Recharge Techniques and Water Conservation in East Africa

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

Sand Dam in Kitui

Acacia Institute /SASOL

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Acacia Institute Solutions in Groundwater

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PWN

co-operative programme on water and climate

SASOL Foundation Kitui -Kenya

Kitui Sand Dams: Upscaling and Dissemination of Good Practices

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Abbreviations
SASOL
IVM
PWN
CPWC
PvW
NWP

Foreword,

This document presents a programme aimed to promote the successful upscaling of community based sand dams (and related water conservation techniques) based on the experiences of the ~500 sand dams constructed by SASOL in Kenya the period 1995-2005. Upscaling of sand dam construction can significant contribute to provide water to rural communities in drought prone arid and semi arid provided that the dams are properly sited, its construction is appropriate to the local conditions and if the communities are effectively involved in construction and management of the dams. The challenge is to incorporate these requirements in an upscaling process that facilitates the construction of dams in large numbers.

This document gives the background of the initiative, the approach to the programme and the components that are identified to reach successful up-scaling.

The programme is initiated by SASOL and the Acacia Institute but is aimed to include sand dam experiences from other organizations as well and to bring together interested partners to develop the programme further and to contribute to the funding and the implementation of programme components. The programme is supported by the Groundwater Group (PMC Groundwater) of the Netherlands Water Partnership (NWP) as part of wider initiative to promote the application of sub surface storage under the name MARS: Managed Aquifer Recharge and Storage.

This is a growing document in which the status is presented of the development, funding and progress of implementation of the various components and sub components. It will be updated on a six monthly basis and serve as such as a progress report of the overall programme implementation.

The first issue of this status report was published in September 2005. Since then significant progress is made and a number of organizations have confirmed their participation in the funding and implementation of the programme: Aqua4All, Institute for Environmental Studies (IVM) /Vrije Universiteit Amsterdam, PWN (Water Supply Company Noord Holland) and the Collaborative Programme on Water and Climate (CPWC). This second status report gives a summary of the progress made in the last 6 months and presents the proposed activities for the remainder of 2006.

We are looking forward to continue the work in the coming months and hope that its results will inspire other partners to join the programme.

March 2006

Acacia Institute
SASOL

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 –and sustainable- storage capacity will be the main challenge for water managers in reaching the Millennium Development Goals

Water security for urban water schemes may include alternative options such as 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. 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, 2003).

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 to below two kilometres whilst making water available for productive use. Typically, women walk more than 4 km to water sources in the district. To date, almost 500 dams have been constructed in central Kitui serving about 100,000 people have access to safe water at an investment of US$ 35 per person. The walking distance has decreased to 1 km on average providing women more time for other economic activities and education. The key success factors of the Kitui sand dams are:

- High degree of community participation in the planning and construction
- The dams only store about 5% of the total water available and hence do not affect downstream communities
- Concept of cascades (many dams constructed in one river bed), creating a substantial volume of storage in a small area and hence reaching a larger part of the population
- The dams are a success, not only under normal rainfall patterns but also during droughts like the recent one (2005-2006) which is the worst natural disaster to hit Kenya since 1971.

The question is how to upscale this success to other regions? There is first a need to quantify the success factors in more detail and to extract the generic factors that can be used to upscale the technology and concept to other regions and match them with the local needs and circumstances those areas. A second action is to approach and mobilize the NGO's, governments and funding agencies and disseminate the results of the Kitui Sand Dam experience

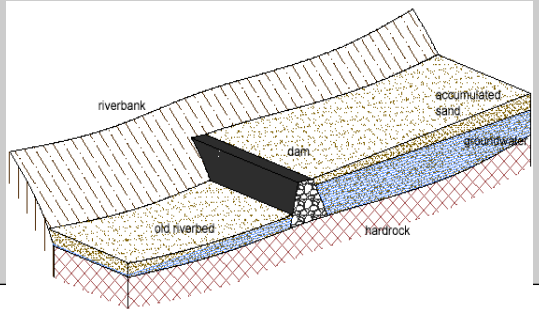
2. THE KITUI SAND DAMS UP-SCALING PROGRAMME

The program

The Acacia Institute together with the Sasol foundation have initiated a program known as "Recharge Techniques and Water Conservation in East Africa; Up-scaling and Dissemination of the good practices with the Kitui sand dams". The program is aimed to promote the successful up scaling of community based sand dams (see box) and related water conservation techniques. Up scaling of sand dam construction can significant contribute to provide water to rural communities during droughts in arid and semi arid regions, provided that the dams are properly sited, its construction is appropriate to the local conditions and whether the communities are effectively involved in construction and management of the dams. The challenge is to incorporate these requirements in an up scaling process that facilitates the construction of dams in large numbers.

The Kitui Sand Dams

The Kitui Sand Dam project is an example of how communities use their knowledge about water to cope with droughts. Since 1990, a local NGO in Kitui (Sahelian Solution foundation, SASOL) assists local communities in building small-scale *sand dams* to store water in artificially created sandy aquifers. This old technique differs from traditional dams by storing water within the sand and gravel particles, which are accumulated against the dam wall. Hence, the term 'Sand' refers to the sand behind the dam that holds the water. The dam itself is obviously made of concrete. Sand dams can store water for up to 35 percent of its total volume. Being groundwater, the stored water is protected against high evaporation losses and against contamination The water is captured for use through a hand dug well or tube well using a bucket or hand-pump.



The programme started in 2005 and is designed as a number of interrelated components as shown in figure 1.

The overall approach of the programme is to establish a framework for dissemination of sand dam construction (component 6) that will support the planning, design and

construction of sand dams on a large scale in Kenya and the surrounding countries (component 7 and 8), Component 1-5 are short term project based activities to develop the tools and foundation for the establishment of the dissemination framework in component 6. Experiences from countries outside the region (like South Africa, India, Brasil) will also be included in component 1-5 and the dissemination in component 6 may also be extended to other countries in a later stage

The preparation and programme design was made by SASOL and Acacia with financial support of PvW and the CPWC in the first half of 2005. Component 1 started in the middle of 2006 with financial support of Aqua4All and is almost concluded.

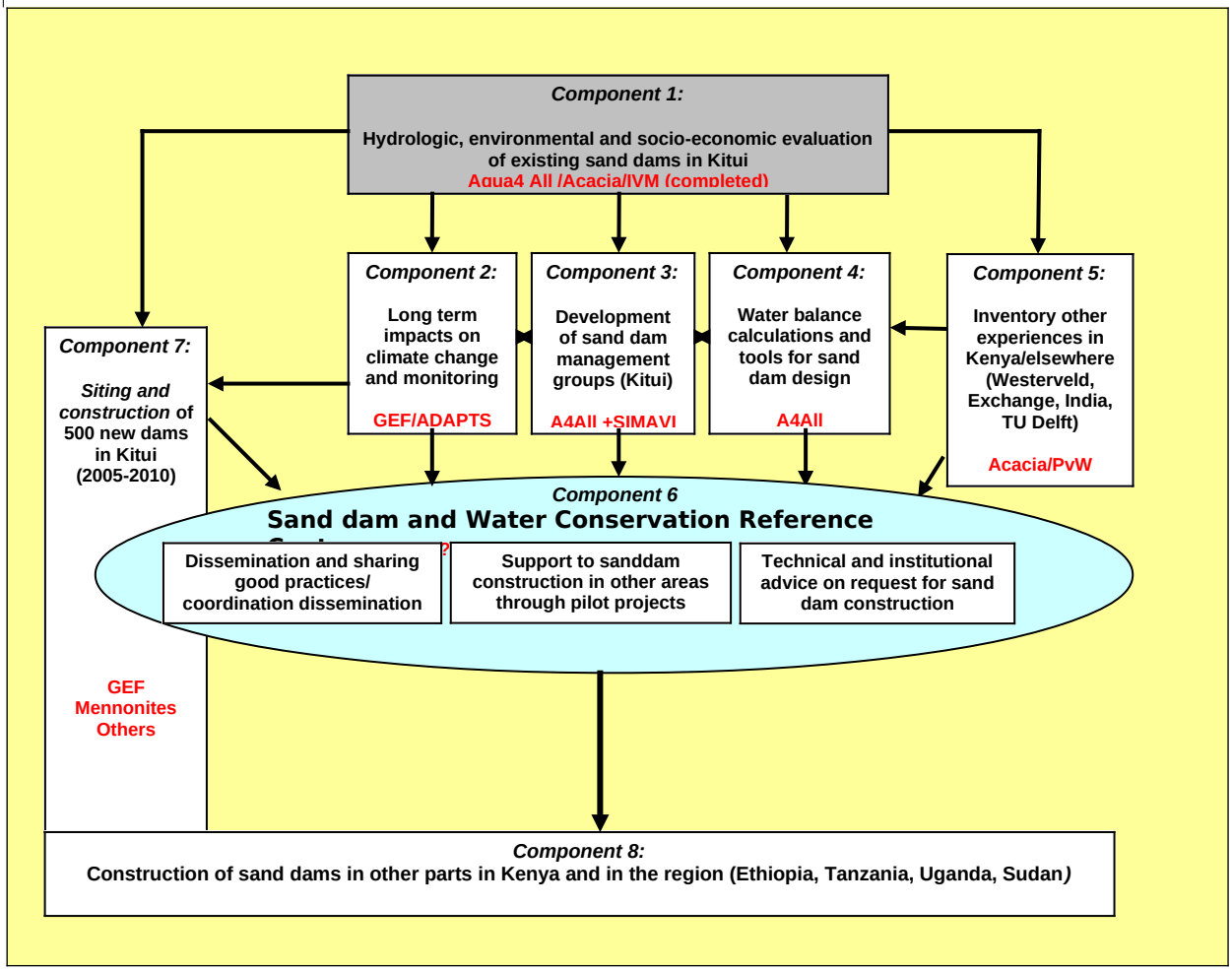


Figure 1: Project components

Component 1

The first component (component 1) concerns a hydrological and socio-economic evaluation of existing dams implemented by SASOL, Acacia, IVM and the PWN with financial support form Aqua4All. The work was based on a thorough review of existing studies and report and additional fieldwork conducted by four students from the Vrije Universiteit in a 2 month period with supervision visits form Acacia and the PWN. The student reports contain a wealth of information and are available through the Acacia Institute.

The result of Component 1 shows some significant conclusions:

- the dams fill rapidly during the floods and an substantial amount of additional water is stored in the riverbanks
- a preliminary water balance shows that only a minor portion of the total run-off water (< 5 %) is intercepted, indicating minor impacts on the downstream users
- the occurrence of a serious drought during the period of investigations confirms that the dams provide water during drought periods
- the socio-economic study shows an significant improvement on income and economic growth (table 1)

Table 1: Socio-economic performance

Vulnerability Categories	Vulnerability indicators	Before dam construction	After dam construction
Agriculture	**# of cash crops**	**1.5**	**2.8**
	% irrigated crops	**37**	**68**
Special aspects	**Water collection Domestic (minutes)**	**140**	**90**
	Water collection Life Stock (minutes)	**110**	**50**
Gender	**Average walking distance women to water (km)**	**3**	**1**
Economic	**Income (US$./year)**	**230**	**350**
Health	**% households suffering from malnutrition**	**31.6**	**0**

Spin-off of component 1

The results of component 1 need further refinement and more studies but do support the overall conclusion that the sanddams option is an effective technology for provision of safe water to rural communities in drought prone areas.

One the immediate spin-off of component 1 was the interest of the CPWC, to finance a film about the Kitui experience as a successful example of community based coping mechanism for drought. The film was shot in January 2006 and shown at the 4th World Water Forum in Mexico. The Kitui Sand Dams were also presented by SASOL and IVM during the session on Risk Management and was nominated for the “Kyoto World Water Price”. There has been a lot of response from a wide variety of organizations and persons showing their interest in the program and offering contributions of different kinds. (see Annex 2)

Another main spin-off is the interest of GEF to finance a large number of and dams in Kitui and elsewhere as part of their climate change adaptation programme. SASOL, IVM and Acacia will be contracted to prepare a detailed proposal for this project (**Component 2 and 7**). The work is expected to start in the second half of 2006. Upon approval of the detailed proposal GEF will fund the construction of the 300 dams in Kitui and in a number of other locations to be selected during proposal preparation. The rationale for the GEF funding is the link to the GEF goals of developing adaptations to climate change and sustainable development. This is also the objective of the **ADAPTS** project (Adapting to Climate Change on a Local Scale) funded by the Netherlands Government and implemented by a consortium of research institute and NGO’s under the coordination of

the IVM. This project will start in the first half of 2006 and it is proposed to include the Kitui Sand Dams as a pilot to investigate the effectiveness of the sand dams under different climate change scenarios (**Component 2**). The outcome of this work will be integrated with the GEF proposal. During the Inception Phase of the ADAPTS project, it will also be explored if a second catchment in the East Africa region can be included as pilot area. Furthermore, UNDP, UNICEF and UN-Habitat have also shown keen interest to participate in the programme and negotiations are under way to for further formulation. A possible role for these organizations is to support up scaling of the Kitui experience to other regions and initiate Sand Dam pilots.

Finally, the NWP has provided funds (through the PVW Programme) to compile a small booklet with an overview of typical solutions of sand dam construction types and other water conservation options under different physical and climate conditions ((**Component 5**). The examples will focus on East Africa and India but will also include smart solutions form other countries. Acacia and SASOL are already in contacted with a number of other NGO's working ion sand dams and other water conservation methods and will use their experiences in the handbook

How to proceed?

Component 1 also provided the necessary information to design the additional work needed for up-scaling of the Kitui experience to other areas:

- Component 2: study of the long term impacts of the sand dams under different scenarios with respect to climate and land use. An short term goal is to extend the socio-economic survey to update the initial socio-economic impacts (table 1) and link them to the tools in Component 4 to assess the change in the impacts under different climate models
- Component 3: creation sand dam management groups to develop an effective approach to consolidate the community participation in planning and construction of the dam into permanent committees for effective use and management of the water
- Component 4: additional fieldwork in Kitui to make a water balance of representative catchments areas and develop simple (generic) tools to determine the feasibility, effectiveness and impacts of sand dam construction projects
- Component 5 Inventory of experiences and lessons learned elsewhere in Kenya and the region (as a reference for upscaling) and the compilation of small booklet showing examples of successful sand dam types and related water conservation technologies

With activities under preparation for Component 2 and 5, the first priority is now the continue with component 3 and 4 which is in fact a continuation of the work done in Component 1.

Component 3 is deals with the development of sand dam management groups to promote an effective and sustainable use of the water by the communities that benefit from the dams. In the current approach of SASOL the communities are involved in the planning and construction of the dams but there is no clear methodology yet to support the communities to organise themselves to use the water effectively, to agree on water allocation and to protect it against pollution. This component will include a number of pilot projects in sub catchments and develop a methodology for development of sand dam management groups that can also be applied elsewhere. Support will be sought

from a NGO with a wide experience in community organization for rural water supply and sanitation.

Component 4 will continue the work on the hydrological and socio economic evaluation of the Kitui Sand dams. Simple tools will be developed to assess the water balance of catchments and to calculate the number of dams that can be constructed, how much water will be intercepted and what the impacts are on the downstream flows. A team of students will collect the field data and be supported by Acacia, SASOl and the PWM for data analysis, tool development and reporting. This component will also include a series of additional interviews in two catchments to update of the socio-economic impacts of the dams (table 1)

The results of component 1-5 will all feed into the **Component 6** aimed to channel the growing interest of many organizations and funding agencies in the programme and to coordinate them effectively in the upscaling process. This is best served by creating a focal point in the form of a sand dam and water conservation reference center. The main objective of this Center is to be a coordination point for sand dam promotion and a clearing house for the exchange of data and information and act as advisory body to NGO's, governments and other. It will not become a Center in the physical sense of the word but a virtual communication platform working mainly through a website and email. The Center will be managed by Acacia and SASOL and the initial thinking is to have focal point organizations in regions of countries to organize, coordinate or support local actions and projects. The Center will also coordinate the preparation of a seminars and pilot projects to adapt sand dam construction and management to local circumstances and conditions. A detailed scope and terms of reference for the Center is still to be compiled.

The ultimate goal: upscaling

The ultimate goal of the components 1 to 6 is to prepare for and to support the upscaling of sand dam construction and management in other regions of Kenya and in the surrounding countries (**Component 7 and 8**). The aim of the programme is to support the successful construction of 500 new dams by SASOL and action programmes for dam construction in other parts of Kenya and in Ethiopia, Tanzania and Uganda. If each of these programmes results in the construction of 500-1000 dams, the total spin-off will be 2500-4500 dams serving almost 400,000- 700,000 people, with a total investment cost of about 15-25 million Euros. The estimated cost of component 1-6 is in the order of 400,000 Euro or about 2-3 % of the total investment cost. A first start of this component is part of the GEF funding which includes the construction of 500 dams in the Kitui area and 2 or 3 other locations in the region

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