Clean

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Kakinga Lake, Uganda.

Water for its People and Agriculture; a sustainable future.

Dr Harvey Wood.

June 2012.

Clean Rivers Trust, 72 Appletongate, Newark, Nottinghamshire NG24 1LR UK

Preface.

I need to thank many people for their participation in my foray into a remote part of Uganda and the research that culminates in this report into the issues of Kakinga Lake and the community that likes by it both literally and metaphorically. The population would not be there if it was not for the lake being built in the 1950s and who are totally dependent on it for their day to day survival.

It was in March 2012 I first heard of the needs of Kakinga though a communication on the LinkedIn web site that requested people reading the piece to take interest. I thank the author of the piece; Lukanga Stanley for doing so. In a short period of time it was agreed that I should visit the area and learn at first hand the needs of the community and see the situation at first hand. It is very easy to get the wrong idea and feed false information if one relies on others to report what they see if they are at all uncertain of detail that is needed to diagnose the main concerns and even more difficult to prescribe the solutions.

The visit took place between the 28th April and 5th May 2012. The time spent at Kakinga was 4 days and on the Friday (4th May) a period of study at the Geological Survey of Uganda was both helpful and enjoyable, thanks to Dorah of the Public Access Office..

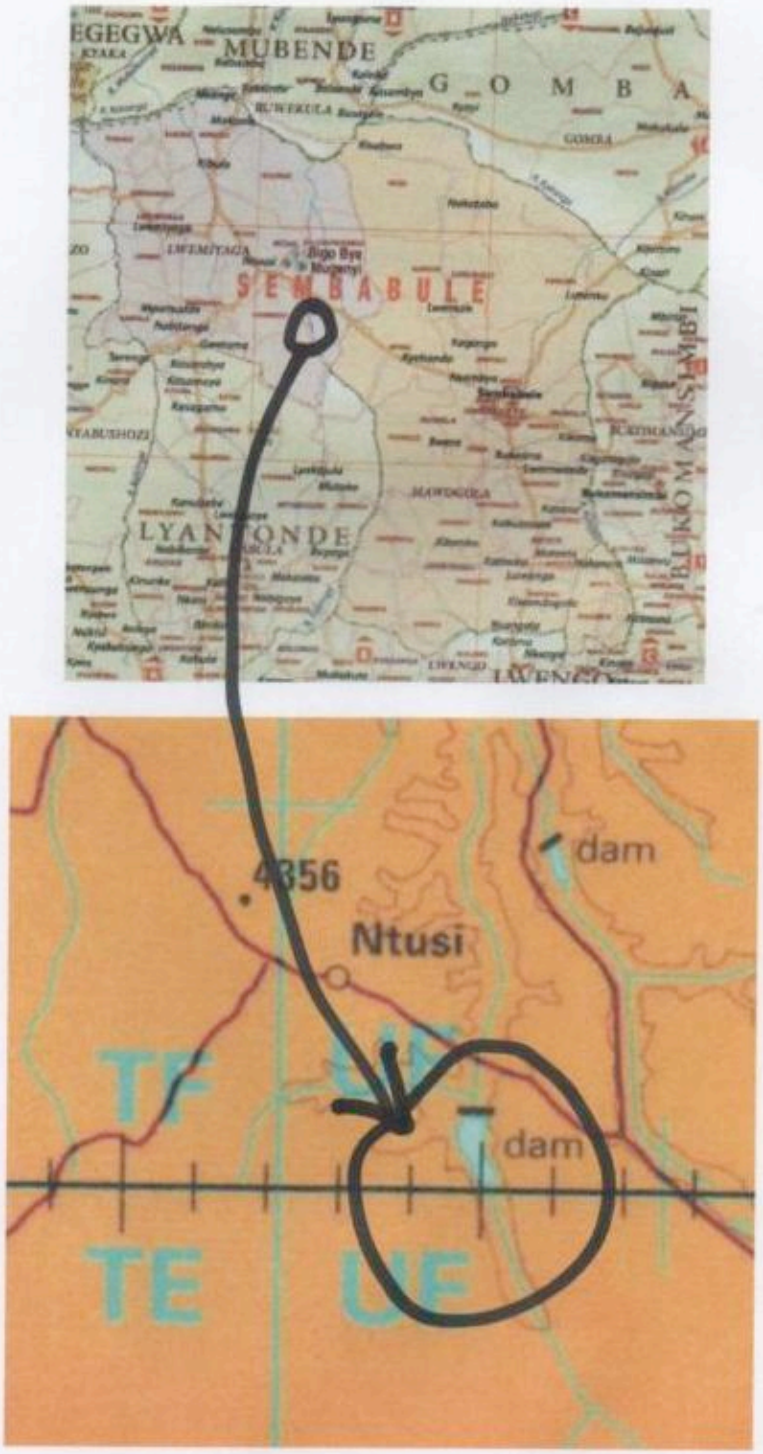
I would like to thank all the people I met, Lukanga Stanley for his hospitality, translation back and for of Lugandan, and being my guide. Stanley's friend Mark who did much to make my visit comfortable and entertaining deserves thanks. Thanks is due to Willy Bbaale, the District Forest Officer/Sembabule, he made the formal invitation, gave me splendid hospitality and ensured that the visit was trouble free. There are several other persons, but they are more numerous for me to mention; they know who they are.

On returning to the UK much time has been spent considering options that may be suitable interventions for the community and the Forestry Department to initiate. Some such as the general care of the lake waters and the maintenance there of being obvious, but these basic and desirable outcomes are reliant on many more minor but equally desirable issues to be addressed. The need for actions that are holistic and general in nature in some ways preclude single issues dominating the text. Topics that are primary to the research are dealt with in some detail and where consequential issues are anticipated these are also discussed within the narrative.

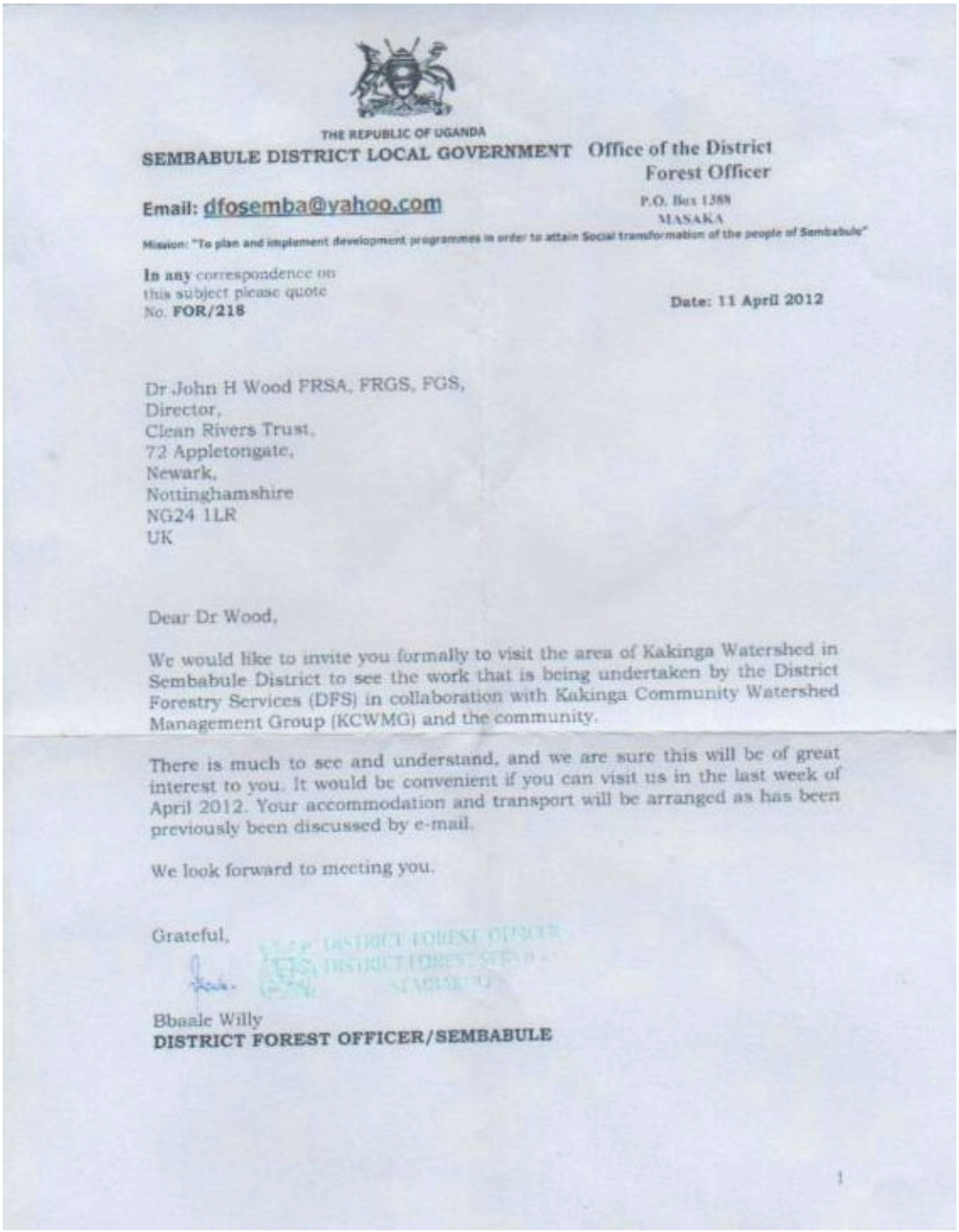
The research carried out on the ground in Uganda markedly altered my perception of the area enormously from that that I had been gleaned from published and internet sources. The whole exercise has given a marked advance in my understanding as to the conditions in reality; the many and diverse aspects of the issues to be addressed.

The whole project is a lesson in sustainability.

Harvey Wood.
Newark, UK.
May 2012.



Location of Kakinga Dam and Lake in Sembabule District of Uganda.



THE REPUBLIC OF UGANDA

SEMBABULE DISTRICT LOCAL GOVERNMENT Office of the District Forest Officer

Email: dfosemba@yahoo.com

P.O. Box 1388
MASAKA

Mission: "To plan and implement development programmes in order to attain Social transformation of the people of Sembabule"

In any correspondence on this subject please quote No. **FOR/218**

Date: 11 April 2012

Dr John H Wood FRSA, FRGS, FGS,
Director,
Clean Rivers Trust,
72 Appletongate,
Newark,
Nottinghamshire
NG24 1LR
UK

Dear Dr Wood,

We would like to invite you formally to visit the area of Kakinga Watershed in Sembabule District to see the work that is being undertaken by the District Forestry Services (DFS) in collaboration with Kakinga Community Watershed Management Group (KCWMG) and the community.

There is much to see and understand, and we are sure this will be of great interest to you. It would be convenient if you can visit us in the last week of April 2012. Your accommodation and transport will be arranged as has been previously been discussed by e-mail.

We look forward to meeting you.

Grateful,

Bbaale Willy
DISTRICT FOREST OFFICER/SEMBABULE

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The Formal Invitation from Willey Bbaale, the District Forestry Officer/Sembabule.

Introduction.

The Kakinga Dam and Lake are situated in the district of Sembabule in central Uganda. It is a remote part of the country with poor roads and little in the way of a transport system.

The Sembabule District comprises of an area of 2,319 km^2 with a population of around 202,700 persons. The population is predominantly reliant on agriculture for its income with cattle husbandry being the major product. In the district it is calculated that there are more than 177,400 head of cattle with 113,000 goats. Other crops include sweet potatoes, bananas, beans, maize, cassava, sorghum and finger millet. Cash crops include some coffee and cotton. Fish are a small scale crop at present in the lakes and marshes of the district.

The district is part of what is known as the Ugandan Cattle Corridor which stretches from the Tanzanian border in the south to the eastern border with Kenya. Though most of the cattle farmers are now settled in communities there are still a large number of pastoralist farmer/herdsmen who move from one area of grazing to the next as weather and climactic conditions demand.

The main concentration of the population centred on Lake Kakinga is at its western and north western edges. Some make up a community towards the south. The numbers of people that make up the populations of these communities being around 1000 to the west and about 500 persons to the south. The numbers of visiting pastoralists is estimated as from 500 to 1000.

The population of livestock is high, with about 40,000 cattle and several thousands of goats making use of the waters of the lake. The numbers of pigs appears small, only 5 were seen during the visit. Numbers of wild animals using the lake were sketchy with the main varieties being buck and wart hogs. In the past hippopotamus have used the lake but do so no longer. The avian species around the lake, pelicans to weaver birds were plentiful.

The villages and the bank sides of the lake were visited; with many miles being covered on foot; all the better for the purpose of this investigation into the issues that are outlined in this document. There was much contact with members of the communities that bordered the water body. A formal meeting of the lakes management committee (KCWMG) was convened and was able to raise issues that were and were not relevant to the issues to be considered but are mentioned within the report.

The people of the area about the lake are aware of the fragility of their lives and the threats that they themselves pose to the lake. They are very willing to follow the directions of the Forestry Department, who are keen to see as much of the responsibility for the area shouldered by the people of the communities though giving support.

Lake Kakinga is the biggest manmade lake in the East African region. Its catchment covers a large area, approximately 800 hectares, and it is the oldest of the several earth

dammed water impoundments in this area of Uganda. Its design was originally finalised in 1937 though it was only constructed in the 1950s.

The regional geology is stated to be that of schist and other material related to volcanic activity overlying post Karagwe – Ankolean granites.

The climate of the area is developing a more arid aspect; rainfall is 30-35 inches per year. The wet season is from the end of October to December; another short period of rain from May into June can also be expected. Apparently this rain falls in severe downpours and much is wasted over the dam spillway.

Hydrologically this region of the country is poor in groundwater resources and over 40% of boreholes fail to locate water at all and most of the remainder are found to produce very modest volumes. This lack of groundwater led to the development of several such schemes in the region from the 1950s and which still carry on being constructed, though on a smaller scale today.

The areas soils are red clay sands which have a high plasticity and are very suitable for lake lining and construction and black soils. There is an active brick manufacturing operation in the area as there is across the district. The landscape is noted to be acacia savannah, but there are good stands of natural forest and a developing Silva flora of both native species and eucalyptus plantations. The eucalypts are a popular tree which is used as a cash crop by local farmers who wish for harvestable timber within 5 years.

Some natural forestry has been lost to illegal charcoal production; an example was seen on the visit to the area. Such activity, apart from the damage to the flora has a major impact on the fauna, particularly the several types of monkey found in the area. There is a fear of this activity as the people carrying out these operations are from outside the local community. The profits from such illegal activity are large and though criminal in nature the threat of physical danger to the community deters the reporting of such acts to the authorities.

The issues raised by the people of the lake included:

- The care of the lake, its sustainability and protection from pollution. The longevity of the resource and its eventual silting up.
- Care of the dam.
- Water supply from the lake and the use of young children to access the waters, their safety and health.
- The impacts of directly watering livestock at the lake edge.
- The fishery and its development.

- Weed growth on and below the surface of the water of the lake.
- Tree planting, indigenous vs. exotics (short term cash generators).
- Animal health and effects on humans.
- Piped water supply.
- Present water supply infrastructures.
- Increased water gathering facilities.
- Sanitation.
- Power generation/biogas/solar.
- Goat ranching.
- Community engagement.
- Increasing local income generating potential.
- Soil erosion in the greater catchment.
- Bank security.
- Treatment of nutrient rich wastes.
- Damage to the ecosystem; such as illegal charcoal burning.
- Private ponds.
- Rainwater harvesting.
- Taiingga.

These issues were put forward by the community and the Forestry Department for consideration at the time of the visit and were considered during then and since.

Several issues have been noted as to the history and management of the site that need to kept in mind; these include the dam and other safety concerns. They are covered within the text.

The dam's construction date is uncertain in that there are documents that claim installation of the dam between 1951 and 1959.

The Ministry of Water and Environment states in a press release (7th July 2007) that work has been carried out to safeguard the dam at Kakinga from collapse and that a new pipe spillway had been put in place at the cost of 1 billion shillings. Whilst on site no sign of these works was evident. Another press release (8th April 2011) states that Kakinga Dam had been successfully rehabilitated.

The Lake.

The Current Situation.

The lake is a large area of water that is formed by the damming of the Kakinga River; a seasonal water channel that flows at the times of rainfall and dries up between times.

The lake at its longest points orientates north south with the dam at its northern end. It is in part dug, with parts just flooded valley bottom. It is the source of water supply for both human and animal needs.

The lake surface at its northern and southern points is heavily populated by water cabbage/lettuce; Pistia stratiotes, sometimes known as water bonnet. There are other plants growing amongst the mats of water cabbage that appear to be of little concern at this present time.

The population collects its day to day water supply in jerry cans from the lake shore; the nature of the activity ensures that the water is mixed with the silts of the lake bank side. This water once the container is full has to be allowed to settle so the muds settle to the bottom. Many of the livestock are watered at the same points so that their faeces mix with the bank side muds.

There is no safeguard as to possible accidents to small children entering the water.

Concerns and Remedial Actions.

There are several issues that are concerning both for the security of the lake and its water: the biological and microbiological purity is constantly threatened by pollution from animal and human waste. There is a need to limit access. The Forestry Department have put a lot of work into this particular area, but more needs to be done. The local use of euphorbia as a living fence is demonstrated as being the most sustainable hedging, especially with thorn interspersed within the hedge structure.

There is a concern that the lake will eventually fill with sediment entering via the feed streams or tributaries that flow towards the lake. The erosion of upstream soils may be considerable. The use of small seasonal watering dams if placed correctly and engineered with timber or other available materials and introduced marginal plants; grasses or reeds, would encourage siltation far from the main water body of the lake. In reality a form of weir and pool stations set back from the main lake. The use of native willow forms such as Salix hutchinsii (Skan) or the rarer West Nile Salix subserrata (Willd) or a water tolerant eucalypt such as C. regnuns may be used for riveting/strengthening as living weirs and small dam walls. These plantings will also help remove any excess nutrients that may be present in the water being held up by the structures.

Bank side erosion either by stock or human traffic may be seen to be neutralised by developing a growing mat of plant matter that will root into the decaying bank and stabilise it. This can be achieved by making a mesh of Salix or other easily rooted plant wands or thin shoots which are then anchored to the bank surface. Where the structure touches the earth roots will soon emerge and a tree will develop. Bamboo can also be used in a close planting scheme as vertically placed cuttings. These protect themselves as their sharp cut tops protruding from the earth do not encourage being walking over.

Recommendations.

Carry out surveys of upstream catchment erosion.

Ascertain the number of nomadic pastoralist herds and their human followers so as to understand the potential stresses that might be placed upon the lake in times of drought. Develop educational tools to explain the care of the lake is for their benefit as well as that of the stable population.

Implement the management and water distribution and management to remove the need for children to visit the lake bank.

The Dam

The Current Situation.

The dam is a major earthen construction with an over broad spillway based on bedrock. Past floods have taken this corner section at its north west extremity of the dam away to its foundation rock.

The dam is used as a track for vehicle and pedestrian use allowing access to the lands to the east of the water body. Animals, particularly goats are folded along its top and lake side.

The base of the dam wall and any toe drain on its northern side was not viewed due to the thick vegetative cover below the structure. This vegetable growth stops any sort of visual safety management.

Concerns and Remedial Actions.

On the northern side of the dam wall, that that is away from the water is developing a cover of vegetation including saplings that need to be removed by cutting back to ground level. Their continued growth will weaken the structure of the construction and its eventual catastrophic failure could be expected. The vegetations clearance will facilitate safety checks.

The spill way, being an eroded section of the dam needs maintenance to stop it developing further and growing to the main earth embankment. There is a strong possibility that the dam's structural integrity could be put at risk if it is eroded any further. As already stated in this report; a press release from the Ministry of Water and Environment suggests that this has already been done is incorrect as no built pipe work spillway is visible. The local fishing community also fear that fish stocks pass over the present eroded spillway section during flood conditions and are lost to the lake.

The edge of the present spillway needs revetment to stop further erosion; it could be achieved by creating a timber palisade around the existing point of erosion and backfilling with stone and clay soil brought from outside the dam area. This would act as a stopgap until the Ministry puts its planned piped spillway in place.

Stock such as goats need to be kept from the waters edge due to their eroding the banks and defecating at the waters edge.

Recommendations.

Under internationally agreed protocols all water retaining dams need to be inspected by a 'competent' engineer at regular intervals so as to ensure that there is no chance of structural failure. This desirable action needs to be checked with the Ministry of Water and Environment to see if such an inspection is taking place.

Re-engineer the widening spillway as soon as possible to stop possible dam failure, loss of water and risk to human habitation and life downstream of the dam.

Water Supply.

The Current Situation.

The situation at present is that the population of around 1500 people access their daily water supply from the lake edge and carry the water back to their homes in jerry cans and other containers. This is, for several reasons not good for the population or the lake.

1/ the waters are muddied in the process of filling the water carrying receptacles; allowing animal waste and soils to contaminate the supply.

2/ the bovine/goat disease of brucellosis is prevalent in the area and is infectious to humans; particularly children. The pathway from the host animal to the human can be via animal waste fluids or unpasteurised milk. Both routes are obvious in the area around Kakinga.

3/ there was for several years a water supply that served the habitations along the north western shore above the lake. The infrastructure still exists in what appears to be a functional state.

4/ the stock dipping facility and watering troughs; supplied by their own water tower could be brought into use again for stock watering.

Concerns and Remedial Actions.

The infrastructure needs to be overhauled and cleansed as soon as a method of pumping water from the lake to the water storage vessels.

The water storage vessels need to be cleaned up and freed of weeds and any wildlife. The site up the hill needs to be fenced securely.

Recommendations

Source a suitable pump and bring the system back into use.

Impacts of Directly Watering Livestock.

The Current Situation.

For most of the lake's bank side animals may access the lakeside to drink. The beasts erode the banks, pollute the water and aid to the impoundment is silted up.

Concerns and Remedial Actions.

As has already been stated within this report the risks to the lake water quality and that of human health are paramount amongst the issues of this investigation. The needs to water animals away from the lake edge are paramount to this goal. At several sites around the area can be found stock drinking troughs, some close to the lake; but far enough away to stop animals defecating directly into the water. These troughs are valuable demonstrations of local ingenuity and the use of local materials. The troughs are constructed of unfired clay and allowed to harden during the dry season. Such troughs last for several years.



A Trough.

These structures could be combined with a shadoof to fill it with water and there would be no contact with the bank water interface and no damage to the bank and the farmer keeps his feet dry.



A Basic Shadoof.

Recommendations.

The need to keep all livestock away from the lake with a buffer zone that can act as a nutrient sink to lesson the volume of nitrates entering the water of the lake is a primary requirement.

The watering of animals should be carried out as far as possible away from the lake or other water bodies.

The water feeds or tributaries that replenish the lake need to be developed as seasonal wetlands so as to neutralise nutrients in the waters before they enter the lake.

The Fishery.

Current Situation.

On visiting the lake three forms of fish that were viewed; 2 sorts of Mud fish, Clarias anguillaris and one Tilapia.

The majority of/all but one of the fish seen were all around 160mm in length or less; which may suggest over fishing, but a longer period of observation may be needed to gain a better understanding of the health of the fishery.

It was noticeable on the first day of the visit there were six feeding pelicans on the waters of the lake. Also there were fish rising all the time around them in large numbers.



Mud Fish from Kakinga Lake.
Clarias anguillaris.

The fishing is undertaken mainly by the use of nets; but some shore based angling was observed. The net fishermen use small punt like boats for the purpose of laying and taking up their nets.



Fishing Punts.
Note. The water round the boats was being collected by children in jerry cans for household use.

Concerns and Remedial Actions.

Concern was expressed regarding the spillway, where it was felt fish escaped in times of flood. Though the majority of the stock will in times of flood be sheltering in areas where the flow of water is least; the creation of an area of turbulence in the spillway will discourage many and force them to find safety in the deeper waters of the lake than pass though a cataract.

The fishing community complained of large masses of submerged water weed; that is hampering their nets at a number of points about the lake. Grass carp; Ctenopharyngodon idella, are voracious feeders on all forms of submerged water weed.

The fishery development of the lake might be improved by the introduction of new stock fish that are multi functional; both culinary and ecologically useful.



Grass Carp.
Ctenopharyngodon idelia.

The recognition that the fishery is both a dynamic and fragile entity has to be accepted. It is reliant on water quality and quantity. The protection of the lake is the fundamental responsibility of the fishermen.

The fishing fraternity is responsible for the bank side where they launch and land their craft. At present it is an eroding and muddy area that needs some work to stop this from getting worse. Stabilisation with an all timber or cement and timber landing stage could be constructed both quickly and at little cost.

Recommendations.

The fishery is of benefit to the whole community and not just for the specialist fisherman. The development and creation of a sustainably managed fishery with a safe landing point need to be considered and addressed. The management of weed is a major issue that can only be achieved sustainably by cutting and bringing the cut weed to shore. It must then be removed away from the bank once the water has drained out of the biomass and the remains composted. If the weed is left in the water after cutting it will rot eventually and release the nutrients that it had previously removed from the lake. Similarly if the weed rots on the bank the nutrients will also re-entre the water.

Weed Growth.



Weed; Water Cabbage/Lettuce growing across the northern lake area.





Water Cabbage/Lettuce
(Pistia stratiotes)

Current Situation.

The northern and southern extremities of Kakinga Lake have developed a mat of water cabbage/lettuce, Pistia stratiotes or Ladies Bonnet. This weed is a nuisance to fishing and also a problem for the water quality.

Another weed that is a problem in the lake as it is developing so plentifully is an aquatic oxygenating weed, which appears to be a member of the Elodea family. Originally it came from North America though now a problem weed in Asia, Australia and Africa; particularly in lakes with high nutrient loadings. The height from the bottom, rooted portion of the plant to the water surface can be 12feet (3metres) or more. In some parts of the world it has become a problem for small craft navigation on lakes where it is growing vigorously.



Elodae densa.

The needs to both protect the water from nutrient build up and algal growth whilst juggling the management of the problem plants that are conspicuous in aiding this work is a difficult task.

Concerns and Remedial Actions,

The uses of Pistia stratiotes are negligible; composting removed weed from the lake is its main option. The plant is not palatable in its raw state to humans or livestock as it burns the mouth and throat. In some instances the calcium oxalate content within the plant matter can increase kidney problems such as the accretion of stones. In some areas of China the leaves are fried or well boiled before consuming. It has been eaten in Sudan and India as a famine food and as such it is unacceptable to many people.

The plant thrives in nutrient rich waters, out competing algae for nutrients and helps avoid algal blooms, though large mats of the plant reduce sunlight action on the water surface coursing oxygen sags within the water body that can kill fish. In controlled amounts water cabbage/lettuce removes large quantise of nitrogen and other nutrients from the water.

Methods that have been used for the control of this plant have included physical removal (best option) and spraying with herbicides. Spraying can be effective but depending on how it is carried out can poison the water, kill fish and other wildlife; it will also increase

nutrient levels in the water by decomposing in the water body and course a possible bloom of algae. There are firms offering to use biological controls, but as yet they are not fully understood as to any environmental side effects they may engender.

Elodae is a similar candidate for management by human means; cutting as far below the surface and the cut portion being taken to the shore and composted. It can also be controlled, to some degree, by Grass Carp which will feed on it happily.

Other plants that are appearing as mat growths on the lake include bamboo which was found to be present close by the dam wall. This will need to be removed from this location as it may root into and damage the dam's structure. It may be replanted/floated at another point at the edge of the lake as it is a nutrient fixing plant and valuable to the lake's wellbeing. Papyrus was also found to be colonising this shore in small numbers. If it was to develop on the bank of the dam it would again damage it and should be relocated elsewhere on the lake's edge.

Recommendations.

It is necessary to consider the concerns noted above and act on remediating the situations outlined.

Trees/Forestry.

Current Situation.

The Forestry Department are in the process of planting the banks of the lake with indigenous trees and pines. There is much eucalyptus tree planting in the area by local farmers looking for a quick financial benefit from his investment. A five year growing period is acceptable compared with indigenous species that may take 80 to 100 years.

There is little in the way of forest woodland management that elongates tree life beyond its first and only cropping when it is removed in total.

Concerns and Remedial Actions.

The use of the old method of forest / woodland management, coppicing is not carried out in the area though for cash crops of small diameter timber. The use of coppice as a renewal tool to avoid the need to re-establish seedlings could be considered for cash crop development. Water loving eucalypts could be used in this manner to take advantage of the nutrient level in the lake. This would allow for nutrient removal on an ongoing and developing level from the lake and at the same time stabilise the lake banks.

This style of timber managements could be used in areas close to where tributaries and water feeds flow and before the waters enter the lake.

Recommendations.

The Forestry Department needs to continue along the lines that it is taking with woodland development around the lake. The encouragement of local farmers to plant other, indigenous, trees should continue.

Continuation of planting fences about the lake to keep cattle away from the banks of the lake and protect the ecological buffer zones should continue. The use of coppice management should be trialled in all areas that it is considered suitable.

The Forestry Department needs to show the project at this stage to the World Bank as a scheme that is limiting the areas carbon footprint. As a demonstration of forest and farm management it may draw funding to aid continued funding and emulation.

Animal Health, Human Impacts.

Current Situation.

Animal conditioning of the livestock seen during the visit was of a high standard. There were no obvious health or welfare concerns. The farmers take great pride in all of their livestock.



Cattle About to be Pushed Away from the Lake Side.

It has been reported that brucellosis is common in the herd generally. The cost of veterinary attention is too high to have an effect in this area. The same is true in the goat population. There are a number of human sufferers from this same infection. As with animal health care, doctoring of human sick is difficult and expensive; there are no clinics in the area.

Concerns and Remedial Actions.

The nature of the area where animals and humans share the water supply and the ease for infection to spread to humans needs to be addressed. The stopping of degradation of watering points as an initial action, followed closely by the removal of both human and animal access to the water except where it is unavoidable is imperative.

Recommendations.

Improve the separation of human contact with animal waste, particularly in the area of close/cross contamination via the water supply.

Piped Water to the Main 'Village'.

Current Situation.

The north western area of the lake had piped water for several years; until the local population could not afford to keep pumping water from the lake to a set of storage tanks above the community and its habitations. The infrastructure, apart from the pump is still in place and considered to be viable to be reused. There may be a need to expand the pipe work along the village as the number of habitations has grown since the cessation of use.

The pump house was locked and it would appear that there has been no examination of its interior condition for some time, though the outside appears to indicate that it is still serviceable.

The hill top water tanks are still apparently serviceable as is the small water tower that was used to operate the stock dipping facility and troughs. The pipe works that connect the entire hard infrastructure are likely to only need disinfection.

Concerns and remedial Actions.

The main issue that saw the pipe work and infrastructure fail originally was, reportedly, due to the cost of running the pumping engine. The question and concern is that the community can resolve to manage any system that can supply energy to pump water from the lake over a period of years. The prospect of developing community responsibility is precisely that. The members of the community are equally and severally responsible for any scheme and resolve the issues that may arise.

The original pump had been diesel powered and capable of lifting water the 100 feet up to the tanks. This head, the height above the lake and the habitations, allows for gravity to be used for the distribution through the pipe work from the storage tanks.

Recommendations.

The pipe work that is existent needs to be checked. The tanks and pump line from the lake need to be checked to see that it still exists and what condition it is in.

A poll of the community's interest in seeing the reintroduction of piped water supply: this is to ensure that maintenance and management do not stop when people become bored or disinterested.

An educational process needs to be considered, particularly around health and safety issues also care of the lake.

Other Present Water Supply Infrastructure.

Current Situation.

To the south of the lake is a water supply pond constructed in the 1980s and which has been falling into disrepair for some time. The pond does not dry out as can be told by the fact that fish are present in its waters that are of several different year cadres.

The fence has all but gone, though the wire is still in place. The water tower at the pond side is intact with its plastic bulk tank still in place. The pump is not functioning but is of a design that may either be easily replaced or this one refurbished. It is a simple up down mechanism that lifts water from the pond to the tank.

The water can then feed several troughs and a tap station that are already in place and appear to be in good order.

At present stock, both cattle and goats use the water as do the local population.

Concerns and Remedial Actions.

The pond and its infrastructure can be brought back to functional life with little effort and what should be little expenditure. The site needs more time spent on securing its perimeter and a visit from a local blacksmith or mechanic to see what is needed to reactivate the pump.

Such a transformation though must have the local populations' support or any effort in repair and reinstatement will be worth nothing if it is not cared for as it should.

Recommendations.

Ascertain the local residents and farmers views before starting any other part of the plan.

If the outcome is satisfactory initiate the rest of the scheme as laid out above.

This is certainly the easiest and fasted positive action possible within the whole catchment area.





The Water Tank for Gravity Feed



Non Functioning Pump That Filled Water Tank.



Tap Facility.



Troughs.



Goats Drinking From the Water.

The banks are eroded; the water polluted with both cattle and goat faeces.
The fence is broken down.

Increased Water Gathering.

Current Situation.

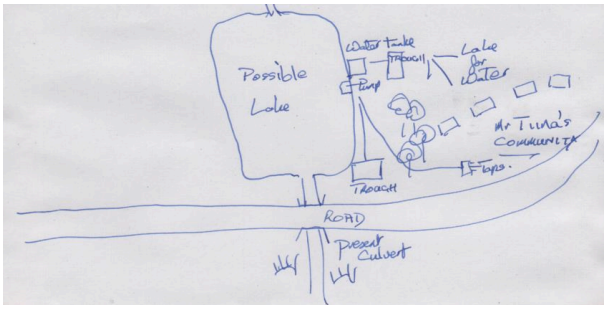
To the southern part of the lake close by a large community where Mr Tiina lives there is a culverted water course under the road. This site would be ideal as a large scale water gathering pond and possible tap and trough facility similar to the one discussed and pictured in the previous section of this paper. At present the water is gathered in the normal manner from the lake and cattle are similarly watered at the bank.

Concerns and Remedial Actions.

To both protect the lake and to benefit the community a water supply system would be a solution to the obvious issue of water availability for the whole community. The northern populous could have piped water close to their homes and similarly those living to the south could have their own supply.

Recommendations.

There needs to be some urgent consultation with the residents in the area and further discussion as to their feelings about such a scheme. This would work as a project if the local community were willing to care for the infrastructure into the future.



Sketch of Possible Location.

Sanitation.

Current Situation.

The sanitary arrangements about the Kakinga Lake community area are variable with some modern pit latrines at the primary school, and in other locations the arrangements are little more than middens or sack filling exercises. Oddly, at one latrine site there is a cornucopia of marsh plants around the small structure that does not bode well for the conditions of use, but as a demonstration of wetland treatment of waste may teach much.



Latrine (hidden) and Wetland Plants.



Latrines Including the Wetland Example.



The Primary School Latrines.

Concerns and Remedial Actions.

There needs to be a development of latrine building that takes account of the environmental concerns that should to be recognised for the care of the community and the lake.

Recommendations.

Pit latrines are the nations preferred option for latrine construction and at the present state of waste use or reuse, which is in its infancy, it is the present answer. There must be a clear acceptance that this might change in time to other methods of disposal or use.

The identification of the flora of the latrine wetland that is pictured would be most useful in the design and specification of native plants that should be considered for placement as part of an ongoing nutrient management program around the lake.

Power Generation.

Current Situation.

The present situation in the communities about the lake is that there is no general supply of electricity. There are a few generators about the locality for the use of business activities such as milling cattle maize.

Considerations.

The old water supply system that fed water to the community had been a diesel or petrol powered pump. This could still be considered an option for the purpose of water supply. Other methods of moving the water could be through wind driven or solar powered pumps. The option of generating power using bio fuel derived from the waste; both human and animal sources should be considered.

There needs to be some considered research carried out, both with regard to affordable, sustainable technologies and community involvement.

Goat Ranching.

This heading touches on the major goat and cattle operation that is undertaken as a private enterprise to the north east and east of the lake. The operation is considered by all who reported on its management as a model of good agri-business.

The operations involve many thousands of goats and cattle that are carefully shepherded and herded, the outputs appearing to be both high quality breading stock for sale and meat carcases.

Current Situation.

As far as this report goes into the issues of this estate the only comment that can be made is that animals from the holding are accessing the water to drink not far from the eastern end of the lake dam.

Concerns and Remedial Actions.

The stock need to be kept from the lake edge as is the case for the rest of its circumference.

Recommendations.

A relationship needs to be developed with the owners to see where mutual areas of interest and expertise may be of help to all parties. The availability of water and forestry expertise could be high on any agenda and available to be shared.

Community Engagement.

Current Situation.

I met several of the senior members of the community and who make up the management committee of the lake area, they were understanding of many of the issues that were raised and supportive of the scheme to reintroduce water supply to the habitations that once were served with water. The majority of the population appear to look on, apparently allowing what ever plan that is put forward to be accepted.

The committee is well appointed with members who span the diverse nature of the community both by creed and occupation. The members are all capable people in their own right and are influential in the locality.

Concerns and Remedial Actions.

The issues that are discussed in this document cover a large range of topics though as will have been noted they are all interlinked one to another. The community has to understand and accept that if some of the benefits that may be available directly to them may require other actions to take place that will not be of direct benefit to all. They may aid others, but this requires a very strong community sense of involvement. This strength of purpose I recognise within the committee, but there are reservations regarding the whole community.

The remedy for this may be a wide ranging educational/hearts and minds development approach that should start, with the school teachers help with the primary school children. Children are strong influences on their parents when they understand the basics of a subject; what is good and what is incorrect. This can and often does develop in their, the children's audience at home.

Recommendations.

Ensure that the committee and the community are willing to take on the responsibility to look after and operate the various elements of an integrated scheme that will make every one more secure for little financial cost, rather an increased involvement with their neighbours and fellow community members.

Income Generation.

Current Situation.

The main income generators in the area would appear to be cattle, goats, meat and milk. The other income delivery crops being timber, bananas and brick manufacture; though on a small local scale. Other agricultural enterprise is very low key, garden, allotment style operations that supply family and to some degree the local population. Such crops being maize and tomatoes; cassava and other root and grains are also produced on a small scale.

There are some small workshop operations such as metal working, milling and the like. Other schemes include a television for the community to watch the Premier League football matches; there are a few very small shops.

Issues.

There is a need to consider how the community may benefit from the development of Uganda's developing position in the world. What has the community got which Europe and the US have lost; community. The locality possesses;

- The largest manmade lake in East Africa.
- Unique birdlife that is remarkably unbothered by human activity.

- Butterflies and insects.
- Isolation in a remarkable landscape.
- Hospitality and amicability.

These could be developed in time to foster tourism and encourage interest in wildlife and the local ecology.

Recommendations.

The development of craft based workshops; baskets, mats and other items can be made to bring in outside money; the use of locally sourced materials would also save costs and increase desirability of items. The demonstration of sustainability would also be a marketing aid.

The Greater Catchment.

Current Situation.

At present little is known or understood about the outer catchment area of the lake. The majority of which will be arid with little useable land for crops or cattle. The pastoralist farmers will during the dry periods rely on grazing close to the lake. The wet season will encourage these farmers to go out to the more remote areas. The seasonal water courses will be heavily used by cattle, goats and humans. The livestock activity in the water will stir up silts and the animal droppings will nitrify the waters. Both problems will generally go with the waters flow eventually pollute the lake.

The use of living weirs and seasonal wetlands can do much to minimise the problems of silt levels and nutrient loadings.

Issues and Remedial Actions.

As little is properly understood about the area and this is vital to any works that might be considered. Study of internet satellite images can give some understanding, but the reality of what is actually happening on the ground can only be achieved by field work.


The Catchment of Kakinga Lake (top).

Bank Security.

Note. At a meeting of the Uganda Geological Survey in 1946 this issue was raised by Sir Edmund Teale the Chairman of the forum: he asked 'how the cattle were kept out of dammed water as they would break down the sides and pollute the water?' To which Mr C B Bisset responded; 'the exclusion of cattle from small dams was certainly a major problem, and it seemed almost impossible of solution. At first it was thought that water would be passed as if from a well; the tendency for cattle to stampede towards water was difficult to control; fences were either torn down or burnt down in the dry season. Attempts to plant prickly pear and other plants as living hedges were unsuccessful. There has been no alternative to cattle drinking direct from lakes. It is more important to keep building dams to develop water resource that consider this problem further at this stage.'

This is about to change.

The Current Situation.

The development of securing the banks from livestock intrusion has worked well where it has been implemented. The fencing off of parts of the north western section of the lake has allowed for an ecological barrier to be put in place. This barrier allows a wide selection of trees and small agricultural crops to be grown along side. The removal of the need to go to the bank side to access water for irrigation is noted as an issue: as are the issues of washing laundry and motorbikes/cars at the side of the lake.

Issues and Remedial Actions..

The washing of laundry at the bank side or at streams leading to the lake is not a sensible thing to do as soap is harmful to the water environment as it increases nutrient levels in the lake.

Car and motorcycle washing anywhere near the lake or its feed streams as oil, metals; including lead as well as the washing compound can course pollution of the lake water and kill fish and wildlife. The effect on cattle and goats could be damaging as well.

All such activities should be done away from the water bodies.

Recommendations.

The ideal solution will be to wash all things away from harms way; a designated washing area may be considered along side a drying area, but away from the water itself.

Fence off the lake to stop casual access for both human and animals.

Nutrient Rich Waste Water Treatment.

Current Situation.

At present any waste water either goes directly to a waterway or to the soil. That that is absorbed by the soil will be far better for the environment than that which passes direct to water. Waste waters entering soils will be, to some degree, treated by soil bacteria and enzymes that are naturally occurring. These soil flora are best homed in the roots and litter of wetland/marsh or wet grassland.

Concerns and Remedial Actions.

The development of wetland fringes to the lake and along the feeder streams are beginning; though due to the semi arid nature of the region a certain amount of human intervention will be needed to develop a sustainable and varied native aquatic and marginal flora.

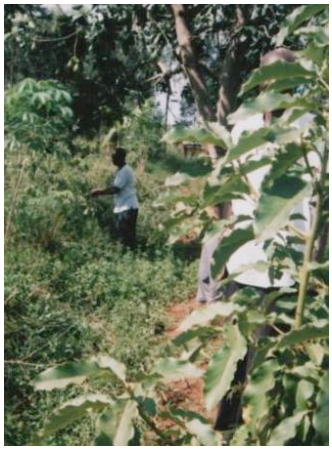
Recommendations.

The development of wetland areas that intercept water feeds to the lake that held up flow velocity so as to maximize retention time within the active water treatment zones. The wetlands can be established between the high and low water levels around the dam. Water loving trees should be established where others might struggle to thrive.

Ecosystem Damage.

Current Situation.

There are many stresses that are challenging the areas eco systems; climate change with attendant changes in weather pattern including extended draught and flash flooding. These conditions make for parched lands to be inundated and increasing the opportunity for increased erosion.



Ditch Cut Across the Slope of the Hill.

The need for income can lead to illegal acts being undertaken. Illegal charcoal making is a growing concern. This form of economic ecological vandalism was witnessed and some of its impacts were obvious at first sight. Habitat destruction, soil damage, nutrient liberation with the development of algal bloom potential; these were all obvious consequences that were witnessed in one short visit to an active illicit operation.



Illegal Charcoal Burning Damage.
Monkey habitat; monkeys in the trees still standing.



Wood Awaiting Being Turned to Charcoal.
Several hectares of forest had been cleared of all timber. This is a major problem both for the Forestry Department and the local residents as they are wary of repercussions to both themselves and their families. The illegal charcoal production industry is a multi million Shi industry with the main market being the capital, Kampala.



Charcoal Burn Site.



Cleared Forest.
The water in the background was already developing a blue green algal growth.

Concerns and Remedial Actions.

The demonstration sites carried forward by the Forestry Department in putting ditches across sloping farmland to stop or slow surface water; the capture of much surface run off with its cutting back of erosion, has proved successful. There is a need for much more to be done though this sort of operation is reliant on farmers being co-operative with such schemes.

The issue of charcoal production illegally needs to be controlled, and if need be licensed so as those taking part can be responsible for replanting with the correct trees. It would be useful to stop the intimidation; either implied or actual. Such fear is bad for a community even if the perpetrators are from outside the immediate community.

Recommendations.

The Forestry Department should continue their collaborative work with the community to control erosion of land in the area about the lake.

Implement the law with regard to illegal charcoal manufacture, though tempered by the offer of managed granting of licenses so as to reforest areas, at the same time protecting important stands of trees and ecologically important areas.

Private Ponds.

Current Situation.

There are two small hand dug dams that have been created by individual farmers, these are both working satisfactory but as private enterprises are not parts of the makeup of this investigation. However there is much of interest that may be learnt by looking at their management that is relevant to the care of water and the lake in particular.



A Private Pond at the North Western Side of the Lake.

Concerns and Remedial Actions.

The development of these ponds can be as large as the land available for them. Though private there needs to be management of the water/watering regime that is operated. Fencing should be put in place to protect banks from being trodden down into the water and also to go some way of keeping children away from the banks for their safety.

Recommendations.

The possible growth of private, farm based ponds needs to be managed with the care of the main lake kept in mind and nothing should be done that might put its well being at risk.

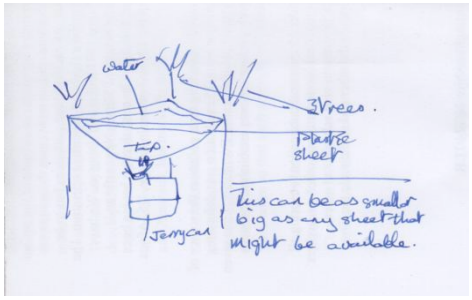
Rainwater Harvesting.

Rainwater harvesting is a traditional method of collecting precipitation, used around the world that otherwise would be lost to householders, gardeners and farmers. The scale of collection can vary from small collection vessels of 45 gallon drums to reservoirs and lakes: Kakinga Lake being a fine example of such a scheme. The benefit of collecting rainwater though on a modest individual scale as that rain collected from roofs of individual homes and other buildings is that the water, if the collection vessels are clean can provide drinking water of a high quality at ones door.

Current Situation.

Around the village by the lake there are few rainwater harvesting vessels of any sort. Those that were apparent were; a large one at the Forestry Office and the school. None were apparent collecting individual household roof water. The simplest schemes have not yet been employed for household supply. There are issues of cost, but the development of collection of water systems can be developed with neighbours who share the same roof.

The use of recycled drums that have been cleaned are inexpensive, there is evidence that they are much less costly in Uganda than in the UK.



Water Collection in Trees.

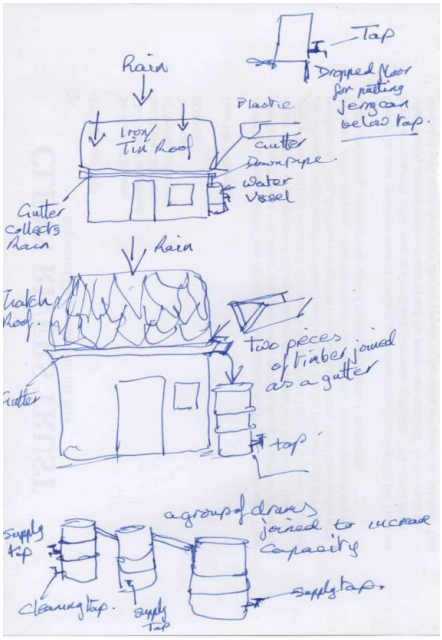
Water can also be collected by slinging plastic sheets between trees with a small weight and emptying tap or closable hole that can be operated to empty the sheet into water containers.

Two farmers, as already stated, have already developed their own small hand dug water collection pits, both of which could be developed further to increase their capacity for future increased use.

Concerns and Remedial Actions.

It was said during the visit to the area that most buildings did not have guttering to collect the rainwater off the roofs of the dwellings. These gutters are inexpensive to make if the purchase of guttering is difficult or they are hard to purchase locally. A V made of two pieces of timber that have been joined together and waterproofed can act as an excellent gutter. This can be fixed to the wall beneath the roof, iron or thatch and angled to deposit the rainwater into a collection vessel.

Collection vessels can be any recycled container; the larger the better. 45 gallon drums can be excellent storage containers and a group of them can be linked one to another to increase water collection capacity.



Gutters and Rainwater Collection.

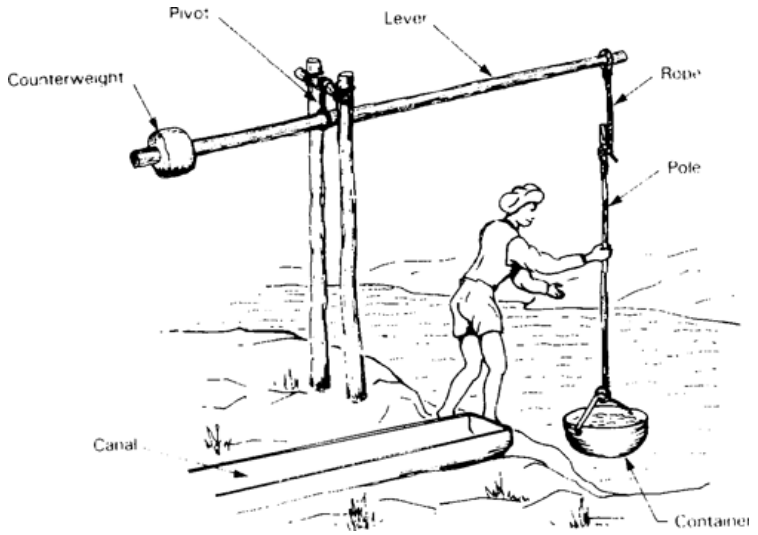
Recommendations.

The more personal water harvesting that can be encouraged the better it will be for the community.

Taiingga.

The local tradition of small scale agricultural gardens or allotments to grow such crops as tomatoes amongst young tree plantations requires water to benefit the cops. The present situation is that water is taken from the lakeside in the same way as household water is collected in containers from the edge of the lake. This continual accessing of the lake edge erodes the bank and creates more sediment going into the main body of water.

The need for water may be more swiftly met by the installation of shadufs where water is to be taken. The use of this contrivance is very old and has been used in Egypt and Sudan since the time of the Pharaohs, thousands of years ago. It has become a widespread method of irrigation in Nigeria.



Shadoof.

The principle is simple and requires little strength to operate. The construction is configured of a long arm lashed to a pole supported by two bracketed stakes set in the bank of the lake. On one end is a bucket on a rope and pole at the other is a weight that is about equal to that of the full bucket and the extended long pole which takes the bucket in and out of the water. When the bucket is filled the arm is lifted and the bucket, with some practise, swings to the operator who does not get their feet wet. The bucket can be emptied of its water into another larger container and the process repeated.

This method is protective of the banks and of those that use it. It may take practise, but after some wettings the principal will appear easy and become second nature to those that learn the trick/technique.

In Conclusion.

This is a report of what was seen and heard during the visit. It is brief, but it outlines some issues that need attention and outlines a few further pieces of research and investigation that should be carried out.

The report details the issues as they appear on the ground, there is no glossing over of concerns, it questions certain areas which may be stumbling blocks to the development of progress for the area and the document does not offer ‘quick fixes’.

Clean Rivers Trust undertakes to investigate pumping engines and alternative methods of driving them. The need to reintroduce water to the habitations of the majority of the population is vital to the lake and its community. A report will follow shortly with a guide to the options and methods of construction; plus the outline of maintenance that would be required.

This is the beginning of a period of intense work for both those at Kakinga and in England. The outcomes will be worth the effort, I am certain.

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* denotes publication available in the Clean Rivers Trust library.
** denotes available at Uganda Geological Survey.