Project Narrative for: Kiruru, Tanzania Proposed Safe Water System

Water Missions International – Tanzania

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Project Description

The location referred to herein as "Kiruru" is located in Mwanga District in Tanzania. This location was selected for as a potentially suitable location for a safe water project based on information in a Rotary report ("Rotary PPP Team for Mwanga, Tanzania, Report of Visit January 2013," July 2013) (Report). The community is located at the following coordinates: 3° 42' 22.17" S, 37° 35' 3.24" E).

Population was estimated during an onsite assessment as 427 households and 2,135 people. A significant number of animals were reported (1,221 goats, 576 sheep, and 775 cows) and an animal watering trough found located west of the community, although the watering trough was inoperative.

Two sources of water are known. One is a mountain spring that is located about 3.4 km east of the highway at coordinates 3° 42' 8.38" S, 37° 36' 52.84" E. Water from this spring is piped to an existing masonry tank located at 3° 42' 5.03" S, 37° 35' 55.23" E. While water quality was measured to be adequate for this source, water volume is not sufficient to provide for the population located in the area of the source plus Kiruru. In addition, people living near the source described plans to increase their use of the water and expressed concern regarding use of the water by others who live remote from the source.

The second source of water possible is a new well (borehole). Three existing boreholes were encountered in the area, the deepest of which is located at the Vocational Training Center at a reported depth of 120m. Water quality results were measured to be acceptable for use as potable water. A hydrogeological study was performed in July 2014. This study concluded that a new borehole is feasible as a water source with depths ranging from 85m to 110m, final depth will depend on field conditions. Based on this study and water quality found from the existing boreholes, a new 100m borehole is assumed as the water source for this system.

A solar powered pumping system provides for the lowest system operating costs. Given the depth of a new borehole and difference in elevation between the likely water level in the borehole and anticipated storage tank locations, a standard solar pumping system does not provide sufficient discharge pressure or water volume.

Water volume may be limited by yield of the new borehole. However, neither the yield nor water quality will be known with certainty until the borehole is constructed.

In order to complete this proposal, pumping rate and borehole water level drawdown have been assumed. Pumping rate has been assumed to be 100 liters per minute (lpm). At this rate and using solar power (will be discussed subsequently), approximately 40,000 liters per day can be pumped using solar power alone, assuming 6.5 hours of power available daily. If a standby

connection to AC grid power is included, the duration of pumping could be extended to about 20 hours and a total pumped volume of 120,000 liters per day. This volume should be more than adequate for the population and provide some capability to water animals.

Water from the proposed system will be pumped through chlorination (assumed the water is sufficiently clear that filtration is not required) to disinfect the water and maintain a minimal chlorine residual to ensure the water is free of micro-bacteriological contamination throughout the water system to the taps. Water will be pumped from the borehole to two 10,000 liter polyethylene storage tanks located at an area high point as shown on the attached layout drawing. From storage, water will flow by gravity to seven tap access points, each constructed with two tap valves. Water will also be piped to an animal watering trough located west of the community. All water will be treated (disinfected).

As solar power significantly reduces operating costs, a solar powered inverter system has been assumed for design. While this type system adds to initial cost of construction, long-term sustainability of the resulting system is significantly enhanced as power costs are virtually eliminated.

The following describes the proposed technical solution for this site:

- Water source: new borehole (assumed water in sufficient quantity and quality)
- Power source: solar power with standalone solar array and inverter system with backup AC grid
- Pumping: AC submersible pump for total discharge of 100 lpm which will provide 40,000 liters per day assuming standard 6.5 hours of useable sunlight and up to 120,000 liters per day using AC grid backup
- Water treatment: three WMI erosion chlorinators to provide disinfection by chlorine
- Water storage: two 10,000 liter polyethylene “poly” tanks on concrete slab located at an area high point
- Distribution: buried HDPE pipe in appropriate pressure class, buried one meter deep per standard
- Water Access: Seven manually operated taps at strategic points (see concept layout diagram), note each tap to be metered. A new animal watering trough will be constructed as shown on the system layout.

Sustainability Plan

This site will be implemented using WMI – T’s “Community Managed” implementation model. A summary of this model follows:

With the Community Managed model, WMI works with the community to implement the safe water system with the goal to turn the ownership and operation of the system over to the community at the conclusion of construction, with certain restrictions/conditions. In order to accomplish this goal, a Safe Water Committee (SWC) is formed of volunteers from the community which then serves as the community based oversight group for the system. The SWC is formed through community meetings led by WMI near the beginning of the project.

Following training by WMI, the SWC is responsible for ownership and operation of the safe water system, including the following specific responsibilities.

Safe Water Committee Makeup and Key Responsibilities

- SWC Membership
    - Chairperson
    - Secretary
    - Treasurer
    - WASH promoter (member)
    - System Operator (ex officio member)
    - Security Officer (optional and an ex officio member)
- SWC key responsibilities
    - Sign and meet requirements of a Memorandum of Understanding (MOU) between WMI and the SWC (the MOU is provided by WMI and controls ownership and operation requirements of the safe water system)
    - Help ensure the community follows through on commitments to provide unskilled labor and commonly available building materials (bricks, sand, aggregate, and hardcore/rocks)
    - Work with WMI to locate facilities and donated land and right-of-way
    - Promote Health & Hygiene (assist WMI to teach Health & Hygiene in the community and continue this emphasis following completion of the project)
    - Micro-Enterprise, including the following:
        - With input from the community, set the price of water
        - Establish a bank account to deposit proceeds
        - Record keeping
        - Make regular financial reports and ensure financial accountability
        - Pay operating expenses
    - Hire and pay a System Operator who is then responsible for the following:
        - Day-to-day system operation
        - Minor maintenance
        - Report any issues with system operation
    - Upon completion of construction, take ownership of system facilities
    - Oversee individual Tap Operators (described below) who are responsible for selling water at their respective taps (distribution points)
    - Ensure that safe water is available to sell to any person without discrimination for any reason

The Community Managed model includes some system elements and features in addition to the elements and features common to both implementation models. These are described as follows.

Community Managed Model Specific Elements and Features

- Taps located strategically in the community to provide reasonable access to community members
- With the Community Managed model, WMI provides a one year warranty on all system components
- After system dedication, WMI monitors system and SWC performance for one year (on a quarterly basis)

In the Community Managed model, revenue is received from each 20 liters (per jerry can) of water sold or, alternatively, a regular assessment is charged to each household in the community. The sales price or assessment amount is determined by the SWC and can vary between communities. Based on WMI experience, a price of about $0.02 - $0.04 (two to four cents) per 20 liters is normally adequate to result in a sustainable system. Some communities may charge more depending on community needs and setting. Water is also sold to use for watering animals at an established price discussed during implementation.

With the Community Managed model, water is dispensed through multiple tap stands strategically located in the community. The number of tap stands can vary depending on the size of the community. Multiple tap stands provide for increased access to safe water by limiting the distance people have to walk and controlling any congestion at the dispensing points. As a result, long lines and wait times for people to access safe water are reduced significantly if not altogether eliminated.

Where water is sold on a per jerry can basis, each tap stand is operated by a Tap Operator who must agree to be present during the day to operate the tap and abide by SWC and MOU requirements, including selling safe water at the price established by the SWC. The Tap Operator pays for water on a bulk basis as recorded by a water volume meter installed in a secure meter box at each tap and at a price slightly below the selling price. Tap Operators then generate a “profit” they keep as income for operating the tap. Since the number of taps and then Tap Operators increases the complexities of managing the safe water system, a balance is required between the number of taps in a community needed to provide reasonable access while ensuring a sufficient number of customers to keep the Tap Operator interested and the effort required by the SWC to manage the corresponding number of Tap Operators. In WMI experience, the need for this balance results in approximately three to six taps in a community, though the number of taps is influenced by population size and location/distance. The final number and location is determined during system design and through discussions with the community. In communities where water is sold through a periodic assessment to each household, Tap Operators are not needed since community members may access as much water as they wish or as is available. However, charging households on a periodic (monthly for example) basis has proven to be less reliable than charging per jerry can as water is collected.

Proceeds from the sale of water are used to pay operating expenses (System Operator salary, chlorine tablets, etc.) with the balance deposited in the bank account (required by WMI as a condition of the project) to provide for any future maintenance or repairs as needed. This model of implementation relies upon sufficiently reliable and transparent money handling by the SWC

in order to provide for community confidence in how money spent for safe water is used, to pay operating expenses, and to bank proceeds to provide for any future maintenance needs. The manner in which the SWC handles money then directly relates to system sustainability. WMI trains the SWC in money handling and a monthly report of water volume produced and sold, total revenue, operating expenses, and excess revenue deposited in the bank is required to be submitted to WMI for review. This report informs follow-up site visits and additional training during the monitoring period after commissioning.