ZIMBABWE'S

UPGRADED FAMILY WELL

PROGRAMME

Peter Morgan

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Peter Morgan
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Even before Zimbabwe's National Upgraded Well Programme began in the late 1980's, one million people drew their water daily from both communal and family owned shallow wells. The number of families owning some sort of well or water hole in their back yard or vegetable garden was estimated at 100 000 at that time. Thus the shallow well concept was well established as a source of water in the rural areas of Zimbabwe.

Whilst some of these wells were adequately protected, most were either unprotected or poorly protected and had the tendency to become heavily contaminated. This was partly because of rainwater run-off but also due to contaminated buckets and ropes laying in unhygienic conditions at the well head, on the ground, and being reintroduced into the well. Many were dangerous, especially for children, because they were poorly lined, if at all, and had little or no protection at the well head. Possibly because they were regarded more as a threat to health than a benefit, these family owned back yard wells did not appear on any inventory of rural water sources, and were not regarded seriously by Government or other organisations at the start of the national rural water supply programme which began in 1980 with the help of external donor support. And yet in some areas over 30% of the population use shallow wells on a daily basis. The National Master Plan for rural water development, written in the early 1980's mentioned them only in passing. The emphasis at that time, was to serve the rural people with a communally based hand pump supply.

Simple open traditional well with little protection

What was ignored at first, as is so often ignored from outside, was the remarkable initiative on the part of enlightened families who saw the value of having water close at hand in a backyard well, which did not depend on government or community sponsorship or manpower. In such cases the family had accepted total responsibility itself. The perceived

value of such home-based water resources was high enough to elicit the expenditure of precious resources such as cash, labour and time. The fact that so many families had invested money and time in the construction of family based wells was a good indicator of the potential for future success of this concept in Zimbabwe. What factors had led to this development?

Early days

Early national initiatives to promote improved shallow wells were launched in the late 1940's through the Ministry of Health, by the Environmental Health Division, and this early history has been well related by the late Nason Mtakwa (pers.comm. – also see bibliography), one of the first Health Officers to be involved in the programme. Most of these early wells were dug down in vlei or wetland areas so that up to 2 metres of water could be available in the dry season. Improved wells were lined with rocks, with the backfill above the water table being lined with clay to prevent water infiltration. Often the well head was raised, thus diverting storm water away from the well head. Initially wells were covered with wooden logs but by the 1950's concrete well covers had been introduced in small numbers by the Health Department, an improvement which was often promoted by the offer of cement. As fired bricks became more common, they replaced stones for lining. Many of these wells were built with MOH help or supervision, and they acted as valuable local demonstration sites.

During the 1940's and 1950's family wells were quite isolated because Zimbabwe's population was relatively small and scattered at that time. Community wells and boreholes fitted with hand pumps were scattered about in the communal lands, mostly fitted with the Zimbabwe Bush Pump which had been introduced into the rural areas in the 1930's. However family owned wells – called *mugodi*, gradually became the preferred option, because they were close at hand and therefore convenient. As a direct result of the Health Departments promotional campaigns in Zimbabwean villages, local communities gradually acquired the extra knowledge they needed to improve their own backyard wells, and from the late 1960's the number of family owned wells began to grow. Many families chose the windlass as a method of raising the bucket, an idea thought to have originated in the mines and was also used on commercial farms. Closer inspection revealed that windlasses of all types, ranging from exact copies of the mining windlass to copies made in wood and in steel were used. The importance of well head protection and hygienic placement of the bucket and rope had been taught and the need to take steps to stop contaminated water around the well head from seeping back into the well chamber were becoming more well known. Thus the concept of the Upgraded Family Well was established by the individual efforts of progressive families, taking their ideas from the mines, the farms and from lessons learned from the Ministry of Health.

Early home built well with mining windlass

Good ideas multiply and over the years, many more families had dug wells and by the late seventies and mid eighties tens of thousands of families were able to obtain water from their own back yard, both in the rural areas and also in peri-urban settlements. All this had been achieved with the barest minimum of government or donor financial assistance. It is possible that during this era, the liberation war and the reduced efficiency of many government departments operating in the rural areas, led to a stronger feeling of self sufficiency, thus promoting the construction of more home based and home funded wells.

Although successful and much in evidence in many rural areas, these home based supplies were not officially recognised by government during the early 1980's. Government continued to concentrate its efforts on the protection of community shallow wells and boreholes fitted with hand pumps. Perhaps at this time, this lack of recognition was justified. Government policy was aimed at providing water at the community level to serve large numbers of people – family sources were simply not included in the Zimbabwean National Inventory of rural water supplies. At this stage, in the mid 1980's no material assistance was forthcoming for family based water development either from the government, or by donor or aid organisations.

Inspections made in the mid 1980's revealed that many family wells were still crudely made., although having the rudiments of protection. Some were just simple waterholes without any lining, and generally open to contamination. The majority however had some protective features. Some were lined but had no other form of protection with others having a combination of full lining and raised collar. Others were built with crude aprons and a water runoff channel. A small percentage had a concrete cover slab and tin lid cover over the opening. The most common lifting divide was the simple rope and bucket without windlass. Inevitably, both rope and bucket picked up contaminants from the waterlogged areas at the well head. Such wells were not hygienic. Many families had built improvised windlasses, often mounted over wooden poles positioned on either side of the well.

Early home financed and built family well

Research and Development.

During the mid 1980's the significance of this home based water technology drew the attention of researchers at the Ministry of Health's Blair Research Institute. The logic of using home-based technologies had already been used with the Blair (VIP) latrine technology – which was being successfully promoted at family level using family based subsidies. One overriding problem of the hand pump based rural water supply programme had been, and remains, the high cost of maintaining and sustaining the national fleet of hand pumps, estimated in 1999 to be nearly 35,000 units. Even in the mid 1980's government researchers at Blair sought solutions that were less expensive to donors and also to government in terms of initial investment and had the potential to be sustained at family or village level in the long term. The upgraded family well offered such a potential solution both for technical and social reasons. However senior government officials and policy makers (both Zimbabwean and International) at the time saw these family wells in a negative light. Family based subsidies for rural water supply had never been tested before. However the research continued.

Blair Institute staff had begun to examine shallow wells and ground water quality in the early 1980's. During 1984 and 1995 an extensive analysis was made of the bacteriological quality of water derived form traditional wells, buckets pumps (a modernised tube well system using a bucket and windlass) and also for hand pumps. These results are shown below.

Faecal E. coli for water samples

Lifting device	**mean E. coli/100ml sample**	**number of samples**
Traditional well with bucket	475.39	197
Tube well with "bucket pump"	16.69	261
Tube well with hand pump	7.67	191

The bucket pump (originating in Zimbabwe, and currently being used successfully in Maputaland, South Africa (David Still. pers.comm.), is an upgrade of the bucket and

windlass system. It uses a tubular bucket which raises water from a narrow diameter tube-well.

These results revealed that the nature of the well itself and the protection from the surface (i.e. headworks) were important factors in determining water quality from shallow wells. All these wells drew water from the same aquifer in the Epworth peri-urban settlement, close to Harare. (Morgan 1992).

The Blair Institute's first move was to demonstrate that an upgraded family well, with all the various simple technical improvements put together in combination, could indeed improve the quality of the water drawn from less protected wells. These improvements included a well lined with bricks built up to one or two courses above ground level, a protective "apron" and water run-off surrounding the well, a raised well collar fitted with well cover slab, a lid and a windlass system. The windlass is valuable since it holds the rope in a hygienic place, and not in the potentially swampy ground around a poorly protected well. It also assists in bucket lifting. Contaminated buckets and ropes can send down contamination into a well from the surface.

The experiment sought also to compare water quality derived from simple wells with water drawn from tube wells protected with hand pumps. These experiments were also conducted at Epworth, where another series of bacteriological tests were undertaken between January and November 1988 which included a heavy rainy season.

Faecal *E. coli* for water samples*

Source of water	**mean E. coli/100ml sample**	**number of samples**
Traditional well with bucket	266.42	233
Upgraded well	65.94	234
Tube well with Bucket pump	33.72	338
Tube well with "Bush Pump."	6.27	281

- Source: Zimbabwe's Upgraded Well Programme. Background Paper. 1992. P. R. Morgan

Further evidence of water quality improvement for Faecal *Streptococci* as well as *E. coli* were studied between January and March 1988 during a heavy rainy period.

Faecal *E. coli* and Faecal *Streptococci* for water samples

	Traditional well with bucket	**Upgraded well**
Mean faecal *E. coli*/100ml sample	**342.48 (n= 85)**	**84.01 (n= 86)**
Mean faecal *Streptococci* /100ml sample	**579.48 (n=88)**	**103.01 (n=88)**

These figures also show that significant increases in water quality could be achieved without the use of a hand pump in shallow wells. These figures were reconfirmed by Grace Rukure

(BRI Report of 1992) with the mean *E. coli* for poorly protected wells being 263 per 100mls sample (n=6) and 45 per 100mls sample (n=16) for Upgraded Wells.

Armed with this evidence for improvements in bacteriological quality and also physical quality (the water taken from lined wells was clearer and more tasty than unlined well which have a higher turbidity) the Blair Staff then started a series of pilot projects.

Early pilot projects

A series of pilot studies were undertaken by Blair Staff during the period 1988 to 1992 when about 5300 upgraded family wells were built. The first were built in Makoni District, funded by Swedish Sida. At the same time training teams from Blair, were deployed throughout the country to pass on knowledge of the technique to health teams and local builders and leave a series of demonstrations, country wide. The concept was studied and debated by MOH officials during 1988 and 1989 and was officially endorsed by the MOH in 1990. This followed encouraging feedback from the users and also from MOH officials who had come into contact with pilot programmes. Notable programmes were running in both Manicaland and Mashonaland East. BRI's own work continued in Rusike during 1990 and then in Chihota during 1991 when more effective implementation techniques were established. This crucial experimental and pilot stage of the programme was supported with financial assistance from Sida, Save the Children's Fund (UK), The Zimbabwe Trust, UNICEF, Redd Barna and Rotary of Zimbabwe. In 1991 the technique was officially endorsed by the National Action Committee of Government and introduced on a small scale at first into their National Integrated Programme. Later, this concept served a significant number of persons assisted by the integrated programme (see later).

Early Upgraded Family well under the Blair Programme

Initial growth of Programme under the Blair Research Laboratory

Year	No. Upgraded Family Wells constructed
1988	180
1989	128
1990	366
1991	1827
1992	2800
Total	**5301**

It was thus during this initial stage (1988 – 1992) that the foundation of the future programme was established in four main areas: technology, implementation strategy, training and funding mechanisms.

Technical developments

All wells were lined with fired bricks, with well heads surrounded by a concrete apron and water run-off. The early dimensions of the central hole in the cover slab were enlarged to allow for entry for deepening. Also several structural improvements were made to the windlass supports. Traditionally these are made from hardwood poles. Slots are cut in the pole head as a bearing surface for the steel windlass and these last for many years. The first series of upgraded family wells were all fitted with wooden pole windlass supports (1988-89). These however had a tendency to loosen and break the seal formed by the apron, thus allowing waste water to run down into the soil surrounding the well. During 1990 experiments began with masonry windlass supports built from bricks with rubber car tyre bearings. Wooden bearings were also tested. These experiments were carried out in Rusike. At first vertical brick windlass supports were used, but some cracked at the base especially on the windlass handle side which was subject to vibration. This problem was solved by buttressing the brick column, with the base being wider than the apex. Rubber bearings were retained.

Experiments were carried out on windlass bearings
The car tyre was the best for brick columns

The windlass used was a standard heavy duty steel type with 25mm bar used for the main shaft. This has been used as a standard throughout the programme. Tin lids were made by tinsmiths often using recycled tin plate for economy. These were painted and fitted with handles. Usually three bags of cement were used for the construction of the head-work's. A Field Manual for the well construction was produced and used extensively in the future programme.

The brick windlass supports evolved into a well buttressed shape

Implementation strategy

The implementation of family based upgraded wells is undertaken as part of the Ministry of Health's rural water supply programme. This arose because the Ministry of Health had a long association with shallow wells and also because the recent initiative itself arose from within the Ministry of Health (Blair Research Institute). The same is true of the Ministry's rural sanitation programme, with the Blair VIP latrine also originating at the MOH Blair Research Institute. The same implementation strategy was used for the well programme as had been used for the latrine programme. This involved an Environmental Health Technician (EHT) touring an area and establishing the potential for wells and also holding meetings with the community, local leaders and other officials. The implementation technique was perfected by Ephraim Chimbunde and the late Nason Mtakwa in 1991 during in depth studies of the Chihota family well pilot project. The following guidelines were established:

1. Supervision by the District Environmental Health Officer (DEHO) is an important aspect of the upgrading exercise. He should take part in community education, data collection, stock checks, monitor progress and encourage family involvement.
2. Well upgrading to the standards required is a new concept in many areas and most district health teams require training before any other promotional activities take place.
3. 3. MOH staff should be given the chance to learn the necessary skills on smaller project first.
4. Each district team should be allowed to start in one small area or Ward before extending the project to other areas. Projects should be expanded slowly from area to area. If funds are available the construction of between 50 – 100 wells should be considered for a Ward.

5. District teams are supported technically by a centralised team from Blair Research Institute (later by the same team when it relocated to an NGO).

Cement, windlasses and tin lids were procured by the Blair Laboratory (and later by NGO's such as the Mvuramanzi Trust etc) and distributed to the areas for use in the programme. Many of Zimbabwe's rural water and sanitation programmes were characterised by too little control of the materials provided. Thus the staff of the laboratory and later the Mvuramanzi Trust (where Blair Institute water and sanitation field staff moved in late 1992 to start operations as an NGO in 1993) were very strict in the distribution of hardware. Lorries carried the cement, windlasses and lids to preselected sites and strict logs were kept of distribution directly to families where the components were signed for. An accepted material assistance per well of 3 bags of cement, one windlass and one tin lid was established. However the process of distributing hardware is only carried out after several earlier stages in the implementation process have been completed. These include meetings with NGO staff, MOH staff and Rural District Council staff. Precise locations for implementation are worked out between NGO and local health staff. Meetings are then convened with the villagers to explain the programme, the plan of action and also what is expected from each family in terms of contributions. Such contributions from the family include digging and lining the well (thus hiring a well digger), paying a trained builder and also collecting local materials including all the fired bricks required. Shortly after builders employed by the government, and later by the NGO (Mvuramanzi Trust) train local builders and "show wells" are built for villagers to examine. The programme then begins in a specified area with material support being given to those families who accept their responsibility. Often existing family wells are deepened and lined in preparation for upgrading, but very often completely new wells are dug and lined by families who wish to take advantage of the programme. The material subsidy is only given to a family once the fully lined well chamber has been completed. Local EHT's inspect the digging and completion of wells and these records are kept in a register. A register is also kept of completed wells.

The material incentive provided with donor support included a sturdy windlass, a tin lid and 3 bags of cement.

Training

The training of builders should be the responsibility of the local EHT who has previously been trained by the Government staff or NGO staff. Trained well builders are certified by the training body and hired by each family. A single trained artisan may undertake work for several families simultaneously. Builders are not employed full time on the well programme, because they can secure jobs elsewhere for building latrines or other buildings. The builders are paid by the families either in cash or in kind. In 1992 a builder would receive about Z$30 – Z$40 for each well built. By 1996 this had risen to Z$200 per unit. After this period the costs rose further. By 1995 over 1000 artisans had been trained either by Government or by the NGO's.

Skilled trainers taught thousands of artisans how to build upgraded family wells

Funding mechanisms and costs

As indicated earlier, the costs for each Upgraded Family Well (UFW) are shared both by the family and by donor, funds being processed through either the government or through NGO's like Mvuramanzi Trust. In 1991 the value of the subsidy was Z$60 – 80 (US$24 – 32. 1991 prices). This included the purchase of 3 bags of cement, a windlass and a tin lid. In 1991 the windlass cost Z$13. By 1992 the costs had risen as shown below:

Distribution of costs for UFW (1992)

Government or NGO contribution

ITEM	COST (Z$) (US$ 1.00 = Z$5.00)
3 bags of cement	63.00
1 windlass	71.39
1 tin lid	12.00
Total	**146.39 (40%)**

Family Contribution

ITEM	COST/VALUE (Z$)
BRICKS (1500)	97.50 (locally procured)
Bucket and rope	40.00
Sand/stone	00.00
Labour to deepen well (est.)	60.00 (2m @ 30.00/m)
Cash to pay builder	40.00
Total	**237.50 (60%)**

By 1995 the subsidy level was Z$300 per unit (about US$30) including training and transport and other costs for operation of the supporting NGO (Mvuramanmzi Trust). These costs compared favourably to the costs incurred for the construction of other types of rural water supply and were estimated in 1995 (Morgan et al. Waterlines Vol.14.No.4. 1996). They overwhelmingly favoured the construction of family wells on a wide scale. The additional benefit was that all further maintenance costs were born by the family itself.

Note than in 2002/3 a bag of cement cost Z$1500 – Z$3000 per 50kg bag depending on where it was purchased. The US$ had devalued to between Z$800 – 1500 depending on the market. What influence this will have on home financed well production has yet to be seen.

The costs of construction of three types of rural water supply in Zimbabwe in 1995.

Type	Project contribution.	Users contribution.	Total cost	Number served	Project cost per /user
Family well	Z$300	Z$700	Z$1000	10	Z$30
Deep well	Z$7900	Z$1200	150	150	Z$53
Borehole	Z$48 000	n/a	Z$48 000	250	Z$192

Costs in 2006

During the period 2000 – 2006 the value of the Zimbabwe dollar declined rapidly. Commercial costs for the windlass with 25mm bar had reached Z$85 000 and with 20mm bar Z$52 000. A commercially made unit with windlass,15m chain and steel bucket cost Z$186 400. A commercially made lid cost Z$17 000. Units made in rural workshops cost less. But the units costed above in 1992 were from the same manufacturer. 50kg bags of cement purchased in 2006 cost around Z$7500 for masonry cement and Z$9000 for concrete making PV15 cement. In 2006 the value of the Z$ compared to the US$ varied considerable with the official rate being Z$250 to one US$ and the rate on the parallel market being Z$18 00 – 2000 to one US$.

Examples of Upgraded Family wells

Very neat and a pride of the family

Women being trained to build upgraded family wells. Nearly 50 000 upgraded family wells were built during the programme

Expansion of the Programme (1993 – 1998)

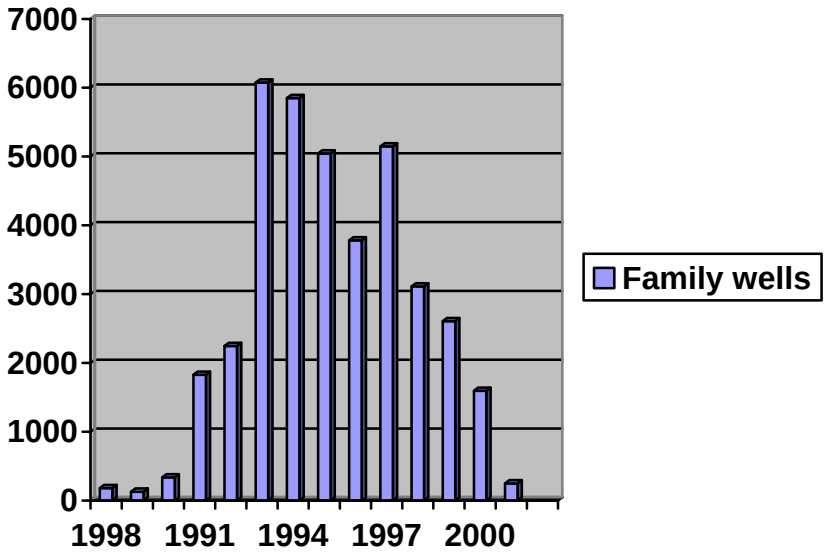
The field staff of the Water and Sanitation section of Blair Research Institute moved away from government into the newly established country office of the international NGO WaterAid in late 1992 and began operations in 1993. Later it became known as the Mvuramanzi Trust. The Trust thus inherited an experienced and active field staff and a well established method of promoting and implementing a well tested well technology. At the same time, the new NGO assisted in promoting reduced subsidy Blair VIP latrines and also the new B type Bush Pump (which became the National Standard Hand Pump in 1989), which had also been developed at the Blair Institute.

This move was largely based on the success of Blair's family well project. NGO's can operate with greater flexibility than their government counterparts. NGO's can purchase

hardware easily, which the staff can transport in reliable vehicles. Finances can be carefully monitored and accountability for material and other costs is considered important. It was already clear that the role of NGO's was becoming increasingly important to the success of rural water and sanitation projects. Ideally NGO's collaborate closely with government departments and the beneficiaries. Such an approach was particularly effective with the family well project.

The number of Upgraded Family Wells put in place by the Mvuramanzi Trust between 1993 and 2001 was 33 459, making a total of 38 206 units for the combined efforts of Blair Research and Mvuramanzi Trust. During this period the Mvuramanzi Trust was financially supported by Sida, Norad, UNICEF, Rotary, and the Oak Foundation of Zimbabwe.

Number of Upgraded Family Well supported by Blair Research Laboratory (1988 – 1992) and Mvuramanzi Trust (1993 – 2001)



1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
180	128	336	1827	2246	6075	5849	5044	3782	5148	3112	2606	1594	249

Also during the period 1995 – 2001 several other NGO's had their own UFW programmes as did the Ministry of Health. DFIDs funded the construction of 1505 units between 1997 and 2000 in Bikita district (Brian Mathew pers.comm.). One windlass manufacture also sold 2500 windlasses (called MOH windlass) to Goromonzi and Nyanga Districts between 1995 and 2000. The NGO's Zimbabwe Ahead, Save the Children's Fund (UK), Christian Care, World Vision International and Plan International also had their own UFW programmes and the Ministry itself continued to implement on a small scale. So did some Rural District Councils. It has been difficult to find precise data for the output of these various NGO's/Govt. departments, but it can safely be estimated that by 2001, at least 45 000 Upgraded Family Wells had been completed, each serving at least ten people and often double that number as families often share the facility. It can therefore be safely estimated that at least 500 000 people have benefited from the Upgraded Family Well Programme in Zimbabwe.

Official government figures for the output of the facilities under the Integrated Rural Water Supply and Sanitation Programme, as at 31st December 1999 record:

24,277 boreholes fitted with hand pumps
10,300 deep communal wells fitted with hand pumps
29,059 Upgraded Family Wells
162 Protected springs
544 Pipes schemes
2002 Dams
377, 325 household VIP toilets
23 132 school VIP toilets

The total number of people served by the programme is estimated at 9,178,347. However figures for NGO's are often not included in these records. This seems to be the case for family wells, as the national figures are less than that for Mvuramanzi Trust alone. It can be seen that UFW's feature prominently in this official list prepared by the government itself.

Decline of the Programme (1999 – 2003)

After 1999 the Mvuramanzi UFW programme began to decline. This was partly due to a reduced priority given to the UFW programme, with other areas, like rainwater harvesting and ecological sanitation taking a greater proportion of Trust funds and time. Also more funds and time were used in fitting rope and washer pumps to wells, a method which was not central to the original concept of the UFW programme. During 2001 only 249 UFW's were built by Mvuramanzi. During the period 2001 to the present Zimbabwe has experienced devastating economic and other difficulties which have seen most of the former water and sanitation programmes enter a rapid decline. Many of the larger donor funding agencies no longer provide financial assistance to Zimbabwe.

The greatest test of Zimbabwe's UFW programme is now taking place. Few new wells, supported with donor funds are being built. Those families that build new wells must be entirely self financed – as in the past. Thus a new era in the long history of Zimbabwe's family wells has begun. Will more families build their own wells, using the knowledge and experience gained from the near 50,000 units that already exist? Only time will tell!

Benefits of choosing the family approach

There are a great number of potential advantages in taking this family-based shallow well approach. The ownership issue is very important and this is very clear in the case of the family owned well, as opposed to a unit which is "owned" by the community. Families invariably use their own back yard well, even when improved community protected sources fitted with hand pumps are installed nearby. The reason is obvious – convenience. The most obvious advantage of the UFW, apart from improving water quality and taste is the sustainable maintenance capability. Many family wells using a windlass and bucket system have been in use for generations and operate effectively without external support. Current evidence shows that UFW's using a windlass lifting mechanisms can also be maintained effectively by the family themselves without any other support or specialised spare parts being required from outside as would be the case with any type of conventional hand pump.

The family well is close at hand and very convenient, so naturally more water is used for personal hygiene, gardening and other activities. This is an important consideration where anticipated improvements in health are concerned. The technology is simple, logical, relatively cheap, fast and easy to build. In addition improvements like this are considered "improved family assets" and are thus cared for and often of prestigious value. They are always preferred to communal systems and thus evoke a stronger sense of ownership and willingness to sustain repair and maintenance. They are also known to be reliable, and of course they are also much safer for children, an important consideration.

Self-help makes sense

This programme is based on years of total logic played on the part of rural villagers who wanted to solve their own problems. The fact that huge numbers of wells, many of them upgraded in varying degrees, already exist and operate outside the national programme offers the hope that even those constructed within the programme are likely to serve the test of time. It has become clear in Zimbabwe, that the family owners genuinely want to improve their facilities and become self sufficient. The MOH has always overseen the shallow well protection area of the rural water programme in Zimbabwe, and for some years promoted the protection of shallow wells with hand pumps (Blair and Bucket Pumps). However these hand pumps also required repair and maintenance - which became a burden on the MOH. The advent of the UFW programme thus solved this problem for the MOH, with a robust and reliable technology in which each family takes responsibility for upkeep was unquestioned. At a time when national institutions are weak, such a move to self reliance becomes even the more important.

Other "Spin-offs"

The completion of the family owned wel1 is not the end of the story. Vegetable gardening becomes a practical option and this is widespread in Zimbabwe in association with the UFW's. Vegetable gardening, a popular backyard occupation in Zimbabwe, has blossomed with the advent of so many new wells, with the obvious benefits of improved nutrition and income generating possibilities (see World Bank Blue Gold Field Note no. 6 on Zimbabwe's UFW's by Peter Robinson) In more recent work, Mvuramanzi Trust are placing rope and washer pumps on some family wells to extract more water to irrigate larger commercially run vegetable plots. The increase in water output can be considerable and larger scale commercial production can become a reality. However the rope and washer pump, like so many other hand pumps, is liable to breakdown and in need of spare parts and repair itself. It remains to be seen whether this initiative will succeed. Sadly pumps given by donors often survive for their allotted time span and then disintegrate. Rope and washer pumps operate on a very ingenious principle, and have reached new levels of efficiency and strength on the international scene (notable advances have been made in Nicaragua). Those used in Zimbabwe are of the simpler type, and it is hoped that they can perform well for long enough to convince their owners to replace them when they finally break down. Progress is made when a family decides itself to lay out funds to upgrade its own well a second time by fitting a pump. Then the chances of success are higher. Some home owned wells are fitted with a range of hand pumps including the Bush and Blair pumps. Interestingly home made pumps are sometimes used and the writer has also seen this in South Africa. Most conventional hand pumps, designed to deliver water for domestic use, do not deliver sufficient water to support

large scale ventures in agriculture. However the time tested bucket and windlass can support meaningful vegetable production on a smaller scale, as the photo below shows.

Productive vegetable garden commonly associated with the family well

The main strength of the UFW programme lies in retaining well established principles which have a long track record of survival – hence the use of the sustainable windlass and bucket principle. This method, unlike that of the hand pump, can deliver water more reliably and for much longer periods with little need for repair or spare part procurement. This is a huge advantage in a poor rural setting. There is also ample evidence that the simple bucket and rope system is quite capable of irrigating meaningful areas of vegetable garden, and it is this method which is practiced so widely in Zimbabwe.

Problem areas

No programme of rural or any other development is free of problems. One of the most serious with this UFW programme is the great fluctuations of water table level in the aquifers of Southern Africa. Every year a proportion of family wells dry up. Most are deepened by the owners when an opportunity arises as their value is considered highly. Indeed the fact that so many family owned wells retained some water during the driest part of the severe 1991/2 drought proves that families invariably do follow the water table down. More recent studies have shown that in any one area, some family wells are more reliable than others and are often shared when the water table is at its lowest.

Whilst properly built UFW's are strong and long lasting, poorly constructed wells can develop cracks in the apron and water run-off and also the brick windlass support columns. These can lead to serious deterioration in the hygienic status of the well. Sometimes poor rubber bearings are fitted and the windlass begins to wear into the brickwork. But there is almost nothing that is beyond local ingenuity to solve these problems. A little cement or wire and the job can be done. Therein lies their strength.

Also Upgraded Family Wells serve areas with shallow aquifers better than those with deeper aquifers. Whilst there are remarkable examples of UFW's being dug to over 20m in depth and more, these are more the exception than the rule. It all depends on the commitment of the family concerned. In a country like Zimbabwe, the greatest concentration of rural folk live in areas with the highest water table.

Also UFW's are intended for the family. They cannot be expected to service community centres and schools for instance. Here the hand pump or piped or rainwater harvesting techniques must come to the aid of the communities. In countries like Mozambique similar wells are used in the neighbourhood setting (see later) and in Zambia on wells fitted without hand pumps have been used successfully for many years in communal settings (see the work of Sally Sutton).

Another aspect on supporting family based water programmes (something that also applies to family based latrine building programmes) is that trained technicians and community workers must be available to visit homesteads and supersvise constructions etc over a wide area. In Zimbabwe, this has been possible under the MOH programme because ministry staff operate at the village level and are able to visit the great number of individual sites which characterise projects of this type. The department of water development, on the other hand does not employ staff at village level, and thus would not be in a position to supervise such a project. For many departments and other organisations it is simply easier and more efficient in terms of time and manpower to go to communal site, drill a borehole and fit a hand pump which may serve 250 persons, the equivant of 25 UFW's.

Water Quality

Also there are disputes on water quality. It is acknowledged that water drawn from family wells does not reach the quality of water drawn from sealed wells or boreholes fitted with a hand pump. Water quality in "open" wells as compared to sealed wells largely depends on the hygienic nature of the well head and the level of hygiene used to withdraw the water and store the windlass and rope. Both the bucket and the rope are open to contamination if carelessly used or stored. Such contamination on the rope or bucket can be introduced into the well chamber. So a hygienic approach to well handling is important. This level of hygiene will clearly deteriorate, the greater the number of users (and of buckets), with the strictly family unit being the most favourable and fully communal units where many buckets may be used being the worst scenario. In Mozambique where small communities use "neighbourhood" wells, a single bucket and rope is used (as in the strictly family units) and this helps considerably to improve well head hygiene. In these cases the bucket is often stored under the well cover when it is not in use. This practice greatly helps to improve water quality. Also the windlass has the great advantage that it "stores" the rope in a hygienic setting above ground level. The presence on an apron and water run-off prevents surface water stagnating around the environs of the well head. The spill water drains to waste into an area planted by a tree. The lids also help prevent foreign debris falling down the well. All these features help improve water quality.

Family wells are used in a closed loop scenario, with the same family members using the facility and coming to terms with the microbial flora and fauna (including bacteria) of the well in their own back yard. There is little chance of cross contamination between well water and other contaminants (such as pit latrines) if the well is sited properly. Indeed in Zimbabwe

the UFW and Blair VIP Latrine programmes were run in parallel and very frequently a 3m deep pit latrine was built on the same plot as the well. To the writers knowledge no problems have been recorded of problems arising from this twin development. Perhaps this is because both programmes have been supervised by the MOH, where such issues as siting are taken seriously.

The main issue as far as water quality is concerned is that the UFW water is a reliable improvement on unprotected traditional sources which would normally be the alternative. Also the chances of breakdown are less in the UFW compared to the hand pump supply – where breakdown forced people to return to their traditional sources, which are invariably contaminated and some distance from where they live.

But is should be clearly stated that water quality alone is not the only factor related to community or personal health. The practice of hand washing, personal hygiene and food preparation and handling are also important factors which must be taken into consideration. Contaminated food is often a serious culprit and poor methods of hand washing in the communal scenario. The communal bowl as a hand washing technique has been replaced by the "pour and run to waste" method – there is no chance of cross infection from one hand to the other. It is now established that water availability and quantity play the important factor in health improvement, with water quality (within limits) being a less important factor. The presence if the UFW improves these parameters.

The family well – is it complementary to the hand pump programme?

The presence of family based or even neighbourhood wells cannot be expected to solve all the problems of rural water supply in the African sub region. At one time in the history of Zimbabwe's rural water programme it was feared that if too many UFW's were present in an area, then the chances of community involvement in hand pump maintenance would be reduced. People would say "I have my own supply. Why should I be responsible for somebody else's? Perhaps this may be partly true, but in fact in those areas where family wells are common, the pressure on community hand pumps is much reduced, and with that the chances of breakdown are also reduced. This in return reduces maintenance costs. With a good coverage of reliable family wells there may be little need at all to provide so many community pumps, which may be restricted to community centres or schools or as a back up service. So in a sense, more wells actually assists the hand pump service – by relieving pressure on the hand pump itself.

In common with so many hand pump programmes in Africa, there is an inevitable rate of breakdown which must be attended to if the supply is to be sustained. This maintenance schedule is expensive, especially for pumps which are often widely scattered (transport costs come into the equation), and the inevitable costs of replacing parts are often far beyond what rural communities can afford (or often governments are prepared to afford). The end result is breakdown and a search by the community for other natural sources of water. There are cases where the pump must be kept working at all costs, to ensure the survival of a community. In very dry areas there may be no other choice. In such cases a community may spare no effort to keep the pump operational. But when alternative natural sources of water like streams and pools or water holes are available, people will obviously turn to them if the communal supply breaks down. In the end it is often left to a donor organisation to come and fix a broken pump

or replace it. Externally funded pump rehabilitation programmes are common and well meaning, but hardly a sustainable solution for Africa.

Over 40 000 Zimbabwe Bush Pumps have been installed in the rural areas

So any programme that can take the pressure of the hand pump supply and thus prolong its life, must be seen as complimentary and that includes programmes of improving traditional wells in areas where hand pumps are used. The family well and the communal hand pump are mutually beneficial. The use of a windlass/well relieves pressure on the pump, thus extending its life. The pump is a good back up source when wells may dry up for short periods of the year. In many areas of Zimbabwe, the numbers of hand pumps could be reduced and the number of UFW's increased, resulting in a more sustainable programme with reduced recurrent costs. In some districts the hand pump may be the only feasible option – in others the family wells could dominate. From a national point of view each district should be judged on hydrological conditions and the ratio of family/community facilities based on this. Institutional facilities should be based on piped, hand pump or even rainwater sources or a combination of these.

Lessons learned

So what is there to learn from near half a century of experience with family based wells in Zimbabwe?

Build on methods which have already taken root. Perhaps first and foremost is the realisation that water (and other) technologies which naturally take root in the village environment should never be overlooked , even if more modern and attractive alternatives are available for use. Simple and easily understood and sustainable methods which actually work in practice should be seen, not as primitive and crude, but as elegant solutions to solve local problems. Such solutions have often withstood the test of time and have made the grade. They form good starting points from which to evolve further – step by step. This is clearly the case for the UFW. The one step at a time in technical evolution is the safest. To big a step and all may be lost.

The history also reveals that technological transfer is going on all the time at a low key level. The adoption of the windlass system from the mining and farming sectors into the villages is a case in point. In order to be chosen such technologies must have great merit. They are judged by the best judges – the users!

Long term training programmes help. The long term – low key training initiatives performed by the MOH in the villages over many decades has also enlightened villagers, not only in construction methods but also in the need to improve homestead as well as personal hygiene. School curricular also add strength to this programme. As Nason Mtakwa once said, the theory should be backed by a practical method of application. Simple effective toilets, water facilities - close at hand and also hand washing facilities are able to transform the theory into practice. Without them the theory may be impossible to put into practice.

Families are the strongest social units. By choosing the family as the central social unit, the programmes taps into financial and social resources and commitment which are not available or attainable at the community level. The family is prepared to invest more of its own money and effort into projects over which it has total control – that is in the back yard. At the same time back yard developments are seen as family assets and sound investment for both present and future generations of the family. By comparison handing over cash into a common pool for future use in maintaining communal facilities is seen with suspicion. In an era when people must be self reliant to survive – the family comes first. Family wells are really owned. There is always doubt as to who really owns a communal installation.

Material subsidies can act as a good incentive. This programme, like the Blair/VIP programme in Zimbabwe has led to huge numbers of people being served (half a million for UFWs and 3 million for VIP latrines). Both developments taking place at the family level and both offer an incentive based on a material "hand out." One must balance the value of the hand out with the level of return. It is important not to turn "handouts" into necessities. This is the delicate balance which the donors and developers face. This has been one of the great weaknesses of the Zimbabwe programme, in that generous "hand outs" have been given by donors to the programme, and the donors must themselves judge whether the return was worth the investment.

In the case of family latrines the material incentive was large in supporting the construction of a unit which would provide a service for a family for 10 – 12 years. For the family VIP latrine the material subsidy was reduced from 5 bags of cement and wire etc to 3 bags of cement "only" in later programmes with the family offering an increased proportion of the investment. But with so much cement moving about – a certain proportion was lost to the programme. Second time around, when Zimbabwe surfaces again, a very different approach may have to be taken, relying on much reduced material hand outs and a more modest step by step upgradeable approach to technical development. The most up to date sanitary technology for rural areas in Zimbabwe relies on lower cost approaches which may consume less than one bag of cement and a great deal of local construction and innovation. The concept of recycling and linking sanitation to agriculture is a strengthening theme for the future.

In the case of economising on material assistance for family wells, useful indicators come from Manica Province, Mozambique where a light weight but durable windlass has been tested for many years and is far less expensive to produce than that unit used in the Zimbabwe programme. Well lining techniques using fired bricks are important, and in fact

this was always a part of the construction supported by the family. It may also be possible to reduce the material input of cement by making aprons and water run-offs smaller and more robust. Perhaps future programmes of support for family well programmes may depend on material incentives being honed into a light weight durable windlass and a single, or perhaps two bags of cement. What remains certain is that some material incentive does work – it does motivate people to act.

Cost sharing is important. The concept of cost sharing is vital. The balance should move towards asking families to provide more with donor contributions being less. The balance is delicate. Also this method favours those better off and not the poorer members of the community. But in such cases the water is shared by tradition. Solid programmes of training and education before implementation always help.

Spin offs bring rewards. The UFW programme has shown that people are astute and take advantage of new projects. Apart from providing more water for domestic use, family wells offer the water to further develop and enlarge vegetable gardens, with the resulting increase in food availability and also income derived from sales. The presence of such wells, especially those strongly built and therefore showing more permanence offer the family increased status. Such robust wells can be shared and thus offer a community service.

Will history repeat itself? Family based initiatives and moves towards self sufficiency appear to get stronger as government supported national programmes are perceived as weak or inadequate. No doubt the large number of family owned wells which came into being in the 1960's and 1970's was partly due to the limited number of government financed communal water supplies available during that era (community hand pumps were scattered – only about a few thousand communal hand pump existed in 1982). The number of primary water points serving the rural community rose to nearly 35 000 by 1999 with considerable donor support. We have seen that during the same era some 50 000 upgraded family wells also came into being, despite the considerable multiplication of communal water points. Nowadays Zimbabweans are facing a new era in the evolution of this programme. The government is unable to adequately support the maintenance of the hand pump supply and the DDF, who were once responsible for this operation, have now almost disbanded. The costs of replacing pump parts, such as pipes and rods is very high (and also in short supply), and far – far beyond the means of most rural folk to buy. The result is an ever decreasing proportion of pumps which provide water. This means that there will be even greater demands made on the 50 000 family owned wells and also poorly protected wells and unprotected sources of water. If history repeats itself, many families will take up the challenge and make moves to gain their own supply by digging and protecting more wells, taking advantage of the widespread practical knowledge of construction and also the well known benefits to be gained from the backyard well. The huge number of backyard wells in existence throughout the country, and half a million rural folk who can speak from personal experience, offer a platform of wisdom to encourage others to build their own wells. Thus the knowledge of construction and the benefits are widespread and far greater than was the case in the 1960's and 70's. But only history will reveal the outcome. Only time will tell. The 20 years of donor assistance has left a legacy of donor dependency, something that Zimbabweans had not experienced before 1980.

Need for monitoring & reinvest knowledge into the programme

What is important is that monitoring programmes are undertaken to record the situation as it progresses. An interesting case exists in Bikita, a programme supported by DFIDs, where during the years between 1996 and 2001, some 1502 UFWs and about 500 communal Bush Pumps were put in place simultaneously. A detailed study of the fate of these various facilities will be very valuable in the years to come. It should be mentioned here that Zimbabwe's Bush Pump, as well as the UFW's, have a history related to survival. Bush Pumps continued to work even during the deluge of the liberation war and with a minimum of management. Some were blown up and still refused to die. A few are still operational in Matabeleland, put in place 60 years ago (although their pipes, rods, cylinders and seals have been replaced many times). Perhaps this is because even the Bush Pump was designed to face a hard life and be left to its own devises for extended periods. Such is a truly appropriate technology!

If programmes of this type are to be successful in the long term, knowledge from the field must be gained, studied, analysed and interpreted and reinvested in the programme. So much knowledge is being gained at local level, by the users, and local NGO and government staff, but invariably this may not reach the decision makers. Monitoring and evaluation is a vital part of any active programme.

Influence of the Zimbabwean experience in other countries

Improved well programmes are well known in a number of African countries. Most of these are based on either a communal supply serving larger numbers of families or a neighbourhood unit serving smaller numbers of families. Many wells are fitted with hand pumps, and therefore lie outside the scope of this paper. One of the best known and well documented communal well programmes which operates on simple lines without hand pumps is running in Western Zambia and has been well documented by Sally Sutton (see reference list). The current and successful programme running in Niassa Province, in Mozambique, with WaterAid support and uses units base at "neighbourhood" level, may have benefited from the lessons learned from the Zimbabwean experience (see Ned Breslin in reference list). Also the Ubombo Family Wells project, executed by Partners in Development, in Maputaland, South Africa, is using both the Upgraded Family Well and "Bucket Pump" models which originate in Zimbabwe, mostly in the "neighbourhood well" setting (Dave Still, 1998). The concept has also spread to Sierra Leone under a Care International sponsored project (Anthony Waterkeyn pers.comm.)

Upgraded Family Well in Maputaland, South Africa

The Mozambican upgraded well experience.

Improved traditional wells are commonly built in Mozambique, although few are owned by single families, rather they are used by small communities – at the neighbourhood level. They are therefore known as "neighbourhood wells." Originally these used wells overlaid by poles with a central access through a tube built into a central raised area of soil. These simple units prevented rainwater from entering the well.

GTZ financed MARRP programme.

The family well concept was introduced into the GTZ funded MAARP programme in the Manica Province in 1992 as a means of providing improved domestic water. GTZ had previously been involved in upgrading wells in Zimbabwe. The first improved neighbourhood wells were introduced in Messica Village and also Sussundenga and Manica Districts. These early wells were built with fired bricks lining the well chamber narrowing down above ground level to a concrete ring at the apex which was covered with a lid. The bucket and chain or rope was supported on a side pole. These early wells had no windlass but were a considerable improvement on existing wells. The well head was surrounded by an apron and water run-off. Water was raised with a 3 litre bucket and chain. Well water was greatly improved in clarity and almost certainly in bacteriological quality. The windlass system had been introduced some years before near the Zimbabwe border area, in Manica province, and was re-introduced again by GTZ in 1993. It was introduced into the Mossurize District in 1994. These units which initially used wooden windlass supports became very popular and later brick windlass support columns were introduced, much like the Zimbabwe model. An elegant and durable low cost windlass was designed for this programme using steel bar. As far as the writer knows, these early upgraded wells are still operating in the Manica Province of Mozambique.

Family well with windlass in Manica Province, Mozambique

Simple family well without windlass, Manica province, Mozambique.
Very robust and no moving parts

Solidly built family well in Manica Province, with simple windlass. The perfect family well – Manica Province

WaterAid programme.

In more recent years WaterAid and ESTAMOS, a local NGO, has taken up the challenge in Niassa Province, Mozambique and has a very successful programme running in Niassa Province with a technology much similar to the one introduced in Manica province nearly a decade before. The new programme, has been fully described by Ned Breslin in recent papers. The simplicity of the design, low cost and ease of maintenance add great merit to this programme. The high rate of hand pump breakdown in Mozambique force people to revert back to their traditional sources which are often grossly contaminated. The neighbourhood well offers an intermediate solution, which, whilst not delivering water of such a high quality as that provided by a sealed well fitted with hand pump, delivers the water far more reliably. This avoids the almost inevitable choice left to the villagers of returning back to contaminated traditional sources if the hand pump breaks down. Villagers cannot afford the high cost of maintaining hand pumps by themselves, and experience shows that national

government, is either unwilling or unable to support pump maintenance programmes in so many cases. The costs of maintenance are high. Donors frequently come to the rescue and rehabilitate or replace old broken pumps, but this is not really a sustainable solution for the African continent as a whole.

The experiences gained in Zambia and Mozambique also offer valuable models on which to plan future programmes for the African continent as a whole. There are several reasons. First and most important the Mozambican models are placed in small communal settings (best referred to as neighbourhood settings) and not in strictly family settings which are not common in most African countries. Most well programmes in Africa are communally based and this is true of the well known and well documented case in Zambia. Second, material subsidy levels are smaller per person served in the Mozambican model since the well serves more people, although the contribution by the user community is less. Mozambican neighbourhood wells may serve up to 30 or more, three times more than the equivalent Zimbabwean well, although DFIDs place their estimates on use of Zimbabwean UFWs at 25 persons per unit (Brain Mathew pers.comm.). The best experiences from a number of countries must be brought together, and country specific solutions found.

Upgraded wells in Niassa Province, Mozambique.

The real challenge of the Mozambican model is to demonstrate that even in a neighbourhood setting, the users are committed to keeping the well functioning as if it were their own family property. Preliminary evidence of this may be gained from in depth studies made of the former GTZ programme in Manica Province, now 10 years after inception. Certainly the Zambian model appears to have achieved communal support for maintenance and if this can be achieved in Mozambique over a prolonged period then these examples provide an open road for future water development in Africa. Perhaps some lessons may be taken from the Zimbabwe book too. Clearly there is much to be gained from developing facilities in the family back yard.

The Zimbabwe UFW programme - ten to fifteen years on

Since the start of the programme, far too little monitoring has taken place to assess the weaknesses and strength of the programme and the technology. According to a UNICEF sponsored inventory 128 629 improved family wells were recorded as having been built in Zimbabwe by February 2006. If this figure was accurate and the wells were in use, this number might serve between one and two million people. Some brief inspections of old sites have previously been made and more recently two made in Chihota and Musami in 2006, by the writer. These visits revealed a mixed bag of experiences. Some units, almost 15 years appeared to be in almost perfect condition, whilst others were broken down and had been abandoned. The quality of original construction appeared to be important, with poorly made units deteriorating more rapidly whilst solid well built units (following the guidelines laid down in construction manuals) held up far better. As indicated earlier in this paper costs have soured dramatically.

A well maintained family well 14 years old in Musami.

Inspections also showed that the later buttressed windlass supports were far superior to the original un-buttressed column type supports which could crack. The rubber bearings could last for as long as 15 years or more, but once again, the life depended on the thickness and how well the rubber had been mounted. A common weakness was the apron, with many cracking up and some breaking apart. Those that remained in tact were made with thicker concrete, possibly reinforced with wire and well cured. Those which became cracked were thinner in construction and usually without wire reinforcing and poorly cured. The strength and durability of concrete work also depends on the type of cement used. PC 15 cement mixed with river sand and well cured is infinitely stronger than masonry cement mixed with river sand and poorly cured. Some wire reinforcing helps maintain strength in both cases. The heavy duty windlass used remained in tact in all cases observed. Later in the programme a lighter duty windlass was introduced in some areas which reduced cost. Also some wells had been deepened to follow the water table down in below average rainfall years, whilst others had not been deepened and were dry and abandoned, at least during the drier parts of the year. Very often wells were used by several families, which were often related. Over the years erosion of the soil around the well head was clearly visible, revealing the scouring

effect of water, rain and wind on the ground. In some cases the apron stood proud of the ground being supported by the well lining.

A poorly made and maintained well in Musami

Of particular importance was the brick well lining. In all cases observed, these were made of fired bricks and generally in a good state of repair. The fired bricks were bonded with well cured cement mortar. The well chamber and well lining form a most important part of the upgraded family well structure, and in nearly every case observed, these appeared to be in good condition. The well lining had collapsed in a few cases, but this was a relatively rare occurrence. The method of deepening wells with fired brick and cement mortar requires further experimentation and refinement.

A well chamber lined with fired bricks and mortar

One interesting point and one not yet fully investigated and answered, is why so many upgraded family wells had defects of the apron and run-off, mainly cracks or broken

segments, and yet no attempt had been made to mend or restore the apron to original condition. This may have been caused by the critically poor financial position most families found themselves in after the 2000 demise in Zimbabwe, when the economy began to collapsed and most rural (and urban families) began to struggled for survival. Buying extra cement and re-plastering, was far beyond the means of most rural families. Broken windlass supports often remained broken. In some cases the windlass was abandoned altogether, and the rope and bucket were pulled up by hand. The apparent lack of interest in maintaining UFWs linked to the programme, contrasts significantly with the willingness of so many families in earlier years to build their own wells completely without any outside financial assistance at all. Could this be the result of the familiar donor dependence syndrome, which became so common in Zimbabwe and other African states, where donors gave so much financial assistance. Many families would respond by saying – we are waiting to be given more cement – a surprising reaction from a family owner, whose unit is in the families own back yard.


Massive erosion around the well head and damage to apron

Future trends.

With the economy of Zimbabwe failing in recent years, and the poverty level of families in both the rural and urban setting alike increasing daily, it is wise to surmise the future of this programme. Some NGOs have taken a route to increase the subsidy level of UFWs even further by providing a rope and washer pump, with this method dominating the programme of certain NGOs in recent years. Partly as a result of this, the number of simpler and more durable wells fitted with a windlass system has dropped dramatically in recent years. This trend is entirely in the wrong direction. Rope and washer pumps use PVC components which are less durable and costly. They may be ideal for irrigation schemes or large vegetable gardens, where the water table is shallow, but they should always be self financed. Also there is much evidence to show that the simpler and more cost effective, durable and sustainable bucket and rope system can irrigate vegetable gardens of meaningful size. In the view of the writer, this trend of subsidising hand pumps on family owned wells is following a path which is unsustainable and undesirable. Where material assistance is given it should be of the most basic type, leaving the family itself to upgrade the system step by step.

A wiser move would be to simplify the UFW even further by eliminating the windlass and windlass supports altogether and making a sturdy basic unit with no moving parts. The essential components of such a unit would be the brick lined well chamber with raised well lining above ground level being corbelled (reduced diameter brick column) topped by a high

strength concrete ring fitted with a tin lid. The raised well lining should be surrounded by a smaller and much stouter and well cured apron and water run-off. This is the unit originally designed for Mozambique. Its simplicity had great merit. With no moving parts it was very durable, especially when the concrete and brick work were constructed to high standards. The cement should be carefully used to maximum effect in lining the well properly and then making a sturdy raised collar and apron and run-off. It is this simpler unit which is the most logical natural successor to the original unit in Zimbabwe. Upgrades with a windlass system are always possible, and there is now evidence in Zimbabwe that the programme has inspired large numbers of families to dig and upgrade their own wells without outside support This has been promoted further by the reduced number of community supplies operating with hand pumps. Self reliance comes to the fore under such circumstances. Families are free to further upgrade their own well by fitting hand pumps of various types. Such upgrades should always be self financed.

Simple Upgraded Family Well in Zimbabwe – a basic unit which can be upgraded later.

Examples of self-financed windlasses added to a simple UFWs. Further improvements can be made by building an apron and run-off.

Conclusions

There seems little doubt that the concept of "self supply" for rural and even specific peri-urban communities is a viable and cost effective method of providing water where other methods are either non existent or have proven to be non viable or unsustainable. This appears to taken place twice in Zimbabwean history. In the period before 1980, many families built their own wells because community wells and boreholes were relatively scarce. It is estimated that 100 000 units may have existed, most being simple and not well protected at that time. During the rapid growth of the rural water supply programme during the 1980's and 1990's large numbers of community boreholes and wells were fitted with hand pumps. Initially the official national programme did not recognise family owned wells as being important, but this realisation changed withy time. Government led research and feedback from satisfied families and communities led the Government to officially recognise the concept. After official recognition, large numbers of family wells were upgraded in the government endorsed Upgraded Family Well Programme, described in this paper. During Zimbabwe's decline after 2000, many community water points fitted with hand pumps went out of action, and once again many families chose to dig and upgrade their own backyard wells in order to be self reliant. In some cases it was a matter of necessity in others of convenience. Thus whilst the national upgraded well programme declined during this era, it is clear that it had inspired progressive families to copy the techniques promoted during the programme. In the early years the use of the simple windlass had been copied from farms and mines. In the later years, the convenience of the windlass became apparent again to communities where the windlass system had been promoted in the national programme. By 2005, some 128 000 improved family wells existed in Zimbabwe (UNICEF 2005).

However, simplicity and step by step upgradeability lie at the heart of this concept. And the most important technical aspects of an upgraded well are lining the well chamber with fired bricks, raising it above ground level and surrounding it with a sturdy and long lasting sanitary apron and water run-off. If finances are limited, it is better in the long run to invest first in a sturdy well lining and sanitary apron. Further upgrades, like the windlass can be added later. This can be considered as an upgrade to the basic hygienically improved unit. Evidence shows that motivated families are prepared to add a windlass to a simple well using their own resources. Hand pumps of various types, and even electrically driven pumps can be added later if conditions allow.

Zimbabwe is blessed with many districts where the water table is relatively high and the shallow well concept has wide application. But many other districts are more arid and water the lies deep in the ground. In such areas the methods described in this paper cannot apply. Deeper wells and boreholes require hand pumps to lift the water, and Zimbabwe's well tried and tested Bush Pump has served this purpose for many decades. Well chosen direct action hand pumps may be ideal to serve Zimbabwe's more heavily used community shallow wells in the future. Ideally the best technology to serve specific and local requirements is what is required. It is very likely that an ever increasing number of households will choose the route of self reliance as a means of obtaining domestic and even productive water.

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