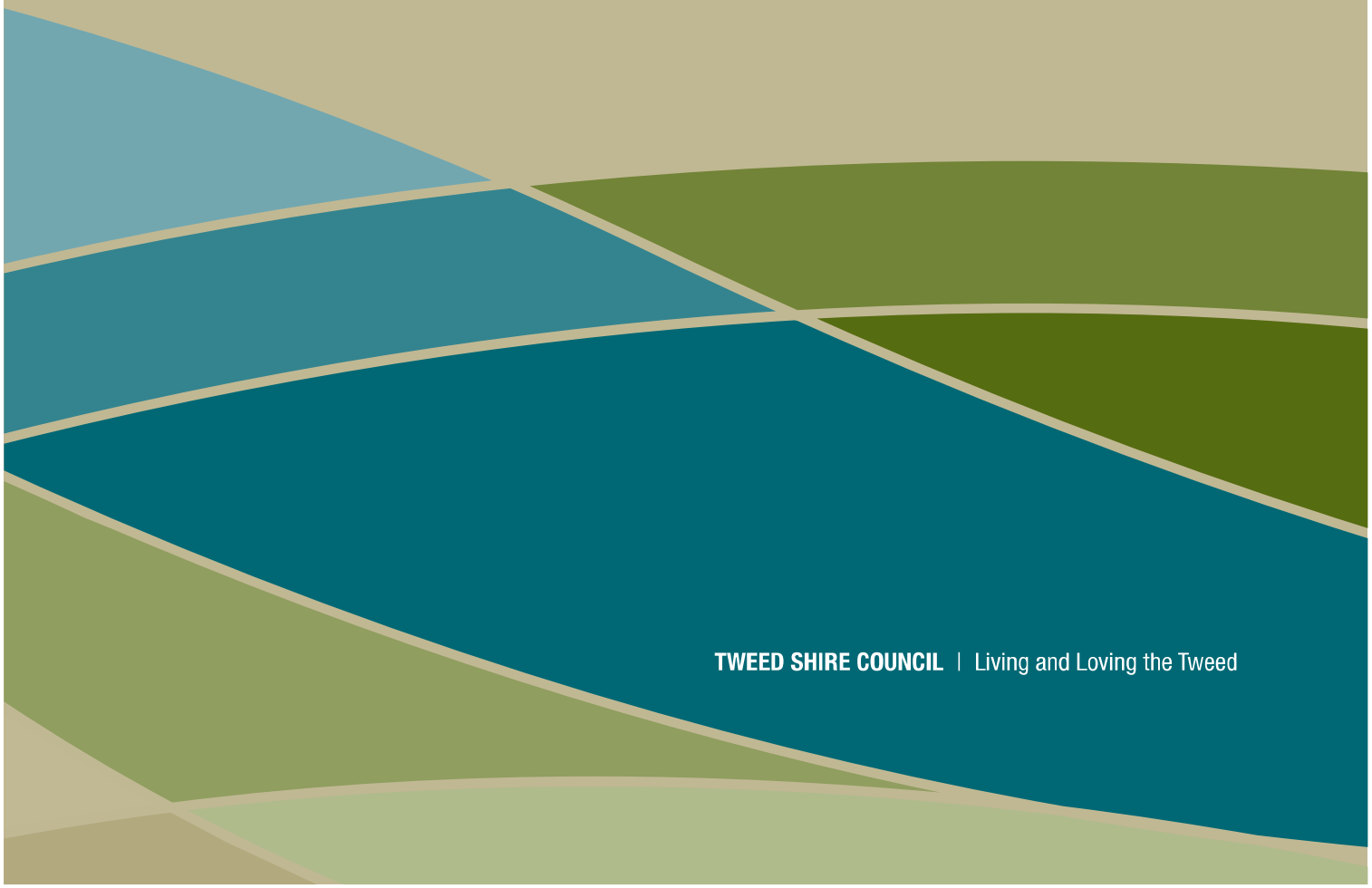
TWEED
SHIRE COUNCIL

Safewater 7
Tweed Kenya Mentoring Programme
Tinga Dam, Siaya, March 2017



TWEED SHIRE COUNCIL | Living and Loving the Tweed

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The intent of this report is to provide an overview of the specifics of the Safewater 7 project undertaken in 2017.

Like all good stories the project did not end with the commissioning of the successful rehabilitation works. Additional issues such as flooding and upstream dam collapses added to the hardships of the community post drought.

These issues and a follow-up of the success of the Safewater 7 project will follow.

Greg Jones
Tweed Kenya Mentoring Programme volunteer 2017.

My only tip for future volunteers is challenge yourself, go and visit the friendliest people you are likely to meet, it will change the way you look at the world and confirm just how lucky we are to live in the Tweed.

1 VISION

The Tweed Kenya Mentoring Programme (TKMP) commenced in 2005. The vision for the programme then, and which continues today is:

"Increasing access to SafeWater and Sanitation, improving community and environmental health for Kenyan families, and strengthening bonds of friendship with the Tweed community"

TKMP is a unique relationship that has grown between the Tweed community and a number of rural villages in the Siaya district of Western Kenya. The programme vision connects water and people, recognising the fundamental similarity of our communities need for water, but extreme difference in our ability to access and manage it.

Rural Siaya is one of poorest areas in Kenya and suffers some of the country's worst human health and welfare indicators, including high infant mortality and very limited water and sanitation service levels. Due to climate and geology, surface water is scarce in the district, and ground water is restricted to deep brackish aquifers generally not suitable for potable water.

TKMP uses the Tweed's human, technical and financial resources to support projects focusing on water, sanitation, hygiene, environmental education and youth development. The program is underpinned by a strong bond of friendship between individuals from Tweed Shire and Kenya who have met and learnt from each other over the life of the program. Ongoing facilitation of visits between the two countries is a key objective of the program.

The program retains the services of committed Kenyan staff, and operates within three villages where volunteer Tweed Shire Council staff members have installed water purification equipment at local dams. Kenyan staff work with local villages to operate and maintain these 'Safewater stations' and visit local schools to raise awareness of environmental issues and organise youth development activities.

Figure 1: School children from a school near Manyasi Dam

2 BACKGROUND

2.1 Siaya County

Siaya County is located in Western Kenya, approximately 400 km from Nairobi, and less than 40 km from the Ugandan border. Siaya County is located on the north-eastern shore of Lake Victoria and comprises an area of approximately 2,530 square kilometers. From the limited available data available for Siaya the projected population for 2017 was estimated at 964,390 comprising approximately 456,441 males (47.3%) and 507,949 females (53.7 %) (NACC, 2015). Based on land area and population that is the equivalent of approximately 381 people per square kilometer. In comparison to the Tweed Shire with an approximate land area of 1,321 square kilometers which is (approximately half the land area of Siaya County), and a population of approximately 92,296 (2017 predicted population) there is approximately 70 people per square kilometer.

Typical rural villages away from the Siaya Township (the main town within the county) have no electricity, no running water and limited formal toilets. Rural villages are typically centred on a surface water source such as a dam or possibly a groundwater bore however surface water is generally more palatable due to the saline taste of groundwater. Communities source water from dams closest to their homes however as these tend to dry out in the dry season or the water quality deteriorates, people are forced to walk much longer distances to an alternative dam within the valley (in some cases a 6km round trip) or pay for water to be delivered via water couriers (eg, bicycle or motor bike).

In Siaya and likewise throughout Kenya water is seasonally dependant. In Siaya the long-term average annual rainfall is approximately 1500mm, however relief and altitude influence the distribution and amount rainfall (eg. it is typically drier in the western districts where the Safewater projects are located). The short rains are typically between the months of September to November with the long rains that provide the majority of rainfall to top up dams and water reservoirs from March to June.

As is the case for Tinga Dam (Safewater 7) if the long rains do not take place or are well below average the water quality of community dams deteriorates to a level that water quality would generally be unfit for human consumption. However if no other source is available, it is consumed.

The community water source is also commonly shared for a variety of uses such as washing of clothes, bathing and also water supply for stock such as cattle. There are typically no off dam water troughs so stock drink directly from the dam stirring up mud /silt, causing bank erosion and further adding to poor water quality from urinating and defecating in and around the dam itself.

The following images in Figures 2 to 5 progressively zoom in on the location of Safewater 7 to be undertaken at Tinga Dam, located approximately 8km west of the small rural town of Siaya in western Kenya.

Figure 2: Partial view of East Africa. The yellow star locates (approximately) Tinga Dam on the north eastern area of Lake Victoria and approximately 400km west of Nairobi, the capital of Kenya.

Figure 3: Partial view of East Africa with Tinga Dam shown (approximately) by the yellow star with reference to Kenya and Uganda.

Figure 4: The location of Tinga Dam (yellow star) with reference to the town of Siaya and the largest city in western Kenya, Kisumu.

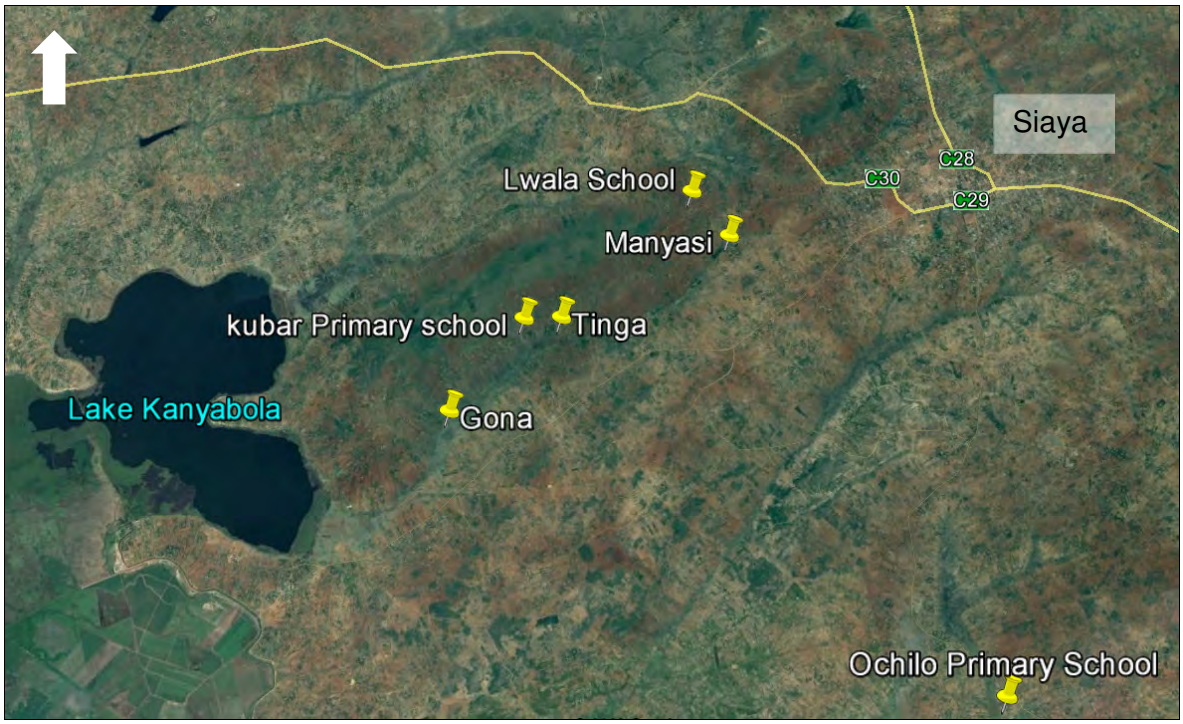

Figure 5: The location of Tinga Dam (yellow star) with reference to the sites of other Safewater projects undertaken by TKMP.

2.2 The Tweed Kenya Mentoring Program

The Tweed Kenya Mentoring Program (TKMP) was initiated and formally adopted by Council in 2004. Originating from a chance meeting between Olita Ogonjo from Siaya County and Mike Rayner, Council's then Director of Engineering at a water conference.

From that chance meeting, TKMP was born and since then seven SafeWater Projects have been undertaken. Table 1 below provides a brief description of these projects. For additional information on TKMP and SafeWater reports refer to the TKMP webpage on the TSC website at the following link (http://tkmp.tweed.nsw.gov.au/).

Table 1: TKMP Safewater Projects

Safewater project	Year	Location	Brief
1	2007	Gona Dam	Installation of a Sky Hydrant water Kiosk at Gona Dam to provide filtered drinking water.
2	2008	Tinga Dam	Installation of a Sky Hydrant water Kiosk at Tinga to provide filtered drinking water.
3	2010	Ochillo Dam	Installation of a Sky Hydrant water Kiosk at the Ochillo school to provide filtered drinking water for school students and staff.
4	2012	Gona Dam	The rehabilitation (desilting) of Gona Dam. Long-term deposition of soil material within the dam (that acts as a large sediment pond) had greatly reduced the capacity of the dam. Desiltation of the dam was undertaken via excavators and dozers within the dewatered dam to remove depositional material of sediment / soil.
5	2013	Manyasi Dam and Kubar School	Installation of a Sky Hydrant water Kiosk at Manyasi Dam to provide filtered drinking water. Additionally work was to oversee the construction of a new toilet block at Kubar School (near Tinga Dam)
6	2014	Manyasi Dam	Complete the installation of a Sky Hydrant water Kiosk at Manyasi Dam to provide filtered drinking water.
7	2017	Tinga Dam	The rehabilitation (desilting) of Tinga Dam. Similar to SW4 where the long-term deposition of soil material within the dam has greatly reduced the capacity of the dam. Desiltation of the dam was undertaken via excavators and dozers within the dewatered dam to remove depositional material of sediment / soil.

The following additional images refer to the Safewater projects and how the dams of Manyasi, Tinga and Gona are all located within a common valley. Flows within the valley flow west eventually reaching Lake Kanyabolas and then further west to Lake Victoria. From a catchment perspective all flows head west via the dams of Manyasi, Nyalnawe, Tinga and finally to Gona Dam. There is no Safewater project completed at Nyalnawe dam located between the dams at Manyasi and Tinga.

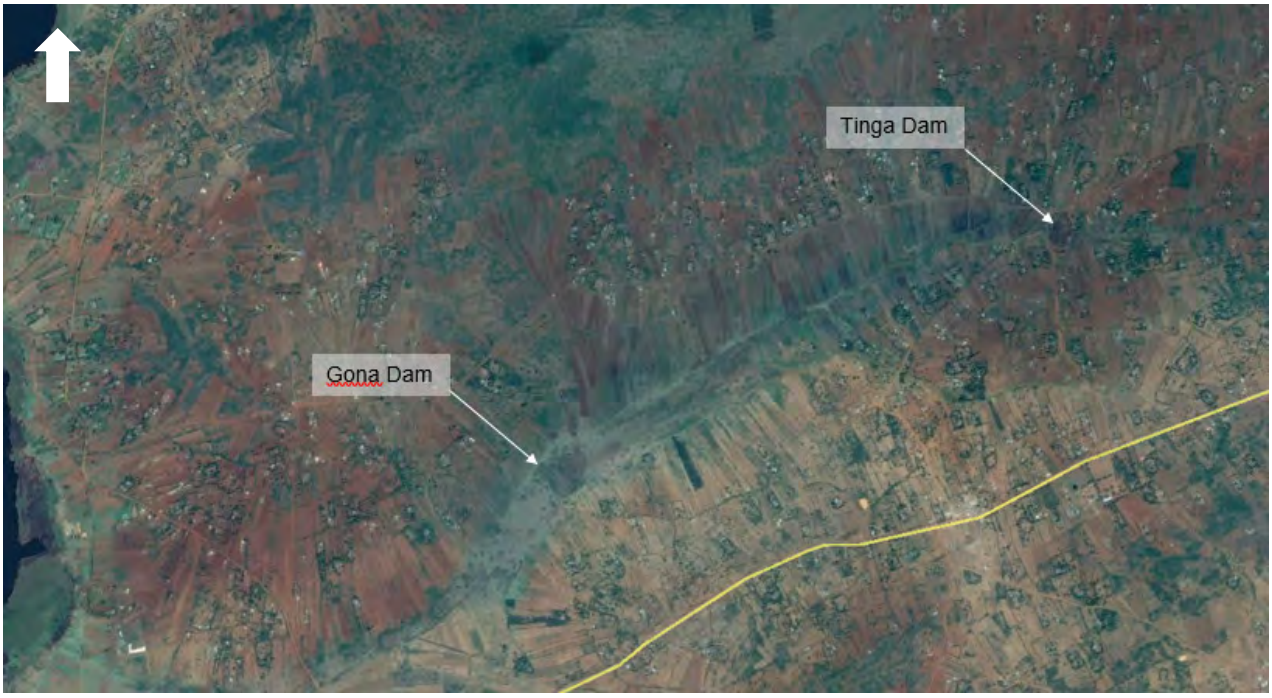

Figure 6: Location of Gona and Tinga Dams within the valley floor. Lake Kanyabola is located to the west or LHS of image.

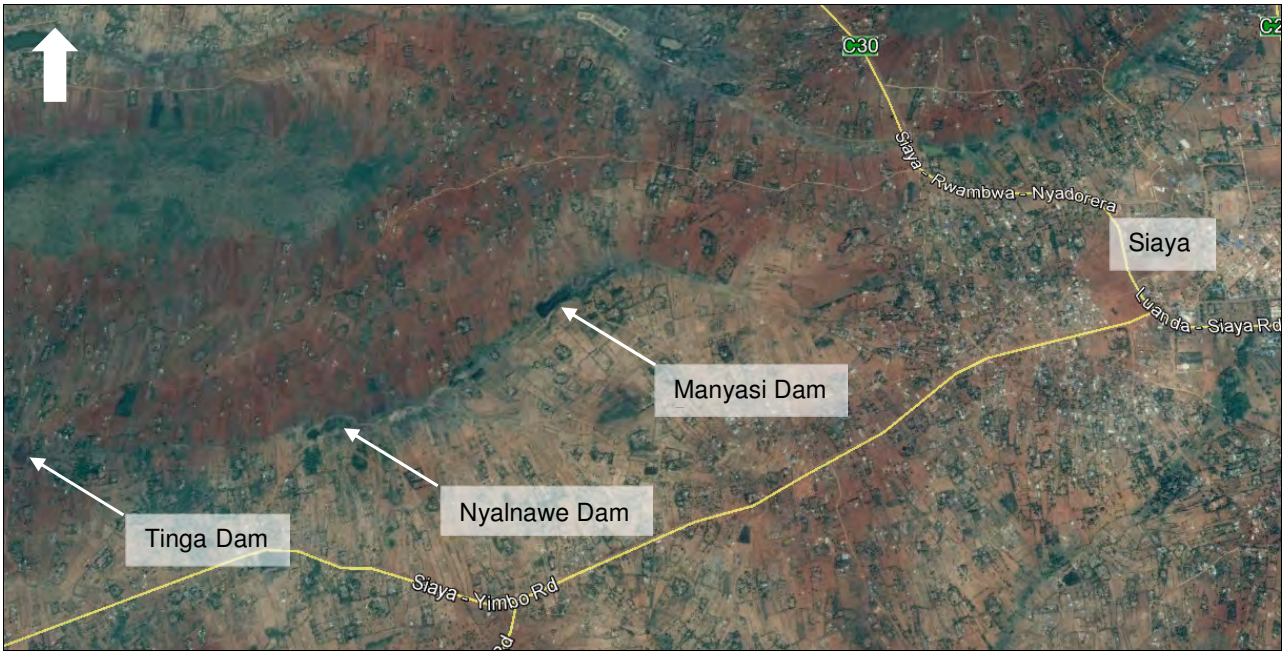

Figure 7: Location of Tinga, Nyalnawe and Manyasi Dams within the valley floor west of Siaya.

2.3 Selection of Safe Water 7

Following on from the success of Safewater 6 undertaken in 2015, being the commissioning of the new Sky Hydrant Kiosk at Manyasi Dam, a variety of options were considered for Safewater 7. Input was provided by both the TKMP steering committee within TSC, as well as from the TKMP

representatives in Siaya (under the direction Olita Ogongo) in consultation with the local community members within Siaya.

Options that were considered for the next Safewater 7 project included:

- Augment the existing Safewater Kiosk at Tinga Dam
- Install a second Safewater Kiosk at Manyasi Dam
- Installation of perimeter fencing and tree planting and inlet works to Gona Dam
- Desilt Tinga Dam or Manyasi Dam
- Initiate Water Sanitation and Hygiene (WASH) programmes with within local schools such as Ochillo School.
- Install / construct a new Safewater Kiosk within the area, potentially at include Owira Dam, Ongoro Dam or possibly Ligamwa Dam.
- Support for cooperative farming enterprises that would include, catchment management, sustainable farming practices and the possible supply of machinery
- Initiate community Health clinics in association with Kenya Health (HOOK)

From the above potential list of projects a submission was received from the Tinga Safewater Dam Committee requesting that the TKMP undertake a Safewater Project to desilt Tinga dam. The Tinga Dam committee stated that the community would support the project in the form of providing manual labour, additional land, and people to act as security guards for hire equipment or plant machinery, and donate construction materials where possible. Refer to Attachment A for a copy of letter of support from the Tinga Safewater Dam Committee.

Based on this submission, the TKMP steering committee determined that the next TKMP Safewater project would be the desilting of Tinga Dam. The other suggestions listed above would be considered for future Safewater projects.

3 PROJECT DEVELOPMENT

3.1 Tinga Dam

The Safewater Kiosk at Tinga dam was installed as the nominated Safewater 2 project in November 2008. Refer to the TKMP site on council's website for the Safewater 2 report http://tkmp.tweed.nsw.gov.au/.

Feedback regarding the state of the dam in 2016 was that it was highly silted, it lacked protection from stock and received catchment runoff contaminated by pit latrines, bush toileting and high soil / silt loads from ongoing catchment clearing and farming practices. The water was turbid, smelly and should not be consumed in its raw state.

In recent years Kenya as a whole had been experiencing continued below average rainfall conditions with western and northern in drought conditions. The combination of below average rainfall, increased demand on water from people and high evaporation rates, was all contributing to decreased water and poor water quality.

Figure 8: Low water Levels within Tinga Dam. View north from the southern shore, August 2016.

From a water storage perspective Tinga Dam is approximately oval in shape and approximately 100m in length and 70m in width at its widest point. In 2016 the maximum depth of the dam was approximately one metre in depth at its maximum depth. Refer to Figure 9 for aerial image of Tinga Dam.

3.2 Safewater 7

The intent of Safewater 7 was relatively straight forward, to leverage the available TKMP donations to maximise the storage capacity of Tinga Dam (drought proof) via desiltation works. There was nothing fancy regarding desiltation works, plain and simple it was the excavation of mud, silt and soil from within the dam basin. As much material would be excavated as possible with the available funds. Excavations would be undertaken with an excavator and dozer and removed from within the dam itself via a lorry /tip truck.

Figure 9: 2015 aerial view of Tinga Dam. (Source: Google Maps)

3.3 The Tender Process

Field Survey Work and Design

In order to determine what could be achieved it was decided to undertake a survey of Tinga Dam to determine the existing water capacity of the dam, including the shape of the dam via cross sections. This would aid in focussing excavation works in areas of the dam to increase the efficiency of works.

Three companies were identified by Olita (in Siaya) that had the experience to firstly undertake a survey of the dam, and then develop a dam rehabilitation/desiltation plan. Once the desiltation plan was developed/ created, it would form the basis of the proposed works for Safewater 7. An expression of interest (EOI) was developed and forwarded to the identified companies.

The EOI stated, *TKMP are currently in the preliminary stages of engaging a consultant to undertake consultation with the local community and survey work to provide a design for the dam rehabilitation works.*

Once a suitable design has been approved by both the local community and TKMP, a contractor would be engaged by tender process to undertake the rehabilitation works. This EOI has been forwarded to you to determine your interest and availability to undertaken the project. Works would need to commence and be completed prior to commencement of rains typically by end of February /March 2017.

TKMP invites you to provide relevant demonstrated experience in the construction and rehabilitation/desilting of earth dams, and equipment that you would use to undertake the works Additionally please provide a copy of your curriculum vitae and contact details.

The EOI was forwarded to the following three companies:

- APEC Engineering Consortium Ltd (APEC)
- Plumtech Engineering (Plumtech)
- Noramma CivilTech Engineering Limited (Noramma)

Based on the submissions, Plumtech were awarded the survey and design section of the works for a fee of 445,000 Kenyan Shillings (Ksh). The fee included travel to site, survey work and the preparation of design plans. APEC's fee was Ksh 560,000 and Noramma declined the survey works, however stated they would provide a fee proposal for the desiltation works.

Based on the completed field survey works a dam rehabilitation/desiltation design plan was developed. Refer to Attachment B for survey plan by Plumtech.

Tinga Dam Rehabilitation

Based on the Tinga Dam design plans created by Plumtech a second EOI was forwarded to Plumtech, Noramma and APEC for the actual rehabilitation / excavation works.

The EOI stated, that the TKMP steering committee had capped the budget for Safewater 7 to Ksh 2,800,000, based on annual forecasts of expenditure for 2017. The intent of the rehabilitation works was to strategically target the removal of material from the dam basin (in accordance with the dam survey and design plan) to increase its depth and therefore increase its storage capacity in an efficient manner so as the community would receive value for money. This may include a combination of excavation of material, and where appropriate, the raising of the dam wall where low points currently exist.

The primary objective of desilting Tinga Dam was to rehabilitate the existing dam to create increased water storage capacity by providing a deeper dam and ensure that the dam spillway and outlet channel conformed to minimum design standards (eg. minimum 50 year design flood or minimum Kenyan design guidelines).

Additional information provided stated:

- In order to dewater Tinga Dam for the purpose of drying the pan out for desilting works, channels were dug within the dam wall. As part of works these channels will need to be adequately filled and stabilised to ensure the dam wall is not weakened, or creates a potential risk to future dam wall failure.
- The existing water draw-off point to service the Safewater kiosk would remain as is.
- The existing two inflow channels to Tinga Dam are reported to be stable and adequate; therefore no new inflow channels are required at this stage.
- Based on the feedback from the survey, the sediment trap appears functional and would potentially require minimal works in the form of sediment removal only.
- The existing overflow channel would be assessed to ensure its design capability would manage a minimum design flood (eg 50 year design flood or as per local Kenyan design guidelines).
- It is expected that soil generated from the desilting would be utilised to rebuild and stabilise spillway and dam wall

3.4 Selection of a contractor

In accordance with the EOI only two responses were received to undertake the dam rehabilitation works. Plumtech and Noramma provided a fee proposal, however APEC did not respond to request.

Response from Plumtech
The cost estimate based on the Engineers estimated rates has been prepared and is presented in appendix C. The overall cost of the project is estimated at KSH 11,200,000 approximately for the storage volume of 36,000 m^3. This translates into KSH 312/m^3 approximately which is considered fairly reasonable.

The budget allocation of KSH 2,800,000 is too low for the rehabilitation works proposed for Tinga dam. The budget is not even sufficient for the desilting item alone. It is difficult to plan for the available budget and it is important that additional funds are availed to carry out the works and provide a reasonable storage quantity.
Refer to Attachment C for copy of fee proposal from Plumtech.

Response from Noramma
We have studied the Terms of Reference (TOR) pertaining to the assignment properly and have thoroughly understood its requirements and conditions. We realised that, the firm is supposed to conduct Desilting and Rehabilitation of the dam to increase water storage capacity, improve collection trenches, sediment trap, spillway and the extraction point supplying the safe water kiosk. We are also expected to form and compact embankment to impound adequate water in the dam besides working in consultation with the other stakeholders during implementation. Costs to undertake works are ***KSH 4,844,107.***

Refer to Attachment D for copy of fee proposal from Noramma.

In light of the above offers which exceeded the TKMP available funds, it was decided to search for an alternative company as the two offers where considered unacceptable.

Olita, after many discussions with staff from the Siaya County Government and locals within and around Siaya, was recommended a company called Moko Technical Services (Moko Tech) run by Mr Aggrey Odeny. After much discussion and site visits to Tinga Dam, Moko Tech provided a fee proposal to undertake the rehabilitation works (desiltation).

Response from Moko Tech
Please find a revised and knockdown quotation to construct the Tinga Kamieno water pan. This is a follow up of a series of negotiation meetings between I and Mr. Olita to reach out to achieving a pan capacity of 16000 m3. The construction entails making a retention wall 3.5 m high and maintaining a freeboard of 1.5m., making of a spillway of 20m. span, making of a silt trap and needful destumping and compaction of the wall and excavation of the pan floor to a depth of 2m. at the centre.

The machinery shall be mobilized to site within 24 hours upon signing of the contract and payment of the 1st instalment. Costs to undertake works are KSH **3,647,340.**

At this time negotiations had stalled with Moko Tech with no further reduction of fee. The KSH 2,800,000 proposed by TKMP to undertake the rehabilitation works had been estimated from previous desiltation works undertaken at Gona Dam some years prior. In line with increased fuel costs and labour hire and the charge to hire the earthmoving equipment and lorries, the estimated cost by TKMP appeared not to be realistic. TKMP were at a cross road to either postpone the project from 2017 to 2018, or continue to seek an alternative company or increase the available funding for the rehabilitation project.

As a side note to the above negotiations to find a suitably experienced company to undertake the works at what was considered a reasonable price, preparation works had continued at the Tinga Dam site. As previously stated the long rains (if they were to take place in early 2017) typically commenced in March to April. As negotiations had stalled between Plumtech and Noramma to reconsider their fee proposal (which neither of them did), then find and negotiate with Moko Tech, time had moved on and it was now 23 February 2017. Additionally, what water was still in Tinga Dam had been drained/dewatered in preparation of works commencing. Standing water within the dam had been pumped out in December 2016 in an effort to dry out the dam bed for the use of an excavator, dozer and lorries.

The ongoing drought within the area had intensified, with the community now having to retrieve drinking water from the neighbouring upstream dams of Nyalnawe or Manyasi. The closest downstream dam of Gona was dry with no water available for stock or people.

After much discussion within the TKMP steering committee it was determined that the project needed to take place immediately and it was agreed to fund the dam rehabilitation works albeit at a higher price. It was agreed that Moko Tech was our chosen contractor.

On the 28 February 2017 the contract was signed by Moko Techs engineer, Aggrey Odeny, Olita Ogongo representing TKMP and representatives from the Tinga Dam committee. Refer to Attachment E for a copy Moko Techs fee proposal and Attachment F for a copy of the signed contract.

An excavator arrived at site on the afternoon of 1 March 2017. The project had finally begun.

4 PROJECT DELIVERY

4.1 Arriving in Siaya

Once the contract was signed, I was able to complete my travel arrangements. It was estimated that the dam rehabilitation works would take approximately three weeks to complete, if all went well. I had planned to be in Kenya for approximately two weeks to oversee the works with Olita for TKMP. I arrived in Nairobi on 11 March, transferred to Kisumu via a domestic flight and was met by Olita for the drive back to Siaya.

4.2 Initial Observations

Siaya, like the majority of Kenya was experiencing below average rainfall with many counties declared as drought affected with ongoing failed crops and little to no water. Counties particularly in the north are relying on government support for food and water supplies. There were many white

UN planes in use and lined up at the Nairobi airport to service the refugee camps along Kenya's northern borders.

The rural areas around Siaya that consist of small land holdings had little to no native groundcover and generally no crops. Land has been prepared (typically dug by hand) in readiness for the rains to plant a crop. What stock people had left was underfed, with many appearing like walking bags of bones. You did wonder how families were surviving.

Over the next few days Olita drove me around the area to inspect all the TKMP sites and to introduce me to the dam committee and community members.

I visited all TKMP Safewater projects with the following brief observations.

Manyasi Dam – Low water but still operational (daily digging of trench to maintain draw off point for pump) with a heavy daily load due to being only clean water supply in area. Due to drought stock are drinking direct from dam. Manyasi Dam is a long narrow dam that has natural pre-treatment of water via upstream reeds instream vegetation. The next dam downstream of Manyasi (before Tinga Dam) is Nyalnawe Dam and it also has a dense area of instream vegetation that acts as pre-treatment for inflows to the dam (eg. filters out sediment to reduce the deposition of sediment within the main dam basin)

Figure 10: Pumping water at Manyasi Dam.

Ochillo School – Low but still plentiful, water quality within dam now green and odorous, people collecting raw water and stock drinking direct from dam. Ochillo Dam is a large water body that is stated to be spring fed and has never run dry.

Figure 11: Low water levels at t Ochillo Dam.

Gona Dam – closed due to lack of water. Stock accessing what little water there is left. Previous fencing to exclude stock gone, fence posts pushed down or eaten by termites etc. Gona Dam is located low in the landscape and is the last in the valley to receive water. Soils are black clays compared to the orange red clays in the upstream elevated areas of the valley. The upstream soils are very erodible compared to the black clays.

Figure 12: Gona Dam basically dry

Tinga – closed for desilting works (Safewater 7). There is no pre-treatment via instream vegetation such as reeds for Tinga Dam. Previously the dam would act as a sediment basin for all inflows which would typically have a high sediment load. High sediment loads would typically be deposited within the dam basin, reducing the water storage capacity of the dam.

Kubar School- toilets operational but very odorous, many flies. Capacity of pit toilets approximately 1 to 1.2 m from top. One water tank within school vandalized and destroyed other vandalized and now no water due to drought. Children would typically rely on Tinga Dam for water, however as this is out of action for Safewater 7, water is being sourced from Manyasi Dam.

Figure 13: The toilet block at Kubar School located west of Tinga Dam.

Olita
Without Olita or someone with his charisma, contacts and constant positivity TKMP in its current format would not be possible.

4.3 Project Delivery

This report provides an assessment of works undertaken by Moko Technical Services (the contractor) in relation to the signed contract dated 27 February 2017 with the contractor, the Tweed Kenya Mentoring Program (TKMP) and the Tinga Dam User Committee. The contract included the accepted fee proposal by Moko Technical Services for the proposed Tinga Dam rehabilitation works. The agreed fee proposal amount was KSH 3,647,340.

In brief, the fee proposal stated that the contractor would provide mobilization and demobilization of a D8 dozer for 23 days, operating for 8 hours/day, approximately 400 litres of fuel/day plus necessary lubricants for 23 days, one operator and one engineer, also for 23 days.

Figure 14: Olita and the dam committee at Manyasi.

The scope included excavating 16,000 cubic metres of material from within the existing dam basin, constructing a 3.5m retaining wall, maintaining a freeboard of 1.5m above the maximum water level, a spillway width of approximately 20m and excavation of material from within the dam to a minimum depth of 2.0 metres.

It also included the mobilization of equipment to site within 24 hours of payment number one, being the initial down payment of 50% of the agreed total contract value.

4.4 Works Completed

The following provides an overview of works completed in reference to the agreed contract conditions dated 27 February 2017, and scope of works provided by Moko Technical Services dated 23 February 2017.

Mobilization
Machinery was mobilized to site to commence works 3 days prior to payment being received. The dozer arrived at the dam site and commenced work on the afternoon of 1 March, with the initial down payment not received by contractor until the 4 March.

Days worked
Works commenced at the Tinga Dam site on the afternoon of 1 March 2017 and continued every day until works ceased on 16 March 2017. Works were undertaken for 15 days.

Equipment Used
At the time of works commencing the D8 Dozer was unavailable therefore a D6 was hired for the project, and was continuously used onsite for 15 days.

Additional machines hired for the project included an excavator (20 tonne) and operator, which were continuously used for 12 days arriving to site 3 days after the D6 Dozer.

Three tip trucks (lorries) and drivers were used to transport excavated material from within the dam basin offsite. Trucks and drivers were used continuously for 3 days.

Volume of material excavated

At the completion of works and in accordance with the contract conditions, an independent engineer, from the Siaya County Government inspected the main components of the dam that included the dam wall, spill way, sediment trap and general dam components. Unfortunately the Siaya County Government surveyor, who was organized to come to site to undertake a post works survey of the dam, was not available on the day. As the contractor had a level (dumpy) onsite, the post works survey to determine the amount of material and volume of water held by the desilted dam was undertaken by both the contractor and Greg Jones representing TKMP. Three east west transects were undertaken at three locations along the length of the dam.

Figure 15: Consultation with the contractor (far LHS) community members and myself.

Based on the post works survey, undertaken on Friday 17 March and the previous survey of the dam undertaken by PlumTech on 22 December, 2016 prior to desilting works, the findings are as follows:

Desilting of the Dam

Desilting was undertaken across the entire dam basin with the deepest section of the dam located on the downstream or western side of dam. Based on the final survey compared to the initial survey, it is estimated that approximately 15, 750 cubic metres of material was excavated.

This is based on a dam width of approximately 70m and a length of approximately 150m. Using an average depth of 1.25 m, approximately 13,125 cubic metres (lower estimation) of material was excavated and removed. Alternatively using an average depth of 1.75m, approximately 18,375 cubic metres (upper estimation) of material was excavated and removed. If the median value of these

upper and lower values was used it is estimated that 15,750 cubic metres of material was removed from the dam.

Depth of water
Based on the material excavated and the height of the relocated spillway it is estimated that the new standing height of water within the dam would be approximately 0.3m above the elevation reference point of dam spill way of 1181.5m. The maximum depth of standing water within the dam would range from approximately 2.2m to 2.5m. This deepest section of the dam is located along the western side of the dam with an approximate width of 25m and 130m in length as it reduces in depth on the northern and southern walls.

Volume of Water
Based on the above information and average estimated depth of water across the dam of 1.75m, is estimated that the dam volume at capacity is approximately 18. 4 Megalitres.

Figure 16: View across dam basin and more consultation.

Dam Components

Freeboard
Based on the maximum height of standing water within the dam a minimum of 1.5m of freeboard has been provided in relation to the elevation of the new relocated spillway.

Spillway
The new spillway was agreed to be relocated by the Dam Committee, based on complaints by the owners of the land directly affected by flows from the spillway. The adjoining landowner has a history of complaints that relate to his land being affected (eg flooding of his land, silt deposition across his land and destroying his crops). It was agreed by the Dam Committee prior to the dam works commencing that the spill way would be relocated to the eastern side adjacent to the silt

trap. Additionally, a new road has been constructed that runs from the Obambo village to the dam, immediately adjacent the dam on the western side in the location of the former cattle trough. The spillway if left in this position would cut directly through this new road.

The new location of the spillway located on the northeast corner of the dam is not without issues as well. During times of high flows when the dam is at capacity water would be redirected via an excavated earth channel from the dam north and around the dam, flowing within the roadside table drain west, crossing the new road and discharging to an existing drainage line approximately west of the Safewater kiosk.

The dam committee realizing that this would require intervention from the Siaya County Government Roads section have made preliminary enquiries requesting a concrete lined table drain and under road culvert to be constructed, that would manage this water.

Whether the existing spillway was maintained and improved or not, both options would require additional works from Siaya County Roads Section. The relocated spill way will require additional works, however it has improved the conditions of the downstream landowner and resolved (hopefully) ongoing complaints to the dam committee.

Collection Trench's and Silt Trap

On the north eastern side of the dam two linear collection trenches were excavated approximately in a vee arrangement, to direct upstream flows into the dam via a new excavated silt trap, which is located within the bund walls of the former silt trap. The orientation of the new silt trap is square to the dam wall, however, when the collection trenches were excavated (with advice from the dam committee) they are oriented at an angle to the new silt trap. The resulting flows have the capacity to short cut the silt trap under high flow conditions.

Figure 17: The newly constructed sediment trap located on the eastern side of dam

The dimensions of the silt trap basin are approximately 9m in width by 12m in length by 1.5m in depth. The inlet ramp to the excavated silt trap was stabilized via a rock lined and cemented riprap, however the discharge point is rock lined but rocks/cobbles are not cemented/stabilized in place.

Disturbance around the collection trenches and silt trap were cause for concern based on loose spoil from excavations (small indiscriminate stockpiles), directional low in height earth bunds not compacted or stabilised, all in the direct flow path to the silt trap and dam. Although this was not completed satisfactorily by the use of dozer or excavator, the contractor agreed to pay members of the community (local boys) to relocated loose material from within the main flow path, to other side of bund walls out of the flow path.

Other Issues

- The contractor had hired machinery and operators from a local businessman in Siaya (SAMCO Ltd). The excavator operator was willing to take directions from the contractor, however the dozer operator was continuously problematic in undertaking directions and completing requested works (such as areas around the spillway previously discussed). Additionally fuel was delayed at times due to the owner of the machinery failing to provide fuel at agreed timelines during the course of works, which resulted in delays and downtime. It is noted that the businessman and owner of the machinery owns a local petrol station in Siaya that was supplying the fuel**.**

Figure 18: Discussions within the dam basin involving the contractor, dam committee members and myself.

- The agreed scope of works that formed the conditions of the contract underwent some minor changes as the works progressed. The changes related to the location of the dam spillway and the resultant depth and width of the spillway. Due to ongoing long-term issues

with an adjoining landowner located immediately downstream of the dam, the committee decided to relocate the spillway from the south western corner to the north eastern corner of the dam. Because of this scope change, the agreed contract conditions where not achieved in entirety.

- Due to depth of silt layer within dam especially within the western section of the dam (the deepest section) the poor subsoil conditions restricted machinery resulting in bogged vehicles and ongoing difficulties for the operators resulting in the reduced levels of excavation.

- Soils located within the upstream catchment of Tinga Dam are highly erodible and easily entrained within flowing surface waters. How would this affect the dam? The current conditions of the catchment where considered very poor as a result of the extended dry season in 2016/2017 year, and sub average rains experienced across Kenya from approximately 2014 to the present. Groundcover to stabilize against sheet erosion and rilling was generally non-existent, subsequently resulting in the mobilization of high silt/soil loads within drainage lines from storm events, and the long rains). The management of silt/soil is a critical management issue that the dam committee must address as a priority, or it may undo the recently completed dam rehabilitation works. This issue has been highlighted to the committee, which have responded by stating they will initiate stabilization works via the planting of grass on the dam walls, flow paths and bund walls locally. The sediment trap will be monitored and would emptied of sediment as necessary. Ideally this would be completed with an excavator however it may be left to the local community to excavate by hand.

- The Siaya County Government had allocated Ksh 2,000,000 from their 2017/2018 budget for additional works at Tinga Dam to aid in the works undertaken so far by TKMP. The dam committee created a list of works to present to the County Government to further complement the Tinga dam rehabilitation works. Although the list had not been formalized likely items on the agenda included additional works to improve the collection drains and silt trap, fencing to exclude stock, a stock watering point (cattle trough) and a toilet located near the current market place.

- With one significant storm (dated 16 March), water was received and stored within the dam. Instantly people, who have been travelling long distanced by foot, with their stock to other sources of water such as Manyasi Dam, were entering the dam with their stock to drink. Also people were filling their containers/jerry cans for raw water directly from the dams muddy water. Fencing and security of the dam is critical especially at this early stage with no stabilizing vegetation to reduce exacerbated erosion by stock and people within the confines of the rehabilitated dam.

Figure 19: Survey works to determine volume of material excavated.

4.5 Recommendations

Although the contract conditions where not achieved in entirety (due to the scope change) the contractor had undertaken the works in good faith to TKMP, the Tinga Dam Committee and the Tinga community, under less than ideal conditions during the course of works. The contractor has also provided two machines in the form of a D6 dozer, an excavator and use of three tip trucks to aid in the removal of material to expedite the agreed works.

From the dam rehabilitation works approximately 15, 750 cubic metres of material was excavated and removed from the dam basin, resulting in a dam capacity of approximately 18.4 mega litres of raw water.

It is acknowledged that the dam is not an ideal depth to counter long-term evaporation rates, however with the available funds limiting the scope of excavations, the result is a significant improvement on the former conditions.

The findings from the assessment by the Siaya County Government water engineer was positive in that he certified the dam and its components. The meaning of this certification, to the community, translates to further TKMP success.

One of the main criticisms of the works was the final state and disturbance of the silt trap and collection trenches. As previously discussed the site was not left in a satisfactory state and required the additional contracting of local community workers to remove and relocate stockpiled and loose material out of the drainage line flow path.

This area now requires stabilization with local grasses and ground covers to stabilize the area from erosion and mobilization of sediment into Tinga Dam.

5 CONCLUSION

Aggrey Odeny of Moko Technical Services completed the Tinga Dam rehabilitation / desiltation works generally in accordance with his scope of works and contractual obligations. Based on the assessment of works he completed with the aid of his subcontractors, and the community, he received payment for completion of works.

Ideally it would have been preferable to increase the volume of water storage within Tinga Dam beyond what we achieved, however with rising costs of labour, machinery hire and fuel it was considered beyond the level of donations set aside for Safewater 7. It is a balance of where to invest the TKMP donations to achieve the best outcome for the community.

On reflection of the project I believe TKMP achieved that outcome and with continued maintenance of the dam and its components, and hopefully limiting the access of stock within the dam basin it should serve the community for many years and provide the Safewater Kiosk with reserves of raw water.

6 ATTACHMENTS

6.1 Attachment A – Community Letter of Support

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TINGA SAFE WATER AND DAM PROJECT.
P.O BOX 38,
SIAYA.
TEL 0728524782
27th JUNE, 2016.

TO THE GENERAL MANAGER,
TWEED COUNCIL,
NEW SOUTH WHALES AUSTRALIA.

C.C. SIAYA COUNTY DIRECTOR OF WATER
P.O BOX 813 SIAYA.

GRATITUDE TO TWEED MENTORING PROGRAMME.

We committee of Tinga Safe water and Dam project humbly submit to you our sincere gratitude on the Safe water project given to ~~them~~ us by your Organization.

We therefore whish to be in touch with you for more support as the safe water project have really Improve the livelihood of more people within the community.

RE: REQUEST FOR TINGA DAM DISILTA ~~DISILTA~~ TION.

We on behalf of Tinga Safe water and Dam project, kindly whish to lay disiltation as described below.

Historical Back ground: Tinga Dam was constructed in the year 1952.

serving eleven villages namely Ohaya, Nyaredo, Simbauluku, Kubar A, Kubar B, Kadhayi, Mulor A, Mulor B, Yenga A, Yenga B and Nyabera as catchment areas in Obambo sub-Location in South Central Location Siaya District in Siaya County.

This Dam serves a population of five Thousand Residents and their High population of their Livestock.

The Dam was constructed because of the following reasons; Due to long drought as famine is experienced in the area in dry seasons which resulted to shortage of wateer.

Using one source of water for animal and human consumption, safe water project was Installed in Tinga Dam in the year 2008 as a way to curb diseases such as cholera and other water bone diseases.

It is therefore to the high light of the above problems for the community to lay their request on the Dam desiltation and enlargement of the Dam since the Dam is in poor condition to support safe water project. i.e Improving the Dam Intake

areas and walls.

However the community are ready to support the well wishers under the following ways.

- Providing manual labour
- Providing the land for enlargement
- Providing security to their
- construction materials and any other which may be directed upon them by the donor.

We therefore thank you in advance as we hope for your positive reply

Yours Faithfully

Chair Lady - Amubayo

Secretary - .

Tressurer - .

(4)

TINGA SAFE WATER AND DAM PROJECT COMMITTEE MEMBERS.

NAME	ID NO.	PHONE NO.	VILLAGE	POSITION	SIGN
PENINA ABAYO	2815315	0718779449	OHAYA	CHAIR LADY	
GEORGE.O. ONYANGO	3552280	0728524782	NYARED O	SECRETARY	
DOMTILA.O. OGUTU	24056166	0712357684	KUBAR-A	TRESSURER	
JOSEPH NALO OGEDA	9286198	0704640157	KADHAYI	MEMBER	
MICHAEL.O. OYEYO	14478628	0724485140	NYAREDO	MEMBER	
HENRY OLOO OWINO	22181661	0702317485	SIMBA ULULU	MEMBER	
HELIDA ANYANGO	8914422	070172225	YENGA B	MEMBER	
CHARLES AWUOR	8202092	0723928855	OHAYA	MEMBER	
ROSE AKOTH ODUOR	27498303	0716798395	NYABERA	MEMBER	
VERONICA JUMA	25337673	0725867092	KUBA RÇA	MEMBER	
JANE A. OKAMO	3936138	0710154559	NYABERA	MEMBER	

6.2 Attachment B – Survey Plan

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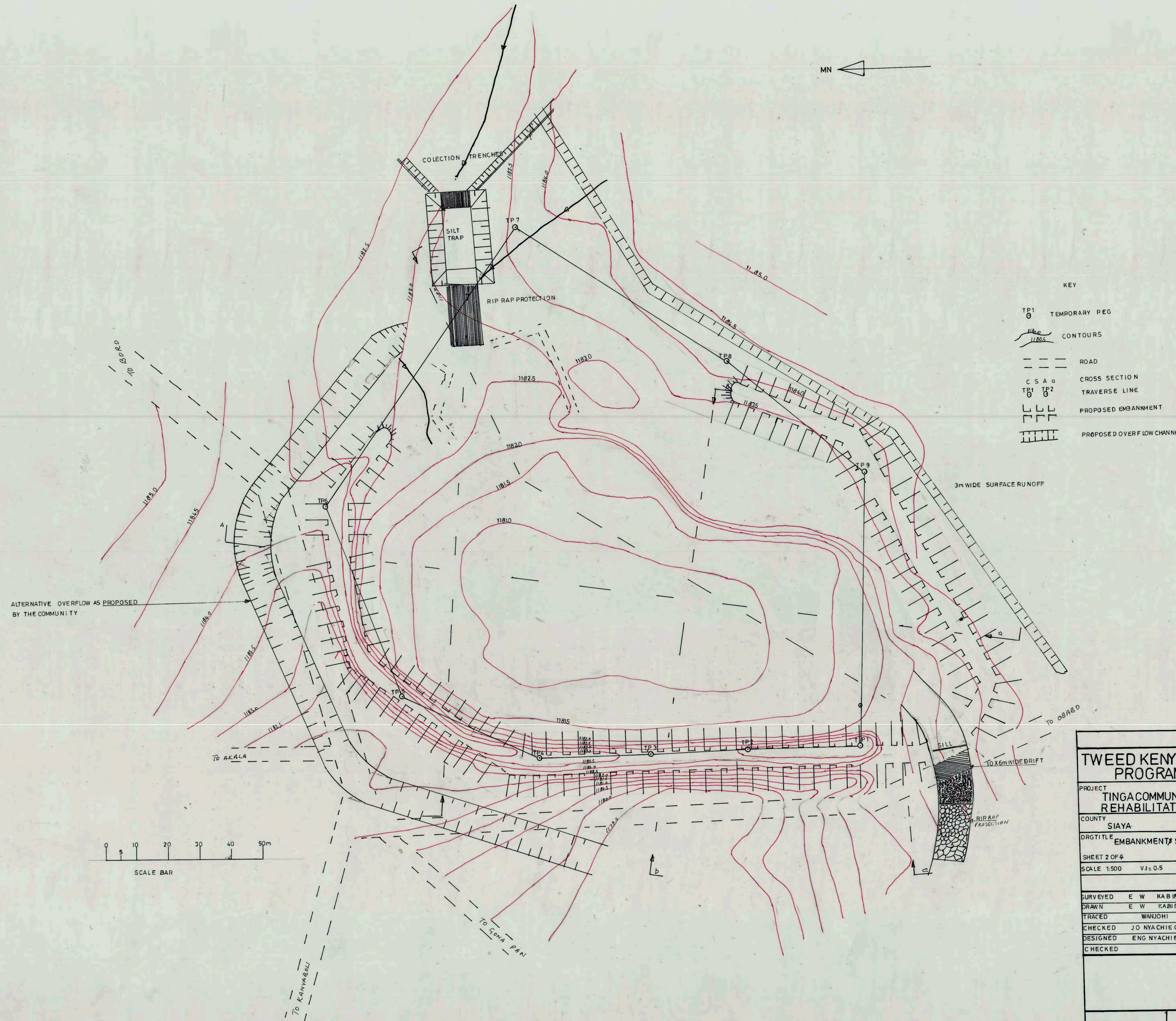
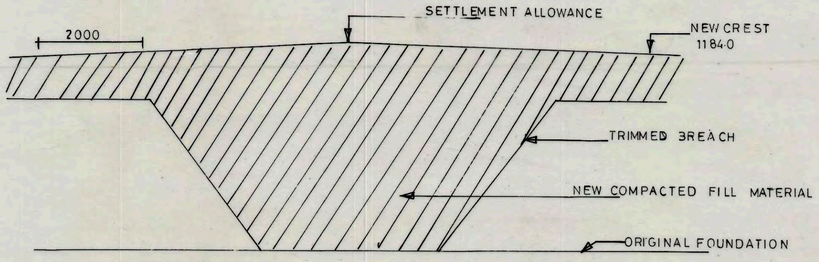
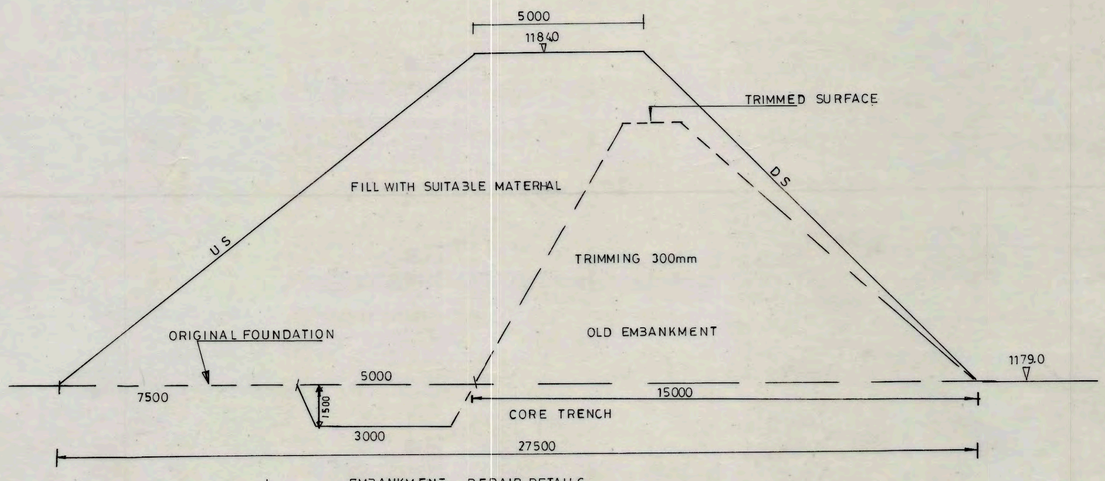
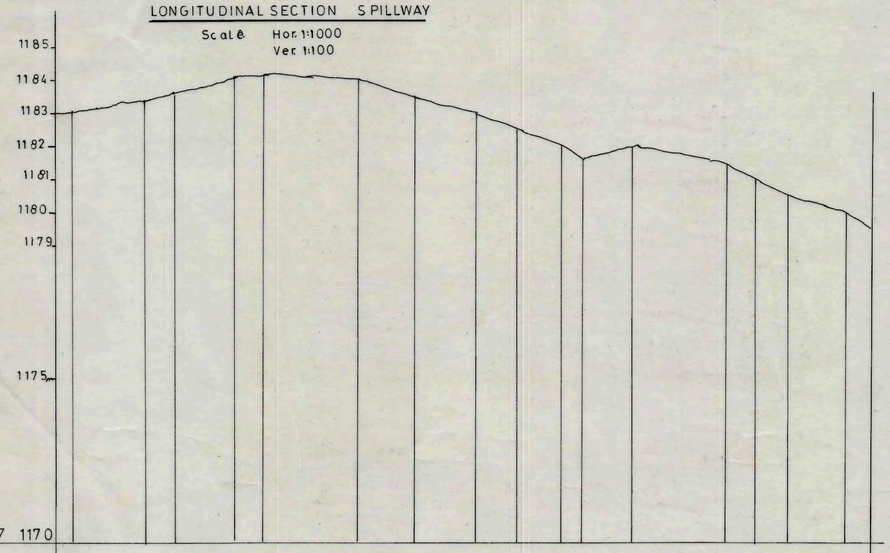

MN
COLECTION TRENCHES
SILT TRAP
TP7
RIP RAP PROTECTION
TP8
TP9
TP6
TP5
TP4
TP3
TP2
TP1
KEY
TEMPORARY PEG
CONTOURS
ROAD
CROSS SECTION
TRAVERSE LINE
PROPOSED EMBANKMENT
PROPOSED OVERFLOW CHANNEL
3m WIDE SURFACE RUNOFF
TO BORO
ALTERNATIVE OVERFLOW AS PROPOSED
BY THE COMMUNITY
TO AKALA
TO OBABO
SILL
TO X 6m WIDE DRIFT
RIPRAP PROTECTION
TO GONA PAN
TO KANYABOLI
SCALE BAR
0 5 10 20 30 40 50m
11850
11845
11840
11835
11830
11825
11820
11815
11810

TWEED KENYA MENTORING PROGRAMME	
PROJECT: TINGA COMMUNITY WATER PAN REHABILITATION	
COUNTY: SIAYA	
DRG TITLE: EMBANKMENT & SPILLWAY LAYOUT	
SHEET 2 OF 4	
SCALE 1:500 V.I = 0.5	
SURVEYED E W KABIRU	DATE 22 12 2016
DRAWN E W KABIRU	
TRACED WANJOHI	DATE JAN 2017
CHECKED JO NYACHIEO	DATE
DESIGNED ENG NYACHIEO	DATE
CHECKED	DATE
DRG. No.	







BREACHED SECTION REPAIR DETAIL NTS

EMBANKMENT REPAIR DETAILS

TWEED KENYAMENTORING PROGRAMME

PROJECT
TINGA COMMUNITY WATER PAN REHABILITATION

COUNTY
SIAYA

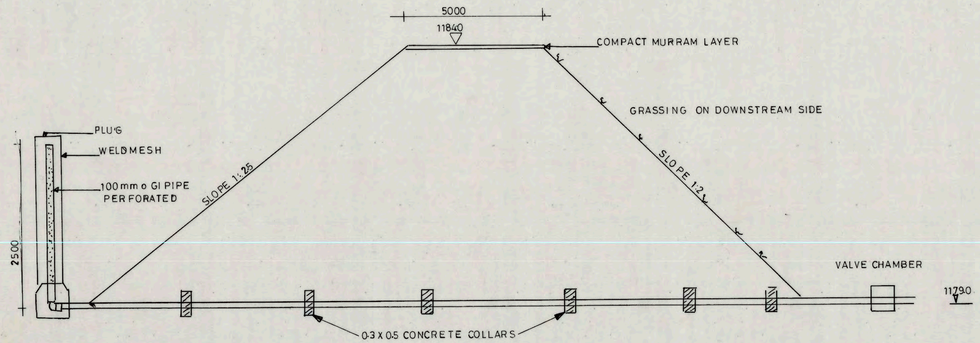
DRG TITLE
PAN CROSS-SECTIONS

SHEET 3 OF 4

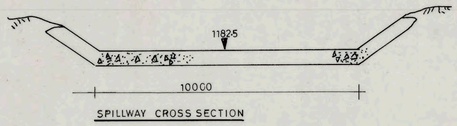
SCALE AS SHOWN

SURVEYED	E W KABIRU	DATE 22-12-2016
DRAWN	E W KABIRU	" " "
TRACED	E W KABIRU	DATE JAN 2017
CHECKED	J NYACHIEO	DATE
DESIGNED	ENG. NYACHIEO	DATE
CHECKED		DATE

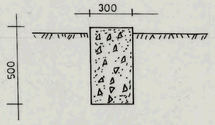
DRG. No.



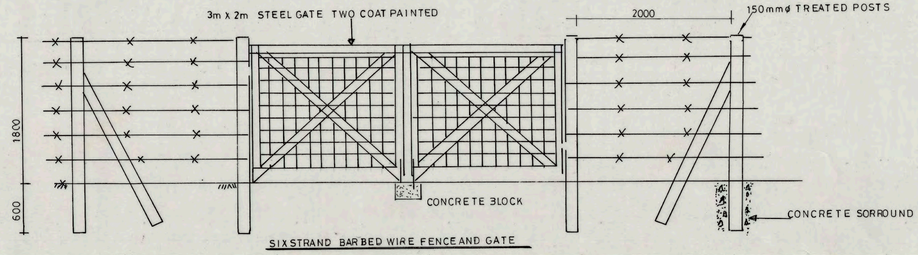
COMPLETE REHABILITATED EMBANKMENT DETAIL



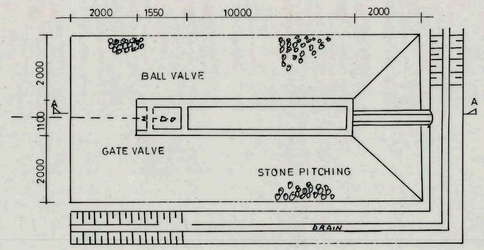
SPILLWAY CROSS SECTION



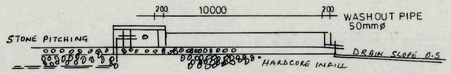
SPILLWAY SILL DETAIL



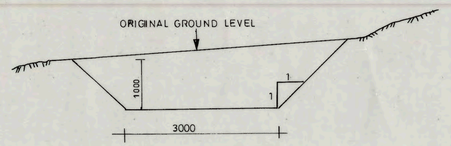
SIX STRAND BARBED WIRE FENCE AND GATE



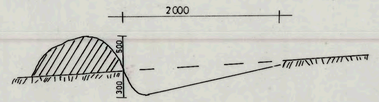
CATTLE TROUGH PLAN



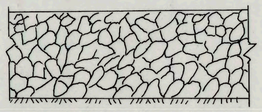
CATTLE TROUGH C.S A-A



SURFACE RUNOFF CROSS SECTION DETAIL

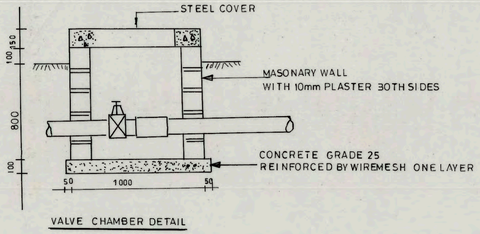


COLLECTION TRENCH CROSS SECTION DETAIL

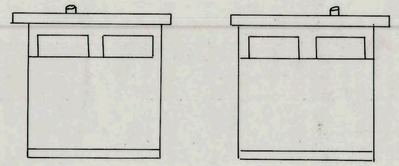


NATURAL EARTH SPILLWAY BOTTOM

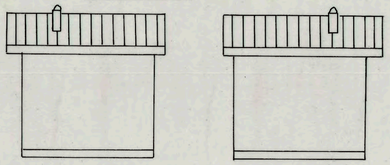
DETAIL OF SPILLWAY PROTECTION



VALVE CHAMBER DETAIL



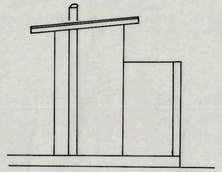
FRONT ELEVATION



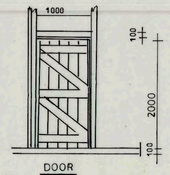
REAR ELEVATION

NOTES

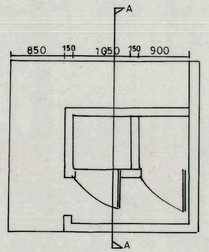
1. G C IRON SHEETS GAUGE 28
2. FACIAL BOARD 250 X 25mm ALL SIDES
3. 200 X 150mm LENTEL
4. PIT WALL TO BE DONE DEPENDING ON SOIL AND AS DIRECTED BY SITE ENGINEER
5. CONCRET CLASS 20 TO FLOOR SLAB MIX 1:2:4
6. USE BRC MESH (TYPE 190)



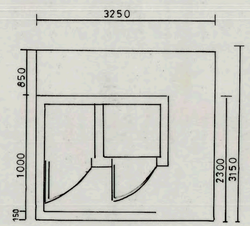
SIDE ELEVATION



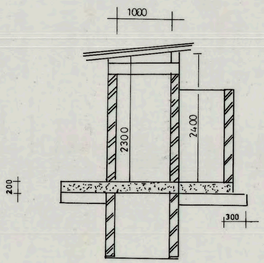
DOOR



PLAN GENTS TOILET BLOCK



PLAN LADIES TOILET BLOCK



SECTION A-A

TWEED KENYA MENTORING PROGRAMME

PROJECT
TINGA COMMUNITY WATER PAN REHABILITATION

COUNTY
SIAYA

DRG TITLE
STRUCTURE DETAILS

SHEET 4 OF 4

SCALE AS SHOWN

SURVEYED	E W KABIRU	DATE 22-12-2016
DRAWN	E W KABIRU	〃
TRACED	E W KABIRU	DATE JAN 2017
CHECKED	J GITONGA	〃
DESIGNED	ENG NYACHIEO	DATE JAN 2017
CHECKED		

DRG. No.

6.3 Attachment C – Plumtech Fee Proposal

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PLUMTECH **ENGINEERING**

P.O. BOX 1684, NYERI

TEL: 0721-819221
TEL: 0733-579959

E-mail address: plumtechengineering@gmail.com
Or
enockwanjohi@gmail.com

DATE: 17th November, 2016

WATER / LAND SURVEYORS & DESIGNERS,
IRRIGATION EARTHDAMS, WATER RESOURCES ASSESSMENT & BUILDINGS,
PIPES & FITTINGS SUPPLIERS & GENERAL CONTRACTORS

BID FOR:

CONSULTANCY SERVICES FOR UNDERTAKING TOPOGRAPHICAL SURVEY, DESIGN AND PRODUCTION OF WORKING DRAWINGS FOR REHABILITATION OF TINGA PAN/ DAM.

TECHNICAL AND FINANCIAL PROPOSAL (REVISED)

1.INTRODUCTION AND UNDERSTANDING OF T.O.R

Plumtech Engineering would like to bid for the consultancy assignment for undertaking Topographical survey, design and production of working Drawings for rehabilitation of Tinga Pan/Dam in Siaya County.

The proposed area of assignment is located 7.5 km West of Siaya Town in Siaya County.

It is our understanding that Tweed Kenya Mentoring Program(T.K.M.P) is implementing this project.

The project is aimed at improving and contributing to alleviating the impact of recurrent drought cycle on the surrounding community. One of the means identified to contribute to the achievement of the project purpose, is the implementation of water related activities such as rehabilitation of water sources.

The objective of this intervention is to ensure the availability and accessibility of safe drinking water for both human and livestock.

It is also our understanding that the aim of this consultancy assignment is to; "**Undertake Topographical Survey, Design and Production of Working Drawings** for the rehabilitation of the Tinga water Pan/ Dam located in Siaya". Key activities to be carried out to achieve the purpose of this assignment include;

- Conducting a topographical survey using a theodolite so as to establish the exact sizes of the pan to be rehabilitated. This will help develop / establish the pan/dam size to be achieved after rehabilitation, B.o,Q s and the project costing.
- Produce designed and working drawings for the project. The drawings will be in hard copy of the transparent paper for the pan/ dam and all the components.
- The contour points taken for longitudinal and cross-sectional profiles will be taken at 10 metres and 5 metres intervals respectively for the pan area, silt trap, inlet and outlet channels and other details as per the site where excavation shall be carried out like filling of gulleys and repair of pan/dam slopes as directed by T.K.M.P technical staff.

2.0 METHODOLOGY AND WORK PLAN

This methodology is based on our understanding of the TOR and scope of work. We will collaborate with T.K.M.P staff and relevant stakeholders in executing our work.

We propose to deliver the outputs implied in the terms of reference through the following process;

Step 1 Briefing and acquisition of relevant information from T.K.M.P technical staff and its community

This assignment will be started by reviewing of **available** information from the technical staff **(If available).**

This analysis will give the consultant an initial understanding of various socio-technical issues and guide the consultant to identify all key aspects to be considered during the field exercise and data investigations.

Step 2 will take approximately 4 days.

Step 2 Field Work (Technical Surveys)

At the site, the survey work and other assessments will require 6 days to accomplish. T.K.M.P staff and the target community representatives teams will participate in the field work for two main purposes: The transfer of skills (Sharing of lessons as well as to build community ownership of the project) and coordination / representation of the overall field work.

The following will be assessed and determined at the project site through topographic survey, excavation of test pits, GPS readings and delineation of catchment areas from local area maps

- Topography of the pan site to allow elaboration of the contour maps.
- Location of inlet and outlet structures.
- Location of ancillary structures (Cattle trough , communal watering points and fence).

Step 3 Preparation of designs

- Estimation of water demand. This will involve the number of people around the project who will be the beneficiaries and the number of livestock.
- The survey data will be computed and plotted to produce survey drawings for the site. The survey drawings should provide all topographic information and details required to carry out the design of the pan and the required ancillary structures eg Pan cross sections, embankment longitudinal and cross sections.
- All the required structures to be constructed during the rehabilitation works will be designed and BoQs will be developed for the rehabilitation / construction works. This assignment(Step 3) will take approximately 5 days.

Step 4 Report Writing

The consultants will prepare design report and technical drawings draft report using outputs from step 1 to 4. The report will capture all aspects suggested in the TOR. The draft design reports will then be shared with T.K.M.P , to facilitate a one day feedback meeting where the report content will be discussed. The consultant will then require 3 days to finalize the report.

3.0 WORK PLAN AND PROFESSIONAL INPUTS

The table below shows our proposed work plan as well as professional inputs. In addition, the consultants are available to begin the assignment within a period of 14 days ,preferably and upon signing of the contract.

No.	Activity	Responsible	Number of Days	Professional(Surveyor)	Professional(Engineer)
1.	Travel Nyeri to Siaya & Back	TMKP	2	1	1
2.	Assignment briefing and logistical planning(TMKP field offices in Siaya)	TMKP and the consultants	1	1	1

3.	Field work at pan site	TMKP and Lead Consultant and community leaders	4	1	1
4.	Preparation of survey drawings, project design, BoQs and specifications	Lead consultant/ surveyor	5	1	1

4.0 EQUIPMENTS REQUIRED INFACILITATING THE ASSESSMENT:

The consultant will avail the following Technical equipment to facilitate the assignment;

- INo GPS
- INo Digital camera
- INo Tape measure
- INo Theodolite, Level and accessories

5.0 OTHER RESOURCES

T.K.M.P will be responsible for the following;

Transport, accommodation and any reimbursable cost.

6.0 FINANCIAL PROPOSAL

Item No.	Items	Cost
1.	Consultancy engineer/ surveyor	275,000
2.	Transport to and from Siaya and local running during the field work	55,000
3.	Miscellaneous	20,000
TOTAL		350,000

Excluding V.A.T

Terms:
50% downpayment for facilitation of works.
50% Balance on delivery of design report together with the drawings

P/s : The client(TKMP) or the community to provide support staff during the execution of survey works in the field.

TWEED KENYA MENTORING PROGRAMME
SIAYA COUNTY

REHABILITATION OF TINGA WATER PAN:
FEASIBILITY AND ENGINEERING DESIGN REPORT

Prepared by;
Plumtech Engineering Ltd

8th January 2017

I SUMMARY OF TECHNICAL DETAILS:

SITE LOCATION	
County:	Siaya
Subcounty	Boro
Location	South Central Alego
GPS Position	N 0^0 2.96` E 34 $^0$ 13.29`
WATER SOURCE	
Catchment Area	70 Km^2
Catchment Condition	not well conserved and partly forested grassland
RESERVOIR/PAN	
Live storage	30,000m^3
Dead storage	6,000 m^3
Reservoir Area	0.927 Ha
Maximum Water depth	3.5m
Excavated volume	21,000m^3
RETAINING WALL	
Crest Elevation	1184 (Relative to BM Datum)
Maximum Height	5m
Length	300m
Crest Width	6m
Earth fill volume	9000m^3
Upstream Slope	1(v): 2.5(h)
Downstream slope	1(v): 2.5 (h)
SIDE OVERFLOW CHANNEL	
Length	100m
Inflow design flood	21.3m3/hr
Return Period	1in 50 years
Weir crest level	1182.5m
Weir Length at control	10m
DRAW OFF SYSTEM	
Piping	70m GI class B 100mm diameter
Cattle trough	1No. 10m long
PROJECT COST	
Estimated project cost	KShs 11.2 Million

TABLE OF CONTENTS:

1. INTRODUCTION

The tweed Kenya Mentoring programme has provided funds to carry out a feasibility assessment for the rehabilitation of Tinga water pan to provide water for domestic, livestock and minor irrigation The assessment and subsequent design of the pan involved establishing the required storage and pan depth, classifying of the soil bed materials and assessment of the catchment area and conditions for the generation of runoff.

The pan site is located within south central Alego in Boro Sub-county of Siaya County. Once rehabilitated, the pan will conserve and provide water for 8,000 people, 12,000 animals (90% cattle), institutions and small scale irrigation during the drought periods. The dam reservoir measures approx. 150mx70m x4m depth with an estimated gross storage of 36,000m^3.

2 SITE INVESTIGATIONS

2.1 Topography and Impoundment details

The topographic survey of the pan site was carried out using a Theodolite. 9TBMs consisting of iron pegs were place as shown in the site layout drawing.
A topographic map of the impoundment was produced with contours at intervals of 0.5m and was used to develop the pan layout and its ancillary structures. The topography maps were used to estimate the storage volume of the pan. The gross storage is estimated at 36,000 m^3 with a life storage of 30,000m^3

The site topography map and pan layout are given in figures 1

2.2 Geo-Technical Investigations

4 test pits 3 m deep were hand-dug within the proposed impoundment area. None of the pits encountered any significant permeable layers at a depth of 3m, which could have undermined the suitability of the site for excavation of the pan.
The general soil profile at the 3 test pit sites was as follows;

- 0 m-2.m m, silt clay
- 2.- 3.0 m slightly silt clay
- Below 3.0 m, deep clay formation

3 HYDROLOGY

3.1 Catchment Area

The catchment area is composed of a gentle sloping valley plain towards the pan site.

Catchment details

Catchment area Km^2	70
Cover condition	Partially covered
Soil	Silt clays with low permeability

3.2 Rainfall

Siaya area is semi -arid and receives reliable annual rainfall of 1400 mm mainly in the month of April and October. The area has a potential evaporation of 2000mm per year. The water sources in the area include one borehole located 1km away and 2 pans.

3.3 Inflow design flood

The inflow design flood was based on a rainfall event with a 1in 50yr return period. Based on the catchment characteristics, and the selected return period, the IDF has been estimated from Richards method using a 12hour storm (ref MOWD manual 1986) and is approximated at $21.6m^3/sec$.

3.4 Sediment inflow

The catchment area is mainly used for small scale farming and as pastureland with medium scale settlement. The area has no gullies and water rills indicating that the rate of sedimentation into the pan could be low. Since the purpose of the pan is small scale irrigation, large scale environmental degradation is unforeseen and the silt load is expected to remain low.

4 PAN DESIGN

4.1 Introduction

The design of the pan evolved through selection of the pan site, establishing the required storage and pan depth, classifying of the soil bed materials and assessment of the catchment area and conditions for the generation of runoff.

The basic design criteria for the pan were set down as follows:

- The side slopes of the excavated pan should range between 1 /2.5 and 1/3. The slope of 1 /2.5 is adopted.
- The bed material (soil) must be impervious and water tight. At the proposed depth, the bed has an impervious clay material
- Spillway and outlet capacity must be sufficient to prevent overtopping of the retaining wall. A natural flow channel exists but another overflow channel was excavated at the opposite edge of the dam. It is proposed that the excavated channel will be closed and the existing natural flow channel will be rehabilitated to accommodate the designed flow.

4.2 Pan design

A 4m depth oval shaped pan will be excavated and part of the excavated materials will be used to build a retaining wall of a max 1.5m m high. The pan reservoir has been designed with the following proposed dimensions:

o Pan length	150 m
o Pan Width	70m(width varies with 70m as average)
o Depth	4m(attained by desilting up to 2m depth
o Excavated pan slopes	1: 2.5

The total volume of silt to be removed is estimated at 21,000m^3

4.2.1 Retaining wall

The existing embankment will be rehabilitated as shown in the drawings provided. The soil scooped from the reservoir has high clay content and is unsuitable for the rehabilitation works. The suitable soil for the embankment will be obtained from a suitable borrows area located close to the upstream end of the dam **and 9,000m^3** will be used.

The dimensions of the embankment will be as indicated below;

- Crest width 6m
- Maximum embankment height 5m
- Upstream slope 1(v): 2.5(h)
- Downstream slope 1(v):2.5(h)
- Cut-off trench; 3m. Bottom Width, 0.5m depth (final depth DOS)
- 5% minimum settlement and consolidation allowance added to the wall height during construction

4.2.2 Silt trap

Generally, the silt load from the catchment is low since the lower portion of the catchment is generally flat and ¾ of the catchment is either forested or covered with grass. Already a natural silt trap exists and there is no need to excavate another one

4.2.3 Inflow channel

The pan has 2 natural and stable inflow channels and no new inlet channels will be excavated.

4.2.4 Overflow channel (spillway)

Two locations for the spillway have been considered

- ***Location along the left edge of the embankment***

At this location, the Overflow channel (spillway) will be near the left edge of the embankment. When the water in the pan reaches the 1182.5m water level, the incoming flood will start flowing into the overflow channel before reaching the pan reservoir area. **This will be the best location for the overflow channel (spillway), but the floods are likely to damage the road located close to the heel of the embankment and high repair costs will be incurred incase the roads are damaged.**

- ***Location along the right edge of the embankment***

The current spillway is located near the right end of the embankment. Maintaining the spillway at this location will make the dam to function as a silt trap. With this location, the spillway will pose minimal danger/ damage to the road (See spillway layout)

Because of the high cost of relocating the road or repairing the same in case of flood damage, the overflow channel will be retained at the current location despite the risk of siltation

4.2.5 Livestock watering works:

The pan will be used to support domestic, livestock water use and small scale irrigation and will be fenced off to prevent livestock from accessing water from the pan. 1No. watering trough of 10m length will be constructed.

4.2.6 Draw- off system

A new draw- off system will be installed and will comprise of 100 mm GI piping, 70m long. The system will have an intake structure comprising of a protected perforated stand pipe supported by a concrete base.
The draw pipe will have concrete collars at the joints under the embankment. (Refer drawing---)

4.2.6 Fencing

The entire impoundment area will be fenced to protect the retention wall and prevent watering of livestock from the reservoir area. 1.8m high, 6strands barbed wire (12 gauges) fence covering a perimeter of 800m be constructed.

CONSTRUCTION PLAN

5.1 Construction plant

Owing to the large volumes of soil to be moved within a short period, the required equipment for the timely completion will be :

- 1 Bulldozer (D6) (hired at 6000 per hr dry rate)
- 1Excavator Hired at KE 5500/00 per hr dry rate
- 2 Tippers

The mobilisation and demobilisation to and from Siaya will be KES 500,000/00 if the equipment will be sourced from Nairobi.

5.2 Construction Schedule

The implementation of the project activities is expected to take at least 2months. The construction schedule is presented in figure---

5.3 Contractors Qualification

The contractor should be registered as a Contractor with the NCAs and should be licensed through the Ministry of water & Irrigation to construct dams. Ministry of water licenses class A allow for construction of up to 10m.

6. COSTS ESTIMATE

The cost estimate based on the Engineers estimated rates has been prepared and is presented in appendix C. The overall cost of the project is estimated at KShs 11.2m

approx. for the storage volume of 36,000 m^3. This translates into KES 312/m^3 approx. which is considered fairly reasonable.

The budget allocation of KES 2.8million is too low for the rehabilitation works proposed for Tinga dam. The budget is not even sufficient for the desilting item alone. It is difficult to plan for the available budget and it is important that additional funds are availed to carry out the works and provide a reasonable storage quantity.

6.4 Attachment D – Fee Proposal from Noramma

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TINGA DAM DESILTING PLAN AND BUDGET TKMP

S/NO	ACTIVITY	RESPONSIBILITY	RESOURCES NEEDED	BUDGET (KSHS)	TIMEFRAME IN WEEKS 1	2	3	4	5	REMARKS
	Preliminary Works									
1	Site Identification	TKMP/ Community.	Vehicle for Transport	-						
	Community Mobilization	TKMP/ Community.	Venue, Members, Lunches	-						
	Signing of the Contract	TKMP/ Contractor	Contract agreement document	-						Work commences after signing of the contract
2	Identification and verifcation of machinery for excavation	Contractor/ TKMP	1 Vehicle for Transport for 1 Day	-						
3	Mobilization and demobilization of earth moving machinery and personnel to site	Contractor/	Funds	100,000.00						
	Sub Total			**100,000.00**						
	Dam Excavation Works									
4	Site clearance and removal of vegetable soil	Contractor	1 D8 Dozer for 1 Day @ 8500 per Hour	85,000.00						Site clearance for 10 - 12 Hrs a day
			Fuel (Diesel) 210 Litres for 1 days @ Kshs 90	18,900.00						
			2 Plant Operators for 1 Day @ 3000	6,000.00						
			2 Helpers for 1 days @ Kshs 750	1,500.00						
5	Excavation of Dam Reservoir /Embarkment formation and compaction	Contractor	1 D8 Dozer for 23 Days @ Kshs 85000	1,955,000.00						Dam excavation of 10 - 12 Hrs a day in order to achieve an excavated Volume of 14,000 M^3 plus 6000 M^3 existing Volume = 20,000 M^3 Final capacity of the Dam. Assumption is that the dam is dry and it doesn't start raining soon.
			Fuel (Diesel) 350 Litres for 23 days @ Kshs 90	724,500.00						
			Lubricants (Engine oil) 40 Litres for 10 times @ Kshs 300	120,000.00						
			Lubricants (Transmission oil) 80 Litres for 10 times @ Kshs 300	240,000.00						
			2 Plant Operators for 23 days @ Kshs 3000	138,000.00						
			2 Helpers for 23 days @ Kshs 750	34,500.00						
			1 surveyor/ Engineer for 23 days @ Kshs 10000 with TopCon Automatic Level.	230,000.00						
			2 Chainmen for 23 days @ Kshs 750	34,500.00						
	Sub Total			**3,587,900.00**						
	Spillway Rehabilitation Works									
	Construction of Spillway	Contractor	1 D8 Dozer for 1 Day @ 85000	85,000.00						Spillway excavation for 10 - 12Hrs a day to manage a 50 years design flood
			Fuel (Diesel) 210 Litres for 1 days @ Kshs 90	18,900.00						
			2 Plant Operator for 1 Day @ 3000	6,000.00						
			2 Helper for 1 days @ Kshs 750	1,500.00						
	Sub Total			**111,400.00**						
	TOTAL			**3,799,300.00**						
	Add 7.5 % Transport and Contingencies		**0.075**	**284,947.50**						
	Add 20 % Company Cotructual Fee		**0.2**	**759,860.00**						
	GRAND TOTAL (EXCLUSIVE OF 16 % VAT)		**KSHS**	**4,844,107.50**						**This is the least amount that can practically work on the dam**

6.5 Attachment E – Fee Proposal from Moko Technical Services

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MOKO TECHNICAL SERVICES

Email ; mokotek 2010 @ gmail.com 23rd february2017

Hi Mr. Olita and Mr. Greg thanks for your continous dedication on this project;

Please find a revised and knockdown quotation to construction of Tinga Kamieno water pan. This is a follow up of a series of negotiation meetings between I and Mr. Olita to reach out to achieving a pan capacity of 16000 m3. The construction entails making a retention wall 3.5 m high and maintaining a freeboard of 1.5m., making of a spillway of 20m. span, making of a silt trap and needful destumping and compaction of the wall and excavation of the pan floor to a depth of 2m. at the centre.

The machinery shall be mobilized to site within 24 hours upon signing of the contract and payment of the 1st installment. I had indicated the company details in the profile.

	Activity/Item	**Unit**	**Quantity**	**Unit cost(ksh.)**	**Total cost (ksh.)**
1.	Mobilisation and demobilisation	no.	2	100,000	200,000
2.	D8 tractor hire rates (dry rate)	Hours	23days x8hrs/day=184hrs	8,500	1,564,000
3.	Diesel fuel	Lts	400 lt/day x 23days =9200lts	90	828,000
4.	Oils and lubricants	sum	20% of fuel cost	sum	165,600
5.	Operator cost	days	23 days	3,000	69,000
6.	Engineers ' cost	days	23days	15,000	345,000

SUB TOTAL ksh. 3,171,600

ADD 15% Tax ksh. 475,740

GRAND TOTAL ksh. 3,647,340

Attached please find the **company profile**

Organisation:- MOKO Technical Services

Registration Date:- 7th May 1991 under cap 409 no. 16115

Bussiness Location:- Plancom House –KISUMU,& at BONDO lower milimani

Moko House

Pin Certificate:- PO51186030R

Bank:-	EQUITY Kenya, A/C no. 0750293258010
E mail address	mokotek2010@gmail.com
Contact person	Aggrey Odeny
Telephone	0713443484
Licenceas a contractor	No.WD/DB 400/224 dated 7th june 2006
Capacty of Works :-	Projects upto ksh. 100m.
Scope of works:-	- Copnstruction of water pans /small dams -Borehole drilling -Irrigation construction -Construction of piped water,Tanks, Towers
Recent successful similar undertakings:- Within the last 5 years	Kianja water pan (20000m3) at Asembo near Nyilima Konino water pan (17000m3) in Rarieda
Credentials:-	The Directors hold degrees in Agric. Engineering ,and one holds a masters degree in Hydrology.
Referee	1. Mr. Charles Olang 0721375685 Sub county water & irrigation Officer 2. Felix Tebangura 0722831131 County Agrcultural Engineer

6.6 Attachment F – Copy of Signed Contract

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KENYA MENTORING PROGRAM

TINGA DAM REHABILITATION PROJECT, SOUTH CENTRAL ALEGO LOCATION SIAYA COUNTY

The signing of this contract pledges that Moko Technical Services, the Tinga Dam Management Committee, and the Tweed Kenya Mentoring Programme (TKMP) will work together as a team to undertake the rehabilitation works to improve Tinga Dam.

Date: 27/2/2017 Day of February 2017

Location: SOUTH CENTRAL – TINGA DAM

MOKO TECHNICAL SERVICES REPRESENTATIVE

Name/s:	AGGREY O. ODENY
Signature/s	

Refer to Table 1 for Agreed works

TWEED KENYA MENTORING PROGRAMME REPRESENTATIVE (S)

Name/s:	OKITA C. OSONJO
Signature/s	

Refer to Table 2 for Agreed works

TINGA DAM USER MANAGEMENT COMMITTEE REPRESENTATIVE (S)

Name/s:	SAMUEL OMONDI OWINO	
Signature/s		

Refer to Table 3 for Agreed works

Moko Technical Services, the Tinga Dam Management Committee, and the Tweed Kenya Mentoring Program (TKMP) referred to as partners in the rehabilitation of Tinga Komieno Water Pan, are represented by:

1. Samuel O Owino, **Chairman Tinga Dam management Committee** Tel +254728286636;

2. Aggrey Odeny, of **Moko Technical Services**, Plancom House Kisumu. Tel 0713443484. Contractor Number WD/DB 400/224. Email: mokotek2010@gmail.com

3. Olita C Ogonjo **Program Management representing the Tweed Kenya Mentoring Program** Tel +254701518882 Email: olitac@gmail.com

CONTRACT TITLE: TINGA WATER PAN REHABILITATION PROJECT, SOUTH CENTRAL ALEGO LOCATION SIAYA COUNTY

ITEM 1: SUBJECT

1.1 The subject of the contract shall be the Rehabilitation of Tinga Dam based on the previous survey works and the resultant scope of works agreed to be completed. The transport of equipment, materials and labour form part of the work on site. It will be up to the contractor to verify the accessibility of the construction site and its logistical conditions.

1.2 The contractor shall comply with the terms of contract and attachments.

ITEM 2: PRICE AND PAYMENT

2.1 The contractor acknowledges the content of the technical specifications and will execute the task as described in the subject for the total amount of:
Three Million Six Hundred Forty Seven Thousand, Three Hundred And Forty Kenya Shillings (KSH 3, 647, 340.00).

2.2 TKMP will provide payment to the contractor via the agreed payment process and schedule listed in the Payment Schedule below.

PAYMENT SCHEDULE

Payment Number	Description	% of Total	Agreed Milestone	Amount (Ksh)
1	Initial Down payment	50	n/a	1,823, 670
2	10 days after commencement of works	25	Removal of 10,000 cubic metres of material from Tinga Dam (minimum)	911, 835
3	At completion of works	25	Completion of works as per agreed scope of works in Table 1. Volume of material excavated would be assessed by independent surveyor and/or engineer.	911, 835
If agreed works cannot be completed due to the commencement of rains or other factors out of the control of either party, payment would be determined based on the volume of material removed or excavated from the dam as a guide. Alternatively, if it is not possible to determine volume of material removed, payment would be calculated on a daily rate as a percentage of works completed (eg Day 14 out of the proposed total of 23 days).				

2.3 The price referred to in Item 2.1 above shall be the sole remuneration owed by the TKMP to the Contractor under the contract. The price shall be firm and not subject to revision.

2.4 Since the Contractor is deemed to have determined its price on the basis of its own calculation, operation and estimates, it shall, at no additional charge, carry out any work that is the subject of any item in the tender for which the Contractor indicates neither a unit nor lump sum.

ITEM 3: AGREED WORKS

In signing this contract the relevant parties of Moko Technical Services, the Tinga Dam Management Committee and TKMP pledge to undertake the following itemized works in association with the rehabilitation of Tinga Dam.

Refer to Tables 1, 2 and 3 below.

MOKO TECHNICAL SERVICES

Table 1 – Agreed works

Item	Description of Works
1a	Moko Technical Services would undertake the de-silting and rehabilitation works at Tinga Dam as per their supplied quotation dated 23 February 2017. Refer to Attachment A for a copy of this quotation.
1b	The mobilisation and demobilization of all earthmoving machinery (eg D8 Dozer) and associated equipment to the Tinga Dam site.
1c	The dry hire of a D8 Dozer as stated and supply all fuel, oils and lubricants for the duration of works.
1d	The supplied quotation includes labour hire costs for an engineer and operator for the duration of works.
1e	The scope of works include: • Excavation of 16, 000 cubic metres of material from within the de-watered Tinga Dam. • Utilise suitable excavated material from de-silting works to reinforce and compact the dam walls where necessary. • Utilise suitable excavated material from desilting works to repair the excavated slipway wall and rebuild to provide a spillway wall of a minimum width of 20m, and a height of 3.5m • De-stumping where required from within the existing dam wall • Removal of material from the existing silt trap as necessary
1f	Completion of works inline with the above.

TWEED KENYA MENTORING PROGRAMME

Table 2 – Agreed works

Item	Description of Works
2a	Provide funding to contractor as per the agreed scope of works in Table 1 and inline with the schedule of payments in Item 2.
2b	Oversee works that would be undertaken by the contractor, and works that the Tinga Dam Management Committee would undertake as per Table 3.

TINGA DAM MANAGEMENT COMMITTEE

Table 3 – Agreed works

Item	Description of Works
3a	Provide community labor free of charge where reasonable to support the chosen contractor undertaking the dam rehabilitation works.
3b	Provide community labor free of charge to help with the construction of fencing to exclude stock from entering the main dam. Ideally a stock watering point would be constructed away from the dam to provide a stock watering point.
3c	Provide labour free of charge where reasonable to reinstall the water draw-off point within the dam to supply water to the Safewater Kiosk associated with Tinga Dam.
3d	Take ownership, operate and maintain the dam upon completion and operate the Safewater Kiosk.

ITEM 4: GENERAL OBLIGATIONS

4.1 The Contractor shall perform the contract with due care and diligence including, where specified, the design, manufacture, delivery to site, erecting, testing and commissioning of supplies and carry out of any other work including the remedying of any defects in supplies. The Contractor shall also provide all necessary equipment, supervision, labor and facilities required for the performance of the contract.

4.2 Plants and equipment

- All construction plant temporary works and materials owned by the Contractor or by any Company in which the Contractor has controlling interest shall, when brought onto the site (or in the case of hire purchase plant on site on its becoming the property of the Contractor) immediately become the property of The Employer.

- No constructional plant temporary works or materials or any part thereof (except hired plant) shall be removed from the site without written consent of the employer where consent shall not be unreasonably withheld where the same is no longer immediately required fro the purposes of completion of the but the Employer will permit the contractor the exclusive use of all such constructional plant temporary works and materials in and for the completion of the works until the occurrence of any event which gives the Employer the right to exclude the Contractor from the site and proceed with completion of the works.

4.3 The Contractor shall respect and abide by all laws and regulations in force and shall ensure that its personnel, their dependents and its local employees also respect and abide by all such laws and regulations. The

Contractor shall indemnify TKMP against any claims and proceedings arising from any infringement by the Contractor, its employees and their dependents of such laws and regulations.

4.4 The Contractor shall treat all documents and information received in connection with the contractor as private and confidential. It shall not disclose or publish any particulars of the contract without prior written consent TKMP. If any disagreement arises as to the necessity for any publication or disclosure for the purpose of the contract, the decision of the Contracting Authority shall be final.

ITEM 5: DISPUTES

5.1 All disputes between contractual parties arising from agreed scope or works within this contract herein that cannot be automatically settled, shall be referred to the exclusive jurisdiction of the Republic of Kenya court.

ITEM 6: TERMINATION OF CONTRACT

6.1 TKMP may after giving the Contractor 7-days notice, terminate the contract in any of the following cases:

i. The contractor substantially fails to perform its obligation under this contract;
ii. The contractor fails to comply within reasonable time with notice given by TKMP requiring the Contractor to perform his obligation under the contract that seriously affects the proper and timely performance of the works;
iii. The contractor refuses or neglects to carry out administrative orders given by TKMP;
iv. Contractor assigns the contract or sub-contract without the authorization of the TKMP;
v. The contractor is bankrupt or being wound up, having its affairs administered by the courts, has entered into arrangement with creditors, has suspended business activities, is subject of proceedings concerning those matters, or is in any analogous situation similar to procedures provided for in national legislations or regulations;
vi. The Contractor has been convicted of an offence concerning professional conduct by a judgment that has the force of res judicata;
vii. The Contractor has been guilty of grave professional misconduct proven by any means which the Contracting Authority can justify;
viii. The Contractor has been a subject of judgment that has the force of res judicata for fraud, corruption, involvement in criminal activities or other illegal acts detrimental the Contracting Authority's interests.
ix. The contractor following another similar procurement has been declared to be in serious breach of contract for failure to perform its contractual obligations.

x. Any organization modification

ITEM 7: TERMINATION BY CONTRACTOR

7.1 The contractor may, after giving 30 days notice to TKMP, terminate the contract if TKMP:

i. Fails to pay the Contractor the amounts due after the expiry of the deadline stated in the Payment Schedule or agreed works table;
ii. Consistently fail to meet its obligation after repeated reminders;

ITEM 8: FORCE MAJEURE

8.1 For the purpose of this Article, the term 'force majeure' means strikes, lockouts or other major disturbances such as storm, flooding, war civil disturbance and other similar unforeseeable events, which are beyond the Parties control.

8.2 Neither party shall be considered to be in default nor in breach of its obligations under the contract if the performance of such obligations is prevented by any event of force majeure arising after the date of notification of award or date when the contract becomes effective, which ever is earlier.

8.3 If circumstance of force majeure have occurred and continue for 180 days then notwithstanding any extension of time for completion of the contract that the Contractor may by reason thereof have granted, either Party shall be entitled to serve the other with 30 days notice to terminate the contract. If, on the expiry of the period of 30 days, the situation of force majeure still applies, the contract shall be terminated and, by virtue of the laws governing the contract, the Parties shall be released from further performance of the contract.

ATTACHMENT A

Moko Technical Services Quotation dated 23 February 2017

MOKO TECHNICAL SERVICES

Email ; mokotek 2010 @ gmail.com

23rd february2017

Hi Mr. Olita and Mr. Greg thanks for your continous dedication on this project;

Please find a revised and knockdown quotation to construction of Tinga Kamieno water pan. This is a follow up of a series of negotiation meetings between I and Mr. Olita to reach out to achieving a pan capacity of 16000 m3. The construction entails making a retention wall 3.5 m high and maintaining a freeboard of 1.5m., making of a spillway of 20m. span, making of a silt trap and needful destumping and compaction of the wall and excavation of the pan floor to a depth of 2m. at the centre.

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3.	Diesel fuel	Lts	400 lt/day x 23days =9200lts	90	828,000
4.	Oils and lubricants	sum	20% of fuel cost	sum	165,600
5.	Operator cost	days	23 days	3,000	69,000
6.	Engineers ' cost	days	23days	15,000	345,000

SUB TOTAL **ksh. 3,171,600**

ADD 15% Tax **ksh. 475,740**

GRAND TOTAL **ksh. 3,647,340**

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Organisation:- MOKO Technical Services

Registration Date:- 7th May 1991 under cap 409 no. 16115

Bussiness Location:- Plancom House –KISUMU,& at BONDO lower milimani

Moko House

Pin Certificate:- PO51186030R

Bank:-	EQUITY Kenya, A/C no. 0750293258010
E mail address	mokotek2010@gmail.com
Contact person	Aggrey Odeny
Telephone	0713443484
Licenceas a contractor	No.WD/DB 400/224 dated 7th june 2006
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Referee	1. Mr. Charles Olang 0721375685 Sub county water & irrigation Officer 2. Felix Tebangura 0722831131 County Agrcultural Engineer

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TWEED
SHIRE COUNCIL

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