CLIMATE CHANGE ADAPTATION FOR SMALLHOLDER FARMERS IN SOUTH AFRICA

VOLUME 2 PART 3: AN IMPLEMENTATION AND SUPPORT GUIDE: LOCAL, GROUP-BASED ACCESS TO WATER FOR HOUSEHOLD FOOD PRODUCTION

E Kruger, MC Dlamini, T Mathebula, P Ngcobo, BT Maimela & L Sisitka

WATER RESEARCH COMMISSION

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Climate Change Adaptation for Smallholder Farmers in South Africa

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ABBREVIATIONS AND ACRONYMS

CA	Conservation Agriculture
CC	Climate change
CCA	Climate change adaptation
CRA	Climate resilient agriculture
EC	Eastern Cape
KZN	KwaZulu-Natal
MDF	Mahlathini Development Foundation
SOC	Soil organic carbon
SOM	Soil organic matter
TLB	Tractor Loader Backhoe

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1 BACKGROUND AND INTRODUCTION

1.1 IMPROVING WATER ACCESS FOR CLIMATE-RESILIENT INTENSIVE HOMESTEAD FOOD PRODUCTION PRACTICES

1.1.1 The current situation

Homestead food production is an important aspect of the smallholder farming system. These systems are small (0,01-0,5 ha; or 100-5 000 m^2) plots adjacent to homesteads where participants plant a range of crops and fruit trees, with or without access to water for irrigation. The homesteads also host small livestock such as poultry and, in some cases, goats and cattle. A limited number of people also keep pigs. These plots are usually fenced. The large majority of smallholders plant for household consumption and sale of surplus.

Production is constrained by infertile and badly structured soils. Often, the smallholders live in areas where soils are not ideal for cropping. This situation is worsened by repeated shallow tillage (with hand hoes and/or tractors), without the addition of nutrients or organic matter, often over many years. The results are very low fertility soils, with many structural problems such as capping and compaction. This is now exacerbated by climate change, with alternating hot and dry conditions and heavy downpours adding extensive erosion of topsoil to the list of woes. Productivity is generally extremely low.

In addition, access to water for irrigation is an enormous obstacle for most smallholders, who battle to have enough just for household use.

Water management in an intensive food production system consists of:

- Reduction in run-off and water erosion; mostly through measures such as diversion ditches infiltration basins, contours, stone bunds, check dams and the like.
- Improved water-holding capacity; mostly through increased organic matter in the soil, mulching and microclimate management (such as improved shade and reduced wind).
- Improved water-use efficiency; mostly through irrigation management, drip irrigation and greywater management.
- Improved access to water; mostly through small dams, spring protection and drilling of boreholes.

Improved access to water can take several forms and interventions are generally conceived as large infrastructure projects implemented through government and municipal processes. In this report, we focus on increasing local level access through processes that groups of individuals can undertake within their communities.

1.1.2 Group-based access to water sources

Water is considered a communal resource and as such water projects need to accommodate all community members. For the large majority of rural settlements, water access is about household water needs and it is this aspect that government services focus on.

It is possible to conceptualise water provision for agriculture at a village level, where an interest group of smallholders undertake to manage and use a specific water resource, such as a spring, or a borehole, with consent from the local authorities and Water Service Authority representatives. We do not include rivers and perennial streams in this activity, as water offtake and management from these sources is socially, politically and environmentally a lot more complicated and does require the whole community to be involved.

Group-based water management options have the advantage that participants can “own” their scheme and thus have a lot more control over their water access. It also has the advantage that the group itself designs, implements, maintains and manages access for the members. The members are responsible for water use and management and are accountable to each other.

In this document two case studies are provided as examples of how this can be done:

- Spring protection and water reticulation for nine households in Ezibomvini, Bergville, KZN.
- Borehole installation and water reticulation for two village-based groups of 20 members each in Sedawa and Turkey, Limpopo.

1.2 Spring protection and reticulation in Ezibomvini, Bergville (KZN)

The Climate Resilient Agriculture learning group in Ezibomvini consists of around 36 members. They have implemented Conservation Agriculture practices for their field cropping and intensive household food production for vegetable production. Access to water in the village is extremely limited, with one or two municipal boreholes with hand pumps providing household water. Not unusually, access to this water is inconsistent, as pumps break and are not fixed, or the boreholes become unreliable and the situation is not rectified. Access to irrigation for farming is non-existent. Most community members also get water from local springs, which are unprotected and shared with the livestock in the area.

There are informal arrangements in the community about access to these springs, and almost everyone in the immediate surroundings has access.

The learning group, under the proactive leadership of their local facilitator, Phumelele Hlongwane began discussing the possibility of protecting a few of these springs and piping water to their households to facilitate their vegetable production efforts, as the spring is far away, requiring about a 1 km walk with buckets. This has severely limited their production ability.

The group presented their concept to MDF and requested assistance with planning and implementation. Each member who wanted to be involved gave a financial donation of R1 000 and agreed to provide the labour for digging trenches and installing pipes and tanks.

This process was initiated in August 2018 and was suggested by the Ezibomvini learning group as a way to provide both household water and agricultural water for the homestead gardens.

A survey of the local springs and potential options was conducted with assistance from an agricultural engineer. A process was initiated for the group to come together and collect monies, which would be matched by a grant from MDF, to provide for a small fund to protect and reticulate one of the springs, with a simple gravity fed system to participants' homesteads.

The participants undertook to provide R1 000 per household. This process took some time and by September 2019 an amount of R8 000 had been put together. MDF then decided to continue with the process. Phumelele Hlongwane, the local facilitator and the main driver of this process, promoted the initiative tirelessly throughout this period. She initially put down R7 000 and also offered her 2 200 litre JoJo tank as the header tank. She has subsequently been paid back most of this money.

Nine participants paid and comprised the water committee: Lungile Sithole, Cabangani Hlongwane, Phumelele Hlongwane, Phumelele Gumede, Goodman Dlamini, Landiwe Dlamini, Hlengiwe Nkabinde, Mantombi Mabizela and Devu Dlmaini/Velephi Zimba.

1.2.1 Progress in July 2019

Conflict emerged early and needed to be resolved. In one homestead there were two participants and an agreement was reached that both needed to pay. Those who had paid but decided to withdraw had their monies returned to them. Another participant, Landiwe Dlamini, requested that water be provided at her new homestead site (across the road and much further downhill than the rest of the group). It was reiterated that water provision was limited and that it was for homesteads and gardens only. For a time, people believed that after elections the municipality would deliver the promised centralised water provision to the area. This did not materialise. Petty squabbles around turf and trust also delayed implementation. Actual work on the process started in September 2019

1.2.2 Phase 1: Protection of the spring and laying of the main pipe to the header tank

The spring is typical of the area, in that the eye is situated in a bank quite close to the streambed.

Local participants have dug out a small catchment dam for the spring, from which people collect water and from which cattle also drink.

Figure 1: Left: The spring's catchment pond with evidence of use by cattle and people. Right: The catchment pond dug out to make a bigger pond and small dam wall.

It was thus important that this part of the spring could still be shared by the community, as the water group did not directly "own" the spring.

Consequently, the design included an offtake from the spring consisting of a slotted pipe buried in a trench filled with gravel and stones below the main catchment dam for the spring. This trench could be completely closed up and covered with soil to avoid any damage and tampering. And it left a source of water from which those not involved in the project could collect their water.

Figure 2: Left: The capped end of the 1 m length (50 mm diameter) slotted pipe that provides for the below-ground offtake of water from the spring. Right: The fittings linking this slotted pipe to the main pipe (50 mm HDPE) (from Chris Stimie – RIEng).

Starting on the trench for the slotted pipe, below the spring and pond

Deepening and widening this trench to 50 cm x 50 cm x 1,2 m

The trench with slotted pipe installed in a bed of gravel, covered by shade cloth and rocks with a small furrow leading water from the spring to this trench

The trench damaged by livestock before it could be properly covered and closed.

Figure 3: Photographs showing the process of installing the slotted pipe for collection of water from the spring

The spring is situated in the veld above the village and thus allows for a gravity-fed system. Because this is a low-pressure system and the main pipe to the header tanks is around 350 m long, it is important that the ditch for this pipe be placed on an even slope. If this is not done, the water will not flow – which the group found out the hard way when they initially just dug a ditch and tried to lead water from the spring.

Following the contours of the land, with the pipe rising and falling accordingly, could lead to air bubbles that stop the flow of the water. These airlocks are extremely difficult to remove without having release valves at the correct points in the pipe. An even gradient for the pipe removes this problem.

Figure 4: Left: measuring the gradient for the main pipeline using a dumpy level. Right: Adjusting the line for the pipe to avoid some of the larger dongas and rough terrain, while keeping it on an even gradient.

The ditches were dug around 30 cm wide and 40 cm deep – evenly throughout the length of the pipe. These ditches were dug by the learning group participants as their contribution in kind to the process.

A header tank with a ball valve (in this case a 2 200 L tank with a drinking-trough ball valve) is placed, ideally at the group's highest homestead. For this group, however, it was placed at Phumelele Hlongwane's homestead as she was the leader of the group and prepared to do the daily opening and closing of taps to provide water to the rest of the learning group members.

Figure 5: Left to right: Group members digging the ditch from the spring to the header tank. The header tank at Phumelele Hlongwane's homestead – which was not installed on a level platform and has subsequently been corrected. Initial rough layout drawing of the flow of the water to participants' homesteads.

Once it was ascertained that the water actually flowed into the header tank, the time taken to fill it was carefully recorded over a few days. In this way, the water flow and overall capacity of the spring was determined. This was then used to work out the daily water allocation for each of the nine participants. As at November 2019, due to dry conditions in the area and low flow of the spring (2 200 L in seven hours, thus ~300 L/hr), participants were allocated 200 L drums with ball valves. These can be filled twice a day – once in the morning and once in the late afternoon.

1.2.3 Initial comments after installation

Summary of observations:

- Water was being decanted from the 2 200 L header tank straight into participants' 200 L drums before the tank was full.
- The water was somewhat muddy due to the damage caused in the offtake trench by cattle.
- The water was running very slowly, which was disappointing for the participants who were hoping for more water.
- Participants suggested making the small pond/dam bigger. It was explained that this would not increase the flowrate of the spring.
- One participant also suggested closing up the whole spring to get more water. It was stressed that the spring was communal and that removing access entirely was likely to cause conflict in the community. Participants also mentioned an old community belief that when you completely close a spring, then the "water owner/spirit" will it dry up and move it to another place.

The facilitation team stressed by that this was an experiment in working together and taking responsibility for management of a local resource. There was no precedent. This meant that they would need very clear agreements and trust that everyone would to stick to the rules that they made. If only one person reneged, or tried to take more water than their allocation, or left their tap open, it would mean that none of the other participants would get water. This would quickly escalate into major conflict among the participants. Thus, was important to commit entirely to the process at the beginning.

The following rules were subsequently agreed to:

- The header tank needs to be left to fill up. Then the tap will be opened and the 200 L drums for each household will fill up.
- Once the top household's 200 L drum is full, the tap for the header tank is again closed – so that it can fill up again.
- No-one can use water while their drum or tank is filling up. You need to wait until it is full, and the main tap is closed.
- Each person can receive 2 x 200 L in one day – so, for example, at 8 am in the morning and again eight hours later at 4 pm.
- The header tank will be left to fill up and remain full overnight, so as not to draw too much water from the spring.
- Phumelele Hlongwane will have access to 3 x 200 L drums – more water than the other participants. (This agreement was made because she is responsible for checking the header tank and opening and closing the main tap twice a day. She also provided a greater initial financial contribution).

1.2.4 Phase 2: Laying pipes and installing drums for each participating household

Thereafter, a discussion was held about where the ditches would go for the pipes to peoples' households. It was agreed that the main feeder pipe would be dug along the small road to Phumelele's house, that people would take their pipes off this line, and that the pipes would go through a few of the participants' fields. It was agreed that Landiwe's main homestead, but not the second, could be included in the system, and that no more participants would be included – those who had not yet paid would be removed from the list.

GPS coordinates were taken for each participating household using "Maveric" (a free cell phone App) and then plotted on a map using Google Earth. From this map, heights and distances could be determined and thereby who could receive gravity-fed water from the header tank and how much piping would be required.

Figure 6: Creating a Google Earth map from GPS coordinates using cell phones is not very accurate, so a correction was made. The blue line indicates the main feeder pipe to participants' homesteads running along the small road to Phumelele Hlongwane's homestead.

1.2.5 The header tank and reticulation to the households

Figure 7: Plinth for the 2 200 L header tank

The learning group constructed a level plinth for the header tank after it collapsed in a storm due to the initial, less secure arrangement of cement bricks and a pallet. This was an important lesson for the group where an attempt to save money and effort led to this unfortunate event. The group shouldered the setback well and collaborated to construct the more secure plinth.

They then dug the ditches for the pipes leading to their households according to the discussion and map provided for them and with assistance from MDF fie**ld staff. Each household procured the 200 L drum required. This was done** within a week, after which the agricultural engineer assisted in laying the procured piping and installing the necessary connections and float valves in the drums.

Figure 8: Left to right: Laying the piping along the edges of the fields. Pipe branches towards the different homesteads. Fitting the inlet pipes to the 200 L drums. Installation of a float valve in each drum.

The group also agreed not to have taps installed in the drums, but to take water from the top of the drums. The system began operating after a few false starts when participants tried to take water before the drums were full and the tap at the header tank had been shut off. Participants eventually came to understand that none of their drums would fill up unless everyone waited until they were all full and the main tap had been closed. This is a requirement due to the low flow of the spring and the gravity-feed system.

1.2.6 In conclusion

Five months after installation, the project was still functioning well and all nine households were receiving their allocations of water. Some maintenance had been done to leaking connections and float valves. All members were very happy with easier access to water for household and gardening purposes and felt that this scheme would really come into its own in the winter of 2020. Phumelele Hlongwane found that managing the header tank was not too problematic or time-consuming and was very relieved that the process was running so well.

Figure 9: Left: The Gumede family's drum with water five months into the scheme's management. Centre: Mr Nkabinde's drum. Right: Phumelele's three drums.

This has been an extremely valuable process for building social agency in the learning group as well as for systemic and systematic learning for all the group members. They had to grapple with both the understanding of the technical aspects as well as the social process that they had to put in place and adhere to.

The whole group was involved throughout, and learning took place through discussions, provision of information, working with the mapping and layout aspects, and practical work. A lot of the learning happened through trial and error, as participants started changing their perceptions and understanding.

Some of the technical aspects that participants needed to experience before fully appreciating them were:

- That increasing the size of the small dam for the spring would not increase the amount of available water – which was primarily dependent on the strength of the spring.
- That the underground water flow into the slotted pipe was just as strong as or stronger than water flowing in a ditch above the ground.
- That the main pipe taking water from the spring to the header tank needed to be on an even gradient even though the header tank was situated well below the level of the spring. The initial ditch that was dug by participants did not adhere to this principle and water did not reach the header tank. This had to do with the broken terrain, the formation of air bubbles in the pipes and the weak flow of the spring itself.
- That households above the header tank were unable to receive water from this gravity-fed system and that estimating the level of the household compared to the tank did not work well – this is something that needs to be measured, and was done with GPS coordinates and Google Earth maps in a participatory fashion.
- That the header tank must be on a secure and level plinth due to the weight of the water in the tank.
- That a gravity-fed system fills up the drums from the bottom of the slope first.
- That the filling of the household drums was dependent on everyone not using water until all the drums were full and the main tap on the header tank had been closed.

In terms of the social aspects, participants initially believed it would be easy for them to manage the water use, but they very quickly realised that it was very important to have upfront and strict rules to ensure that everyone received the same allocation of water. This was a deeply empowering process for learning group participants.

1.3 Borehole installation and water reticulation in Sedawa and turkey (Limpopo)

Access to water for household purposes and small-garden household food production has become the most pressing problem in the Lower Olifants region of Limpopo. In some areas there are no water services at all and people still rely on local springs that they share with their livestock. In other areas, the few boreholes/wells that have been provided by local governments are running dry, have broken down and are inadequate to provide for everyone in the community. In these villages, women now have to buy water and must survive off around 200 L of water per week for their entire household. Even under these circumstances the women are still trying to cooperate to produce small quantities of food.

In two villages (Sedawa and Turkey in the Mametja area of Limpopo) women and men formed water committees to cooperate to source water for their households and gardens. They received the necessary permissions from their traditional authorities, but undertook to do this work independently of government officials, given the perceived high levels of corruption in local government circles and local government's lack of commitment to support poor rural people's agricultural activities The water committees collected small amounts of money (R500/household) and developed plans for drilling wells/boreholes and sharing the water.

Financial assistance was found for these groups as the infrastructural costs of drilling boreholes and reticulating gravity-fed systems for so many participants (20 per group) was unaffordable for them. As was the case in KZN, participants volunteered their labour for digging trenches and laying pipes and agreed to arrange for their own homestead storage containers.

1.3.1 Introduction

Initially, meetings were held with the two water committees representing four learning groups across four villages to discuss how the process could be undertaken and to work through some of the logistical and financial details. Participants were given the task of looking for possible locations that had good groundwater retention potential to be surveyed and to look for drilling companies that had worked in their villages, and whom they trusted. The groups also finalised participants to be involved and their financial and labour contributions to the project.

Figure 10: One of the water committee meetings held in Turkey in November 2019 to prepare for the borehole project

1.3.2 Possible locations and borehole survey

Participants from each village chose two to three possible locations to be surveyed as a starting point. Raymond Vonk from Georay geophysical services and his assistant undertook the surveys using a process that incorporates both vertical electrical sounding and horizontal profiling activities. These tools determine the depth and thickness of various subsurface layers and their relative water-yield capacity. They started working at Turkey 1 with the water committee members and MDF fieldworker, Betty Maimela. Raymond moved along the most plausible lines from the positions suggested and the best option for drilling was calculated from there. Private property such as orchards and existing unutilised boreholes as well as other obstacles were considered. He also surveyed three suggested locations at Sedawa.

Figure 11: Left: View of rock and pebble formations typical of an area where subsurface water is flowing. Right: Raymond surveying at Turkey 1.

1.3.3 Choosing location for borehole drilling by participants

The process of choosing the right location was difficult. From the options provided, participants had to consider distances between the borehole and their homesteads, options for where the header tank would be and where the mainline pipes would go. Some conflict arose due to a lack of trust and some participants initially refused to accept and discuss these challenges objectively. It took a few meetings and a lot of discussion to make these decisions, after which Betty used the cell phone app *Maverick* to survey the GPS coordinates of each household. This was in order to map out (using Google Earth) the participants' respective distances and heights to design the best possible system within the given constraints of topography and budget.

The maps assisted in outlining the quantity and type of pipe to be used and clarified that some participants were too distant or elevated to be serviced. Further negotiation was required, which saw the removal of piping to irrigated fields – these were all over one kilometre away and participants did not see themselves being able to afford and install their own piping. For those few households that fell above the header tank, arrangements were made to provide tanks for them at a household nearby.

The drilling company that participants preferred was not immediately available and eventually everyone agreed on the agricultural engineer's recommendation – Afrisolutions from Tzaneen – who were already working in the area and had experience installing community-based infrastructure. There was a lot of debate about the reliability of drilling companies.

Figure 12 (Right): Core samples taken during the drilling process. These pictures were sent to Mr Vonk to determine whether drilling should continue or stop, based on the structure and consistency of these samples.

Figure 13: Left: The drilling machine. Right: Water starting to flow during the drilling process.

Only two of the four proposed boreholes drilled were successful, yielding around 14 000 L/hr (Sedawa 1) and 500 L/hr (Turkey 2) respectively.

1.3.4 Designing and mapping the mainline pipelines

The agricultural engineer worked closely with Betty to finetune and finalise the maps. These were discussed and negotiated with the water committee groups repeatedly until everyone agreed. The maps also indicated the size of pipes and the different connectors needed. Pipe sizes differed to ensure even pressure within the system and a reasonably even supply of water to all households.

Figure 14: Map of a section of the Sedawa pipeline outlining the different pipe sizes in different colours

Figure 15: Map of a section of the Turkey 2 pipeline with the different pipe sizes indicated in different colours

1.3.5 Decision-making with MDF and the participants

Once the boreholes were drilled, a number of decisions needed to be made, including the best use of available budget, whether to proceed with the two working boreholes and how to accommodate those participants who lived in the two villages where the boreholes drilled came up empty.

First, we discussed the process of borehole drilling, the costs involved and how much of the budget was left thereafter. Some suggestions here included that further sites be surveyed and drilled in the two villages without water – so that all four should end up with a borehole – and then to find further funding to develop these boreholes later. It had to be explained to participants that project budgets could not be so diverted from the purposes for which they were proposed. It was thus decided to continue with the two boreholes and support the villages without boreholes by providing 15 x 2 500 L Jo-Jo tanks for participants in Turkey 1. For Sedawa 2, the three participants suggested that a 4 500 L Jo-Jo tank be placed in the system for them as close as possible to their homesteads and they would arrange between themselves to fetch the water from there. MDF also undertook to search for further funding opportunities.

Participants also decided on where to place the electric box for the boreholes and who would be in charge of pumping water.

Figure 16: Left: Jo-Jo tanks delivered in Turkey 1. Right: Tank installed at a homestead in Turkey 1. Note the stable plinth constructed here. All participants were urged to do this.

1.3.6 Continuing with installation of pumps and header tanks

Afrisolutions then continued with the process of installing PVC casings, pressure pumps, lock boxes and electric cabling for both boreholes, as well as the piping, valves and stands required for the installation of these tanks. Afrisolutions worked with the two teams of participants in Turkey and Sedawa. It was found that the borehole in Sedawa had partially collapsed, and this required “blowing out” again, which delayed activities in Sedawa somewhat.

Figure 17: Left: Lock box for Turkey. Centre: Lock box for Sedawa. Right: Controlling valve for the pump inside the lock box.

Afrisolutions hired three participants (decided upon in their groups) to dig the trenches to take cabling to the households which would manage the electricity supply.

Figure 18: Left: Electricity supply in Sedawa showing the cable and plug for the borehole pump. Right: The cable in Turkey linked into the electricity box with a switch.

1.3.7 Planning the digging of the main pipeline trenches

The MDF team worked with the two water committees to understand the maps and then undertake walks to stake out the different sections of pipe, where the pipe sizes changed, which fittings to use and where the pipes would cross paved roads.

The agricultural engineer also worked with the committee members to ensure that they understood how the fittings worked, what the reducer couplings looked like and how to install them. People were confident that they knew how to do this themselves.

Figure 19: Erna Kruger and Alain Marechal working with the Turkey committee to explain the pipeline on their map

The paved road crossings were a cause for concern, but the water committee members felt that they could easily get permission from their traditional authorities. In Sedawa, the process of approval and installing pipes below the paving and replacing paving thereafter worked smoothly. In Turkey, however, local residents stopped work on the day – after approval by the traditional authority – insisting instead on having a cement speed bump on top of the paving, with the pipes inside the structure encased in a steel sleeve. They insisted that they did not trust the water committee or the implementer to restore the road to its original state after laying the pipe.

Figure 20: David van Wyk from Afrisolutions working with Alain Marechal to site and measure the two paved road crossings in Sedawa

At the same time, Afrisolutions was installing main tank stands before connecting the Jo-Jo tanks to the boreholes. Again, some discussion was required as participants had envisaged much higher stands and felt that the 1 m high stands would not allow for proper emptying of their header tanks. The MDF facilitator and the engineer needed to re-explain how the heights and pressures were calculated and the reason for choosing these lower and cheaper stands.

Participants took it upon themselves to dig the mainline trenches from the borehole to the header tank to ensure timely implementation. It was very difficult for participants from Sedawa to cooperate and dig the trenches. Some participants didn't work on the trenches, and they all became convinced that the soil was too hard and rocky to dig. The local facilitator, Christinah Thobejane, requested assistance from the municipality with digging trenches using a TLB, but was told that the TLB was occupied on a sanitation project. Participants held meeting after meeting to discuss the way forward. They eventually reached the decision that they would each dig 20 metres of trench and that each person's section would be numbered, so that everyone knew which section they were meant to dig. Most of the participants adhered to the decisions taken, but there were a few who did not. Participants again made more rules, where fines of R350 were instituted for noncompliance and the threat that their pipes would not be connected until they paid the fine.

Figure 21: Left: One of the Sedawa group meetings to thrash out how the main trench would be dug. Right: Measuring a rope to stake out each person's 20 m section.

Figure 22 (Right)*: Left: Digging the main trench to the header tank in Sedawa. Centre: Alain Marechal working with Alex and Magale in Sedawa to stake the crossings. Right: Digging the main trench to the header tank in Turkey.*

Once the header tanks arrived in Turkey and Sedawa and had been tested, Afrisolutions connected the pipes.

Figure 23: Left: Header tank at Sedawa (Joyce Seotlo). Right: Header tanks (4 500 L each) fully functional and tested at Turkey (Michael Makgobatlou).

1.3.8 Laying the pipes from the header tanks to the homesteads

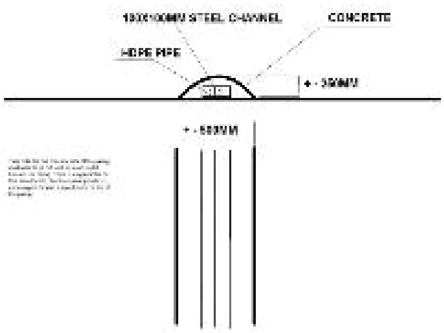
Delivery of piping was done in both villages and participants started digging their trenches around the last week of February 2020.

Figure 24: Piping and fittings delivered to Sedawa

Figure 25: Piping and fittings delivered to Turkey

After the pipes were delivered, participants started laying and connecting the pipes and closing the trenches with the help of MDF facilitators Betty Maimela and Jessica Mangema. Afrisolutions in the meantime installed the speed bump across the main road to connect pipes from the borehole to the main Jo-Jo tank in Turkey.

Figure 26: Left: Sketch for speed bump construction (Alain Marechal). Right: Construction of speed bump.



After the speed bump construction, community members were still unhappy that the bump was too steep and rounded. After much negotiation, in which the traditional council notably failed to help, Mr Malatji eventually agreed to use some group funds to buy more cement and the group helped to even out the bump to the grumblers' satisfaction.

At Sedawa, the crossings were done differently – three crossings were constructed on the paved road sections where the paving was removed, the steel sleeve and pipes were buried and the pavement carefully replaced. This was completed without incident and the crossings were all but invisible.

Figure 27: Left: Final speed bump crossing in Turkey. Right: One of the crossings under the paving in Sedawa.

1.3.9 Connection of pipes in Turkey

Turkey participants thought it would be a simple job to connect the pipes and that they could do without the help of the engineer. When they encountered several challenges, however, Betty assisted the group, with continuous telephonic support from Alain Marechal.

During the process it became clear to the group that if they wanted to divide the participants into two groups, who received water on alternate days, as they had decided, then further valves would be required to close off one section and open the other. These were then installed in the lines. It took participants five days to install all the pipes and fix the speed bump. Below is a figure of one of the connections and the drawings provided by the agricultural engineer to facilitate the process.

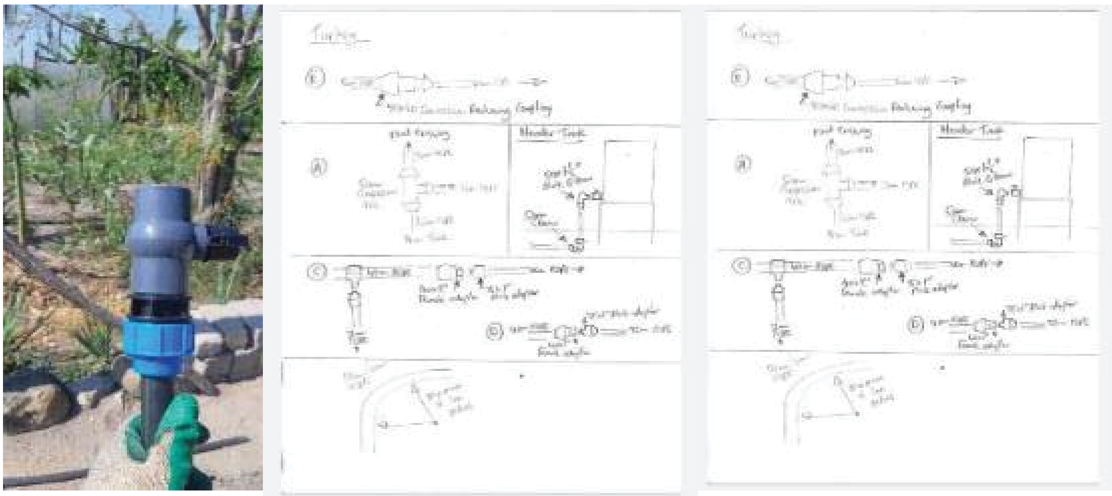


Figure 28: Left; A picture of one of the connections. Centre and Right; drawings indicating how the connections are put together

1.3.10 Connection of pipes in Sedawa

These participants also thought it would be easy to install their pipes, but found the actual implementation quite challenging. The figure below shows a photograph and drawings of an example of the household connector valve for Sedawa.

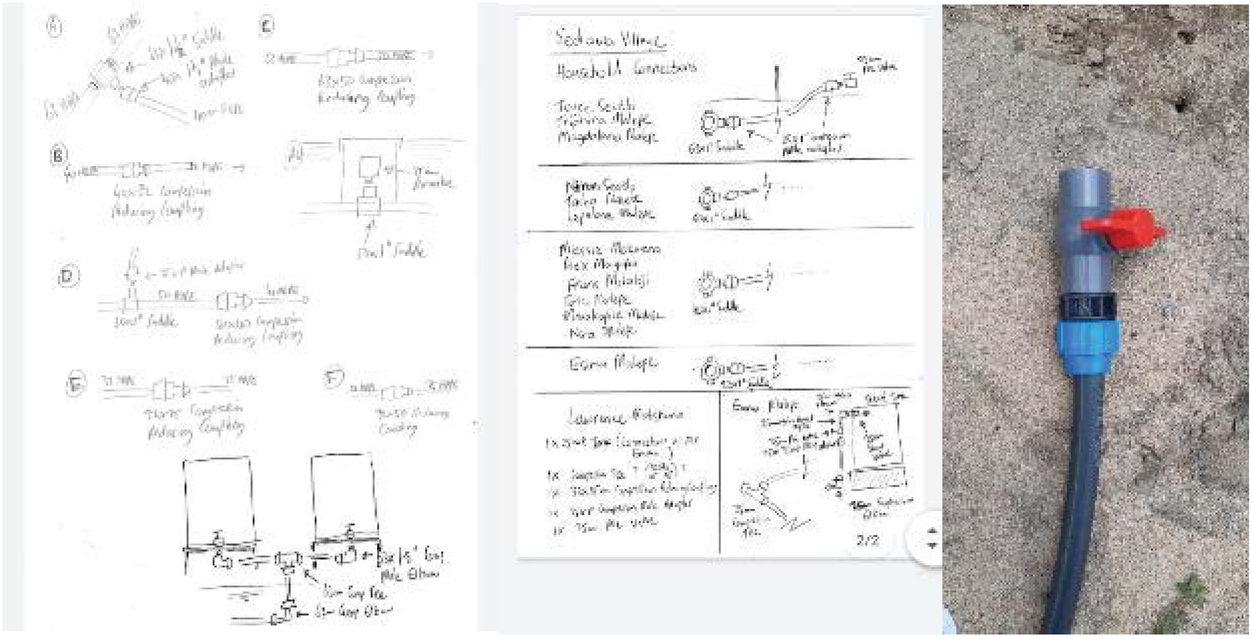


Figure 29: Left and centre; drawings depicting how to install the household connector valve to pipes and tanks and Right; an example of a household connector valve in Sedawa

The pictures below provide some indication of the work and process in Sedawa.




Figure 30: Clockwise from top left: A homestead connection into the main pipeline. Top centre and far right: Digging out the trenches using picks. Bottom centre: Laying a pipe into one of the trenches.

Both these systems and the system in Turkey are running smoothly. Participants have calculated the costs and determined the processes for which each individual is responsible. Generally, pumping is undertaken once a week for each participant, and in this case, as the borehole is not very strong, participants receive an allocation of 800 L of water per week.

In Sedawa, participants took longer to install their household connections and tanks and by May 2020 the pumping regime had yet to be finalised. Each participant is to receive 2 200 L of water per week.

In conclusion, these processes have been a very important empowerment process for these villagers, who now have access to a reliable, self-managed source of household water.