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RAPPORT DE MISSION

Subject: **UGANDA WASH RO Mission (Nakivale and Rwamwanja sites)**
Auteur: **Jerome BURLOT (WASH Adviser/RO Nairobi)**
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Main partners and visited sites list:

The mission was accompanied by Filomena Santoro (Country TA Kenya-Uganda) and Eunice Maina (County PA Kenya-Uganda).

The entire visit was accompanied by:

- UNHCR: Juliet Ojeo Mbwesa (WASH Specialist and acting Burundian-Congoleses response focal point)

Nakivale:

- ARC: Jean Baptiste Ntirenganya (WASH Field Officer)
- UNHCR: Barry Nouhou (Acting head of sub office of Mbarara and Head of sub office in Kyaka II)

Rwamwanja:

- LWF: Nelson Kiige (WASH Officer)

Kyaka II:

- DRC: Sunday Anyanzo (WASH Officer)

Appendices list:

⇒ *Factsheet Nakivale settlement*
⇒ *Factsheet RWAMWANJA settlement*
⇒ *Factsheet Kyaka II settlement*
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⇒ WASH strategy: COP WASH working group presentation

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1. EXECUTIVE SUMMARY

During the mission two main sites have been visited: Nakivalle, site gathering Burundian and Congolese as well as numerous others nationalities and Rwamwanja also gathering Burundian and Congolese refugees mainly. Those two sites are mixing up old case load with new arrival.
The mission end up with the visit of Kyaka II, old site plan as contingency area in case of mass influx of refugees (the election in DRC and the frozen crisis in Burundian could trigger huge displacement of people).

For long time, the refugees policy in Uganda is very particular when it comes to the right given to the refugees. The Uganda government does not want camp to be implemented, rather they foster the implementation of settlement composed of villages with access to land for agriculture. The access to land ensures a bit of self-reliance for the refugees and enables as well to increase the local food production.
The fact is that all the sites selected for the refugees are totally undeveloped area where in most of the case all the infrastructures have to be implemented by humanitarian partners/funds, not only for the refugees but also for the local/national population living around the settlement.
Following this policy, the site are very spread out, with an average of about 80km2 for a population of about 80 000 to 120 000 people. The living habitat is pretty scattered with very few dense villages and numerous small hamlet/village.

Regarding hygiene and sanitation (human excreta management), such dispersed living habitat has a positive impact as not dense and then there is less routes of disease transmission. Following this statement, strategically (limitation of fund) the partner's investment in hygiene and sanitation is pretty limited, when new arrivals still need support with regards to sanitation (latrine) especially PSN.
Actually, such settlement configuration brought one of the main response challenges when it comes to water supply system (number of equipment necessary; length of pipeline…). Whether in most of the old case load villages the water ratio is quite adequate, the WASH actors struggle to maintain such level of service. In addition to that, the level of needs for the new arrival remains pretty high.

In Nakivalle, the ground water is more than limited only few BH have been positive and provide very low water quantity through hand pump. Few shallow wells with highly polluted water are also in used, normally only for domestic purposes. The main supply comes from surface water, which means need of treatment and high operating cost.
In Rwamwanja, there are no surface water resources and the ground water is in most of the case not suitable for motorized system (*less than 2m3/hrs*), then almost only hand pumps have been installed. Though, it is very tricky to ensure the supply of such population with mainly hand pumps. The partners try to enhance the groundwater prospection as few BH even still with low yield (*about 4-5m3/hrs*), could be motorized and equipped with storing capacities to supply more population through a pipe network.

Actually, the limitation of funds for Nakivalle, being even more limited for Rwamwanja, is also one of the main challenges (to don't say the main one) encounter by the partners on the ground. This situation becomes even more of concern, as the way partners had cope with the shrinking of funds so far reach its limits nowadays. The two mentioned sites are old sites (Nakivalle was open in the 60's) which have been reopen to uptake the new arrival from DRC and then from Burundi. The partners being limited by the funds had struggle to adapt the water supply system to each new influx meaning the new water demands, by adding equipment to the ones existing. The problem is that today this way to develop the infrastructure is not relevant/feasible anymore. The continuation of such approach will rocket sky the operating and maintenance cost of the system with clear depreciation of the quality of service.

In addition to the need to cope with new influx of refugees and have some contingency capacity, there is a strong need today to rationalize the water supply system: replace or add some new type equipment; to modify part of the set up; and to fine tune for instance the water treatment… Thus, there is need to increase the level of investment. In the meantime, this investment should enable to substantially decrease the operating (fuel, consumable...) and maintenance (lifespan of the equipment…) costs of the water equipment. The level of user's contribution should also be pretty improved in the meantime.

The level of performance of the partners, taking into account this context, is quite acceptable with some very relevant input and output. Some of the WASH actors have demonstrated appreciable resourcefulness and attempt to solve issues in a cost efficient manner and with creativity. In addition to that, the partners tried to work with professionalism (technical documentation in Rwamwanja for instance…), they have been very open to discussion; they most of the time acknowledges their failure and they try to learn from their mistake.

Nakivalle and Rwamwanja, given the current context and the high risks of new important influx, as well as the level of achievement and commitment from the partners, should get more support in order to:

- make the sites more viable and the vector control better managed
- the service more rational and sustainable
- the response less costly (operating and maintenance cost)
- ensure a minimum of necessary contingency in case of new influx

2. BACKGROUND:

History of the settlement, profile of population, response sectorial outline: see factsheet in appendice

Gaps identification, problem analysis cost estimation and planned activities: see water problem analysis sheet

Level of service per settlement: see indicator matrix in appendice

WASH strategy: COP WASH working group presentation in appendice

The main technical challenge for the WASH sector in addressing the need of people is coming from the water supply sub sector. Actually, the scattered settlement and the limitation in ground water resources make the water supply response very complex and very costly. In the meantime, such scattered set up facilitates people resilience and mitigates the public health hazards. Thus, the sanitation and hygiene promotion issues are much less a concern, and community approach should be more effective.

Out of that, the main general challenge encounter by the partners is the limitation of fund, which also had some positive impact by fostering creativity, community contribution and cost efficiency.

Whether the indicators notably in terms of water availability per capita do not look alarming for the settlement as a whole, the level of service within the settlement can be totally different from one location to another. Then, it is important to consider disaggregated data per sites/villages within each settlement. For instance in Rwamwanja, the Mahega villages/sites get only 6 to 8L/pp/day when the overall for the settlement is close to 15L/pp/day. In addition, the Mahega population needs to walk about 10km go and back to fetch water at the closest water point.

3. CAPACITY OF THE PARTNERS:

UNHCR and IP's (ARC, DRC, LWF):

The UNHCR WASH focal point for the Congolese and Burundian response demonstrates quite good proficiency in WASH in general, as well as strong commitment in her work. She has an impressing workload on her shoulders but still quite aware about what is happening in the field. Unless she could answer a question, she quickly found a way to get the requested information.

She is very resourceful to deal with the funds constraint in planning activities for such challenging surface area of settlement.

UNHCR work with WASH implementing partners:

- ARC in Nakivale
- LWF in Rwamwanja
- DRC in Kyaka II

The level of proficiency and achievement of the IP's are variable from one actors to another but in general let say that it is more or less adequate considering the context, unless it comes to more technical field such as solar direct pumping system, hydraulic and water treatment. The implementing partners are quite limited in terms of strategic thinking and planning forward the response. In the meantime, taking into account the environment (very spread and scatter settlement) and the limitation of funds, the overall level of achievement can be consider satisfactory.

The partners in general have demonstrated some relevant achievement and output in: trying to reduce the cost of the response; in promoting community contribution and then limitation of the level of dependency from the relief; as well as in adapting response to the situation and in learning from what they do.

To balance the lack of technical proficiency of the current implementing partners in assessing and designing water supply system, UNHCR had relied efficiently on Water Mission only on this aspect of the response and in technical training. Especially compared to others WASH actor in general in Uganda, Water Mission demonstrates good proficiency and professionalism, even of course there is still room for improvement.

LWF: on the field LWF was able to produce a relevant bench of technical document highly appreciable (*mainly issued by water mission*). The proficiency in solar by the staff on the field seem quite low, when apparently at country office they have a relevant technical capacity.

ARC: when the WASH specialist demonstrates clear commitment for his work and strong presence on the ground, his proficiency especially in terms of water treatment was quite weak. Otherwise, his knowledge about the response and its history was quite good. The level of technical documentation on the field was too low; in the meantime the coordinator was not present during the visit.

DRC: the comments are more or less the same for DRC WASH staff than for ARC. Good knowledge of the response, some relevant technical documentation (*but still need of improvement*), an appreciable attempt to think forward and find more durable solution. The level of funds for DRC being very limited especially for this old settlement (*did not get new arrival, but some space are planned as contingency in case of others sites reaching their hosting capacity*), their focus is on water supply.

4. MAIN FINDINGS AND ISSUE TO FOLLOW UP:

4.1. NAKIVALE settlement:

4.1.1. Water supply:

The settlement gather about 104 000 refugees living in an 80km2 space area, and then 40 000 individual from the national population surrounding the settlement also benefit from most of the services offer to the refugees. The settlement includes few concentration habitat spot and then 86 small villages or hamlet scatter within the perimeter.

The spread out of the living habitat implies many water equipment or centralized pipe network with very long length of pipeline. Thus, the water supply infrastructures become quite expensive in terms of initial but also in terms of operating and maintenance cost.

In addition to that the groundwater potential is pretty low in the area. In the settlement, there are 55 hand pumps, numerous shallow wells with poor water quality and yield, and only 2 motorized BH with low yields. Several small lake or water ponds can be found within the settlement area as well. Thus, to cover the demands of water about 4 water treatment plants have been implemented next to those lakes/water ponds. The treatment is basic coagulation, decantation and chlorination but no filtration. Then, after treatment the water is pumped up to an elevated tank (using the topographic potential) and distributed from it by gravity to the water point.

UNHCR has promoted the rain water harvesting to decrease the operating cost. Although, there are still some areas and few schools supply by water trucking. 2 water trucks operate in the settlement and about 2760 m3 of water is trucked per month. One truck is private and cost about 23M UGX (about 7000USD) for 1400m3. And the others truck is UNHCR owned and operate by a partner; it costs 2,4M UGX (about 750USD), for 1360 m3. So, the private truck cost about 10 times more than the one own by UNHCR. The payback period for instance for the purchase of a new truck based on those assumption would be about 1year, for a truck cost of over 40 000USD.

The setup of the water treatment plant and pump stations shown a lot of default or wrong sizing of equipment. This situation is coming from the necessity to adapt the production to the influx of people, difficult to predict.

Actually, and it is one or the main problem for the partners to ensure appropriate and cost efficient response, the partners were trying to cope with the various influx of population along the years by, due to the lack of fund, just adding more equipment (e.g.: for instance instead of to change a pump into bigger one, they will add a new small pump to work in parallel, …). The problem is that such approaches have limits that have been reached now.

Nowadays, there is a strong need to upgrade substantially all those centralized system. The restrictions of fund have bound the partners to plan properly, the development of centralized hydraulic equipment, as there is need of an initial substantial investment. The problem is that now the system cannot by extend without implementation of additional equipment and replacement of some of the existing ones to ensure a rational set up and operating of the water supply system. This need is coming with high investment need (LRRD?). Such investments should enable the partners to improve the level of service, and make substantial save on the operating and maintenance cost of the centralized water equipment.

Water treatment plant (WTP), pump and booster station:

- The O&M[1] cost of the centralized system is pretty high notably due to inappropriate set up and control

[1] Operating and Maintenance

- The quality of treatment is low. The water after decantation remains quite turbid and even small floc can be found in the water. This issue affects the quality of water produced and increases the quantity of chlorine necessary to ensure adequate free residual chlorine.
- Because of the lack of appropriate mixing system for the coagulant, the consumption of Al2SO4[2] is pretty high which clearly impact the operating cost of the system
- Because of a lack of appropriate setup of mixing chamber, contact tank and decantation being the same facilities, the treated water quality is clearly sub-optimal and the fact that many flocs are pumped into the pipeline. This situation implies higher consumption of chlorine than necessary, as the flocs with react with the free chlorine.
- In some of the WTP the raw water is pumped until elevated facilities to be treated and then pump up again until an elevated storage tank. Normally, the raw water pumping should the minimum. Actually, the raw water should be treated close to the intake and then pump up to a an elevated storage facilities, as the raw water content dirt that can affect the lifespan of the pump and then the raw water have more density than clear water, which means raw water need more energy to be pumped.
- At the booster station, there are 3 pumps and a clearly under sized generators. Two of the pumps in used are pumps with speed variator/controller, then they can be started despite of the generator size issue but they work at an inadequate level of performance with low efficiency (*need more fuel for less performance*).
- Problem of energy supply: the 1st and bigger treatment plant visited had 3 generators, 2 of 33kVA and 1 of 100kVA (backup). The 33kVA generators are now undersized for the current level of production expected from the plant. When one pump is running, it becomes very tricky to start the 2nd one, and then even more difficult to start the extraction pump (1st pump on the line). Then, to cope with this issue, the operators need to overexploit the 100kVA generators (18hrs per day) with consequence on the fuel consumption.
    - The ***good point*** is that: UNHCR for the bigger plant extend the electrical grid (about 30 000USD) and setup a 50kVA transformer (a bit undersize to cope with potential production increasing if more population to be supplied) at the pump station location. UNHCR planned to phase out the generator before the end of April. The ***new energy supply will enable to decrease the cost of energy per more about 3*** compare to generator supply (from 200USD/day to 65USD/day roughly).

Water supply network, storage tank, water point and water quality monitoring:

- The setup is well done in a way that the distribution of water is made by gravity which is the most cost efficient way. Although, there is needs to improve the level of hydraulic calculation as the pressure is given by gravity which means that topographic survey and calculation have to rigorously be performed to ensure appropriate regulation of the system (fair supply of every water point).
- The water supply network (made of HDPE pipe) seems to have been properly implemented.

[2] Aluminum sulphat (coagulant)

- The storage tanks in PE need replacement (some already blow up and many get leakage…) as some are used for almost 10 years. UNHCR start the renewing of those tanks, which are replaced by more permanent concrete structure.
- In some location, fees collections (about 500-1000UGX/month, very limited) have been started by the community at least to ensure payment of the care takers. There is no formalization of that system.
- The planned water supply of Mahega village (closest water point 5km) which could supply along the way potential area for new arrival can be achieved in two ways: extension of existing centralized system or implementation of a new treatment plant with a separate water supply system. Economic analysis has to be performed but the first option is usually the most appropriate for two reasons:
    - economy of scale as the cost of the service should be lower as share by more people,
    - it is easier in terms of management to have less system to control and to supply
- Given the surface area of the settlement, the standard for water point distance is 1km.
- The water quality monitoring at water point and at HH level is not formalized. Only one person (with two or three assistant) is performing it for the whole settlement.

4.1.2. Sanitation:

Only PSN get support to build their latrine through the community service: materials and labor (same for shelter). The latrines are mainly family share and HH[3]. Only the slab and 4 poles are given as subsidy. Nowadays, given the limitation of fund, only new arrival get support for latrine construction:

- They got plastic sheeting, pole and slab for the communal latrine upon arrival;
- and then only slab for the family share latrine.

As the latrines are supposed to be built by the communities, the quality level of achievement is very variable from one facility to another. This type of approach is highly appreciable as it reduces the dependency to the relief and ensures good cost efficiency of the response. Nevertheless, with regard to the quality of achievement, it is crucial to implement a rigorous, regular and systematic monitoring to ensure stability of the equipment and no risk to harm.

The main findings for the visit are:

- Whether it is mentioned a latrine coverage of 65% as average for the settlement, regarding the water access this indicator can varies a lot from one village to another. In addition to that, the

[3] Household

ratio presented does not take into account the status of the latrine: hygienic or not; close to be filled up or not; use or not use; etc…

- The PSN latrines visited were adequate and cost efficient (about 170USD/stance)
- In the dense habitat such as base camp (kind of economic center of the settlement), the population made their own design of latrine based on what they used to do in their place of origin. It is mainly aside pit latrine. When the pit is filled up, they make a new one and then move the structure.
- As the settlement is pretty spread out and living habitat scatter, the risk in terms of public health due to sanitation issues is clearly mitigated. Then, the settlement situation in terms of sanitation did not show high level of risk.

4.1.3. Hygiene promotion:

The hygiene promotion strategy used to be based on the VHT (Village Health Team) approach foster by the government. The good point of such approach is that it is cost efficient in a way that the same pool of hygiene/health promoters is used to address hygiene, nutrition and health promotion campaign, and implement related activities.

However, according the partners the approach in Nakivalle did not produce relevant output/results. Then, the hygiene promotion team tries to implement an approach inspired from PHAST and then create the PHAST group to better interact with the communities and to have more formalized activities coming with.

Still the new approach (PHAST group) has shown lack of targeting, lack of adaptation, and lack of sustainability.

4.2. RWAMWANJA settlement:

4.2.1. Water supply:

In Rwamwanja, the water supply is mainly based on groundwater resources. Rainwater harvesting equipment have been also implemented at most of school or health center locations. The equipment are more or less properly design and installed.

The main problem in terms of water access is that the groundwater resource potential is very limited, and most of time only hand pump can be installed. This situation means need to achieve numerous water equipment and then BH[4]. As one borehole equipped with hand pump cannot supply more than 300 people per day (500 pp in emergency). Few BH with a bit better yield have been upgraded to motorized pumping and water network equipped with storage tank have been implemented. The motorization of BH is still ongoing in order to limit the number of BH to be implemented to supply the refugee's population.

[4] borehole

In the meantime, it is important to note that the dynamic of the local aquifer is not known. Very few features with regards to the aquifer have been identified. It seems that the aquifer is not homogenous and most of the storages are fractured. This means that, it is crucial to rigorously monitor the ground water table to avoid depletion of the ground water which could lead to serious consequence with regards to the water supply of the refugees.

Once again, the spreading out of the settlement makes the water supply pretty challenging. In addition to that, there are no map which could enable the water specialist to plan properly the distribution of the water equipment according the density of population. In such situation, the partner can only work step by step and then need to keep some flexibility in design and implementation of water equipments to adapt it to the effective demands/frequentation notice when water points would be commissioned.

Three hybrid (using fuel and solar energy) solar powered direct water pumping systems have been implemented on the morotized BH. The levels of their management were very different from one place to another. There is no clear instruction (level of power output) about when the energy supply needs to shift from solar to fuel. The management of the equipment and then the resources needs in general to be clearly improved.

The log book and parameters monitor have to be enhanced in a way which enable to monitor the percentage of solar and generator use and then better estimate the economic added value and payback period for the solar asset compare to stand along fossil fuel generator.

It is important to better assess the ground water potential when it comes to motorized equipment to ensure also selection of appropriate technology to get more chance to match the demands of the targeted population, based on potential of the resource. It is clear that pumping using solar energy is not the best way to ensure optimal abstraction of the ground water resources, especially when the aquifer has a limited potential. Then, the ground water resources being quite limited, the relevancy of solar powered direct pumping technology should be clearly assessed to ensure that it is the most technical and economic way to match the demand of people.

The distribution of water for the motorized system is done by gravity (*good point*). Then, it is important to ensure appropriate hydraulic calculation and thus water supply of water point when designing the network.

Chlorination occurs at motorized BH. The problem is once again the chlorination system is not adapted to solar pumping (*variation of flow rate along the daylight*).

The partners on the ground provide relevant technical documentation about the equipment implemented and their O&M (*highly appreciable in such context of resources limitation*).

The level of supply is more of concern in the last villages implemented. For instance, when the average water availability per capita is about 14,6L/day for the whole settlement, it is only 6 to 8 L/pp/day for the village so called Mahega.

The partners are trying to implement a fees collection system to ensure user contribution to cover at least operating of the equipment (*and maintenance for the hand pump*).

The level of communities' involvement and organization remains at concern and need improvement notably at strategic level.

The host communities (*about 30 000pp*) benefit as well from the water supply.

4.2.2. Sanitation:

The drainage needs is yet to be properly assessed. The UNHCR site planner was supposed to visit the settlement the week following our visit. No serious sign of erosion have been noticed during the visit as the vegetation cover is still important.

The latrine are family share and very basic, the support and level of subsidy being quite limited. Only new arrivals are supposed to get some poles and slab. IOM gets some fund to implement iron sheet for roofing and door (*to check that it is not for the whole shelter*). By principle, the shelter of the latrine should be made of same materials as the shelter for living, for sake of coherency.

The level of achievement of those latrines (*made by the user*) has showed large quality variation from one to another. This problem related to latrine completion lead to some issue related to stability of the slab/pit and privacy. The privacy issue is less at concern as the latrines are usually close to very scatter HH. The stability of the slab should be ensured by supervision/monitoring from the partners (*risk related to the rainy season should also be identified prior to rainy season*).

The configuration of the settlement contributes to efficiently mitigate most public health threat due to sanitation issues.

The PSN latrines are made of wood floor, mud wall, iron sheet doors and roofing and equipped with seat. The level of achievement in the context is proper and quite cost effective (170USD/latrine).

4.2.3. Hygiene promotion:

The positive point of hygiene promotion is that partners mutualized the resource to achieve both health and hygiene promotion. The partners try to be innovative and implement the model home approach in about 30 HH, though only 4 HH were from the refugee's communities.

The approach is relevant but its implementation should be clearly improved to have more focus on the refugees and to propose solution that affordable for them. Some of the improvement made in the model home visited by host community would not be affordable for the refugees.

4.2.4. Miscellaneous:

The lack of access road is at concern.

4.3. KYAKA II Settlement:

4.3.1. Water supply:

The water supply at Kyaka II is the less problematic among all the settlement visited. There is ground water potential, surface water and spring.

In Mukondo village (*one of the main area in case of new arrival*) there is a spring catchment made by DRC. The visit of the water equipment demonstrates clearly that it is under used. The exploitation of spring water can be enhanced and it is actually plan by the partners. The spring water catchment could be extending until the health center and protection house with implementation of a pump station. For the time being, this health center is supplied by water trucking.

The water consumption made us suspicious about the reliability of the figures of 2500 inhabitant in Mukondo (*seem to be much less*).

Still few locations, as also the transit center are supplied by water trucking, tapping surface water coming from a dam and treated with coagulant (*but in an improper way which make very difficult the quality control*).

4.3.2. Sanitation and hygiene promotion:

Not monitored

5. RECOMMENDATIONS:

5.1. Water supply:

- Prior to any implementation of gravity water network, appropriate hydraulic calculation should be performed.
- The involvement of the communities in the O&M of the equipment and their financial contribution should be clearly improved. There is need to build a capacity building strategy for the users to be as much as possible in charge of equipment O&M.
- The water quality monitoring component has to be improved and formalized.
- Any technical solution selection should come with an economic analyze integrating the O&M various requirement.
- By principle and in general in the context, it is more relevant to extend an existing system rather than to build a new one with new water intake, treatment plant, network for a sake of economy of scale (as extension means more user to share the O&M cost, though the initial cost might be higher …) and as it is more easy to control and supervise the system. Although, potential of extension of every component of the existing system should be taken into account and appropriate economic and technical analyzes should be performed in any case.

- Log book and copy of technical documentation should be available at every treatment plant or pump station.
- In certain case, for instance very remote small community with unsafe surface water access, water supply strategy could focus on HH level (according economic analyses) promoting adapted HH water treatment solution such as: ceramic filter eventually accompanied by a bio sand filter to ensure pretreatment in case of turbidity peak or water boiling…

Specific to NAKIVALE:

- The way to mix coagulant and raw water has to be clearly improved to ensure cost efficiency (not over use of the coagulant) and appropriate mixing.
- Upgrade the water treatment plant to make optimal the dosage of coagulant and chlorine, and as well to ensure that the outlet of the coagulation/decantation tanks is made by overflow to avoid presence of flocs in the outgoing water.
- Assess technical and economic relevancy to fine-tune the water treatment process with implementation of a slow sand filter or ultra-filter after coagulation.
  The fine tuning of the process should enable to make substantial save on the chlorine and coagulant consumption and then on the operating cost.
- The set-up of pumps and generators have to be investigated and correction in accordance made, in order to ensure rational use of the equipment, optimal level of performance and ensure cost efficiency of the energy used.
- The treatment of water should be by principle close to the water intake to minimize the pumping of raw water usually denser and more load with particles which can in time damage the body of the pumps.
- The use of electrical grid as energy resources started by UNHCR should be fostered when economically viable.
- The water trucking using a private contractor being about 10 times more expenses than operating the UNHCR truck. If still need of water trucking for long time, the purchase of a water truck should be envisaged with appropriate solution for hand over.

Specific to Rwamwanja:

- Implement a water point frequentation survey in order to be able to identify the most crowdie water point and plan in accordance the development of further infra-structure (given the lack population density map).
- Ensure appropriate monitoring of the use of fossil fuel generator, solar array or grid with water pumping is performed with an hybrid system. The use of each source of emergency should be recorded with the water production and the time in accordance, as well as fuel consumption for generator.
- In a context of ground water limited potential (and knowledge), in general the solar energy is not the source of energy enabling optimal exploitation of the water resources (*the pumping rate cannot exceed the safe yield of the BH and the flow rate variation along daylight…)* . Then, the relevancy of use of solar powered direct pumping and hybrid system should be demonstrated

both technical and economic wise. In case of use of a hybrid system, the payback period should be estimated based on realistic assumption of solar potential along a year. In general, when the solar pumping represent less than 30-40% of the pumping production, it is not relevant to implement solar direct pumping technology.

Specific to Kyaka II:

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5.2. Sanitation:

- The monitoring of latrine status (functional or not, stable or not, hygienic or not, …) should be implemented in order to have a more accurate overview of the latrine access situation and then facilitate their management. Specific assessment should be performed as contingency measure prior to the rainy season to ensure stability of the structure and "minimum" risk of overflowing of the pit in the habitat.
- The supervision of new arrival communal and then family share latrine construction should also be enhanced to ensure appropriate completion. This supervision could contribute to improve the capacity of the refugees to build and manage their facilities.
- The lifespan of the construction materials use to build the latrine should be assessed and users inform in accordance.
- The capacity of the refugees to ensure appropriate decommissioning should be built notably through work shop and field supervision.
- By principle, the latrine shelter should be made of same materials as for the shelter for living for sake of coherency.

5.3. Hygiene promotion:

- In general the hygiene promotion component need to be more dynamic, better targeted on issues noticed within the settlement, creative/innovative and participatory
- The activities and tools use for hygiene promotion should be design, tested and adapted with a representative sample of the target population.
- The use of awareness notice board should be fostered at strategic location (water point…).
- The training of the hygiene promoter should enable identification of the strongest element who should be promoted as focal point and relay for continuous field training. Regular refreshing should be organized integrating debriefing from the hygiene promoter and focusing on practices. The training could propose two or three different level to reach to ensure that strongest element keep motivation and increase the involvement of the targeted population in answering their own needs and manage their life with limited dependency from the relief.