Recharge Techniques and Water Conservation in East Africa

Up-scaling and Dissemination of the good practices with the Kitiu sand dams

POSITION PAPER AND PROJECT PROPOSAL

SASOL Foundation

Field Office LIASON
Po Box 85
Kitui
Kenya

email sasol @kenyaweb .com

Acacia Institute

Vrije Universtiteit Amsterdam
Faculty of Earth and Life Sciences
De Boelelaan 1084
1081 HV Amsterdam
The Netherlands

Email a.tuinhof@acaciainstitute.nl

1.

BACKGROUND

Storage of water to bridge periods with low rainfall and dry rivers is a key element in securing water supply to rural and urban populations. This is particular the case in semi-arid and arid regions outside the reach of perennial rivers and where there is no groundwater available. Storage needs are sharply increasing due to growing population and water demand, catchment degradation and changes in climate variability. Provision of sufficient storage capacity will be main challenge for water managers in reaching the Millennium Development Goals

Water security for urban water schemes may include alternative options such construction of dams, long distance conveyance of water or desalination. For rural water supply such solutions are generally too costly and complicated. Storage provisions for rural water supply require low cost systems with easy maintenance that can be constructed and operated with a high degree of community involvement.

Water conservation (or water harvesting) techniques are known since ancient times in arid and semi arid regions for example in the Middle East (ACSAD, 1998). Also today there are numerous examples of rural communities, often with the help of NGO's and local water authorities, which have developed such systems in many countries. These systems include a variety of recharge and storage techniques and include both rainwater harvesting and conservation of surface run-off through (direct or indirect) groundwater recharge (IAH, 2002).

Although based on the same principle, the technology used in different countries or regions is generally adapted to the site specific (hydro-climatological and socio-economic) conditions. This is also reflected in the different names used in different regions for almost similar technologies (Appendix 1, IAH, 2002). Regardless the name, small scale water saving structures have in common that:

- adaptation to the local conditions and circumstances is an important element for the success of these community based systems
- often no use is made of existing good experiences in areas with comparable conditions (reinvention of the wheel effect) because :
  - in areas where water conservation schemes are developed there is generally no incentive to explore if use can be made of experiences elsewhere and
  - in areas where good practices exist, there are generally no triggers to disseminate these experiences

- community based water conservation systems are generally cost effective but serve a small number of families (20-50).

The significance of the Sasol experience in Kitui (Kenya) is the approach to construct sand dams in cascades and so providing a substantial source of water in one catchment to serve a large part of the population with for drinking and for small scale productive use (livestock watering, small scale irrigation)

This project is an initiative to use the experiences in Kitui as a case study to upscale the construction of sand dams in other parts Kenya (including in Kitui district) and in the surrounding countries. The challenge is to develop an effective strategy to accelerate the construction of the systems without affecting the community based approach. Such a strategy should be based on an exchange of existing experiences and the dissemination of good practices.

2.

THE KITUI SAND DAMS

One of the successful examples of a rural water conservation programme is the construction of sand dams in the Kitui district in Kenya . This programme is a co-operation between the community and the Sahelian Solution Foundation (SASOL). SASOL, founded in 1990, assists Kitui communities to address household and production water scarcity through the sand dam technology.

The planning objective was to shorten the distances to water sources king w km to nstruc dams nning s con torage lation.

Photo impression sand dams in Kiiundu river

3.

PRJECT OBJECTVE AND APPROACH

The overall objective of this initiative is to contribute to scaling up of community based small water supply schemes in order to reach more consumers but without affecting the principle of the community based approach.

This proposed programme intends to thoroughly evaluate the experiences of Sasol in the last 10 year (component 1) and use it and as input in a seminar (component 2) that will result in action plans for construction of these systems in other regions in Kenya and the surrounding countries (component 3 and 6). The workshop will also feed SASOL with information on the establishment of sand dams management groups (component 4) and on long term monitoring requirements (5). The coordination is with Sasol and the Acacia Institute (component 7).

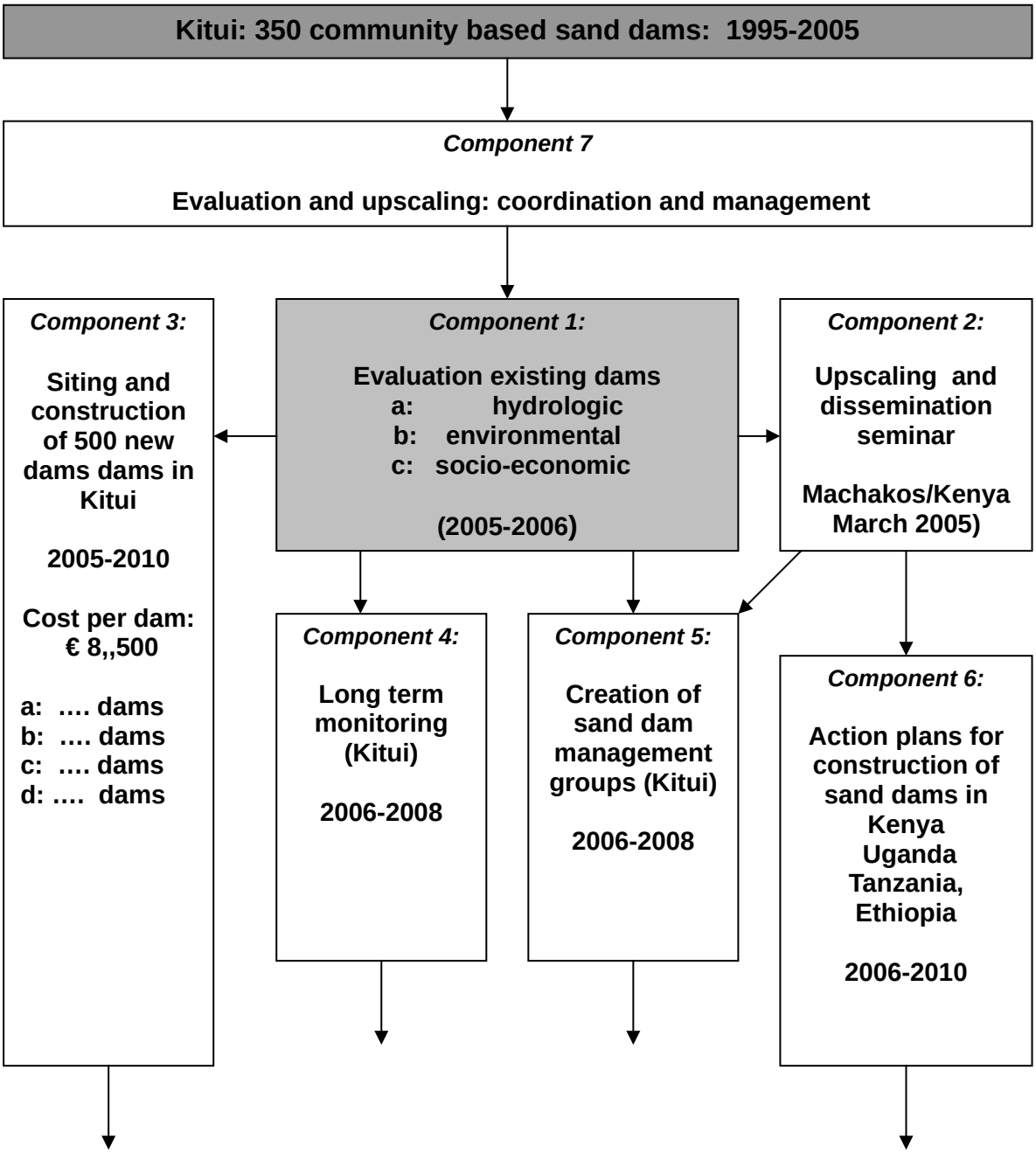

Figure 1 : Overview of programme components and sub components

3. PROJECT COMPONENTS

Component 1; Evaluation of the Kitui dams

The functioning of the current sand dams and its positive impacts are confirmed by SASOL through their internal evaluation and monitoring system. The different papers produced by SASOL clearly illustrate the positive impacts on poverty alleviation, income generation and health. But with completion of over 350 dams and the planned upscaling with another 500 dams, there is a need for a comprehensive hydrological, environmental and socio-economic evaluation. This evaluation will focus on the Kiindu basin in which 35 dams have been constructed, all of which are mature.

- The hydrological evaluation (component 1a) will include a geophysical survey and a monitoring campaign of at least one year and verify how much water is stored behind the dams (and its seasonal fluctuation) and how far the groundwater has migrated in

the river banks. The hydrological evaluation will also quantify the effectiveness of the cascade approach and shine light on the question how much run-off water is intercepted and what the changes are in the down stream river flows. The quality component of the evaluation will focus on the natural water quality and its changes during storage.

- The environmental evaluation (component 1b) will make use of data already collected by Sasol over the years. The use of satellite images would be useful be conducted according to international EIA guidelines and include an evaluation of the water quality, its pollution hazards and possible pollution protection measures. This evaluation will also include a assessment of the functioning of the dams under different climate change scenarios
- The socio-economic evaluation (component 1c) will collect complementary field data to quantify the socio-economic impacts on household/village level as well as the impacts on the District level. This will involve detailed sampling of the dams in Central Division of Kitui on a catchment-by-catchment basis to establish economic impacts at the individual, household and community levels. The mission will be led by Prof. Rempel of Manitoba University and is co financed by MCC and CFGB.Please add the mission in June

The evaluation will be carried out in 2 phases:

1. Dutch and Kenyan students will carry out the fieldwork and data collection (+ evaluation) and produce status documents (June-December 2005)
2. an team consisting of 3-4 senior (Kenyan and international) experts will use this material to carry out the final evaluation and recommend on lessons learned and main issues for upscaling (January 2006). This evaluation reports will be a main input for the upscaling and dissemination seminar and be an important background document to justify the investments in upscaling of the sand dam construction in the Kitui District ad adjacent districts.

Component 2: Upscaling and dissemination seminar

The good practices and generic elements from the SASOL experience as concluded be the evaluation will be an important input in the workshop aimed to initiate similar programmes by NGO's in other provinces in Kenya and in the neighbouring countries and to develop promote the construction of sand dams becomes part of the national water resources management strategies. The workshop could also be used to share experiences with countries outside the region and to establish a global sand dam network. Details of the proposed workshop are given in Appendix 2. The proposed timing is March 2006 which is a dry season in Kitui and hence a suitable time to demonstrate the functioning of the dams to the participants of the seminar. When held in the first half of March 2006, the outputs can also be reported to the 4th WWF in Mexico.

Component 3; Construction of 500 new dams in Kitui

SASOL has the intention to scale up the activities in the Kitui area with the construction of 500 new dams. The proposal for this new construction phase is under preparation (Appendix 2). The funding for this new phase could come form different financing sources as its implementation can be planned in batches. The total duration of the project is expected to take 5 year. The unit cost for one dam includes the overhead cost for Sasol (expansion of the field office, transport, logistics) and the cost for siting of the new dams. The siting of a number the new dams require a geological and hydrogeological

reconnaissance study as they will be constructed outside current stream beds into ancient (burried) river beds.

Component 4: Establishment of sand dams management groups

One of the plans of Sasol is to establish sand dam management groups in order to optimise and manage the use of the available water. The intention is that these groups manage the water in 10-15 dams in one river bed. Details of this component are still to be worked out.

Component 5: Long term monitoring

One of the needs for sustainable operation of the dams is a long term monitoring plan. A needs assessment of such a plan will follow form the evaluation study

Component 6; Action plans for sand dams construction in the region

These action plans will be a main output of the seminar. A framework for these plans will be prepared on the basis of the evaluation and serve as an input in the seminar.

Component 7: Overall coordination and management of the programme

The different components of the programme will be financed by different organizations (section 5). Even within one component there can be different financial sources. The overall coordination by Acacia and Sasol will ensure that the specific requirements of different funding agencies are followed (reporting, financial, monitoring) while safe guarding the consistency of the programme, the timing and planning of missions and the information transfer to the different partners.. The intention is to provide a periodic progress reporting through a short newsletter distributed by email and for publication on existing web sites. (a.o NWP, Acacia Institute, SASOL).

5.

COST ESTIMATES AND FUNDING SOURCES

The cost estimates for the project components are given in Appendix 2. The projects will be managed by SASOL and Acacia and implemented with the help of third parties. Both Acacia/IVM and SASOL have a limited budget available for the implementation. Table 1 gives a summary of the total cost, our contribution and the remaining funds to be covered. The costing of project components may be redefined or phased depending on the type of financial support that is received

Table 1 Project components and financing

Component	**Coordinator**	**Total cost**	**Contribution from other sources**
Evaluation existing dams: student Expeer	Acacia	140,000	Acacia/VU: students/equipment: 15,000 SASOL: accommodation 5,000
	Acacia	70,000	

t e v a l u a t i o n m i s s i o n			
S e m i n a r o r g a n i z a t i o n a n d l o g i s t i c s S e m i n a	S A S O L	1 0 0 , 0 0 0	SASOL :preparation 10,000
	A c a c i a	6 0 , 0 0 0	Acacia: preparation time 10,000

r c o n t e n t a n d r e p o r t i n g			
S i t i n g a n d c o n s t r u c t i o n o f 5 0 0 n e w d a	S A S O L	4 , 0 0 0 , 0 0 0	Communities; 1,600,000 Mennonites …….. (50 dams)

ms			
Establishment of sand dam management groups	SASOL	40,000	SASOL Communities
Long term monit	SASOL	40,000	

oring programme			
Action plans in Kenya, Uganda,	Acacia	-	Is output of workshop
Coordinational a	Acacia/SASOL	40,000	

n d p r o g r a m m e m a n a g e m e n t			

Organization and agencies that have already shown interest are:

Ministry of Water (Nairobi)
UNICEF (Offices in Nairobi and Addis Ababa)
UNEP-GPA and UNEP Nairobi
World Bank – Water Supply and Sanitation Program
Dutch Embassy Nairobi
Dutch Ministry of Foreign Affairs (Development Cooperation)
UNHABITAT Nairobi
International Reference Centre (IRC)
SIMAVI
Aqua4All
Mennonites

References

ACSAD (1995); "Rainfall Water Management in the Arab Region" State of the Art Report, ROSTAS, Cairo

IAH-NCC (2003), "Management of Aquifer Recharge and Sub Surface Storage, *Making use of our largest reservoir".* Seminar 18-19 December 2002 in Wageningen, The Netherlands. A – attached as appendix 1

Appendix 2:
Project description and cost estimates

1.

Hydrologic, environmental and socio-economic evaluation

1a: data collection and field campaigns by students

The hydrologic evaluation includes an assessment of the effectiveness of the dams in terms of water storage. All dams will be inspected and 3-4 representative mature dams will be selected for a detailed inspection of the size of the aquifer, the infiltration rates, the inflow of water into the banks, depletion (and leakage) during the dry periods and water quality (changes). Testholes will be drilled and water level observed using divers. Data on stream level will be collected (rainfall, river flows) to quantify the total run-off, the percentage of water intercepted and the impact on the downstream users

The environmental evaluation will be carried using a certified EIA checklist. Satellite images will be used to assess changes in vegetation patterns before and after completion of the dams. The EIA will also address the water quality pollution and protection issue.

The socio-economic evaluation will make use of a baseline survey carried out in 2002, complemented with information from an additional field data campaign. The data sets will be used to give an accurate picture of the socio economic benefits on household level and for the district economy.

Students for the Netherlands and Kenya will be involved for the field campaigns and initial evaluation. Professional support will be given by Kenyan and international experts. The duration of the study should be approximately one year in order to cover one hydrologic cycle

Cost estimate

Hydrologic evaluation

€
Students (2 students for 3 month, travel, accommodation and allowance)

8,000
Drilling of 30 observation wells

Other equipment, sampling, analysis and local transport	20,000
Supervision and reporting: international hydrogeologist (2 weeks)	10,000
Travel and accommodation international expert (1 travels)	9,000
Supervision and reporting: Kenyan hydrogeologist (4 weeks)	4,000
Subtotal	4,000
	55,000

Environmental evaluation

Students (2 students for 2 month, travel, accommodation and allowance)	6,000
Satellite images	

Other equipment and sampling, local transport	20,000
Supervision and reporting: international EIA expert (2 weeks)	5,000
Travel and accommodation international expert (1 travel)	9,000
Supervision and reporting: Kenyan EIA expert (2 weeks)	2,000
Subtotal	4,000
	46,000

Socio-economic survey

Students (2 students for 2 month, travel, accommodation and allowance)	6,000
Transport	

Supervision and reporting: international socio-economist (2 weeks)	5,000
Travel and accommodation international expert (1 travel)	9,000
Supervision and reporting: Kenyan socio-economist (2 weeks)	2,000
Subtotal	4,000
Coordination and unforeseen	26,000
Total	10,000

140,000

1b: Evaluation mission January 2006

3 international experts for 3 weeks

45,000

1 Kenyan experts for 5 weeks

8,000

travel and DSA

9,000

other expenses

8,000

Total

70,000

2.

Upscaling and Dissemination Seminar

The proposed seminar is a regional workshop in Machakos (1 hour from Kitui) with the following objectives:

- to present the Kitui experiences as a detailed case study in which all the success factors ands pit falls of the programme are addressed
- to exchange these experiences with the participants and explore the generic elements of a successful approach and the elements that are location specific
- to develop a strategy for local communities ands NGO's in selection of the technology and for the implementation of water conservation programmes
- discuss the embedding of the strategy in the national water policy
- to discuss financing options (credit system, community contribution, grants)
- to discuss the need for a permanent structure for exchange (global network)
- to assess the need for (technical and institutional) support to NGO's/communities working on water conservation development on water (helpdesk function).

The main target audience for the workshop is NGO's working in rural water supply in the East African region (Kenya, Tanzania, Uganda and Ethiopia) and representatives from the national water ministries of these countries.

In addition we propose to invite a selected number of persons from countries outside the region where water conservation is widely applied (India, Brazil, South Africa, West Africa, ….) to share the practices in these countries with the experiences in East Africa.

Expected output

The desired output of the workshop should include:

- strategy and action plans for the participating countries and NGO's to start (or accelerate) the construction of these systems

- a (global) network and strategy for exchange of experiences and good practices aimed to support the accelerated construction of community based water conservation systems

Workshop organization

Some preliminary ideas concerning the preparation and implementation of the workshop

- length appr 5 days
  - day 1: general introductions, Kitui/SASOL case study
  - day 2: exchange of experiences
  - day 3: field visit to Kitui
  - day 4: strategy formulation, action plan and follow up support
  - day 5: link with national water policy, financing issues / proposal to establish a global water conservation network/ summary and closing
- no. of participants :
  - 5 NGO's from each country , 2 persons per NGO: 40
  - 6* 2 national water planning representatives 12
  - International NGO's, donor agencies etc 10
  - Representatives from other countries 10
  - Others 10

Total between 75 and 100 (maximum)

- Venue: proposal is Machakos (accommodation available and close to Kitui)

- Timing: in the dry period: March 2006

- The workshop should be output oriented and be a real working meeting. Therefore the program should be well prepared and moderated by a professional person (from Kenya)

Preliminary action plan and cost estimate

Cost items to be covered for preparation, implementation and follow up of the workshop:

-

approaching organizations participation and financing of the workshop

- logistical preparation (selecting and approaching participants, workshop design, venue and accommodation, circular and inviting participants, travel arrangements, selecting moderator, fieldtrip, social programme)
- preparation of status report on the experiences of SASOL in the past 5 years with special emphasis on the (technical and institutional) successes and problems encountered. This report serves as the basis for the case study (day 1)
- preparation of detailed workshop programme
- implementation of the workshop (including travel and accommodation cost for participants, cost for venue, moderator, fieldtrip, social programme,
- follow up activities (preparing and printing, other follow up activities)

Estimated cost:

€

Organisation and logistics

Participants; accommodation and DSA (100*5*50)

25,000

Participants: travel cost (100 * € 250 at an average)

25,000

Local transport an field visit

Secretariat (sub contracted in Kenya)	10,000
Moderator (Kenyan, 2 month @ € 5000)	20,000
Miscellaneous and unforeseen	10,000
	======
Total	

1

00,000

Contents (preparation, implementation and follow up)
International experts (8 weeks @ € 4000)

32,000
National experts (4 weeks @ € 1500)

6,000
International travels and DSA (4 * € 2500)

10,000
Miscellaneous and unforeseen

4,000

======
Total

50,000

3.

Siting and construction of 500 new sand dams in Kitui

SASOL is planning a new construction phase of 500 new dams in the Kiuti district. The sites form these new dams are in existing streams and in buried riverbeds. Potential sites for new wells will follow from a hydrological and geotechnical investigation. The community mobilization process will then determine where new dams will be constructed and in which sequence. The construction of the dams will take approximately 5 years and may be implemented in badges, depending on availability of funds.

Cost estimate
For the siting of new wells, a extensive field inspection is needed with the support of satellite images, The cost estimate for the siting of potential new dams is:

						€
2	junior	geologist	(	4	month)	
1	senior	geologist		(2	month)	24,000

satellite images (Regional Remote Sensing Facility, Nairobi)	12,000
miscellaneous and unforeseen	10,000
	4,000
Total	=====
	50,000

The cost of new dams depends on the size and location but has an average price of For the construction of new dams a unit price of € 8,000 and is built up as follows

Standard sand dam (requiring 350 bags of cement)

€

-

community input (labour, sand, stones and water)

3,600

-

external financing (cement, bars, masonry, supervision)

4,600

====

total

8,200

Total cost 500 dams

4,100,000

Community / SASOL contribution

1,800,000
Contribution form other sources

2,300,000