependency on agriculture, with 65 percent of the population employed in the sector. Changing weather patterns are impacting social stability, poverty, migration and food production. Consequently, increasing the risk of instability and conflicts (Maplecroft).

The United Nations Intergovernmental Panel on Climate Change (UN IPCC) estimates a decline in food staples such as wheat, maize, and rice up to 50 percent in the next 35 years, resulting from climate change. Ten of the eleven countries classified under extreme risk are in Africa. These are Ethiopia, Chad, South Sudan, Eritrea, Central Africa Republic, Sudan, Burundi and DR Congo. These countries have the highest levels of displacement, poverty, conflict, and political violence (CCVI, 2015).

2.2.1 Climate Change and Its Interaction with Africa's Development.

Climate change is a reality in Africa. This can be seen from the prolonged droughts in Eastern Africa to the unprecedented floods in Western Africa to the depleted rain forests in Equatorial Africa and increased acidity around Africa's southern coast. Extreme weather and climate patterns threaten agricultural productivity, food, water and energy security, further undermining growth and development in the continent. Environmental and climate hazards and disasters induce migration, putting pressure on scarce resources, thus posing potential threats to stability.

Agriculture and Food Security

Agriculture provides a livelihood to over two thirds of populations in Africa. However, it is mainly rain fed, exposing it to severe drought spells, floods, loss of arable land due to desertification and soil erosion. This contributes to crop failure, migration and loss of livestock. Ocean acidification depletes fish stocks, threatening small scale fishing and other livelihoods of coastal populations.

Landscapes are changing in Africa. Heat stress, droughts and flooding have contributed to reduced livestock productivity and crop yields. East Africa is the worst hit by the food crisis with over 12 million Ethiopians, Kenyans, and Somalis in need of urgent food supplies. Below average rainfall poses a threat to the rain-fed agriculture dependent countries in the continent. Women, children and the elderly are most vulnerable to climate change. Water scarcity burdens women who often walk long distances to fetch it. Children and the elderly are susceptible to infectious diseases such as Malaria, diarrhea, starvation, and malnutrition (Intergovernmental Panel on Climate Change (IPCC), 2014).

Health

Water scarcity from drought contributes to the spread of infectious and water-borne diseases. Temperature increase, and intensified rainfall affect malaria-free areas in the Ethiopian and Kenyan highlands. Ecosystems degradation, unsafe water and poor sanitation contribute to cholera, malnutrition and consequently child mortality.

Forced Migration and Conflict

Degradation of ecosystems threatens livelihoods, inducing migration in search of alternatives sources of livelihood. This, poses concerns linked to scarcity of resources and thus competition of the resources between the migrants and local inhabitants.

Climate change threatens the political and economic stability of nations due to the pressure and competition for scarce resources. Combination of climate change vulnerability and food insecurity amplifies the risks of civil unrest and conflict (7th Annual Climate Change Environmental Risk Atlas (CCERA)).

The climate change menace is not getting any better. The associated risks have the potential to not only destabilize regional and national security, but also hurt business supply chains, consequently affecting national economies. Outcomes such as increased migration, poverty and reduced education levels may lead to disenfranchised communities and support of radical groups.

2.3 Climate Change and Water Scarcity – The Kenyan Reality

Photo Credit: ASAL Stakeholders Forum

Kenya has an exceptional climatic and landscape variation, within and between regions. The coastline is characterized by low plains, giving rise to plateaus and mountainous ridges moving inland. The Great Rift Valley divides the Western and Central regions with broad arid plains and lush highlands before reaching the shores of Lake Victoria to the West. The country is split by a climatic divide: An arid and semi-arid climate in the North and North east, some parts of East and Central regions; and a tropical climate in the West, South and South-Central regions. Two distinct rain seasons characterize the country: Short rains in October to December; and Long rains in March to June. The amount of rainfall varies from less than 200 mm per year in the arid areas to over 2000mm per year in the Rift Valley.

Kenya is a water scarce country, having less than 1000m3 per year of renewable freshwater supplies (Black et al., 2012). The water sources are projected to decrease given the population bulge in the country. A water stressed nation has below 1700 m3 per capita (UNDESA, 2014).
Over 80 percent of Kenya is Arid and Semi-Arid (ASAL), with large portions unfit for agriculture. For favorable agricultural lands, agriculture is mainly rain fed, which in turn is affected by rainfall variability (Black et al., 2012).

Population bulge further exacerbates the water problem in Kenya. From a population of 5.4 million in 1948 to over 40 million currently (Republic of Kenya, 2010), these numbers are projected to rise at an estimated rate of 2.6 percent per year (World Bank, 2012). Land and water availability sources will significantly decrease as a result. Therefore, a lasting solution would be increase of land and water resources.

Deforestation and land denudation also put pressure on water sources. Kenya's main highland areas-Mt. Kenya, Cherangani hills, Tugen hills, Aberdare Ranges, Mt. Elgon and Mau forest- are constantly exposed to anthropogenic activities. As a result, forest cover has reduced from an estimated 100 percent in 1920s to 1.2 percent in 2010 (Republic of Kenya, 2010). This affects water supplies from these areas.

Climate change significantly threatens water supply in Kenya. Climate scenarios predict increased rainfall in highland areas and decrease in others but predicts a great variability in cycles. (Ngigi, 2009). More droughts and floods are expected as a result, that will have massive socio-economic implications. Centralized efforts by the Kenyan government are deficient as most vulnerable communities are situated furthest from Nairobi, thus requiring costly infrastructural investments.

Furthermore, these areas are less attractive to private investors given the low economic incentives they promise (Black et al., 2012). About 54 percent of rural households, lack access to potable water, thus relying on rivers, springs, lakes, dams or ponds (Republic of Kenya, 2010). This means long distance travel in search of water; whose burden mostly lies with women and children.
Water scarcity, water sanitation, water resource management and accessibility have a direct impact on both economic and social sectors in ASAL areas.

The studies so far conducted have shown that communities living in ASAL areas in Kenya can effectively pursue solutions to expand their surface water run off catchment and management.

In Kenya, water management programs are gaining recognition due to recurrent episodes of drought and food insecurity. Despite the awareness and the initiation of a water conservation program by the World Food Program, World Agroforestry Centre (ICRAF) and the government of Kenya known as the Billion Dollar Alliance for Rainwater Harvesting (BDARH) in 2017, the country still faces food insecurity caused by insufficient methods to conserve water.
Climate resilience techniques to curb the increasing effects of climate change specifically health and food security are crucial in Kenya. A study by the United Nations Environmental Program indicates that Kenya has a potential of harvesting 350 billion cubic meters of rainwater. If well conserved, the water can support more than 233 million people which is way above the country's population (UN, 2018).
Kenya remains a water scarce country due to its overreliance on secondary sources of water. With increased climate change effects, the secondary sources are non-dependable due to their seasonality. This make Kenyans vulnerable to the shifting climatic conditions. Only 56 percent of the population in Kenya has access to safe water. Additionally, 80 percent of hospital attendance is due to preventable diseases that are hygiene and water sanitation-related (UNICEF, 2018).

Rainwater harvesting in Kenya, dates back several decades. However, there is a general lack of proper utilization of technology and methodologies in handling rainwater. In turn, this hinders the sustainability of other issues such as health and food security. Nissen-Petersen (2018) clearly highlights that water is a scarce resource with only two sustainable solutions to meet the world's demand to which Kenya lies.

In 2017, the Kenyan government declared a national drought emergency where over 23 counties out of 47 counties were affected. Acute malnourishment and food insecurity affect more than 3 million Kenyans annually. Data by UNICEF indicated that close to 175,000 children in 10 most affected counties did not attend primary school in 2017 due to drought's impact. Moreover, drought triggered local conflicts over scarce water dams and escalated mortality rates in the country (OCHA, 2017).

The solutions include water conservation and rainwater harvesting. The current processes and projects like the one spearheaded by BDARH are on a large scale. The picture below illustrates an example of water harvesting in an ASAL region in Kenya.

Two men digging a pit meant for rainwater harvesting in Machakos County, Kenya

Source: World Agroforestry Centre

The current situation in the country requires small-scale interventions to boost large-scale mechanism for sustainable water security. Moreover, Kenya heavily relies on agricultural products for its economy. Making the ASAL areas more productive with the availability of water will result in economic stability, farmers moving out of poverty, resilient country towards adverse effects of climate change and a healthy nation (Kimani et al., 2015).

Water resource management in Kenya’s ASAL areas is key to boosting agricultural production and improving household welfare. Apart from addressing climate change aspects, water will be a solution to the shifting communities in search of water and the persistent conflicts between communities due to scarce resources.

Transiting the ASAL places in Kenya from water scarce to water stable regions is possible with the small-scale initiative of rooftop water harvesting.

3. Water Harvesting and Management Initiatives in Kenya

Water shortage is a phenomenon not only common to ASAL areas, but also an urban problem. Urban and rural dwellers alike, face acute water shortages despite the heavy downpours (Mose, April 14, 2016). The 2009 Kenyan population census indicates that only 0.8 percent of the population makes use of rain water (Mose, April 14, 2016).

Adaptation to Climate Change in Arid and Semi-Arid Lands (KACCAL)- UNDP

3.1 What Has Been Done

Rainwater harvesting (RWH) is not a new practice. It dates back over 4000 years (Worm and Hattum, cited in Kimani, et al, 2015). RWH is a common practice in Africa, parts of the United States, India and Australia. In fact, it has been a source of drinking water in rural Asia and Europe. Africa is coming up in its efforts to harvest rainwater, but the uptake is relatively slow. Mati, De Bock, Malesu, Khaka, Oduor, Nyabenge & Oduor (2007) classifies rainwater technologies as:

(i). **Macro-Catchment Technologies** - This involves collection of large runoffs from surfaces such as hillsides, roads, and pastures. These technologies include: sand dams, earth dams, rock catchments and hillside rill/sheet runoff utilization.

(ii). **Micro-Catchment Technologies** – This is the collection of runoffs close to crops to replenish the soil moisture. Used for growing water-demanding crops such as sorghum, maize, millet, and groundnuts. These include: strip catchment tillage, Zai pits, semi-circular bunds, contour bunds and meskat-type system.

(iii). **Rooftop Harvesting Technologies** - These collect relatively clean water. They basically involve rooftop collection methods.

Gould & Nissen-Petersen (1999) classify RWH by type of catchment surface and scale of activity. Domestic consumption is mainly fed from roof and rock catchment systems. On the other hand, ground catchment systems, sand river storage, earth dams and water pans provide water for small scale irrigation, livestock consumption, and some domestic use.

Water scarcity, is a barrier to economic development. Kimani, Gitau & Ndunge (2015) explore the various rainwater harvesting technologies adopted in Makueni County, an ASAL area in Kenya. Their research goes further to determine the factors contributing to adoption of such technologies in the ASAL areas, with Makueni as a case study. The research identified various technologies which were classified as macro-catchment, micro-catchment and rooftop catchment. Under macro-catchment technologies; earth dams, sub-surface/ sand dams were most common. The micro-catchment technologies identified included: contours, semi-circular bunds, strip catchment, tillage and Zai pits. Rooftop catchment -water harvesting from rooftops, was identified as the most common practice in the area.

Despite the availability of such technologies, adoption was noted as slow, significantly attributed to factors such as gender, literacy levels, technological know-how, social, and economic status. Towards promotion of these technologies, Kimani, et al recommend adoption of strategies such as: poverty alleviation through enhancing income generating activities; community mobilization; capacity building and technologies in favor of women and children.

Dams Construction, desalination of water and long-distance conveyance are among ways of ensuring water availability in the urban areas. Despite their efficacy, these methods are costly for rural areas. Instead, low cost systems have been constructed, operated and manned with greatest autonomy and community involvement.

Fog Harvesting: Polypropylene mesh nets/ ridges are used to capture water loaded fog in coastal and mountainous areas. Collected water droplets are channeled into troughs and gutters which drain into a series of tanks. It is a cheap, simple and replicable technique, which is best practiced in South Africa.

Sand Dams: A common phenomenon in Kitui County, Kenya, through the intervention of various NGOs, the sand dams serve over 150,000 residents in the area. The dams are placed across a bed of intermittent small rivers, consisting of 1.5 to 2-meter-high impermeable barriers from stones. Alternatively, concrete is placed on a firm and impermeable layer of rock or clay, which prevent water from underground seepage. Runoff water creates an artificial aquifer that stores up to 35 percent of its volume as ground water. The sand dams have an ability for prolonged community water storage.

Contour Trenching: Involves digging trenches along contours lines such that water flowing downhill is retained by the trenches, infiltrating the soil below. Amboseli, Kenya is a best practice, where trenches 4 meters and one meter deep at 25 meters interval have a capacity to capture up to 150 mm per day. Crops can be grown in between the trenches when there is less rainfall. The subsoil water reserve gathered after the rainy season nourishes the crops.

Finger Ponds: A technique used in wetlands and floodplains to enhance the natural productivity of these areas. They consist of artificial ponds 5-12 meters long, extending along wetlands like fingers. The ponds fill up during flood cycles and trap fish as the floods recede.

RWH projects are growing interest in Kenya as a solution to water resource problems. Its benefits include:

- Source of domestic water in dry seasons
- Harnessing rain benefits for increased crop production
- Rehabilitation of degraded pasture land
- Source of drinking water for livestock.

These benefits spark enhancements in sanitation, food security, health and ultimately, economic growth (Black, Malesu, Oduor, Cheregony & Nyabenge, 2012). Further, RWH projects enhance community mobilization, engagement, and ownership. This is through engaging communities in coming up with water shortage and management solutions, consequently influencing poverty reduction (Black et al., 2012).

RWH techniques have been used for agricultural, domestic, pastoral and commercial needs. Efforts by the Kenyan Government and other development actors are increasingly in search for durable, decentralized and sustainable water solutions. However, RWH implemented projects face many sustainability issues, with many degenerating soon after project completion. Long-term sustainability of such projects is thus of great concern for future programs.

4.Maji Uhai Project Overview

The Maji Uhai project proposal seeks to contribute to the resilience building of ASAL communities by promoting access to clean and drinkable water as well as water for irrigation. Maji Uhai is a water collection and management system. It brings together households within communities and links their water collection efforts by means of a system-based central reservoir.

Households will be provided with 10,000-liter water harvesting tanks, a locally made efficient gutter system and installation services to cater for the rooftop collection. As part of the collection system, Maji Uhai will mobilize the community and facilitate the sinking of 20-foot underground water storage boreholes to collect surface runoff.

The boreholes will be fitted with filters at the entry point of the runoff to ensure no debris goes into the borehole. This water will be used mainly for irrigation, watering livestock, and other uses apart from drinking and cooking.

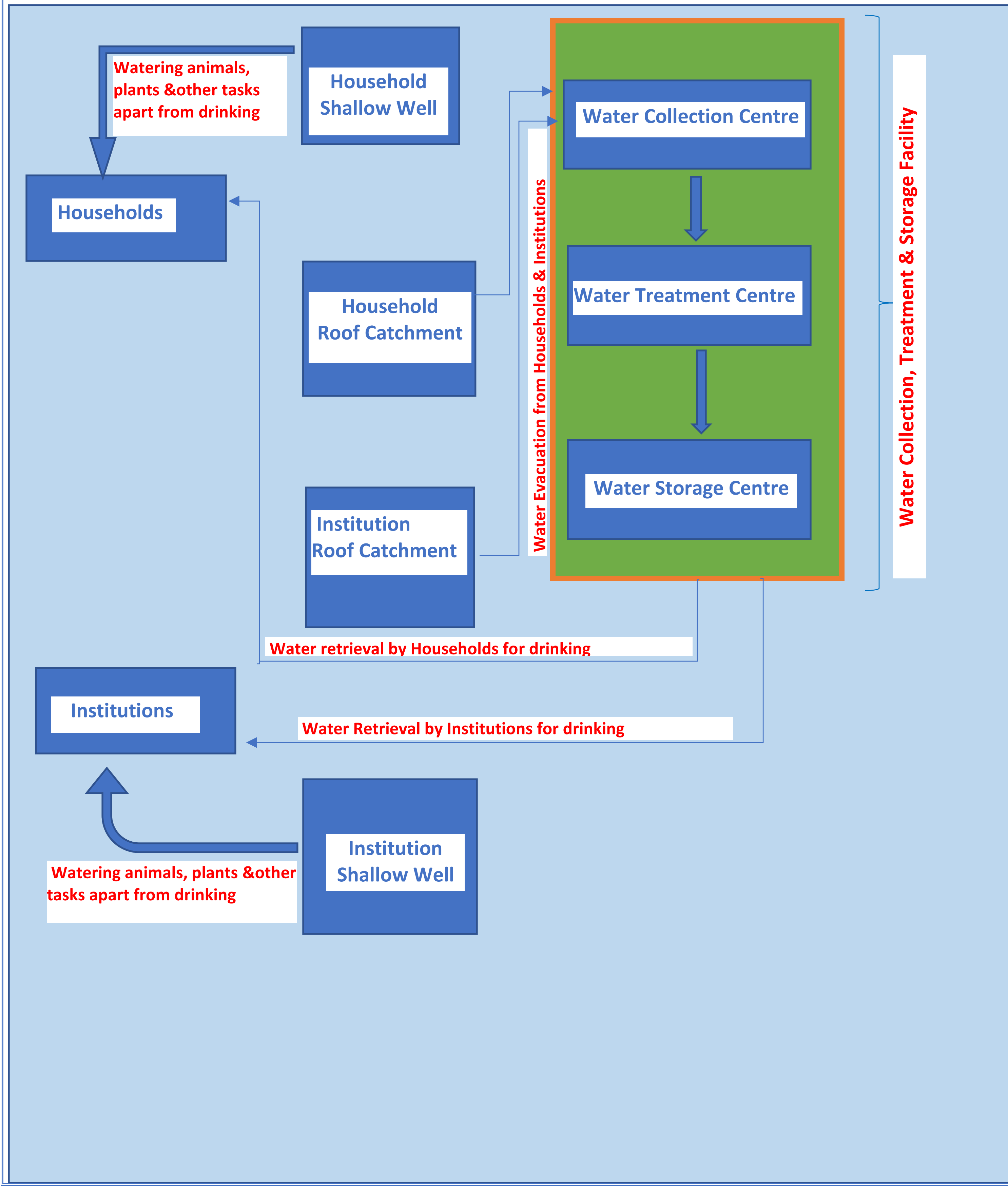
From the borehole, the water will be retrieved through hand pumps. These have been in use in many areas in Kenya and have proved to be functional and effective.

Every house will be issued with an identification (ID) number which will be used as their account number at the central reservoir system. Once the households harvest water through the rooftop, they have two options. The first option is to use the water directly without sending it to the central reservoir collection system.

The second option that is inevitable especially during heavy downpours, is for them to send the water to the central reservoir to create capacity to harvest more. One of the objectives of the Maji Uhai project is to expand the water harvesting capacity of the households and this is through evacuation of harvested water to the central storage.

Since the central storage will be in the same community within reach of households, the Maji Uhai project management team will ferry the water to the storage point. All that households need to do once the tank is nearing full capacity is to send an SMS or call toll free and give the team their system ID number. The team will pull the details and immediately facilitate the evacuation of the harvested water.

4.1 Maji Uhai Project Flow Chart



4.2 Project Infrastructure

The modelling of our water harvesting solution is simple. We want to transform the water harvesting efforts of ASAL communities by creating infrastructure that allow for individual water harvesting and channeling of excess water into a central reservoir.

The components of our system are

i. **Households** - These are individual families that collect water through roof catchments and surface runoffs.

ii. **Institutions** - This will include churches, schools, health facilities and any other non-household water harvesting points within the community.

iii. **A Central Collection, Filtration and Storage System** - This acts as the larger reservoir where all the excess community water from rooftop harvesting can be channeled to. At the center, there will also be an independent collection system to supplement supplies from households and institutions. The collected water will be filtered and then stored.

iv. **A Credit System** - This will be part of the central collection system. Basically, depending on the quantity of water collected from households and institutions, they are assigned credit points. These points accumulate, and they can redeem them for water during the dry season.

    The credit system allocation is such that households will be able to combine both the credit points redemption and use of cash to buy water. This will boost accessibility to the water resource as well as control equitable distribution through credit points redemption caps.

4.3 Water Harvesting

The project management team will ensure that every designated collection point (households and institutions) has a functional 10,000-liter water tank and a shallow borehole approximately 20 feet deep always.

The tank will be fed through a gutter system installed and regularly inspected by the Maji Uhai project team. The gutters will be made from pipe systems which are easily available in local hardware stores at an affordable price.

Typically, a 10,000-liter tank takes a lot of time before filling up. This is the first instance of expanding the capacity of households who have traditionally used 20-liter jerrycans to harvest water. As the tank fills up after subsequent rain events, households will text or call our toll-free number so that we can evacuate and create more space for them to continue harvesting.

The second point of harvesting is the borehole. This will be lined with non-porous material upon completion so that the harvested water doesn't seep into the ground. The point at which the runoff enters the borehole, there will be a sieve to trap debris from getting in. This water will be used exclusively at the household level for functions such as watering animals, crops, and household chores.

4.4 Water Evacuation

Every household will be issued with a unique ID number to facilitate evacuation. When the water is being evacuated at the household level, the project officials will ensure it is measured and the liters recorded into a customized data capture form. One of the household representatives will then sign the form after confirming the number of liters evacuated and recorded.

At the central reservoir, the water will be fed into a natural filtration and treatment system before storage. The costs of the filtration process and any other costs incurred will be treated as administrative expenses and recovered in the pricing of the water.

Every household and institution will have a computer-based account at the central storage center. The liters of water supplied will be converted into credits posted into the respective accounts.

4.5 Water Retrieval System

When the rains stop, the water retrieval system will be activated. Households and institutions will be able to access water based on their credit points. The credit points pricing will fluctuate depending on the season of access. For instance, during the drier months when water is extremely scarce, credit points will have the lowest value to balance off and ensure equitable access to water.

Households will also be free to buy more credits and use that to access water. The proceeds from the sale of water will be used to construct more gutters and water collection points at household level to maximize the collection.

4.6 Impact of Our Intervention

ASAL communities will have expanded access to water harvesting resources. Water tanks will be provided for roof catchment and runoff harvesting will be through manually dug 20 feet shallow wells. These will be cemented and lined with non-porous materials.

Water from the central reservoir will ensure continued access to water even when households have exhausted their water resources. The water will be properly handled to ensure clean drinkable water.

The credit allocation system will create a sort of saving culture. This will make communities manage their water resources well and harvest enough to send to the collection center for the tough times ahead.

The benefits will spillover to other areas such as health, food security, improvement of education outcomes, and peaceful coexistence among communities.

5.0 Conclusion

Water scarcity has been a problem in arid and semi-arid areas around the world. Kenya being in the Sub-Saharan region, has been affected by this phenomenal as well. The reality of climate change has been largely appreciated in ASAL areas due to the drying up of existing water sources and increase in unpredictability of rainfall patterns.

Unlike other regions around the world with established rainwater harvesting systems, Kenya is not prepared adequately and lacks the necessary technology to maximize water harvesting. Most communities in ASAL areas live below the poverty line and this further complicates the ability to harvest in rainwater harvesting systems.

Maji Uhai comes in as an appropriate water harvesting solution customized for these disadvantaged areas in Kenya. It harnesses the power of communal living to extend the water harvesting capacity of these communities. Most of the resources the project utilizes are within community reach and generally acceptable. This makes it easy to be adopted and the learning curve less steep.

The end goal of Maji Uhai in providing clean drinking water and sustainable access to water resources in ASAL areas will have a knock-on effect in other areas as well. The success of this project will see it being replicated to other communities so that at the end of it all, ASAL areas can be water sufficient and adapt well to the changing climatic pattern.

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