Tweed Kenya Mentoring Program

Safe Water 4

Final Report by Nigel Dobson

June 2012
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1.0 Project Background

Obambo-Kadenge village is located in Western Kenya, approximately 400km from Nairobi, which is a 10 hour plus drive. The closest town centre is Siaya. These people make a subsistence living, eating what they grow, with very limited access to markets to sell food and receive income. Water for the home is carried by the women and children in 20 litre containers.

In 2007 Tweed Kenya Mentoring Program (TKMP) through the support of Tweed Shire Council (TSC) and the International River Foundation (IRF) commissioned Safe Water 1 in Obambo-Kadenge's Gona Dam. Gona dam serves a population of 6000 people and 2500 livestock. The project was based on a simple, low cost community water treat plant using self cleansing micro filters donated by the SkyJuice Foundation. The other features of the project were 2 water storage tanks, a 5.5HP Honda water pump and a water kiosk. The project was managed by a committee selected from 8 catchment areas that use the dam. A trained operator was employed by the community to oversee the day to day operation of the project. The area is known for the high incidence of HIV/Aids and water borne infections such as cholera, dysentery and typhoid. In the period the project was operational, there was reduced disease rate within the community along with other social benefits such as being able to wash white cloths and confidently hosting visiting relatives.

The project operated until mid 2008 when it could no longer produce safe water due to critically high levels of silt within Gona Dam. This was mainly caused by increased cultivation and destruction of the Akara Hills and Manyasi Valley Catchment areas. There was also the added damage by livestock over time and high evaporation rates. These causes combined, lead to the premature failure of the filter units and the Safe Water 1 kiosk became unusable to the residents of Obambo-Kadenge village. When Gona dam is dry, residents need to fetch water from alternative sources, this then places further strain on those water supplies. Sometimes water for the home can be carried up to 6km.
Upon community request, TKMP contributed $6000 towards the excavation of the dam. Dominion Farm (a “relatively” nearby American owned rice farm) and Water Resource Management Authority (WARMA - Kenyan Government) were approached for support to undertake this work. Nothing from this ever materialised and the money was held in trust.

It is against this background that the Obambo-Kadenge Community requested TKMP to provide further support with the dam excavation. TKMP decided to provide this support and undertake the excavation as a Safe Water project. Tweed Shire Council's Senior Construction Engineer, Nigel Dobson, was selected as the Safe Water 4 volunteer to deliver this project.
2.0 Project Development

2.1 Gona Dam

Initially, the Primary Objective of the project was to "provide the Obambo-Kadenge community with a permanent source of safe water by de-silting the Gona dam to create storage capacity and refurbishing Safe Water 1 (filters, tank and pump)". A secondary objective was also defined; this was to "establish a basis for Safe Water 5 by creating community awareness of disease transmission (treatment, sanitation and hygiene) and catchment management". Originally a budget of $35,000 was proposed.

Safe Water 4 was officially launched on Thursday 21 July 2011 at the Council Chambers. His Excellency, Mr Stephen K Tarus, High Commissioner of Kenya attended the launch.

Meshack Awitti of Noramma CivilTech (Siaya based company) was engaged for a fee of $750 to design the new dam and provide a design report detailing the usage of the old dam, water demand for the new dam and an estimated construction cost. The design brief requested a target capacity of 30M litres, a silt trap, spillway, collection trenches, cattle trough, cattle fence, gravel roughing filter and vegetation planting. These items were requested based on what the community was asking for balanced against what TKMP considered as important inclusions for educating the community, reducing disease and improving the environment. Considering the scale of the works, it was decided that the initial budget of $35,000 would not be enough money and that 2 years worth of funds would be used. A new budget of about $55,000 was set.

After a few design iterations based on feedback from TKMP, WARMA, LBA (Lake Basin Authority) and Gona dam committee, Meshack submitted his design and final report in November 2011. During the design phase of the project, concerns were raised about the potential cost of the project but it was decided to proceed as originally planned so that the local community could understand the financial implications of their requests. The final report confirmed the financial concerns and stated an estimated construction cost of $192,000 for the dam as designed.

The design report and estimated cost was then taken to the community and used as justification to scale back the project to something more achievable. The community decided that their only priority was water capacity and wanted the biggest dam possible for the available money and nothing else. They were advised that simply digging a hole would not achieve a suitable outcome and in a few years (10 years ?) the community would be back to where it is now. TKMP insisted that a silt trap, adequate collection trenches, a spillway and fencing were to be included as part of the project to ensure lasting benefits of securing safe water and reducing disease.

The idea of manual excavation was discussed to significantly reduce the cost of the project and also distribute the money throughout the village rather than just a single contractor receiving the whole payment. The community rejected this idea because of 3 main reasons:

- They could not guarantee enough labourers to complete the work because of the need to continue farming (surviving day to day).
- They didn’t think they could complete the work during a single dry season.
- They have had bad experiences in the past with manual excavation where they did the work and didn’t get paid.
In the end it was finally agreed with the community that the work would be completed using a machine with a target capacity of 10M litres and including the items that TKMP required. The rainfall data, catchment data and water demand that was detailed in Meshack's report, showed that a dam of this size would provide a permanent source from the end of one wet season to the start of the next, but only just. Rather than redo the design and then give it to contractors to quote, it was decided to ask some contractors to submit proposals for what they could achieve for the budget, using the minimum criteria as a starting point.

3 proposals had been received by TKMP when I arrived in Kenya.

1. RUID Constructions based in Nairobi. The proposal was for a dam of 10M litres capacity and a depth of 2.5m, including collection trenches, sediment pond, spillway and extraction point for the filters. Community training in how to manage the water and maintain the dam was also offered. The cost was approximately $30,000 with a delivery time of 4 weeks.

2. WARMA (Kenyan Government Office) based in Siaya. The proposal was for a dam of 10M litres capacity and a depth of 0.5m. No other works. For a cost of approximately $15,000 and a delivery time of 1 week.

3. Local Siaya Contractor (Name Unknown). The proposal was for a dam of 20M litres capacity and a depth of 1m. No other works. For an approximate cost of $15,000 and a delivery time of 1 week.

### 2.2 Kenya Health

As the Gona Dam project developed, it became apparent that the benefits of the project could be significantly amplified by partnering with Kenya Health. This partnering would provide an opportunity to add value to the existing Safe Water program and subsequently improve the everyday lives of the community.

Kenya Health is an organisation founded by Lyle Burgoyne, a registered nurse and midwife, from Murwillumbah NSW. It is an organisation dedicated to the provision of health care to women and young children in Kenya but they treat anyone who presents at the free clinics. One of the biggest problems with medical care in Kenya is that no matter how poor a person or family is there is no free medical care and, because of this, many of the poorer people miss out on all medical care and surgery. The aim of Kenya Health is to provide medicine, medical treatment and education to help these people achieve better health. Kenya Health provides at least 20 free medical clinics per year and treats between 300 and 400 people per clinic.

Kenya Health agreed to visit the village of Obambo-Kadenge and provide free clinics to the community during the delivery of Safe Water 4. The proposed travel dates for both organisations were aligned for February 2012.

Tiffany Dobson, my wife, was planning on travelling to Kenya to volunteer at the Mission in Action Orphanage located in Nakuru while I was in the village. This orphanage was established and is currently run by an Australian couple from Lismore. After discussing plans with Olita Ogonjo, TKMP’s desk co-ordinator, he convinced Tiffany that it would be more beneficial to work in the village with me and tackle some social problems that exist. These included a lack of education about using safe water to reduce disease and also that females drop out of school when they reach puberty. Because of the male dominated
culture within the village and the social stigma associated with the menstruation cycle, it is a problem that could only be dealt with by a female.

Due to the lack of safe water in the village of Obambo-Kadenge, people don't typically travel to this area and female visitors are almost unheard of, so it was an ideal opportunity to work with the women in the village. Two other Murwillumbah ladies volunteered to assist Tiffany with this work, Hopal McClintock and Cara Gately. Although this work was purely to benefit TKMP, Kenya Health agreed to adopt this part of the project and the 3 volunteers were officially part of the Kenya Health Team.

2.3 SkyJuice Foundation

Larry James from SkyJuice Foundation supported Safe Water 4 as he has done for the previous 3 projects. 4 new SkyHydrants were donated free of charge to replace the existing filters within Safe Water 1. These were shipped to Kenya for an approximate cost of $1500. It should be noted that products used for agriculture or water supply do not incur duty when they arrive in Kenya. As learned from other Safe Water projects, it is important that the filters are shipped by themselves, if other items are included, then duty is payable on everything.

The filters arrived in Kenya late December 2011 while Olita was in Australia for Sam's funeral. As they remained with Customs for an extended period of time without being cleared and collected, they attracted storage charges. After finally clearing customs, they were freighted to Siaya for collection in February 2012.
3.0  Project Delivery

3.1  Nairobi

I arrived in Kenya on 22 January 2012 and stayed with John Nyachieo who lives just outside of Nairobi. John has visited Australia previously as a guest of TKMP, he is a civil engineer for RUID Constructions. Due to civil unrest in Nairobi caused by proceedings in the international court, the planned visit to the urban projects of TKMP was postponed; this provided a perfect opportunity to discuss the ins and outs of the proposal to construct Gona Dam. It was decided that the proposal was solid and achievable given the time constraints, the weather constraints and the budget.

The next day, the unrest had settled down and it was considered safe to enter Nairobi, so the urban projects within the slums of Dagoretti were visited with Olita, Kori and Godi. A meeting was also arranged with Sam's family and personal belongings of Sam's were returned. Whilst returning to John's place, Olita decided to detour through the slums of Kibera to show me what projects he had implemented before joining TKMP. Just as we were leaving Kibera, about 20 youths with guns robbed us. Along with everyone losing personal items, 3 cameras that belonged to the TKMP program were lost along with about $1200 cash that Olita had just withdrawn from the bank in preparation for travelling to Siaya the next day.

Plans for travelling to Siaya were abandoned because the next day was spent between the police station and the bank. Documents had been stolen that contained details of the money transfer for the project and the bank couldn't guarantee the security of the funds even though the funds had not yet arrived. The Kenyan Police were even more unhelpful and it took all day to obtain a copy of the police report lodged the night before. Only one officer could release it and he wasn't there (but for a small fee we could have it immediately). After waiting over half the day, they finally decided they weren't going to get their fee and the officer at the front desk handed it over to us.

3.2  Gona Dam Preparation

Early the next morning (Thursday), I boarded a bus with Olita and John for Siaya. It took over 12 hours to travel the 400km, I can only say that Australia doesn't have traffic congestion and that our gravel roads are of exceptionally high quality.
The next day was spent in Siaya with the Gona Dam Committee reviewing the proposals from the 3 contractors. Explaining technical documents through 2 translators was almost impossible, first into Kiswahili and then into the village language Luhya. The committee wanted to accept the proposal from the local contractor because it was twice the water and half the money, leaving them with the rest of the money (that's what they thought). It was difficult trying to convince them that:

- it was impossible to move that quantity of dirt in a single week,
- there were no details of how the construction was going to be undertaken,
- they were not going to pocket the left over money,
- the other works were necessary to protect the dam and keep it operational,
- the contract stated that the contractor had the final say in measuring the volume of the dam and it could not be contested, and
- the dam was not deep enough to hold water all year and the extra volume meant nothing.

The committee (and community) could not understand the concept of volume. They simply understood water in terms of surface area, the bigger the area - the more water. Trying to explain volume was difficult, trying to explain evaporation was impossible. That part of Kenya has evaporation rates in excess of 1.7m per year and a dam 1m deep would be dry in 7 months without any water being extracted for other uses. Increasing the area of the dam only made evaporation worse and the extra volume proposed by the local contractor would actually yield less useable water. Therefore, the only proposal that would benefit them, and that TKMP would support, was the expensive one from RUID Constructions.

After many hours of debate, the Chairman (who could speak English) was finally convinced and persuaded the rest of the committee to listen. John and I then spent the next few hours explaining the details of his contract, who was obligated to do what and what would happen
if people didn't meet their obligations. Contracts were finally signed and I made it to the village of Obambo-Kadenge well after dark.

![Contract Signing](image)

John needed to return to Nairobi to arrange machinery and Olita returned with him because the money transfer had still not gone through despite it being over 2 weeks since it was sent from Australia.

John had tentatively lined up a suitable dozer and once he had the contracts signed he paid the initial deposit on it. Since we had no money to pay John his deposit he could not pay the transport costs to float the dozer and ended up losing the machine and his deposit. Olita spent the best part of a week chasing the banks. Due to the time difference between Australia and Kenya, banks don’t share any common working hours, so it takes a full day to pass a single message between the banks. After many midnight phone calls, receiving a form that the bank in Australia said they would never release due to security concerns and Olita's refusal to leave the bank unless he had the money, he finally received the money. At this stage we were in breach of our part of the contract but John understood the difficulties we were facing. John eventually found a second dozer, slightly smaller than the first but still good enough to complete the work. Securing a dozer is incredibly difficult in Kenya and it was only through John's vast network of contacts that it was possible on such short notice and during the dry season when they are in demand. Transport was arranged - it took 2 days on the back of the truck to travel the 400km from Nairobi.
While Olita and John were making arrangements in Nairobi, I remained in the village with Opondo and had many meetings with various Government Departments based in Siaya, along with the Mayor, the District Commissioner, and the Chief. Because we refused to pay the "visiting fee", most of these meetings were cancelled and would have to reschedule. This meant catching the motor bike taki back to town the next day. Eventually Opondo and I met with all the officials that could cause political problems and stop the project from happening. Some of these officials were plainly corrupt and just demanded bribes while others were a little more subtle with their requests for payment. Only one was fully supportive and helped us with the project even though he didn’t receive anything. The others (after not receiving any money) agreed to leave us alone to do our thing but would not help us.
Wanjohi, the surveyor, also arrived from Nairobi during this week, so the detailed survey work was undertaken and a beautiful contour map of the whole area was produced. This enabled further design work to be undertaken. The dam was also cleared of all remaining vegetation and test pits were dug to ensure the soil was suitable and that the dozer would not get bogged. Un-bogging a 20T machine by hand in black clay soil would have been impossible.

After a week in the village, I decided motor bike taxis were not an acceptable standard of transport for the 3 ladies about to join me in the village (in the nearby town of Kisii, 10 motorbike riders a day are killed in traffic accidents). Olita was still in Nairobi and needed to move office furniture from the TKMP desk in Nairobi to the TKMP desk in Siaya, so it was decided that Olita would hire a ute, drive to Siaya with the furniture and then return to Nakuru with me to meet the Kenya Health Team before returning to Siaya with the 3 ladies and the boxes of medicine. After delaying for a day (so he could get some rest after spending all night on the phone with the bank in Australia and all day in the bank in Kenya) he set off with the relatively new Nissan Navara hired at about half the cost of normal. After exploding the top tank on the radiator, getting that replaced on the side of the road, having that one leak and getting it soldered back together, then having it leak again and fixing it with superglue and Omo washing powder, Olita finally arrived back in Siaya. After driving all night (and fixing the radiator) he arrived about 4 hours after we were due to leave for Nakuru.

Since Olita was so exhausted, I had my first introduction to driving in Kenya. Olita couldn't sleep because he needed to navigate but at least he didn't need to concentrate. Driving in Kenya is either flat to the floor or hard on the brakes, there is nothing in between - even on the highway. The engine didn't sound healthy but the superglue and Omo held and we covered the 250km to Nakuru in about 9 hours (after a 12km detour that took 2 hours, you have to pay the traffic controller if you don't want to take the detour). The Kenya Health Team had already arrived at the Mission in Action Orphanage and were wondering where I
was. Since the vehicle was sounding so unhealthy, Olita kept driving back to Nairobi to return the vehicle. We later found out that it had a blown head gasket.

I spent a couple of days with the Kenya Health Team at the Orphanage while they settled in, organised medicine and ran the first clinic at the Nakuru Rubbish Dump where people live. Olita could not find an alternative vehicle to hire without it costing double, so the Mission in Action Orphanage kindly offered to hire us one of their vehicles for the same money. The entire team of 11 people then headed for Siaya.

### 3.3 Kenya Health

The Kenya Health team, consisting of 6 nurses and 1 assistant ran 2 free health clinics in the village of Obambo-Kadenge. The first was at the Kubar primary school where they saw and treated over 500 people. Most cases could be treated on the spot, but serious cases were referred to hospitals and treatment paid for by Kenya Health. The second clinic was run at the Gona Dam site and the timing coincided with the first day of work on the dam with the dozer. At the second clinic, Kenya Health treated over 300 people.
The village of Obambo-Kadenge and surround villages had a recent outbreak of Jiggers. Jiggers are a flea like insect that live in the dirt and then burrow under peoples skin to breed. This is a painful and contagious disease that usually results in entire families catching it. They start in the hands and feet but spread over the whole body. There had been a death in the village cause by jiggers only weeks before I arrived.

The treatment for jiggers is simple but takes follow up care for over a month. To treat this disease, Kenya Health provided supplies and training to the community health workers and a "Jigger Campaign" was started. It only costs about $10 to treat a whole family. This involves soaking the infected areas in dettol and clean water, then applying vaseline. This is done every day for a week and then every week for 4-6 weeks. The people’s home also needs to be sprayed with insecticide to prevent reinfection. Other simple techniques to stop jigger infestations is to keep the dirt floor inside the hut higher than the surrounding ground (reduce the moisture in the dirt) and keep rubbish out of the hut. Over 120 families have now been treated for jiggers.
After the 2 clinics were done and the Jigger Campaign was underway, the Kenya health team left Siaya to run clinics in other parts of Kenya. Tiffany, Cara and Hopal remained in the village with me to do further work with the girls in the school.

**The village team**

### 3.4 Sanitation and Hygiene

The 3 ladies worked with 2 schools in the village. Kubar Primary School, which has about 750 students and Obambo Primary School, which has about 1000 students. The WASH program was used as the basis of the teaching so the students could learn about simple disease transmission and how to avoid it. It was discovered that about 95% of the students had soap at home but it was only used for washing clothes, using it to wash hands wasn't even considered. Other techniques were also taught, such as using ash or sand to wash hands when soap is not available. Lessons were also given on basic health, nutrition, sleep (Kenyans only sleep about 4 hours per night), exercise and the value of safe water.

**Teaching in the school**
All of this work with the school students was done as preparation to get to know the students and tackle the bigger social issue of menstrual hygiene. The shops in Siaya sell disposable hygiene products and it is compulsory that all school students have them, unfortunately the reality is that the girls in the village cannot afford to purchase them every month. There is also a disposal problem because they have no waste system in place. On the last day in each school, the boys and girls were separated. Kori took the boys to play soccer and the 3 ladies held sessions with the girls about the menstrual cycle and possible ways to deal with it and remain in school.

Female hygiene is a taboo topic within the village. If the girls are lucky, a grandmother might mention a couple of things to them before they reach puberty. But with the high death rate within the village, many of the girls only have a father at home so they have no one to tell them anything. The problem is further exacerbated by a lack of female teachers in the schools (1 between both schools).

The girls quite often drop out of school when they reach puberty because it is too difficult to manage and the social stigma is too great. If the girls keep persisting, they miss a week of school every month and end up falling behind. It is common to find 15 year old girls still in primary school.

Only days before leaving for Kenya, Jenny Rawson, a local Murwillumbah lady, heard about some of the issues that the 3 volunteers were going to tackle. She provided some sample reusable sanitary pads and a suitcase full of the various materials required to make them. These were taken into the village and it was discovered that 2 of the community health workers in the village were sewers and the school board chairman was a tailor by trade. The reusable pads were shown to these people and they decided that they were capable of making them.

On the first attempt they made the pads upside down, but after that they were fine. The school board chairman was a male and it was expected that he would have nothing to do with the process, but he pushed past the social boundaries and stuck with it. He stated that it was the single biggest problem facing the schools; they had to find a way to keep the girls in school if the village was going to progress. With the suitcase full of material, over 90 of these pads were made and distributed to the girls.
3.5 Additional Projects

Whilst in the village other minor projects were carried out.

A staff member from TSC had donated $1500 specifically to install a water tank at one of the schools. Kubar Primary School was first approached about the installation of the water tank. A tank had already been donated to this school as part of Safe Water 2, but Kubar is financially much worse than Obambo School and it was decided that a second tank would provide the greatest benefit. The $1500 was enough money to cover the required materials and labour for the installation. Kubar School was asked if they would be willing to undertake the labour if the materials were provided and they jumped at the opportunity. It cost just under $800 to provide the tank, gutters and cement for the tank stand. Obambo School was then approached with the same offer and they jumped at the opportunity. For about $1550, both schools received a water tank. This saves the students walking 2km to fetch water during the wet season.
Someone had given Cara $500 to put towards whatever was needed most while she was in Kenya. 6 of the 8 eight classrooms at Kubar school had dirt floors, meaning the students are sitting in the dirt all day with the jiggers. The $500 was offered to the school on the basis that it was to be used to purchase sand and cement if the school provided the labour to concrete as many floors as possible. Again the school jumped at this opportunity. The sand and cement is used as a skin about 20mm thick over the floor. To give it strength, rock ballast is placed under the cement. The school kids were sent out into the bush and they all brought back a few rocks each. In no time at all the rooms were ready for concreting. Concrete floors in 3 classrooms were achieved.
Cara also took with her 16 soccer balls and few ball pumps donated by a business. In Nairobi a soccer ball is worth about $15, in Siaya a soccer ball is worth over $50. These soccer balls were given to a number of schools and community groups. Of particular note were the 2 balls given to Ochillo Primary School, the site of Safe Water 3. The Safe Water 3 project has had a number of political challenges since it was built, mostly caused by factions within the community not talking with each other. The students were playing sport when the soccer balls were handed over to the school and despite a soccer game being in progress (using a plastic bag ball); the 2 new balls went to volley ball and net ball. The only comment the teachers gave us was that they were far too valuable to kick. After the soccer balls were handed over, we sat down with the principal of the school and the school ball chairman and discussed some of the problems surrounding Safe Water 3. The lines of communication were suddenly re-established and the political issues have been set aside.
A suitcase full of clothing was donated and taken to the village with us. Giving items to individuals within the village can cause tension and fighting so care needed to be taken distributing these clothes. It was decided that the clothes should be given to a pastor (about 80% of the village is Christian) to distribute for us as he would know who needed them the most. Within a few days, the pastor reported back that he had distributed the clothes and the people had accused him of sneaking into their huts through the night to measure them because all the clothes fitted the person perfectly.
3.6 Gona Dam Excavation

When the dozer finally arrived at Gona dam it was unloaded on the side of the main road and walked down to the dam on an impassable road. The float driver was strictly told not to drive down because he would get stuck. Additional security was hired to watch the float overnight on the side of the road. Because the Kenya Health Team was holding a clinic at the dam site the next day and needed vehicular access, a couple of village people were employed to fix the road. They started about 4:00am in the morning and by 8:00am Kenya Health got their van to the site. I got a message that they were there and waiting and I started heading down with the second vehicle. In the 10 minute delay, the float drive saw the van go down and decided they must have fixed the road and took the truck down. Unfortunately, they only fixed the ruts and he didn't get very far and became wedged in a cutting around a bend. So after all the repair work to the road, the second load of medical supplies in my vehicle was carried by hand anyway.

The dozer had started work and we wouldn’t release it to go and pull the float out so they were just going to leave it stuck. But we needed to get the Kenya Health van back out, so the men who fixed the road for us spent the rest of the day digging the float out for the truck driver. By 4:00pm in the afternoon they had finally widened the cutting enough to get the truck around the corner and it turned up at the dam site.
The dozer spent the first few days working but wasn't achieving the productivity that we were expecting. I spent a bit of time just watching it and every couple of hours talking with the driver trying to teach him new tricks. He could drive the dozer fine, but he just didn't know how to go about the work. Talking through a translator it was difficult speaking the right jargon but I managed to increase his efficiency about 30%. After a couple more days John arrived from Nairobi, and being able to talk the right language, managed to almost double his efficiency.

John and I went over all the costs and the production rate now that everything was bedded down. John generously offered to ignore the contract and work as hard as he could for as long as he could until the money ran out and not make any profit himself. He figured that he could excavate about 15,000m$^3$ of soil for the money. Reviewing the design plans and the detailed contour map the surveyor produced, we figured we could adjust the dam embankments, lift the inlet channel and provide an extra 10M litres of storage capacity for no extra cost. There were a few tradeoffs however with creating localised flooding upstream of the dam.
This proposal was taken to the dam committee and they thought it was a wonderful idea. After a couple of days, they came back to us and said that the community did not support their decision and we could not get the extra storage capacity. Almost daily John and I reviewed the design and progress to date with Wanjohi. Eventually we found another way of achieving an extra 7M litres storage capacity without flooding the upstream area but diverting the water coming from a side catchment away from the dam past the Safe Water 1 Kiosk.

This idea was discussed by the dam committee and taken to the community but eventually rejected because they wanted the dam to capture all available water and not waste any. After a couple more days of studying the plans another option was discovered that increased the storage capacity by 5M litres and only cost a small amount extra. This was discussed with the committee and accepted by the community.

This option was based on separating the small dam immediately upstream of the new one so that it was completely independent. The existing collection trenches, silt trap (which is full of silt) and inlet structure were to remain in place but be modified slightly to also act as the spillway. Basically, when the small dam is full, water is bypassed to the new dam down the Western side. The new dam would also have the same combined inlet/spillway arrangement on the Western side with a bypass channel dug downstream until it is clear of the dam walls. To capture the water from the side catchment (Eastern Side), a second silt trap and inlet only structure would be created. This caused a small amount of flooding to the side catchment but it was only the size of the proposed silt trap and well vegetated so the community accepted its dual function.
The dozer progressed through the work as expected. Maintaining a fuel supply was a challenge. The average quantity of fuel purchased in Siaya seemed to be less than 1 litre at a time. The dozer was using slightly less fuel than anticipated but still in the order of 160 litres per day. Fuel is Kenya is slightly more expensive to purchase than Australia but relatively is so valuable to the local people. Fuel was bought 1000 litres at a time in 200 litre drums and transported to site by ute. It was locked in the Safe Water 1 kiosk but an additional 3 security guards were employed to watch it. Every morning and night, independent fuel readings were taken by the dozer operator to ensure the fuel wasn't disappearing.

The window to complete the work was very short from the end of the dry season when the old dam was dry enough to work in to the start of the wet season was only about 6 weeks. With the delays at the start trying to get money sorted and find a dozer, we knew we would be pushing out luck. The dozer operator was working everyday from first light until his eyes couldn't focus any more. After a couple of light rain showers to keep us on our toes, the weather predictions turned out to be correct and on the last day of planned work the pin was pulled for fear of getting stuck.

A final depth of 3.35m was achieved (instead of the intended 3.5m) but the final capacity achieved was still 20M litres, over double what was thought possible.
Tiffany, Cara, Hopal and I left the village a couple of days before the excavation was complete. We rejoined the Kenya Health Team at Nakuru and then went on safari to the Masai Mara for a few days to enjoy the African wildlife. This was spectacular and completely indescribable. We departed Kenya after almost 6 weeks (4 for the Kenya Health team).

Before I left the village, I tested a 200 micron disk filter to see if it would remove some of the load from the SkyHydrant filters. It was found that the disk filter had negligible effect on flow rates but it was not fine enough to remove the discoloration from the water (clay particles). It was found to effectively remove large amounts of silt and other debris from the water so it was decided to install the disk filter prior to the SkyHydrants anyway.

The new SkyHydrants were not fitted while I was in the village because of community concern about not being used until there was water in the dam. I conducted a dry fitment with Opondo to ensure that everything would work when they were installed. Since receiving water in the dam, Opondo has fitted the new filters and Safe Water 1 is now back in operation. After almost 4 years out of action, it was found that everything was still accounted for and working, including the Honda pump.

Also, John has completed the dam management training, the fencing has been installed to keep the cattle out (utilising the small dam as a cattle trough) and vegetation has been planted around the dam.

Overall, Safe Water 4 is a considered a great success.
4.0  Project Costs

The total cost of Safe Water 4 to TKMP was in the order of $58,000. On top of this, significant personal contributions were made by each of the volunteers, including myself. Exact figures from each person are not known, but it would be in the order of $3500 each (including airfares) attributable directly to the project. The amount committed by Kenya Health to conduct the 2 clinics and start the jigger campaign was approximately $2500. Each of the nurses also made significant personal contributions paying for their own travel.

Along with the financial cost of the project, it is estimated that I have dedicated approximately 800 hours of voluntary time to the project. This includes the preparation time needed to successfully establish the project, the promotional work, the time working in Kenya and the tidy up after the trip.

With the outcomes achieved in improving everyday lives and reducing disease for the people of Obambo-Kadenge in Rural Western Kenya, I consider the time, cost and effort well worth it. I sincerely appreciate the opportunity of being a part of this wonderful program.
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