The use of Canzee Pumps in the Zinder region of Niger.

A report of Richard Cansdale's visit to Winrock International, Zinder, 29th August – 11th September 2009.

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Background

In September 2009 (harvest time in Niger) Winrock International planned to launch a publicity campaign for the Canzee Pump, hoping to help a local importer sell 50 Canzee Pumps to households at full-cost. The Canzee Pump is an extremely simple pump that is resistant to break-down and is easily repaired. However, in order to sustainably promote the Canzee Pump in Niger we thought that it was important that the pump be made locally. Richard Cansdale, the pump's inventor, is anxious to maintain the quality and the image of his pump and requires that those interested in manufacturing the pump work in collaboration with him.

With support from the MUS Group (as well as from Winrock International), Mr. Cansdale came to Niger and was able to develop an extremely low-cost household version of the Canzee pump. The first prototype was made and installed during Mr. Cansdale's visit. Follow-up visits have shown that the prototype is functioning normally and an order has been made for 10 more locally-produced pumps.

Emily Kovich.

Winrock International.
Zinder, Niger. October 2009

Since 2007 Winrock International has installed of Canzee Pumps in the Zinder region of Niger. These pumps are serving communities varying in size from 50 to 660 individuals.

Whilst there have been a number of temporary breakdowns, the pump's simplicity and ease of maintenance has meant that **all** the installed pumps are currently functional, having been maintained and where necessary repaired by the villagers themselves. Furthermore there have been many requests for more pumps from both communities and individuals.

In September 2009 Richard Cansdale, developer of the Canzee Pump was invited to evaluate the technical performance of the pumps to date; to look critically the installation techniques and maintenance practices and to suggest how the current pump design might be modified to make the pumps more affordable by private purchasers.

Tour of existing pumps.

Village name.	**Garin Brah**
Date of installation.	2007
Size of village	Large*
State of pump upon arrival	The pump was functioning, but the pump head was loose in the galvanized metal threaded socket. The pump was able to pump water but did not hold its prime. (i.e. after pumping, water ran back and did not yield water immediately when pumping resumed.)

General impressions.

This was known to be one of the most heavily used pumps with approximately 660 users. There have been numerous interventions, including valve disc replacements, a new pump rod, and repairs to the tail pipe. The pump was extracted and examined. A number of obvious indicators revealed some of the interventions:-

1. There was considerable play between the rod and the venting plug.
2. The tail pipe had been repaired with an external split pipe glued onto the pipe and bound with rubber strapping.
3. The tail valve had obviously been removed several times, but when we wanted to examine the disc it was very difficult to unscrew. When it was removed the threads were full of silt but the rubber disc seal itself was in good condition.
4. The pump head was very difficult to unscrew from the tail pipe, and like the tail valve, when it was unscrewed the threads were also found to be full of silt.
5. The pump spout had become detached from the head, but was tied on with rubber strapping.

Actions taken at the time of this visit:-

1. The plunger valve disc was found to be slightly split so it was removed and replaced with a new one.
2. The pump head was screwed off the top of the tail pipe (with the greatest difficulty) and replaced on account of the worn 3" threads. When the new pump head was screwed into place, just as the final tightening occurred the threads jumped! (This suggests that the original metal fitting was slightly over size which explained the problem of the stripped threads in the first place.) To compensate for the over-size threads, a strip of plastic (from a plastic bag) was wrapped around the threads at the base of the new pump head and the pump screwed back into the socket on the well slab. This time when the pump was replaced, the threads appeared to hold. (The maintenance teams will be briefed to look out for a potential problem when they next visit this pump.)

Note. After the pump was reinstalled and pumping resumed, a quantity of sand was spotted in the water being discharged. This probably explains why the pump does not hold its prime despite the tail valve being in good condition. (If sand is drawn in and lodges between the valve body and the rubber disc, the disc is cannot lie flat and close totally, thus allowing water to run back out of the valve.) It seems that the

external pump valve is too close to the sand at the bottom of the well so really the pump pipes need to be shortened. This is an action the villagers should be capable off provided they have the knowledge of what to do. The only materials they will need will be some spare pipe, a saw blade and a small quantity of fresh pvc glue.

Village name.	**GARIN MANGOULE**
Date of installation.	2007
Size of village	Medium 400 - 500
Maintenance carried out to date.	The pump rod had been repaired and on two occasions new valve discs fitted.
General impressions.	A well cared for pump. The pump did not hold its prime and the community was aware that a new disc seal was needed. They were intending to replace it shortly so we did nothing else.

Village name.	**TASHAL BADAWA**
Date of installation.	July 2007 with Richard Cansdale present.
Size of village	Originally Small (120) but it has now grown on account of the pump.
Maintenance carried out to date.	Pump rod repaired once. No other interventions needed.
General impressions.	The pump was in good working order, and much appreciated by the community.

When asked, they said that the children health was much better since the pump was installed with many fewer stomach problems.

Village name.	**GUNGARE KAWARE or CHARGALE**
Date of installation.	2009
Size of village	360
Maintenance carried out to date.	None needed.
General impressions.	An exceptionally clean and well- maintained pump surround. Waste water runs underground through a pipe to a soak-away which was actually the pit from which the sand for the plinth was dug. The pump handle is made of a metal tube flattened centrally. This was not the design intention, but at least in the short term is perfectly good and viable.

The spot on which buckets and plastic containers are placed slopes more than necessary and would be improved if a larger brick was available to stand the buckets on. In every other respect the installation was outstanding.

Village name.	**BIMA**
Date of installation.	2009
Size of village	300
Maintenance carried out to date.	None required.
General impressions.	Another impressive installation. This pump had been fitted with the 32mm/40mm pipe combination not because the water table was particularly deep, but because at the time of the installation no 50mm pressure pipe was available. This is of no importance because whilst the pump's yield is perhaps slightly less than one might expect for a 40/50mm pump, it is also easier to user so at the end of the day the amount of work needed to fill a bucket is the same.

Summary of maintenance requirements since the installation of the pumps:

DISC SEALS. Most of the pumps installed in 2007 had had their rubber disc seals replaced at least once. One had had not needed any new seals in two years whilst one had had them replaced twice. This is the one procedure which has always been anticipated and is expected to be done on a "need to do basis".

If a pump seals are working well the pump should hold its prime. The main indication that a seal needs to be changed is when the pump does not hold water when pumping stops, and the next pump user has to raise water from the water table before any water emerges from the pump spout. In this case the rubber disc is likely to be damaged and the pump is simply inefficient. If the pump will not produce any water at all, it will be because one of the seals has become removed entirely from its valve. This occurs when the rubber disc is very old or perished.

Changing disc seals is something to be expected. There are some who say that the pump users should be encouraged to change the seals every six months or so, to remain familiar with the maintenance procedure. To be realistic, this is unlikely to be done so all one can do is to encourage the users to do is to chose the best quality discs possible when replacing the rubber the discs.

Note. There is another reason why a pump might not hold it prime, and that is there is a leak in the outer pipe or the valve is not screwed home completely. If, after replacing the rubber valve disc, water still runs back, the pipes should be checked to see if they are damaged in any way.

PUMP RODS. The pump rod and the pump rod guide are also likely to require changing after a while. The frequency of change will be proportional to the amount of use the pump receives with heavily used pumps needing attention more often.

It was noted that *all* three of the 2007 pumps had already had had their pump rods repaired. In one respect it was disappointing that they had needed repairing quite so soon, so this is an issue which we will need to look at from the design aspect, but on the other hand it was most encouraging that the villagers themselves, in some cases without the involvement of the maintenance teams, had arranged for the repair to be carried out. When visiting ESMA, the hardware store in Zinder, it was encouraging to see that stainless steel pump rods are available for sale thus providing a local source of replacement rods.

BREAKAGE BETWEEN THE PUMP SPOUT AND THE PUMP BODY.

The joint between the pump spout and the body is vulnerable if the pump spout is not supported from below. Two of the pumps had had broken spouts but in both cases they had been repaired with rubber strapping; perhaps not the most aesthetically pleasing repair ever, but perfectly practical, appropriate and functional.

2009 INSTALLATIONS.

Visiting the two most recently installed pumps was most encouraging. The teams are to be commended for the excellent pump surrounds, and the users for keeping them is such a clean and tidy condition.

There are still things to be learned about the installations, in particular the best way to ensure that tall and short users (i.e. adults and children) are able to operate the pumps at a comfortable working height. The plinths surrounding two pumps installed during the course of my visit in September 2009 were modified in the hope that adults and children could stand at different levels. In the event the new design was still not 100% right but with a little more modification this will be possible in the future.

Conclusions to be drawn.

To have visited five pumps at random and without notice, and to have found all five functioning and being actively used is extremely encouraging. Pump installation projects in Africa have been plagued by breakdowns and abandonment. In the case of Canzee Pumps the hope was that the pump could be maintained and repaired either by the users themselves or if not by the local maintenance teams. We now have some confidence that this indeed is proving to be the case.

Even as recently as 25 years ago, pvc pipes were not present in the hardware stores in the local towns. Now anyone can buy pvc pipes, a wide range of pvc pipe fittings and the special pvc glue to join them in most towns. This makes the introduction of a pump like the Canzee quite feasible - and also offers a challenge as to how a simple and inexpensive version of the Canzee pump might be made locally.

Where do we go from here?

Since Canzee Pumps were introduced in the Zinder region they have attracted significant interest. Often when the village pumps were installed, individuals then asked if they could buy pumps privately for their family compounds.

What factors need to be present to make local manufacture of Canzee Pumps possible?

There are three main things to consider:-

1. The availability of the necessary materials.
2. The availability of the necessary tools and equipment to make the components.
3. The required skill level to make the components to a high standard.

Before answering these questions let us consider what design of pump is we intending make. Do we want to replicate precisely one of the existing Canzee Pump designs, or might it be possible to offer a simpler design to private users?

Winrock International would like to offer an affordable Canzee-type pump to individual families. Logic suggests that the amount of wear in a privately owned pump is likely to be much less than that of a village pump. Not only will there be fewer individual users, but those using it are family members who one might expect to respect their own pump more than they would the communal village pump. For these reasons the pump could, at least in theory, have be a much simpler and lighter design than the existing village pump, which would of course also make it significantly cheaper.

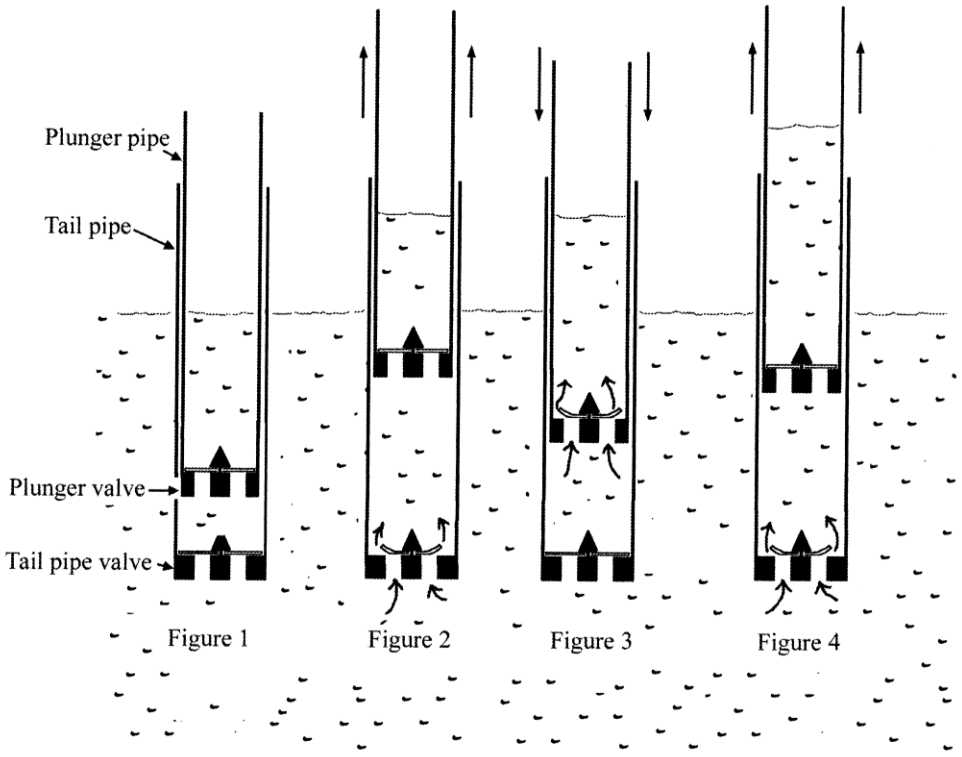
The challenge is how to simplify the pump design, a) without compromising its performance in terms of its discharge and ability to lift from the water table, and b) by using materials obtainable from the local markets.

DISCUSSION – How does the Canzee Pump work?

For those reading this report who may not be too familiar with Canzee Pumps, we will first consider what design features constitute a Canzee Pump, and what sets it apart from other apparently similar pumps.

Canzee Pumps make use of a very simple pumping principle based on TWO concentric pipes, with a non-return valve at the bottom of each pipe. The most common pipe combination is a 40mm pipe inside a 50mm pipe, but for higher lifts a 32mm pipe inside a 40mm pipe is used.

When the pump is installed the bottom ends of both pipes must be below the water level in the well or borehole. The outer pipe is suspended from the pump head and remains stationary, while the inner pipe can be moved up and down by the pump user.



These diagrams illustrate how the Canzee pump lifts water.

In Figure 1 the pump has been lowered into the well. Water has entered both inner and outer pipes and risen to the same level as in the well.

In Figure 2 the inner (plunger) pipe is being raised creating a space below the bottom of the plunger valve. This space is being filled by water entering through the tail pipe valve.

In Figure 3 the plunger is being pushed down into the tail pipe. Water below the plunger valve cannot escape so it is forced up into the plunger pipe through the plunger valve.

In the final figure the plunger is being raised again so more water is entering through the tail pipe valve. Note how the water level in the plunger pipe has risen further than before.

This sequence of events continues until water reaches the top of the plunger pipe and ultimately flows out of the pump spout.

Upon the first upward movement of the inner pipe (known as the *plunger pipe*), the water within it is raised. This creates a space below it in the external pipe (or *tail pipe*). This space immediately fills with water running in of its own accord through the valve in the tail pipe. During the first downward stroke of the plunger pipe the water below it is compressed. Some rises up the space between the two pipes, but most of it is forced into the plunger pipe through its valve. During the upward movement of the plunger pipe water is lift the within the pipe, then during the next downward movement more water is forced into the bottom of the pipe. After a short time the water reaches the top of the plunger pipe where it fills the pump head. As soon as the pump head is full, water pour out of the pump spout.

The key points to note are first that the pump is a lift pump and NOT a suction pump, like for example the Treadle Pump. Water is lifted by the closed valve at the bottom of the plunger pipe. The second important point is that there is no need for a tight fitting cup seal which is normally the case in a piston pumps. Canzee Pumps can perform quite satisfactorily with quite a loose fit between the inner and outer pipe. Clearly if the fit is too loose the efficiency of the pump is affected, but even here there are things which can be done to improve the pump's performance.

All Canzee Pumps share this basic "pipe within a pipe" principle. What can vary enormously is the design of the pump head and the method used to attach it to the top of the well. In fact the design of the pump head is almost irrelevant. It can be more robust or much lighter depending on its specific application. Early models had an extremely solid head which fitted directly onto a strong plastic embedded in a cement post. The head was locked in place by a ring of six bolts.

Since 2006 most Canzee Pumps have been fitted with a 3 inch male thread which allows them to be screwed directly into a 3 inch female iron socket, cast into the top of the cement slab. This allows for a quicker means to install or replace the pump head, but if the spout is not supported it may be damaged.

Up to the present time most Canzee Pumps have been intended for use by small rural communities. 100 users per pump is a good target to aim for, but after a pump is installed one has no control over the number using it. We are fairly sure that well over 200 are using some pumps, and other communities have grown as a direct result of the pump and the access to clean water it provides.

To date most Canzee Pumps have been made in the United Kingdom and exported to Africa, but workshops have been set up in Madagascar and Malawi. (In Madagascar SWS supplied more than 400 pumps in 2004 and 2005 and the assisted a local firm to start manufacturing the same design of Canzee Pump. To date there are over 1000 Canzee Pumps operating in Madagascar.) In 2008 SWS Filtration sent a shipping container to Malawi with the tools and materials to make 600 Canzee Pumps.

As it happens, at this very moment, groups in several countries are interested in starting local production, using as far as possible materials, skills and facilities available in country.

As mentioned earlier, the main aim of my visit to Niger was to suggest how a simple Canzee Pump might be made using locally obtainable materials at a price which would be affordable by individuals and families. Low cost drilling techniques are established, so now the time is right to introduce a low cost pump to complete the package and make access to clean water truly affordable.

Is it possible to make a light weight, inexpensive Canzee pump using locally available materials?
If yes, what performance might it have, and how durable will it be?

The three key components which make up the Canzee Pumps are …

1. **the pipes and pipe fittings,**
2. **the pump head,**
3. **the valves.**

Are they available locally?

1. **Pipes.** All Canzee Pumps in Niger are fitted with locally bought pipes, so clearly this can continue. Since the same 40mm and 50mm pipes would be used as are used in the standard village pump, the pump's performance (in terms of yield or output for a given depth) will be unchanged. 40mm and 50mm pvc pipes and a good range of 40 and 50mm pipe fittings are available in both Zinder and Maradi.

2. The current Canzee **Pump head**, as installed in the villages since 2007 is much lighter than those of other village pumps, but still more robust than absolutely necessary for a privately owned pump. By substituting the existing head for a **50mm Tee piece,** would allow one to make a perfectly functional pump. 50 mm pvc Tee Pieces are available in both Maradi and Zinder.

3. Non-return **valves**. These are absolutely vital to the performance and durability of the pump. The valves consist of four separate components:-

    1. The valve body. At present SWS Filtration Ltd. makes the valves bodies individually on a lathe from a **solid pvc bar** 40mm in diameter.

    2. The tiny **cone** which holds the rubber disc in place is injection molded for SWS in the UK.

    3. The special **stainless steel pin** which holds the cone onto the valve body is bought in the UK

    4. The **rubber disc seal** which sits on top of the valve is cut from old inner tube (vehicle tyre.)

Except for the rubber discs which are cut from widely available inner tube (tyre) rubber, all the other items are harder to source locally. We were told that solid pvc bar from which the valve bodies are made can be obtained in Kano, although we did not find any. If proved to be difficult to source it could be sent from the UK.

Can the valve bodies be made locally if solid pvc bar can be obtained?

When we met Sani Rabo at his Maradi workshop on Moday 31st August we learned for the first time that he has a large engineering lathe with thread cutting capabilities. We therefore left him with a block of pvc for him to make two valve bodies. The following Monday (7th Sept) we returned to Maradi and were pleased to see that he had produced two perfectly functional valve bodies. This was most encouraging because it represents one of the key parts of the Canzee Pump.

The tiny cones can also be cut from solid plastic rod, but they are critical and are not as easy to make as might appear at first glance. However, both they and the stainless pins which hold the cone to the valve body are tiny items so they could be supplied in large numbers by SWS in a small packet.

IMPORTANT NOTE AND WARNING:-

The current design of the valve has proved to be durable and easy to service in the event of the failure of the rubber disc. Whilst it might be tempting to make a lighter and cheaper valve, I would not wish to compromise the performance and reliability of the pump by considering a simpler valve without thoroughly testing it first.

In the early days of the Canzee Pump, (when it was still the New Zealand Pump), lighter valves were used, but they quickly failed. The current valve design is one of the items responsible for the Canzee Pump's reliability and durability.

The valve **holder** is made from a short length of pressure rated 40mm pipe. A valve screws into one end and the other is glued to the bottom of the pvc pipes. The valve holder is made from a pipe must have a wall thickness of 3.0mm. All of the pressure rated 40mm pipe we found in Niger had a wall thickness of 2.4mm which is inadequate for our purpose but in Kano we found plenty of suitable pipe.

To summarize, provided we can locate the solid bar and pvc pipe in Kano the entire below-ground pump can be sourced in Niger or Nigeria except for the tiny cones and stainless steel pins which SWS can easily send from the UK.

The above-ground components.

The current Canzee Pump head is made from a plastic not available in Niger or Nigeria. The plastic used is ABS, (Acrylo Butadiene Styrene) a strong engineering plastic with a number of ideal properties for such a structure. For as long as SWS has been making the pumps in the UK this choice of plastic has been justified, but it does not lend itself to local production if the aim is to use locally available materials.

We have mentioned earlier that it is not the pump head which makes the pump a Canzee Pump, so if in the future we decide to make a local Canzee pump for village use, there is no reason why a metal head cannot be fabricated in one of the existing Treadle or Rope pump workshops. Working out the optimum design will require considerable thought, but it offers an option for the future.

Returning to the present, if we are to concentrate on a pump aimed specifically at families and households we should start by reducing the cost of the pump head. Something as simple as a 50 mm Tee will function as the head, so long as a way can be found to attach it directly to the top of the well.

In Niger, most new wells are sunk using a plastic well casing, so the challenge will be to find a way to attach the simple pump to the well casing. We put this challenge to Sani Robo, an experienced rope pump maker in Maradi (sanirabomaradi@yahoo.fr) who within a couple of hours had welded up an ingenious clamp. Externally it gripped the casing, but internally it held the pump with a clever bolted flange. We now have the potential for a very simple, but functional Canzee Pump. In fact because the below ground components are identical to those of a standard village Canzee Pump, it performance in terms of output should also be the same as that of a village pump.

Suggested construction of a Private Canzee Pump.

The plunger assembly:-

40mm pvc pipe. Pressure rated if possible, but could be made from waste pipe if really necessary.

At the bottom of the plunger pipe.

40mm pvc pipe. Pressure rated if possible, but could be made from waste pipe if really necessary.

Split internal joiner.

Valve holder. One end threaded internally to take the screw-in plunger valve.
Other end has the wall thickness reduced to the same as that of the plunger pipe to ensure the split joiner makes a good joint between the two parts to be joined.

Valve. Machined from solid pvc bar.*
Threads cut so the valve screws easily (but not too loosely) into the valve holder.
Note how the last thread is cut flat so the contact surfaces between the valve and the valve holder meet flush.
2.0mm pilot hole drilled centrally to take the pin which holds the cone.
Disc retaining cone.
Rubber disc with central round 4.0mm hole.

Note, whilst we currently use pvc for the valve body, any other hard plastic will be acceptable. Perhaps a recycled or reconstituted plastic could be molded into a cylindrical block which is then machined to size?

PLEASE NOTE. This design of valve was introduced in 2008.

At the bottom of the Tail pipe.

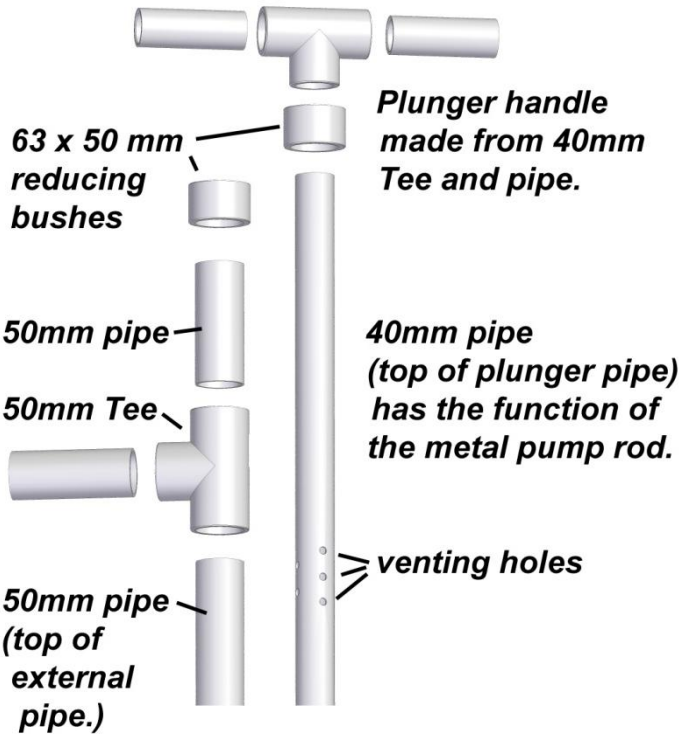
50mm pvc pipe. Pressure rated if possible, but can be made from waste pipe if necessary.

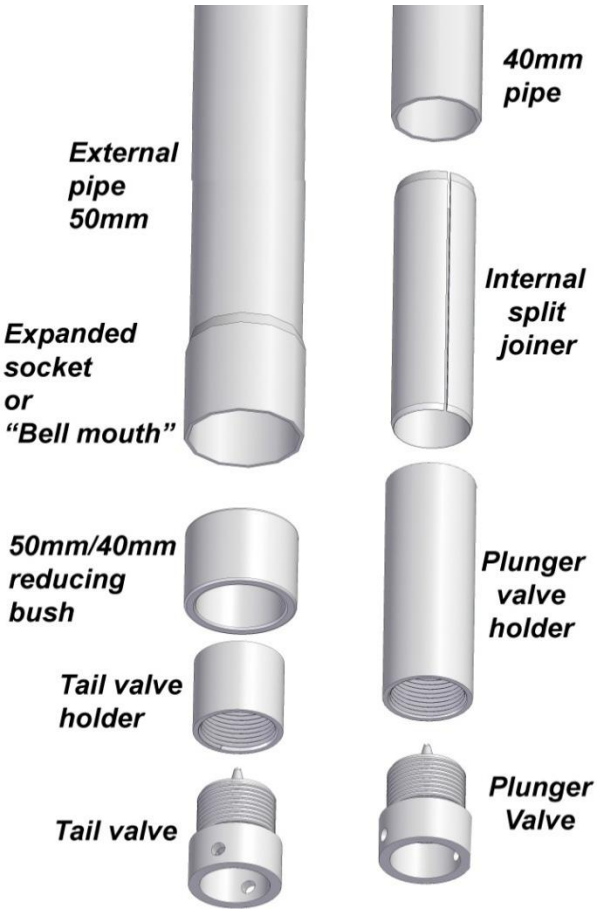
Bottom of the 50mm tail pipe to be swaged open to give a 50mm INTERNAL diameter. (also known as a bell mouth)

40mm/50mm reducer glued into the end of the 50mm pipe.

Valve holder. A short length of 40mm O.D.pressure rated pipe with 3.0mm wall thickness, threaded internally to take the tail valve. This fitting is then glued into the 40mm/50mm reducer.

Valve. An identical valve to the plunger valve.


Plunger handle made from 40mm Tee and pipe.
63 x 50 mm reducing bushes
50mm pipe
50mm Tee
40mm pipe (top of plunger pipe) has the function of the metal pump rod.
venting holes
50mm pipe (top of external pipe.)


40mm pipe
External pipe 50mm
Internal split joiner
Expanded socket or "Bell mouth"
50mm/40mm reducing bush
Plunger valve holder
Tail valve holder
Plunger Valve
Tail valve

Unlike the village Canzee Pump in which a venting plug is locked onto the bottom of the stainless steel rod, venting holes can be cut directly into the wall of the plunger pipe, and in place of a conventional handle, the user can either grip the top of the plunger pipe directly, or a pvc 40mm Tee can be glued onto the top of the plunger pipe to create a handle.

On Tuesday 8th September we took a simple Canzee Pump to the village of Sara Sara, where an Elhadj Mahamadou Adamou had paid for his own well to be sunk in his own compound.

Using the clamp welded by Sani, the pump was mounted directly onto the well casing and clamped in place. At the time of the installation no cement plinth had been cast, so test pumping was effected by standing on an upturned mortar (The large wooden vessel in which corn or millet is pounded).

The pump performed precisely as hoped, yielding as much water as the recently installed villages pump one hundred metres away.

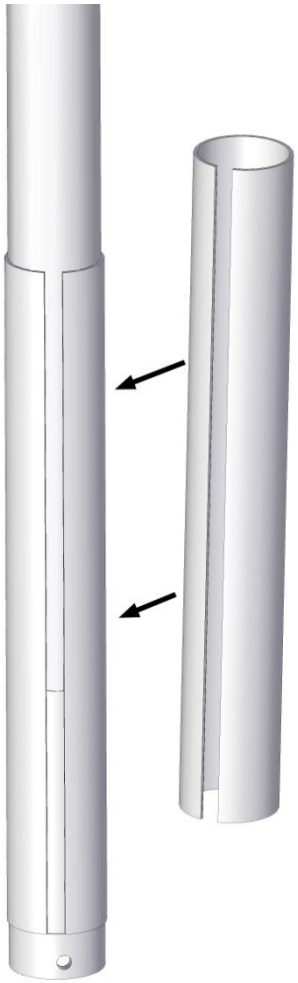
Observations.

Even more important than would be the case of a village pump with a stainless steel rod, pump users MUST be as careful as possible to avoid rubbing the inner plunger pipe against the inside of the 50mm pipe. One can see from the photograph and drawings that the 50mm pipe has to be extended several centimeters above the 50 mm Tee, to allow for water to collect somewhere before flowing out of the spout. This is a vulnerable part of the pump and we would expect wear to take place. There are measures which can be taken to minimize unnecessary wear, for example a sleeve made by splitting a length of 40mm pipe may be placed around the plunger to act as a sacrificial surface. It this wears away it may be replaced very quickly. If the plunger pipe itself wears, then the pipe will need to be cut and re-glued.

Choice of pipes?

All metric-sized pvc pipes have an outside diameter exactly that of the name of that particular pipe. So, for example, 50mm pvc pipe has an outside diameter of exactly 50mm. (This might seem to be stating the obvious, but I mention this because with Imperial sized pipes, i.e. Inch sizes, the stated size approximates to the internal bore of the pipe. The actual outside diameter of inch sized pipes is fixed, but is NOT exactly that of the stated pipe size.)

Returning now to the choice of pipes, in Niger most pvc pipes are available in two grades, Pressure (*Pression*) or Waste (*Evacuation*). Canzee Pumps can be made from any combination of these but the waste pipes have the thinnest pipe walls I have ever encountered so if given the choice I would be choose the pressure rated pipes every time.

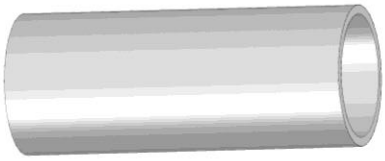


The pump is most efficient if there is a relatively small gap between the two pipes. Conversely, if the gap between the pipes is larger, there is **less** pressure to force water up into the inner pipe during the downward stroke of the plunger. Since even the pressure rated 50mm pipe has relatively thin wall, there is considerable movement between outside of the 40mm (plunger) pipe and the inside of the 50 mm tail pipe. A very simple measure which may be taken to improve the efficiency of the pump is to cut a length of 40mm pipe, (approximately 300 mm would be sufficient), make a single cut lengthwise, and snap this pipe onto the bottom of the plunger pipe. A small quantity of glue will serve to hold it in place, but even this is hardly necessary. The effect of this action is to reduce the space between the two pipes and thereby significantly increase the pumping efficiency.

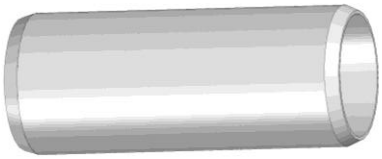
Another place where a split pipe can be used it to reinforce the plunger pipe where the venting holes are cut.

The Split Internal Joiner.

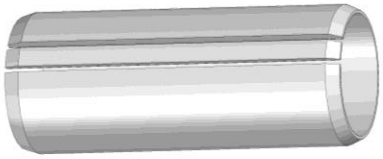
The Internal pipe, or Plunger pipe cannot be joined with a normal socket (manchon). Instead, it must be joined with an internal sleeve. We call this a "split internal joiner". It is made from a short piece of the same pipe which makes the plunger pipe. All that is needed to make it is a saw to cut the pipe, and a file to taper the outside ends.



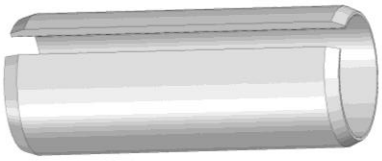
1. Cut a length of inner pipe as square as possible.



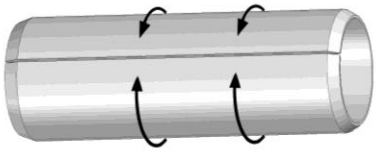
2. Chamfer the outside edges (make them pointed.)



3. Cut out a strip of pipe by making two parallel cuts.

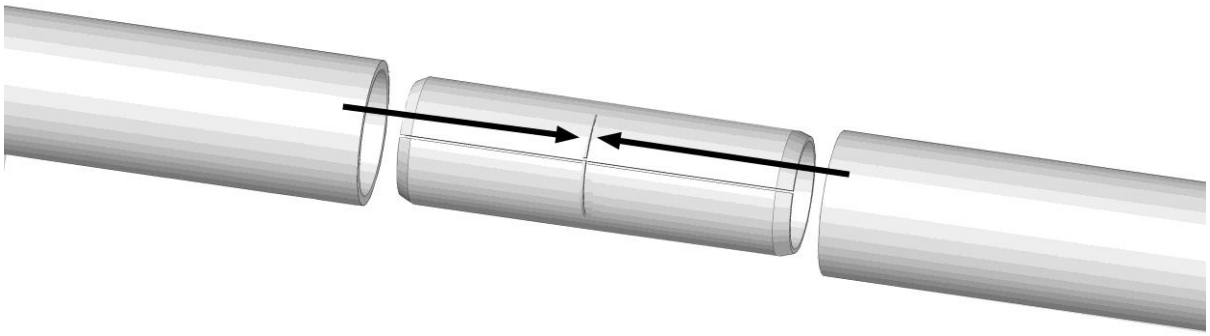


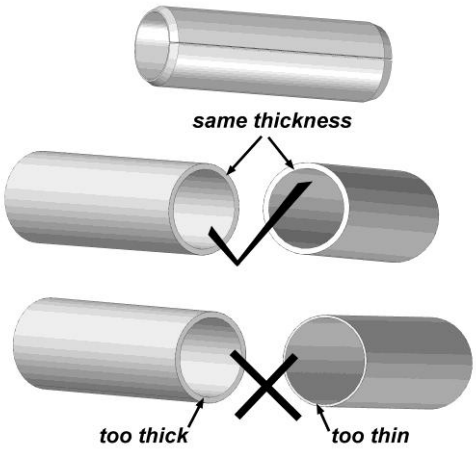
4. The width of the cut may be wider or narrower depending on how thick the walls are of the pipes to be joined.



5. Squeeze the pipe in and push it into the pipes to be joined.

(see below).



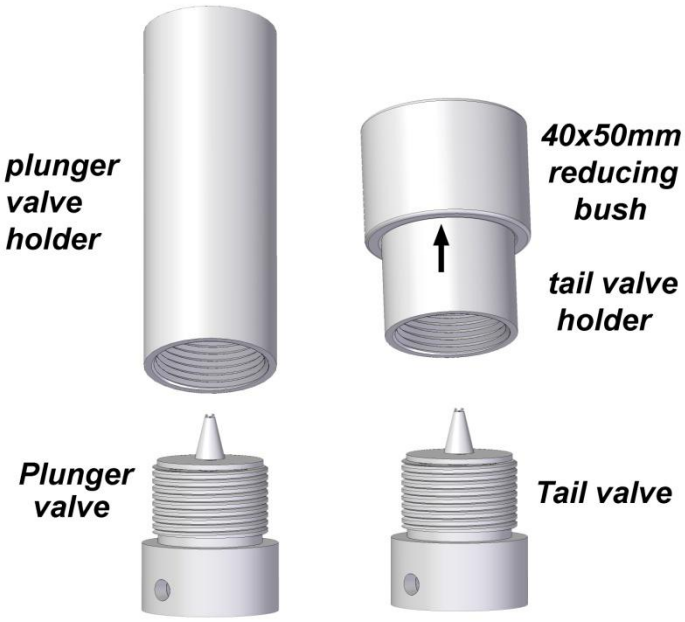


IMPORTANT NOTE.

The split internal joiner is used to join separate lengths of the plunger pipe. It makes a flush joint and does not need an external collar or expanded “bell mouth”.

However, to make a really strong joint the wall thickness of the two pipes to be joined must also be the same.

For this reason, the unthreaded end of the plunger valve holder may have to be cut down to the same wall thickness as the plunger pipe itself.



NOTES.

1. ***The plunger valve and tail valve are identical.***
2. ***The two valve holders have the same threads.***
3. ***The plunger valve holder connects to the plunger pipe with a split internal joiner.***
4. ***The tail valve holder connects to the tail pipe with a 40mm x 50mm reducer. This reducer can be glued directly into the expanded end of the 50mm tail pipe or connected to the tail pipe with a straight (50mm) socket.***

Conclusions.

Some final thoughts on the viability of a locally manufactured, simpler version of the Canzee Pump.

During my visit to Zinder we achieved our objective of constructing a functional Canzee-type pump using locally obtained pipes and fittings. The only imported parts were the two valves and their holders.

The pump had the same output and performance as a village pump, (about 20 litres per minute) but it had a much lighter construction so we would not expect it to have the same life as the village pump. However, if it is only going to be used by a small number of people – who actually own it personally -, and therefore will hopefully treat it with respect, it should function for as long as the more robust village pump before it needs any repairs or maintenance.

The design suggested is very much a starting point from which to develop the concept, but it is totally repairable by replacing worn parts with new sections of locally bought pvc pipe, glued together with locally obtainable pvc glue.

The clamp made by Sani Rabo in Maradi was an excellent first offering but I believe it has room for simplification and improvement.

To allow for more of these pumps to be made I will supply a quantity of solid pvc bar from which Sani can make more valves, together with a quantity of the tiny cones and stainless steel pins which hold the rubber disc in place over the valve body. I will also supply some readymade valves and valve holders to speed things along.

Please keep me informed of progress and feel free to ask me any questions at any time to assist you in your quest for a local version of the Canzee Hand Pump.

What I find particularly exciting is that Winrock International is not alone in wanting to construct a pump of this kind. We have contacts working in several other countries who are looking for exactly the same thing. I believe we may well have made a significant breakthrough with this very simple design, based on a thoroughly proven principle. I await feedback with much anticipation.

Richard Cansdale. Hartburn, 20th September 2009.

Acknowledgements

Many thanks to Emily Kovich and her colleagues at Winrock Niger, particularly Maman Yacokuba and Omar Abdou, for making me so welcome and for arranging the itinerary so efficiently.

Thank you to The Multiple Use water Services Group* for the funding which enabled this study visit to go ahead.

**The MUS Group is a collaborative partnership between international and national organisations interested in its mission: the provision of better water services for multiple uses at the household level, including the productive activities that help make water work towards alleviation of poverty and food security.* (see www.musgroup.net)

Executive Summary.

The Canzee Hand pump is an inexpensive yet reliable and easy to maintain pump, ideal for small communities. After two years of trials, Winrock International asked its developer to suggest an even simpler design which could be made from locally sourced materials and offered for sale to private households. A prototype pump was made in September 2009, and over the following months a further fifty units will constructed and marketed.

A check list for maintenance teams when inspecting Canzee Village pumps.

The Canzee pump has been developed with easy maintenance in mind so with an understanding of how the pump works and how plastic pipes can be glued together, it should be possible for it to be maintained and repaired by the villagers themselves. Some jobs, for example the repair or replacement of the steel pump rod, may need the broken part to be sent away for welding, but apart from that, the pump caretaker should be able to keep the pump functioning indefinitely.

An essential role of the project's technical staff and maintenance teams when visiting the pumps is to ensure that there is at least one caretaker who is totally familiar with the pump, who has a supply of spare pipe, valve seals, a saw blade and some pvc glue to repair the pump when necessary.

The following notes are primarily intended for the Project's technical staff, but they should be shared with the village caretakers who can use the same questions to discover why the pump may not be functioning as well as expected.

QUESTION NUMBER 1.

Does the pump produce water immediately, even if there has been a long delay since the last person used the pump?

If the answer is YES, the pump mechanism is in good working order and does not require any attention. (Even if this is the case, the pump head should be checked for damage and the pump surroundings check for drainage, tidiness etc.)

QUESTION NUMBER 2.

Does the pump yield plenty of water but only after making several strokes with the handle?

If the pump valves are in good condition they should hold the water in the pipes and prevent it leaking back into the well. However, in reality, the water may run back out of the pipes for a several of reasons, so if the pump has not been pumped for a few minutes, the next user may have to make several strokes before water starts flowing out of the pipe.

Possible reasons for the water to run out of the pipes.

1. One or both of the pump valves seals (the rubber discs) are damaged and need to be replaced.
2. There is a leak between the valve and the valve holder.
3. There is a leak in the outside pipe allowing water to run back into the well.
   (Note. If there is a small leak in the inside pipe, this does not present a particular problem because the water will still be held inside the outer pipe.)

If the pump still yields plenty of water, this leakage is not a major problem, and there is no need for the users themselves to dismantle the pump.

QUESTION NUMBER 3.

Does the pump produce water but only after making many strokes with the handle and even then the amount of water is very limited, and much less than it did when first installed?

Clearly a problem which needs to be investigated.

QUESTION NUMBER 4.

Is the pump unable to produce any water at all?

As in the case of Q3, there is obviously a problem, but in both cases, before the pump is assumed to be broken, check to see if there is plenty of water in the well. The water level in wells often fluctuates from season to season, and in heavily used pumps, the water level in the well may be drawn down faster than it can be replenished, so after a period of continuous pumping, users may need to wait for a time before they can continue pumping.

The remedy for this problem may be to lengthen the pipes, to deepen the well or to wash a textile wrapped screen into the sand at the base of the well to increase the rate of recharge.

If the pump is only able to produce a tiny amount of water, or none at all, it should be removed from the well and examined for signs of obvious damage. Are there any obvious breaks in the pipe, between the joints or between the pump rod and its handle or the top of the internal (plunger) pipe?

1. The most common reason for a pump to stop working is because one of the pump seals has failed and come off the small cone which holds it onto the valve body. To check this, remove the valves and check the rubber discs. When checking the valves it is recommended that both seals are replaced with good quality new ones.

2. Now check the joints between the valves and their holders are watertight.

3. Finally check the pipes are free from damage such as splits or holes.
   If the internal pipe is damaged, remove a section and use two split internal joiners to glue in a replacement length.
   If the external pipe is damaged it may be possible to repair it without needing to remove and replace the damaged section. The repair may be made with a split length of the same size pipe, glued and strapped to the damaged area. If necessary remove the entire section and glue in a replacement part.

   Always ensure that the pipes are clean and dry before gluing them together. After gluing, leave the pipes for a few hours before returning the pump to the well.

If the pump rod is worn out or broken, or the pump rod has become disconnected with the venting plug, replace this section as if one was setting up a new pump from the beginning. In a workshop the venting plug may be salvaged and re-used to fix another pump.

QUESTION NUMBER 5.

Are there any other problems with the pump not covered so far?

For example is the pump very stiff to operate? Are the pipes twisted or bent which is causing them to rub against one another.

QUESTION NUMBER 6.

Is the pump head in good condition?

QUESTION NUMBER 7.

Is the pump surroundings clean, well drained and in good condition? If YES, congratulate the pump caretakers and thank them for their efforts. If no, explain to the pump caretaker, the pump users and the senior villagers the importance of keeping the pump surroundings clean and tidy. Stress that if children play on the pump they are likely to damage it.

QUESTION NUMBER 8.

What is the history of the pump? Has it needed much attention since it was installed.
Has the pump ever stopped working, and if so, what was done to repair it?

QUESTION NUMBER 9.

Who is responsible for the care of the pump?

Who is the pump caretaker?

Does he / she understand how to maintain the pump, or who to contact in the event of a problem he cannot fix?

Is anyone responsible for keeping the pump surroundings clean and well drained?

QUESTION NUMBER 10.

Water quality? Has the water quality been tested? Do the pump users like the taste? Are there any water quality issues?

Before leaving, the maintenance team should make a full record of their visit and note what actions were taken. They should also check that they have the correct details of the village, the pump location, the headman, the caretakers etc.