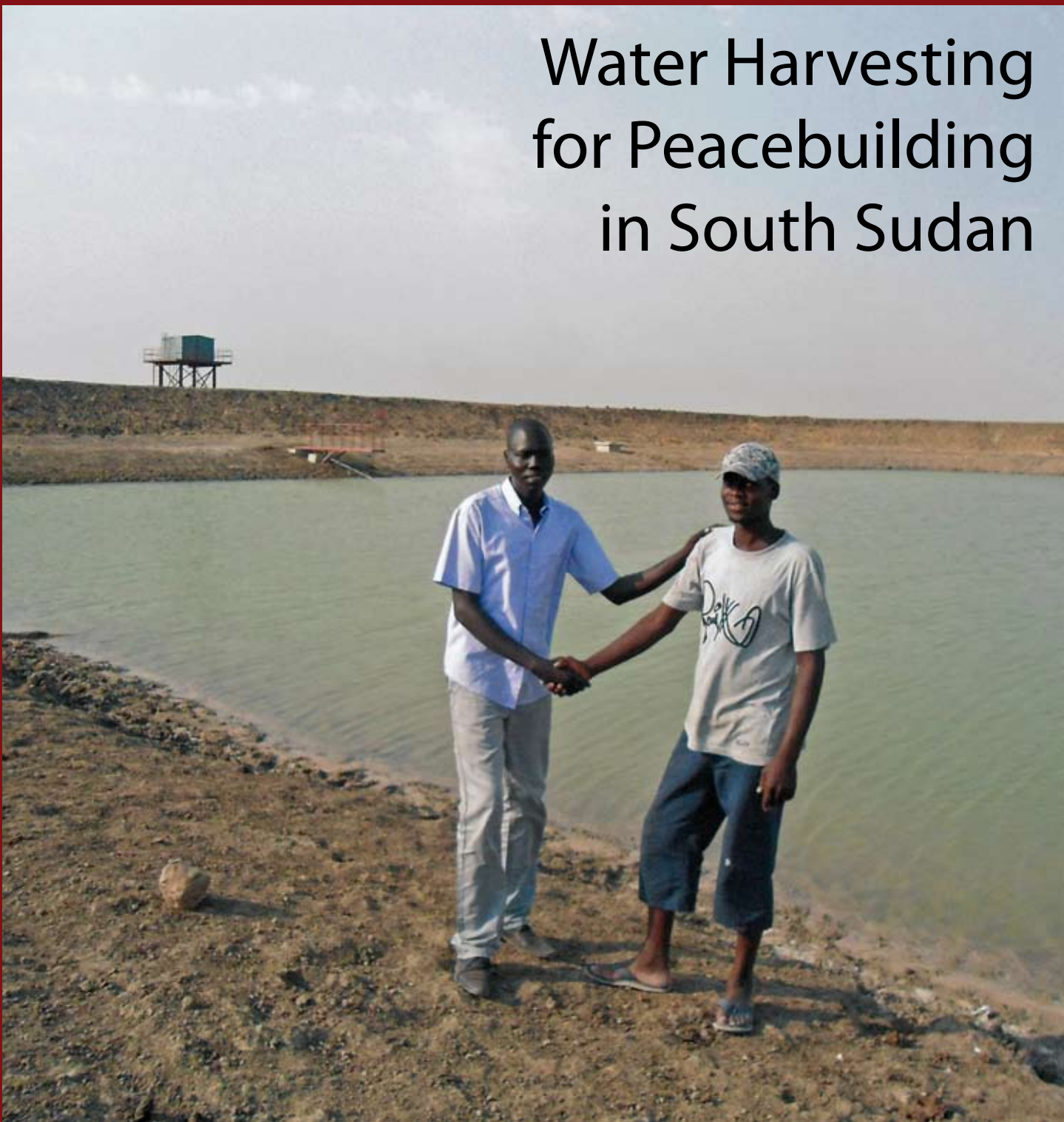




Ministry of Electricity, Dams, Irrigation and Water Resources

Water Harvesting for Peacebuilding in South Sudan



An Assessment of Livestock Water Harvesting Structures
in Eastern Equatoria, Western Equatoria, and Lakes States



Food and Agriculture
Organization of the
United Nations



United Nations Peacebuilding Support Office

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- Technical Assessment Report prepared by Eshetu Abate Legesse, Water Resources Assessment Consultant - FAO South Sudan
- Gender Mainstreaming Assessment Report prepared by Abigail Wathome, Technical Officer (Gender in Agriculture and Rural Development) - FAO South Sudan
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Acronyms

CIDA	Canadian International Development Agency
CPA	Comprehensive Peace Agreement
DFID	United Kingdom’s Department for International Development
EES	Eastern Equatoria State
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
GIZ IS	German International Cooperation International Services
GTZ	Former German Technical Cooperation
HOA	Horn of Africa
MDTF	Multi-Donor Trust Fund
MEDIWR	Ministry of Electricity, Dams, Irrigation and Water Resources
MOE	Ministry of Environment
MWRI	Ministry of Water Resources and Irrigation
NGO	Non-governmental Organization
NRMC	Natural Resources Management Committee
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PBF	United Nations Peacebuilding Fund
PBSP	Peace Building Strategic Plan
RSS	Republic of South Sudan
SEAGA	Socio-economic and Gender Analysis
SSDP	South Sudan Development Plan
SSRF	South Sudan Recovery Fund
SSTC	South Sudan Transitional Constitution
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNHAS	United Nations Humanitarian Air Service
UNICEF	United Nations Children’s Fund
UNOPS	United Nations Office for Project Services
USD	United States Dollar
WASH	Water, Sanitation and Hygiene
WES	Western Equatoria State
WFP	World Food Programme
WH	Water harvesting
WHO	World Health Organization

Executive summary

The initial sites selected for the assessment were located in Jonglei, Lakes and Eastern Equatoria States. As a result of the on-going conflict in South Sudan, with Jonglei State being one of the most affected states, the assessment could not be conducted there and was shifted to Western Equatoria State (WES). WES was selected because of its biophysical and agro-ecological distinctness from Eastern Equatoria and Lakes States, thus enabling a better understanding of livestock water harvesting (WH) in the Green Belt livelihoods zones. Conflict over water resources is common in the selected areas, particularly during the dry season when water scarcity often forces people to migrate.

The states and counties visited during the assessment included: Cueibet and Rumbek Centre Counties in Lakes State; Yambio County in Western Equatoria; and Kaopeta North and Kapoeta East Counties in Eastern Equatoria State. The locations and WH sites visited are listed in Table 1. The WH sites in WES are not included in the table as the facilities were not for livestock watering but were for fish harvesting purposes.

Major findings

- Dry season livestock watering in South Sudan is carried out through both natural and man-made means. The natural sources are perennial rivers/streams, swamps (locally known as *toic*) and ponds. Man-made sources are community ponds, roadside dugout pits, rock catchments, water barrier and *haffirs* (ponds). The natural sources currently provide more water than the man-made facilities, which are technically limited in terms of functionality and sustainability.
- Of the man-made WH structures that have been implemented, some, like the *haffirs* in Jonglei, were preceded by feasibility studies whereas other, like the *haffirs* in Lakes State, were carried out without feasibility studies.
- Those *haffirs* without feasibility studies were found to have fundamental design problems related to sizing, location and lack of components.
- There is a lack of harmonization among the stakeholders with regard to the designs of *haffirs*, particularly with regard to type, size, number of components and minimum standards.
- The current standard designs for 30 000 m³ and 40 000 m³ capacity *haffirs* need revision as these facilities are experiencing problems relating to water abstraction, siltation basin, number of cattle troughs as well as type and size of power supply.
- There is a need for more technical expertise in operating *haffirs* by management committees/operators.
- There is no clear division of responsibilities for allocating the budget for operation and maintenance activities.
- There is a lack of awareness of the different roles and priorities of the women, men, girls and boys who are involved in the design and management of the existing WH facilities.
- The initial community mobilization and consultations to create awareness of the construction of WH structures only involved community leaders, who for cultural reasons, were all men.
- Planning did not involve a gender analysis or gender-sensitive feasibility studies to inform type, design, size and cost of WH structures. Thus, women were not consulted in the selection of sites or design of the *haffirs*.
- *Haffirs* are often the only source of water for domestic use and are located in remote areas. It is common for women and girls to walk 5-7 km to collect water. These daily trips expose them to physical harm and are potential sources of conflict. Furthermore, the journey takes a significant amount of time, which could otherwise be used for other productive activities.
- Some *haffirs* have no provisions for domestic water collection; households sharing the source with livestock presents a contamination and disease risk.

- EES *haffirs* lack proper committee management. Communities use the *haffirs* to provide water to livestock during the rainy season but herders are forced to migrate in search of water during the dry season. This inevitably leads to conflict.
- *Haffirs* have management committees in place but their roles and responsibilities are not well defined.
- Although female representation in the committees is 30 percent, men dominate the decision-making processes and leadership positions. There is strong resistance towards women's membership and voice in the committees.
- There is very little capacity building of the committee members. The only instance was in Lokoges *haffir* in EES where three elders (all men) were trained in pump operation.
- There are gaps in capacity relating to understanding of water, natural resources and environmental management by all committee members, men and women alike.
- There are no formal directives on the management of *haffirs* at the state or community levels.
- No gender awareness or peacebuilding and conflict reduction trainings were conducted. Nor were there any exchange visits to expose committee members to other successful community-based water management initiatives.
- Widespread overgrazing has resulted in degraded land and reduced grazing areas.
- There have been high levels of siltation, soil erosion and vegetation burning.

Conclusion

The assessment has shown that *haffirs* serve both human and livestock water needs, particularly in EES where surface water is a serious problem. Access to traditional grazing land and water remain fundamental challenge to peacebuilding and livelihood development in the assessment areas. The inequitable distribution and lack of access to water will remain a driving force behind poverty, hunger and conflict among these communities. Poor farming practices and overstocking has set into motion a cycle of environmental degradation, which will ultimately lower productivity and increase vulnerability. Soil erosion and infertility, damaged watersheds, floods and a host of other disasters have frequently undermined communities, threatening their health, livelihoods and security. Action is required to ensure that natural resources are used in a sustainable manner and that communities are guaranteed access to water and natural resources to ensure their livelihood security.

Recommendations

Existing WH facilities are affected by a range of problems associated with initial design, construction, operation and maintenance, all of which affect their sustainability as described in the previous sections. As such, all stakeholders including the national/state/local governments need to:

- consider the rehabilitation of existing water points/facilities before constructing new structures;
- consider management, operation and maintenance from the very beginning of any WH project;
- have a sound understanding of the socio-economic and political contexts that influence the selection of areas around WH structures;
- include environmental and socio-economic assessments as major components of the feasibility assessment in order to determine the likely effects of the project on the target communities;
- ensure adequate storage capacity by carefully estimating demand levels and accounting for water losses and unforeseen variations in seasonal rainfall;
- select sites with adequate consideration of equity, optimal inter-spacing with other related facilities (i.e. avoid overstocking) and environmental and socio-economic effects;

- apply participatory planning by including all key stakeholders in the entire process from inception and site selection to implementation and management;
- explore alternative WH options other than *haffirs*;
- evaluate the existing standard designs of *haffirs* and ensure that they meet the needs and capacity of users;
- integrate the design and development of livestock watering with other pastoral and natural resources management and development interventions;
- consider seasonal variability in South Sudan for planning, construction and implementation of WH facilities;
- establish proper supervision and monitoring mechanisms with clearly defined responsibilities at the national/state/county levels before starting any construction;
- promote water use service fees (in cash or in kind) where possible;
- establish a simple business plan for operation and maintenance of WH facilities;
- do not promote technologies that the users are not able to maintain;
- establish/strengthen trained and equipped management committees for the facilities and for the broader management of natural resources;
- promote community co-management approach to monitor vegetation and grazing pressure;
- continue peacebuilding efforts in South Sudan on the part of water sector development partners;
- agree on common approaches/guidelines for development/financing to ensure the sustainability of WH facilities;
- provide alternative livelihood options for the communities in order to reduce dependence on fuel wood and charcoal production for income generation; and
- focus water policies on the sustainable management of WH facilities, taking into account not just on the provision of water but also gender. The government and local stakeholders (including men and women) should be key actors in the sustainable management of WH facilities.

1 Introduction

While the drivers of conflict in South Sudan are numerous, conflict over natural resources, particularly competition over access to traditional grazing lands and water rights, remains a fundamental challenge to peace and stability in the country. Various approaches and strategies are required to manage and resolve conflicts depending on the sources of the conflict. However, there is a general understanding between the Government, conflict-affected communities and development partners that resource-based conflicts could be mitigated or addressed through a combination of development and conflict transformation interventions. To this effect the Government of South Sudan and the international community have been investing in livestock water provision, including *haffirs*¹, over the last several years as a means to mitigate the conflicts arising from dry season water demand. Developing water facilities for livestock is an expensive intervention. Such investments should be accompanied by activities that aid in the understanding of the dynamics of pastoralists in conflict-prone areas for better planning, design, organization and management of water facilities. It is equally important to understand the effectiveness of *haffirs* in reducing conflicts between communities as well as other socio-economic and environmental impacts.

To better understand the effectiveness of water harvesting (WH) interventions in livelihoods improvement and conflict reduction and to contribute to policy discourse on WH in South Sudan, the Food and Agriculture Organization of the United Nations (FAO), in collaboration with the United Nations Environment Programme (UNEP), has embarked on a joint project entitled “Assessment of WH structures for sustainable livelihoods and peacebuilding in South Sudan”, financed by the United Nations Peacebuilding Fund (PBF) for South Sudan.

The assessment aims to draw lessons learned from the *haffirs* developed under projects implemented by FAO, the United Nations Office for Project Services (UNOPS), the United Nations Development Programme (UNDP), the Government of South Sudan and other partners in various parts of the country with support from the PBF, South Sudan Recovery Fund (SSRF), Multi-donor Trust Funds (MDTFs) and bilateral funds.

Based on the assessment findings, lessons learned, best practices and a review of existing documents, FAO and UNEP will develop guidelines for WH in South Sudan to maximize impacts on conflict reduction and peacebuilding. This will include: guidelines for the establishment and functioning of Natural Resources Management Committees for *haffir* management; environmental and social impact assessment; feasibility assessment, implementation, operation and maintenance; and gender mainstreaming in WH projects. In addition, the assessment will also contribute to capacity building in planning and implementation of WH interventions by the Government and other stakeholders through training and knowledge sharing.

The assessment was divided in two phases. The first phase was the WH inventory/mapping exercise that was carried out in Lakes, Western Equatoria and Eastern Equatoria States. The second phase was conducted in the same three states with a sample of WH sites but with detailed aspects that included technical, environmental, gender and natural resources management. The number of samples in each state was determined based on the accessibility of each WH site i.e. the distance and security situation within the given timeframe and the arrival of the rainy season. The selection of each WH site was carried out after consultation with state/county authorities and approval by United Nations Department of Safety and Security (UNDSS) Fifty percent of existing WH structures were assessed in detail in Lakes and Eastern Equatoria States. Three fish ponds that were developed for asset building were also assessed in Western Equatoria State (WES).

The assessment looked further into the technical issues relating to functionality and sustainability of the structures. As such, it was necessary to explore what had happened at different phases, included planning and design, construction and implementation, and operation and maintenance.

¹ Haffir is an Arabic word for a pond.

Figure 1. Bad sections of roads to Lokoges Haffir Site (Kapoeta North, Eastern Equatoria State)



This report, therefore, focuses on the technical issues of the findings based on the review of relevant documents, discussions made at different levels, WH inventory/mapping exercise² and detailed field assessment of sample sites. Other aspects such as gender issues, natural resources management and environmental impacts have been dealt with in separate assessment reports.

It is also worth mentioning the challenges the team faced during field assessment. The assessment team mainly faced insecurity and accessibility challenges. A community meeting scheduled to take place at one of the *haffir* sites visited in Lakes State was, for example, rescheduled to the next day as the result of a security incident in the area. In another case, a team was obliged to travel with UN force protection to and from Torit and Kapoeta in Eastern Equatoria State (EES) owing to frequent armed robberies along the road.

Another challenge during the rainy season was the lack of accessibility to the *haffir* sites as most of them were located several km off the main roads. A *haffir* site of Lokoges in EES, for example, involved a 70 km drive and took one full day because of bad road as shown on the pictures above. The team was also forced to fly back to Juba from Lakes State the next day as the United Nations Humanitarian Air Services (UNHAS) plane was unable to land at the airstrip in Rumbek Town because of heavy rain and landing visibility problems.

² Refer to Annex No.1

2 Objective of the mission

The assessment of WH in South Sudan was aimed at generating lessons needed to support a long-term, cost-effective and environmentally sound programme for livestock water development in South Sudan.

The lessons learned will lead to guidelines development. The guidelines will be published and shared with The Government, UN, non-governmental organizations (NGOs) and other stakeholders to increase awareness, to initiate policy dialogue on the effectiveness of WH in South Sudan.

3 Assessment methodology

Prior to the detailed assessment and field mission, a mapping/inventory survey and characterization of the existing WH structures was carried out in three states in order to determine which WH structures would be sampled in the detailed assessment. Checklists and tools were also developed for gender analysis, natural resources management and technical, environmental and socio-economic issues pertinent to WH structures.

Tools for the gender analysis were developed with reference to the Socio-economic and Gender Analysis (SEAGA) Field Level Handbook, which focuses on demographics, local institutions/community structures, trends (environmental, demographic and economic), benefits of on-farm and non-farm activities, daily clocks, seasonal calendars, community resources, use of resources and priorities for development. Guide questions were designed to: (1) enable learning about community dynamics, including the linkages among social, economic and environmental patterns, priorities for development, division of labour within communities (including gender and other social characteristics); and (2) facilitate an understanding of resource use and control and participation in community institutions. Various methods were used during the gender analysis exercise for triangulation purposes. This enabled cross-checking of the information collected for accuracy and also participatory data collection by listening to different views of women, men, youth, community leaders and other stakeholders.

A natural resources management assessment tool was developed to provide guidelines for collecting information on: natural resource management issues around the WH structures; conflicts associated with livestock use of the WH structures; and supplementary natural resource use like pasture. The tool also assisted in gathering the views of the communities on how to mitigate conflicts with the use of the WH structure and other related natural resources. The tool further helped in comprehending the institutional arrangements and challenges associated with the management of the WH structures. In order to compile natural resource issues for WH in the various locations, a number of approaches were used. Throughout the assessment, a consultative approach was adapted with key stakeholders, which involved discussions with traditional authorities, *haffir* users, youth groups and women representatives. Discussions were held with key government institutions like the Ministry of Animal Resources and Fisheries at the state level, county Agriculture Department, County Water Department and County Commissioners. A number of focus group meetings were also held with key informants (women, men, youth and community leaders) in order to get their views on gender issues and how the *haffirs* are managed as well as identify key natural resource issues and conflicts associated with the use of the *haffirs*. Furthermore, *haffir* site visits, transect walks around the structures, observation and pictorial documentation at field level were carried out.

In order to have a better understanding of both human and livestock movement within and among the counties, a participatory cattle route mapping process was also undertaken with key informants during focus group discussions (FGDs). The participants in the FGDs mainly included chiefs, elders and cattle camp leaders from the different locations visited. The maps provided additional information for understanding the implications of migratory patterns on the right of access and use of resources like water and pastures. The mapping information collected during the initial assessment was used to determine the sample of WH structures in terms of location and quantity of *haffirs* to be assessed in order to enable the detailed socio-economic and environmental assessment of the selected structures to be undertaken.

The checklist for technical issues was developed to gather information on: the type, use/purpose, and selection criteria for WH structure sites; whether or not feasibility assessment was done before construction; existence of proper design and supervision; and technical issues relating to sustainability at each WH site.

A comprehensive literature and secondary data review was conducted. A review was conducted on Government policy on water and the environment, WASH (water, sanitation and hygiene) Strategic Framework, project planning, assessment documents from NGOs and development partners like German International Cooperation, International Services (GIZ IS), UN Peacebuilding Priority Plan for the Republic of South Sudan (RSS), best practices from other countries and other relevant literature and documents pertaining to WH. Secondary data was reviewed to complement qualitative data collected from the field.

Discussions were conducted at the national level with technical staff from the Ministry of Electricity, Dams, Irrigation and Water Resources (MEDIWR), Ministry of Environment (MOE), FAO, UNEP, other UN agencies such as UNDP, UNOPS and NGOs such as Pact. Additionally, discussions were held with respective state ministries, relevant county authorities and community members.

4 Assessment locations

The initial locations selected for the assessment were Jonglei, Lakes and Eastern Equatoria (EE) States. As a result of the on-going conflict in South Sudan, with Jonglei State being one of the most affected states, the assessment could not be conducted there and was shifted to Western Equatoria State (WES). WES was selected because of its biophysical and agro-ecological distinctness from Eastern Equatoria and Lakes States, thus enabling a better understanding of livestock WH in the Green Belt livelihoods zones. Conflict over water resources is common in the selected areas, particularly during the dry season when water scarcity often forces people to migrate. This in-depth technical assessment followed reconnaissance visits jointly undertaken by FAO and Government counterparts from MEDIWR in Lakes, Eastern Equatoria and Western Equatoria States in order to ascertain the presence of livestock WH facilities in these states.

The states and counties visited during the assessment included: Cueibet and Rumbek Centre Counties in Lakes State, Yambio County in Western Equatoria, and Kaopeta North and Kapoeta East Counties in Eastern Equatoria (8-15 May 2014). The locations and WH sites visited are listed on Table 1. The WH sites in WES are not included in the table as the facilities were not for livestock watering but were for fish harvesting purposes.

Table 1. Assessed WH Sites for Livestock Watering

State / County	Name of WH structure / (status)
Lakes / Rumbek Central	Nyankot <i>Haffir</i> (under construction)
Lakes / Cueibet	Abiriu <i>Haffir</i> (under construction)
Eastern Equatoria / Kapoeta East	Nakrumai Water Barrier (operational)
Eastern Equatoria / Kapoeta East	Jie <i>Haffir</i> (operational)
Eastern Equatoria / Kapoeta North	Lokoges <i>Haffir</i> (operational)

5 Water harvesting in South Sudan

The main water sources for livestock watering during the dry season in South Sudan are perennial rivers/stream, swamps, locally known as *toic*, community ponds, recently *haffirs* and, to a less extent, water yards.

Water harvesting structures in South Sudan are in the form of ponds, rock catchments³, roof WH, roadside dugout pits, proper/standard *haffirs*⁴ and water barriers/pans⁵.

Ponds are constructed for both human and livestock use in Upper Nile, Unity, Jonglei, Warrap, and Eastern Equatoria States by communities, governments and oil companies. There is no recorded data on the number and size of community ponds in these states. There are ponds in Western Equatoria and Warrap States that have been implemented by the World Food Programme (WFP) and World Vision. These ponds were constructed by community members for asset building purposes.

Roof WH facilities have recently been implemented by the United Nations Children's Fund (UNICEF) and the Government in some schools and health facilities for WASH promotion.

Rock catchments have been implemented by Torit Diocese in Eastern Equatoria State, primarily for harvesting water for human consumption.

Roadside dugout pits can be found in Jonglei, Central Equatoria, Lakes and Northern Bahr el Ghazal States along the main roads. These pits were quarry sites for road construction companies and became ponds afterwards.

Proper *haffirs* have been implemented in Jonglei, Eastern Equatoria, Lakes and Warrap States by UNOPS, Pact South Sudan, FAO and the Government while the water barrier/pan was implemented in EES by the Government and constructed by GIZ IS.

Large scale WH construction in the form of ponds in South Sudan was started by the former Sudanese Government there during the early seventies in the greater Upper Nile areas after the Addis Ababa Peace Agreement of 1972. These ponds were intended to provide water for human consumption. They were, however, being used by both livestock and human populations. Most of them quickly became nonfunctional owing to siltation and design problems as shown in the pictures below. The ponds were not designed properly and did not have defined capacities.

Construction of proper/standard WH facilities in South Sudan, however, was started during the Comprehensive Peace Agreement (CPA) using funds from MDTFs in Jonglei and Eastern Equatoria States by the Government and other development partners. This has continued to date using more funds such as the SSRF, PBF, and Canadian funds and extended to additional areas in Lakes and Warrap States targeting pastoral communities as shown in Table 2.

3 A rock catchment is a structure that uses a large barren rock surface to collect rain water as with a roof water catchment structure. The collected rain water is stored in a separate reservoir.

4 Proper/standard *haffirs* are those *haffirs* with defined purposes, dimensions, components and protections.

5 A water barrier/pan is an impounding structure using a micro/small earth dam.

Figure 2. Ponds abandoned due to siltation and design problems in Fashoda County, Upper Nile State. Oriny Pond at Fashoda Payam, Agworo Boma (top); Parikworn Pond at Nyigir Payam, Parikworo Boma (bottom)



Table 2. Standard haffir construction in South Sudan, Implementing Agencies and Donors

State/location	Implementing agency	Donor	Number / Name of haffirs/ water barrier	Capacity in m ³	Remarks
Jonglei (Uror and Nyirol Counties)	FAO	CIDA*	2 Pul Nyayaka, Pul Kar, Boiloch, Pul Buow	40,000 each	Construction suspended due to conflict
Jonglei State (Uror County)	MWRI/RSS	MDTF	1 Pul Dool	40,000	
Eastern Equatoria (Kapoeta East County)	MWRI/RSS	MDTF	1 Nakrumai	80,000	Nakrumai water barrier has been assessed
Eastern Equatoria (Kapoeta East and Kapoeta North Counties)	Pact	SSRF	4 Nawoyatom, Jie, Lokoal, Lokoges	30,000 each	Jie and Lokoges have been assessed
Warrap (Tonj East County)	Pact	SSRF	2 Paweng, Makuac	30,000 each	
Lakes (Rumbek Centre, Rumbek North and Cueibet Counties)	UNOPS	SSRF	4 Nyangkot, Nyok Jok, Agar, Abiriu	30,000 each	Nyangkot and Abiriu have been assessed

* Canadian International Development Agency

Before embarking on the construction of standard *haffirs*, the then Ministry of Water Resources and Irrigation (MWRI) initiated feasibility studies in 2010 for 10 selected *haffir* sites using an MDTF. The initiation was triggered by the recommendations of “Improved *Haffir*⁶ Technical Guidelines” that was developed by MWRI in 2009. The former German Technical Cooperation (GTZ) was commissioned to carry out feasibility studies. The feasibility studies covered two, four and another four *haffir* sites in Warrap, Eastern Equatoria and Jonglei States respectively. The feasibility studies included environmental and social impact assessments, topographical survey, soil investigation, hydro-meteorological, data, technical designs, bill of quantities, etc. for each site. In addition, two standard designs were developed for 30 000 m³ and 40 000 m³ capacity *haffirs*.

The results of the feasibility studies have been used for *haffir* construction by the Government in Jonglei State and NGOs such as Pact South Sudan in Warrap and Eastern Equatoria States. Pact South Sudan, however, modified the standard design of 30 000 m³ to accommodate the local conditions. FAO, on the other hand, reviewed the whole process and carried out its own feasibility studies for the *haffirs* in Jonglei State. FAO not only addressed technical issues, but also soft components such as the establishment of Natural Resources Management Committees, gender issues, identification of gaps in capacity building and mechanisms for construction supervision.

⁶ An “improved *haffir*” has been defined in the technical guideline as a *haffir* that has water treatment system components for human consumption.

6 Current water harvesting and peacebuilding efforts in South Sudan

While the then Southern Sudan remained largely calm following the signing of the CPA in 2005, several tribal conflicts, armed groups and militia continued to undermine peace and stability in many rural areas. Since then, conflicts over access to traditional grazing lands and water rights have increased.

With the exception of improvements in Central and Western Equatoria, and deterioration in Unity and south/central Jonglei, the overall distribution of violent conflict in 2011 was similar to 2009, the most violent year of the CPA period in which about 3 000 South Sudanese were killed in recorded violent conflicts⁷. In 2011 the number of incidents recorded by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) rose in each of the ten states. As a proportion of all reported conflict, the relative prevalence of conflict decreased in Warrap (albeit temporarily; raiding and insecurity increased markedly in early 2012) and Western Equatoria. Conversely, conflict increased in Lakes, Unity and Upper Nile.

As in 2009 and 2010, Jonglei remained, by far, the most conflict-affected state⁸. Significant inter-tribal violence between the Lou Nuer and Murle groups in Jonglei began during the period December 2011-January 2012 and escalated in 2012⁹. Persistent conflict between the two groups along with the surge in refugees from Sudan over the previous year, combined with ongoing minor conflicts and insecurities in Jonglei in 2012, created a situation of significant instability with the fledgling state's capacity to respond to these issues severely limited.

In Lakes State, the most notable conflicts were reported to have involved the Agar Dinka (Rumbek East), Gok Dinka (Cuibet) Atuat Dinka (Yirol West), Ciec Dinka (Yirol East), Aliab Dinka (along the river Nile and bordering both Yirol East and West counties) and the Jurbel in Wulu County. The Jurluo in Mvolo County (Western Equatoria State) and the Mundari (Terekeka County in Central Equatoria State) have also been affected by conflict emanating from the neighbouring communities mentioned earlier. EES also suffers from conflict that is mainly attributable to the scarcity of water in the dry season. Some incidents are characterised by violent armed conflicts resulting in the death of innocent people, extensive destruction of homes and livelihood assets and the displacement of large numbers of people. Initially the project was planned to target Jonglei, Lakes and Eastern Equatoria States, however as a result of the on-going conflict in South Sudan, with Jonglei State being one of the most affected states, the assessment could not be conducted there and was shifted to WES. . These three states are among those in South Sudan where *haffirs* have been built with MDTF, PBF and SSRF resources, thus providing an opportunity to undertake a comparative analysis of the past and existing *haffirs*. In addition, communities in these states have access to various forms of WH facilities including traditional *haffirs* and ponds.

The majority of violent conflict in these areas is over cattle. Although cattle were not always the primary driver, the use of cattle for dowry payment put potential grooms under tremendous pressure to meet escalating dowry costs. This is especially important considering that marriage is seen as a rite of passage for both male and female youth. This resulted in the involvement of youth in raids of neighbouring communities during which massive numbers of cattle were appropriated and widespread civilian casualties occurred, triggering reprisal attacks to recoup lost cattle and avenge lost lives.

7 Reeve, R., 2012, Peace and Conflict Assessment of South Sudan, Understanding Conflict. Building Peace International Alert.

8 In 2011, UN OCHA reported 208 conflicts - 43% of the total conflict incidences in South Sudan.

9 IRIN, "In Brief: MSF May Suspend Operations in South Sudan's Pibor over Escalating Violence," *IRINnews*, IRIN Africa.

The cycle was exacerbated by the absence of other livelihoods or employment opportunities for youths¹⁰. Also significant were conflicts over access to water and pasture as well as disputes over political boundaries that delimit pasture, water and migration routes. These conflicts existed in all states, although they were notably more widespread in the predominantly pastoralist states of Jonglei, Lakes, Unity, Upper Nile (southern areas), Warrap and, to a lesser extent, Eastern Equatoria.

The Government and international community have been investing in livestock water provision, including *haffirs* (Table 2), for several years as a means to mitigate the conflicts arising from dry season water demand. It is very well known that water development for livestock is expensive, more costly per m³ than all other sectors except for energy¹¹. Therefore, there was a need to carry out a socio-economic assessment to understand the complex social dynamics of pastoralists in conflict-prone areas for better planning, design, organization and management of water facilities. It is equally important to understand the effectiveness of *haffirs* in reducing conflicts between the pastoralist communities as well as other socio-economic and environmental impacts.

As part of the analysis in the South Sudan Development Plan (SSDP), the Government identified serious threats to peace and development that, if left unaddressed, may undermine progress over the next generation. In the lead-up to the referendum and independence, the Government's own Bureau for Small Arms and Community Security conducted consultations in more than half of South Sudan's counties. The results confirmed that violence in the new country was driven by a complex combination of factors including political marginalization, lack of state authority in remote areas, the absence of a credible justice system, competition over natural resources and inequitable distribution of resources.

The Government of the Republic of South Sudan, in this regard, requested the UN to use the SSDP and the South Sudan Transitional Constitution (SSTC) as the basis for the PBSP. In accordance with the principle of national ownership, the peacebuilding priorities in the PBSP have been drawn directly from the four constituting pillars of the SSDP. Elaborated during a consultative process involving hundreds of Government officials and partners at all levels, the SSDP covered the first two years of statehood and included more than 80 development objectives, from which 20 programmes were identified as high priorities, and five as peacebuilding priorities. The five peacebuilding priorities were: a) supporting legitimate politics by fostering inclusive political settlements and conflict resolution; b) improving security by strengthening people's security; c) promoting justice by addressing injustices and increasing people's access to justice; d) laying economic foundations by generating employment and improving livelihoods; and e) supporting basic services by building government capacity to manage revenues and to establish accountable and fair service delivery systems. The PBSP built on the work done in the SSDP and identified 43 priorities that the Government and partners had agreed upon as critical for peace consolidation.

It is under this understanding that the PBF was allocated and UN agencies such as UNOPS, UNDP, FAO and NGOs like Pact South Sudan engaged in peacebuilding activities. One of the peacebuilding activities is the implementation of WH facilities in Jonglei, EES, Lakes and Warrap States to address the key conflict factors of competition over and inequitable distribution of natural resources.

10 Peacebuilding Fund Priority Plan South Sudan.

11 World Bank (Nov. 2012), Development, Utilization and Management of Water Resources: Rapid Water Sector Assessment and Way Forward. Water Resources Unit, Africa Region.

7 Assessment findings

7.1 General

Pastoralist communities generally live in isolated, remote and underdeveloped areas. These areas are often conflict prone, food insecure and associated with high levels of vulnerability. Service provision in pastoral areas is usually less developed than in other areas, with low health and education indicators as compared with national-level figures. As in other areas of Africa, population growth is also driving changes in pastoral areas and in some cases, increasing levels of vulnerability and destitution.¹²

The two *haffir* sites visited in Lakes State were not functional due to technical errors in the design, which had resulted in siltation.

The assessment was also conducted in the two counties of Kapoeta North and Kapoeta East in Eastern Equatoria State. The whole of Greater Kapoeta lies in the semi-arid belt covering the greater part of EES along the borders with Ethiopia and Kenya. This belt receives less than 100 mm of rainfall per year spread over 2-3 months. As there are no rivers or other sources of water, *haffirs* are the only secure source of water for livestock and human consumption. Underground exploitation of water is not a viable option in the two counties of Kapoeta. Rangeland degradation is common in Nakrumai in Kapoeta East whereas rangeland shrinking is common in Lokoges in Kapoeta North. *Haffirs* serve both humans and livestock in all visited sites in Kapoeta except one *haffir*, located far away from the surrounding villages. Humans and livestock share the same water at Nakrumai Water-Barrier in Kapoeta East County.

Western Equatoria State, another location for the assessment, has vast natural resources including arable land, forest, pasture, rivers, streams, suitable rainfalls, wild life and human resources. Cattle-raising is mainly found in Mundri and Mvolo Counties where the communities are agro-pastoralist, but livestock production is limited owing to the presence of the tsetse fly, which transmits zoonotic diseases like Trypanosomiasis in animals and sleeping sickness in humans. In spite of the threats from the tsetse flies WES attracts livestock from Western Bahr el Ghazal and Lakes annually and sometimes from Jonglei as a result of the abundant pastures and river water. The influx of cattle into the state is reported to be the main cause of conflict between the predominately agriculturalist communities in Yambio and the pastoralists from the neighbouring States of Lakes, Jonglei and Western Bahr El Ghazal. Except for fish ponds there are no *haffirs* constructed in the area. Most importantly, the state has streams, which do not dry up during the dry season making it an ideal destination for cattle keepers from the neighbouring states.

The WH inventory/mapping showed that a total of 10 WH structures (8 *haffirs*, 1 water barrier and 1 rock catchment) and 5 roadside dugout ponds exist in Lakes and Eastern Equatoria States for livestock purposes. The document review and discussions with MEDIWR, Pact, UNDP and FAO, however, revealed that there are an additional 5 *haffirs* in Warrap and Jonglei States (2 and 3 respectively) bringing the total number of WH structures to 15 (13 *haffirs*, 1 water barrier and 1 rock catchment) for livestock and human consumption. The capacity of the *haffirs* ranges between 30 000 m³ and 40 000 m³. Most have a capacity of 30 000 m³ while the water barrier is 80 000 m³.

The WH inventory recorded that there are roadside dugout pits that were previously used as road construction quarries in Lakes State, which accumulate runoff water during the rainy season. These facilities are collateral benefits from road construction. Cattle herders use them as additional sources for livestock watering. On the other hand, they could be a potential source for Guinea Worm infection as they are not fenced and protected.

¹² African Union, October 2010: Policy Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities.

Figure 4. Siltation at community-dug ponds in EES



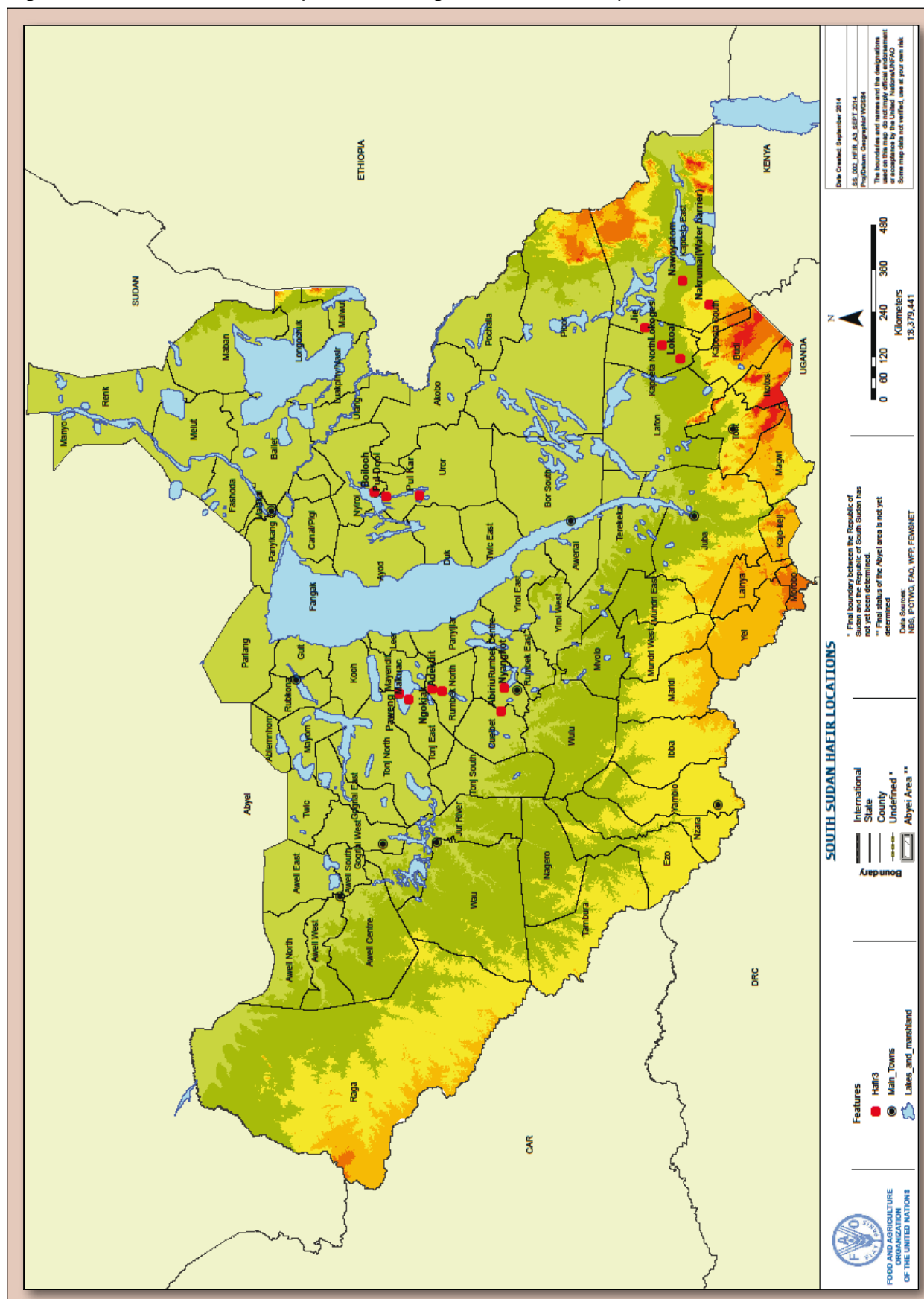
There are also rock catchment structures in EES that could serve as sources of livestock watering. These structures are appropriate in areas where barren rocks with significant surface area exist.

A total of four *haffirs* and one water barrier were assessed in Lakes and Eastern Equatoria States. Each of the *haffirs* have a capacity of 30 000 m³ while the water barrier has a capacity of 80 000 m³. Sixty percent of the assessed WH structures are functional and the other forty percent are still under construction.

It was observed in EES that there are plenty of community-dug ponds owned by groups of families but all of them were dry at the time of the assessment. Siltation is a serious environmental issue for both *haffirs* and community-dug ponds.

All assessed *haffirs* and the water barrier have management committees comprised of men and women. With the exception of the two *haffirs* in EE, the management committees did not receive training. Furthermore, the members of the management committees do not have defined roles and responsibilities.

Figure 5. *Haffir* sites in Warrap, Lakes, Jonglei and Eastern Equatoria States



7.2 Specific findings

7.2.1 Planning and design phase

7.2.1.1 Technical issues

According to the RSS technical guideline¹³ for improved *haffirs*, implementers are required to assure that the following major activities are carried out in the planning and design phase:

- preliminary investigation of sites with discussions at different levels (national/state/county/payam/boma) with concerned authorities and community representatives in order to identify the site where the *haffir* will be constructed;
- feasibility studies (after site identification) that include topographical survey of the *haffir* site and the catchment area with clear delineation of the catchment area, soil investigation of the site, etc.;
- collection of meteorological and hydrological data that includes rainfall, temperature, evapotranspiration, etc.;
- collection of data on the number of users (livestock/human population);
- environmental and social impact assessment that includes mitigation measures;
- establishment of management committee and identification and preparation of timeframe of the required trainings for committee members; and
- preparation of the technical design with clear components of *haffirs* that includes detailed design, construction, supervision and training costs.

From document review and the discussions made with different stakeholders, it was found that preliminary investigations were carried out at all sites despite lack of preliminary discussions with national authorities for the *haffirs* in Lakes State. The national authorities confirmed that the selection of states for *haffir* construction was done where there were/are conflicts among pastoral communities owing to competition for natural resources such as water and pasture. State authorities also selected counties using similar criteria. County authorities, on the other hand, prioritized and selected bomas for *haffir* construction in consultation with payam authorities, chiefs and community representatives where access to water during the dry season is limited and scarcity is severe.

Feasibility studies, including the collection of meteorological and hydrological data, estimated number of users, environmental and social impact assessment and preparation of technical designs have been carried out for only 10 *haffirs* of Warrap, Jonglei and Eastern Equatoria States. These processes were not carried out for the *haffirs* in Lakes State.

Technical designs were also prepared by the then MWRI for 30 000 m³ and 40 000 m³ capacity *haffirs* to be adapted and used by all stakeholders. The typical technical design had been, however, modified by implementing partners for 12 *haffirs* in Warrap, Eastern Equatoria and Jonglei States.

It is a normal practice that the design of any WH structure, including gravitational hydraulic structures such as *haffirs*, should at least indicate the following components:

- catchment area to capture the rainfall and collection or feeding channels to collect and convey the runoff to a sedimentation basin;
- sedimentation basin to hold the runoff for a specific time and allow sediment particles to settle before entering into the reservoir;

¹³ Technical Guidelines for Improved *Haffirs*, MWRI, RSS.

- inlet structure to allow the water from the sedimentation basin into the reservoir;
- reservoir to hold the entire quantity of water for dry season periods;
- intake for the pumping system;
- delivery or distribution pipeline systems to the cattle troughs;
- cattle troughs for both small and big stocks;
- overflow to convey and direct excess water to downstream location;
- embankment;
- perimeter fence to protect the reservoir by blocking free access by livestock and human population; and
- optionally, additional elevated reservoir where direct pumping supply is not enough for the troughs. Where the human population shares the same water, the design shall indicate components (like hand pumps or water points) for this purpose. However, the quality of water for human consumption should satisfy water quality guidelines of either the World Health Organization (WHO) or the Government of South Sudan.

A review of the designs used by different partners and observations made at the sites showed that some *haffirs* do not have feeding channels, which made them unable to capture the entire runoff. Sedimentation basins have not been provided or are very small in size. As a result, the small inlet boxes at some of the *haffirs* had been filled with sediment materials.

The size of inlet pipes from inlet boxes at some *haffirs* are too small to accommodate the amount of runoff coming from the catchment areas, thus taking too long to fill the reservoir. At another *haffir*, it was observed that the sizes of inlet pipes are adequate for the amount of incoming runoff.

Except for the three *haffirs* in Jonglei State, the designs of *haffirs* did not provide energy dissipation structures at the outlet of inlet structures that prevent erosion of the walls and scouring of the reservoir floors.

Figure 6. Inlet boxes filled with sediment material (Nyangkot *haffir*, Rumbek Centre County, Lakes State)



Figure 7. Properly sized inlet box and inlet pipes (Lokoges *haffir*, Kapoeta North County, Eastern Equatoria)



Figure 8. Outlet of inlet structure without energy dissipation provision (Lokoges *haffir*, Kapoeta North County, Eastern Equatoria State)



The typical design by MWRI provides an inclined intake pump base. Partners, including the contractors, reported to MWRI on the unavailability of such pumps in the market for inclined intake. They have been forced to modify the intake accordingly (horizontal or vertical).

The number of cattle troughs at the *haffirs* varies from 1 to 10. Those designs with only one cattle trough did not consider the number of livestock in that area. The designs with more cattle troughs, however, were much better at accommodating a large number of livestock during animal watering, thus avoiding unnecessary conflicts among animal herders over long queuing at the *haffir* sites.

The designs also show abstraction of water from the reservoir to the cattle troughs or elevated reservoir to be accomplished by installed surface or submersible pumps using a diesel-driven generator or solar power or a combination of both. Additionally, the designs provide for embankments and perimeter fences to protect *haffirs* from direct access by livestock and humans.

The cost of construction for *haffirs* vary from USD 500 000 to over USD 900 000¹⁴. This variation is mainly the result of the high cost of construction materials and varying distances from Juba to the *haffir* sites.

Except for the 2 *haffirs* in Jonglei, no *haffir* management committees had been established for 13 WH structures at the planning and design phase. The management committees had been established later during the construction and implementation phase without clear and defined roles/responsibilities or proper training.

7.2.1.2 Gender issues

The first points of contact between the implementing agencies and communities were elders, all of whom are men. This meant that women had no direct information on the projects and were not engaged in community mobilization and community-level consultations to create awareness on the construction of the WH structures. Women were not recognized as important users of the WH structure since these structures are primarily intended for livestock water provision, a task traditionally undertaken by men.

All assessed *haffirs* were located in remote locations having large numbers of livestock. Since livestock is regarded as men's business, women were not involved in siting of WH structures. For example, the Abiriu *haffir* site in Lakes State was selected by community leaders without the involvement of women. During the dry season women must walk long distances each day to collect water from the *haffirs* for domestic use, exposing them to risks such as abduction and rape. The availability of water near the villages reduces women's workloads. However, the location of the *haffirs* visited do not allow women to effectively divide their time between domestic and productive activities¹⁵ or to actively engage in management activities because they have less time as compared with men who are mobile and able to access facilities in more distant places.

The availability, quantity and quality of water have different impacts on women and men and among households. For instance, the responsibility of collecting water for domestic use lies with women and girls. Potable water, which has both health and social benefits for the household, is paramount to women whereas water for livestock is more important for men. In the communities assessed women prioritized the lack of water for livestock over their own. Thus, the provision of water for livestock, though "hidden", is also a priority for women. However, some of the *haffirs* visited, such as Nyankot and Abiriu in Lakes State, were not operational for various reasons.

14 Source: MWRI, Pact and FAO project documents.

15 Productive activities included the production of goods and the provision of services for consumption and trade.

Some of the WH structures' designs had provisions for domestic and livestock water while others only had cattle troughs and no domestic water collection points. This is because it was assumed that women will collect water for domestic use from boreholes. However, during the dry season cattle herders collect drinking water from the WH structures. This implies that differentiated needs of the community members (men and women) were not recognized during the design of the WH structures. In locations like Kapoeta East in Eastern Equatoria, unfavorable conditions for ground water exploitation mean that *haffirs* like the Nakurumai water barrier are the only major source of water for livestock and humans. Women's needs as water users were not recognized equally as those of men. Both genders should be seen as central to the sustainable management of the WH facilities.

Prior to their construction (during feasibility studies), gender analysis was not conducted for any of the *haffir* sites and no gender specialist was engaged in the pre-construction phase. Feasibility studies include various assessments covering livestock, gender, environmental and social impact, land tenure, topographic survey, soil analysis, hydrological, remote sensing analysis and catchment delineation. These studies inform the type, size, design and cost of WH structures.

Although management committees were in place for all the *haffirs* visited, the value of these committees was not understood by the members or communities at large because they were not clearly defined. There was a lack of awareness among the committee members on the benefits of being a committee member or the roles that such committees should play.

Haffirs that were operational had management committees in place with gender representation (30 percent female) in recognition to the affirmative action policy in South Sudan that requires 25 percent representation of women across all levels of the government (Table 3). In WES, there are no *haffirs* other than small fish ponds supported by NGOs for asset building. Gender representation in the two fish ponds visited (Akorogbodi Fisheries and Bazorungu Fisheries Groups) is 50-50.

Although this is a laudable effort, given the highly patriarchal nature of the communities in Lakes and Eastern Equatoria, the management committees are male dominated in terms of decision making and influence; women are generally overruled by men in meetings. This situation is exacerbated by the local culture's opposition to women mixing with "outside" men¹⁶. This has resulted in women being reluctant to actively participating in water management committees. In addition, women lack interest as a result of having less free time; they prefer to focus on household roles, which have more direct benefits for their families. Moreover, they refrain from actively participating in the committees because they do not see the value-added of their participation since there is a perception that men represent their family's needs and take care of important issues in the community. As such, they are content to relegate the management of WH facilities to men.

Table 3. Management Committee and gender composition

State / County	Haffir / Water barrier name / status	Management committee training	Management Committee by gender	
			M	F
Lakes / Rumbek Centre	Nyankot (not operational)	None	9	3
Lakes / Cueibet	Abiriu (not operational)	None	9	3
Eastern Equatoria / Kapoeta East	Nakrumai (operational)	None	14	10
Eastern Equatoria / Kapoeta East	Jie (operational)	None	10	10
Eastern Equatoria / Kapoeta North	Lokoges (operational)	3 elders trained (all male)	7	3

¹⁶ Men who are not related to the women.

In the assessed communities there is a local understanding that leadership is the prime responsibility of men. Discussions on gender are a problem from both men's and women's perspectives. Women and men have clearly defined roles and responsibilities at the household and community levels. Strong cultural practices reinforce the continuation of the traditional role of men as heads of households and, thereby, decision makers. Moreover, since livestock is regarded as men's business, it is challenging to convince both men and women that women should participate in the management of WH interventions for livestock. Thus, during the formation of management committees there was resistance in allowing women to become committee members. Although women were allowed to join the committees ultimately, it was only as members and not as part of the executive level¹⁷. Culturally speaking, community leaders, men and even the women themselves are not comfortable with women interacting with men from outside their households. Consequently, women engage very little in community life and confine themselves to household matters while community leadership rests with men.

7.2.1.3 Environmental and socio-economic issues

Environmental Considerations

Environmental considerations with regard to planning and implementation of development projects, including those involving WH systems, usually constitute two different aspects. The first aspect is the environmental effect/impact, described as the degree of change resulting from a development intervention on the existing local environment, including the biophysical and socio-economic settings. The second aspect is the effect/influence of the environment on the practicality and performance levels of the project implementation as well as effectiveness of the outputs to be realized at any particular location. Some writers (e.g. Gould *et al*, 1999) also described the latter as the "environmental feasibility" of the project.

Both perspectives of the environmental consideration are, nevertheless, about describing the effects contributed by the existing environment (i.e. because of its inherent setting) and the changes introduced on the latter by the development intervention. In the process, not only are the respective effects of each of the two individual settings considered, but also the effects that result from their interactions/relationship. The latter is taken into account for describing the anticipated impacts and subsequent implications on the sustainability of a project. Yet, analyzing environmental effects from the two perspectives remains within the realm of a typical impact anticipation process and signifies using knowledge of both the intervention and the receiving environment to predict the likely effects and consequences.

Effects of *haffirs* on the environment

These effects have been analyzed in terms of positive and adverse effects on the environment. Positive effects included ecosystem services and removal of crusting animal trampling whereas the adverse effects were in human health and well-being and reduction in the service life of *haffirs* as a result of sedimentation. The service life of *haffirs* was also reduced because of water losses, structural ineptitudes and localized overgrazing.

Environmental effects from WH projects cover a range of possibilities, including chemical, physical or biological changes in the existing local environment. The different environmental features and aspects include human beings, fauna, flora, soil, water, air, climate, landscape, natural scenery, material assets (including the architectural, archaeological and cultural heritage). There can also be a range of direct and indirect effects resulting from the interactions between the latter factors.

¹⁷ Chairperson, Secretary and Treasurer.

Figure 9. Children collecting water and playing along the periphery of the reservoir (Nakrumai water barrier)



The potential environmental effects of a WH project on the local environment can be described in terms of spatial and temporal interactions of the environmental elements with the key elements/events in the project lifecycle. The spatial aspects of the environmental effects of *haffirs* can be described in terms of their system components: the catchment area from which the runoff originates; the runoff collection ditches directing the flow into the *haffir*; the *haffir* itself (storage); as well as the point of consumption, including the water lifting devices (solar/diesel pump) and the cattle troughs. Accordingly, the potential impacts of WH projects on the biophysical environment, both negative and positive, were considered for the various stages of the project and utilization phases (after completion of project implementation). The possible mitigation measures were also identified for the negative impacts, while opportunities for enhancing the positive impacts were also specified where they existed.

While the potential environmental effects of WH projects vary based on the type of catchment system used to harvest runoff/rainwater, most of them generally involve minimal effects and tend to have positive environmental impacts – e.g. reducing storm runoff, thereby reducing soil erosion and flooding problems in an area. The *haffirs* provide important ecosystem services (i.e. regulatory, provisioning, cultural and supporting services) to the environment as the fauna and flora within the catchment area of *haffirs* will directly benefit from the erosion control and water availability (subsurface and surface). During the initial site preparation and construction activities, however, there could be some impact on the soil (compaction and disturbance) and the vegetation resources in the catchment area as a result of clearing and/or treatment.

Effects of the Environment on the Project

Effects of the environment on the project have been analyzed based on impeding and favoring effects. The impeding effects included erratic rainfall patterns, which jeopardized the *haffirs'* ability to provide adequate water as well as the promotion of the peacebuilding processes.

Impeding aspects

Erratic rainfall patterns: Given the erratic nature of rainfall patterns in the arid and semi-arid environment, coupled with the typical trend of recurring drought in those areas, it is still possible that the *haffirs*, though well-designed and constructed, could fail to optimally serve their intended purpose. This is because of a number of uncertainties involved with the meteorological aspects of arid and semi-arid environments. A prolonged drought may result in insufficient runoff entering the reservoirs, making the costly structures unusable/defunct.

Socio-economic effects

Socio-economic aspects affected by the haffir projects: *Haffir* development projects are implemented in selected conflict-prone areas of South Sudan in order to provide pastoral communities with livestock water, thereby reducing their seasonal migration in search of water and grazing land during the dry season. By facilitating the availability of livestock water at strategically located dry season grazing areas, these projects serve as a mechanism to minimize incidences of conflict among pastoral communities over scarce water sources and grazing lands. The *haffirs* constructed by these projects are typical surface water storage facilities, which generally involve minimal adverse environmental impacts. Nevertheless, their performance is constrained by a range of shortcomings that limit their effective utilization and sustainability. For the most part, these limitations are attributable to inadequate attention given to socio-economic issues during planning, implementation and management phases.

Some of the major potential socio-economic effects of *haffir* construction projects, both beneficial and adverse, are briefly highlighted in the following sections.

Positive socio-economic effects

Reduction in conflict over access to water and grazing lands: With the introduction of *haffirs* closer to where they are needed, there is increased availability of water for livestock and domestic water supply during the dry season.

The greater and closer availability of water enables pastoralists to limit their seasonal movement in search of water and grazing land during the dry season. This reduces incidences of clashing with other communities while competing for the use of limited water sources and/or as they cross others' territories on route to favorable areas.

Livelihood Improvement: As a result of closer and more reliable livestock water provision from *haffirs*, there would be improved income levels for pastoralist households from their production of livestock. Livestock herds benefit both quantitatively and qualitatively. Increased access to water will minimize energy losses and higher maintenance required to cover long distances to and from water sources. More time for grazing and resting favors improved productivity.

Adverse socio-economic effects

Endangered sustainability of haffir construction projects: One of the common problems with nearly all *haffirs* visited was the lack of repair and maintenance services and spare parts for the electromechanical components of the facilities. The water sector offices in almost all the local governments are not in a position to provide support because of limited capacity, including technical, human resource, budgetary and practical skills. For example, problems of a purely mechanical kind, but having major implications for supply, often occur with pumping, for which a wide variety of different systems are employed. Often, the pumps break down for lack of a minor spare part or a technician with ordinary-level skills to repair. The parts then prove to be unavailable or there is no money to procure them or no one will accept responsibility for procuring them. As a result, the pump can no longer be used and the community members are forced to collect water from the *haffir* directly. It is clear from the above that there is a need to: define responsibilities to procure spare parts and facilitate repair services; and determine what the subsequent water charges need to be (as appropriate) in order to ensure uninterrupted operation and proper maintenance.

Major Issues and Concerns

Lakes State: There were no environmental and socio-economic assessments carried out for either the Abiriu or Nyangkot *haffirs*.

Eastern Equatoria State: In Kapoeta East County there are three functioning *haffirs* (Nakrumai, Jie and Jaliel). Nevertheless, these *haffirs* are not serving the communities long enough because of their limited storage size and excess of users. Subsequently, cattle are still driven to other places to obtain water and pasture during the critical period of the dry season. Based on subjective and objective indicators, the latter situation is likely caused by high sedimentation rates (leading to reduction in storage capacity) in *haffirs*, increased livestock population and/or inadequate design provisions that might have led to an underestimation of the required capacity (e.g. inadequate consideration of evaporation and seepage losses; inaccurate estimation of users/demand level; and inadequate estimation and/or actual yields of runoff).

Concerns expressed by community members during FGD at Nakrumai Boma in Kadodiri Payam of Kapoeta East, have brought to light some important adverse environmental impacts, which also concurred with the probable environmental effects directly observed at the *Nakrumai* water barrier. Increased incidences of diarrhea and stomach diseases among the villagers consuming water from the Nakrumai water barrier was reported during the FGD held with community members. The latter problem is probably caused by pollution of the water stored in the reservoir owing to a combination of factors, which include:

- The relative location of the reservoir, which is situated directly downstream from one of the user villages. The runoff carrying undesirable wastes from the village drains into the reservoir, which exposes the stored water to higher level of pollution.
- The water barrier at Nakrumai, which was used for both human and livestock consumption had damaged fencing and electromechanical pumps failures. The reservoir has turned into an open access resource, allowing for excessive direct contact with the stored water. It was observed that the livestock drank directly from the stored water and pollutes the water with urine, dung and other bacteria (Fig. 15). This is the same water source where people collect their drinking water; wash their vessels, hands and legs. Children also play along the periphery of the water surface (Fig. 16). This has resulted in increased exposure of the reservoir to significant levels of pollution and subsequent human health risks.
- As the fencing is partially damaged, uncontrolled access to this water source (Nakrumai water barrier) also presents a serious safety risk of people and animals falling into and drowning in the reservoir.

Currently, the water barrier is experiencing an increase in sediment accumulation. The sediments are mainly washed down from the uncovered (bare-earth) embankment around the structure and are supplemented by the runoff entering the reservoir, which is heavily loaded with silt. Increased sediment accumulation has resulted in reduced storage capacity and extended shallow water depths along the entire periphery of the water body. This has created a favorable breeding ground/habitat for disease vectors and has reduced the overall quality of water. While the problem of malaria incidence existed before, the presence of the water barrier, with its favorable conditions for mosquito breeding, has exacerbated the situation. The negative effects can be overstated, but in those areas where malaria is a problem, the presence of the ponds will exacerbate the situation unless appropriate preventive measures are instituted.

The shallow water depth has also contributed to deteriorating water quality in the reservoir. There are signs of increasing algal growth and a large population of frogs, which threaten the quality of the water and other environmental hazards. The water barrier has also attracted crocodiles, which pose serious threats to both people and livestock.

The Nakrumai water barrier is currently experiencing a high rate of sedimentation, which has been caused by turbid runoff resulting from the untreated steep catchment and a lack of annual maintenance (de-silting of the reservoir). It was observed that accumulation of sediment has already claimed a significant part of the storage capacity that the reservoir was designed for.

The adverse environmental and socio-economic effects of the Nakrumai water barrier have largely been the result of insufficient attention given to the environmental and socio-economic consequences of this WH system during the planning and design stages.

Mitigation Measures

Mitigation measures arise directly from the adverse effects of the project on the environment, impeding effects of the environment on the project as well as public concerns. Possible mitigation measures have been suggested to address environmental and socio-economic effects and are provided in Annex 5.

7.2.2 Construction and implementation phase

7.2.2.1 Technical issues

The following have been assessed under this phase: setting out of the plan on the ground; quality of construction; and supervision. The setting out of the plan was carried out by the contractor in order to confirm the previous topographical survey results and the technical design on the ground. If disparities arise, it is at this stage that actions are taken to correct or modify the disparities. Reference benchmarks are fixed at appropriate positions to control the dimensions including the elevations of each component while the construction is progressing. If construction starts without a proper setting out of the plan on the ground, there is a probability that some components, like intake boxes or pipes, will be constructed above the flood level, resulting in a complete loss of runoff, leading to additional costs for rectification, which is the case in some *haffirs* as shown below.

Even if the design has no problems, unless there is quality check and confirmation on construction some *haffir* components will be damaged immediately because of poor work quality, affecting the sustainability of the facilities. The assessment observed blown up solar panels and corrugated iron sheet pump houses, poorly welded cattle troughs and poorly compacted embankment (wall of a reservoir) that was exposed to quick erosion. Blown up solar panels do not produce the power required by the pumping system. Blown up corrugated iron sheet pump houses no longer serve as shelters to electromechanical parts. Poorly welded cattle troughs will be major points of leakage and wastage of water.

Figure 10. Inlet box constructed above the flood level resulting in *haffirs* being unable to receive runoff (Abiriu Haffir, Cueibet County, Lakes State)



Figure 11. Inlet pipe constructed above the flood level resulting in haffirs being unable to receive runoff (Oriny Haffir, Fashoda County, Upper Nile State)



Figure 12. Blown up solar panels (Abiriu Haffir, Lakes State)



Figure 13. Poorly compacted wall of a reservoir (Lokoges *Haffir*, Eastern Equatoria State)



Figure 14. Poorly welded cattle troughs (Abiriu *Haffir*, Lakes State)



Installation of small size distribution pipelines for cattle troughs was also observed at some *haffirs*. Small pipelines require long hours to fill the troughs, which by itself could lead to long queues, potential misunderstandings, disputes and unnecessary problems between the operators and cattle herders. There are also cattle troughs constructed below ground level which inconvenience livestock while accessing water.

Figure 15. Small size pipelines installed as inlets for cattle troughs that can cause unnecessary queuing at *haffir* sites (Nyangkot *Haffir*, Rumbek Centre County, Lakes State)



Figure 15. Small size pipelines installed as inlets for cattle troughs that can cause unnecessary queuing at *haffir* sites (Pul Dol *Haffir*, Uror County, Jonglei State)



7.2.3 Operation and maintenance phase

7.2.3.1 Technical issues

This phase of the assessment focused on: the presence and functionality of management committees; establishment of user fees; availability of fuel or spare parts; and repair and maintenance works. The Local Government Act of South Sudan provides local authorities, which in this case was the county administration, with ownership of and the right to manage basic services. The county administration is represented by payam authorities who themselves are represented by chiefs in the bomas. The local government is the facilitator for the establishment of management committees including technical support to facilities within its boundary.

All FGDs at the *haffirs* sites visited confirmed that they have management committees with gender representation (men and women). Some *haffir* sites have committees with 25 percent women representation, which is in line with the national Government policy for female representation across all levels of the government.

The number of management committee members varies from 10 to 24. Although management committees at some *haffirs* said that they had a chairperson, secretary, treasurer and members, they did not receive the required trainings to carry out these tasks. Members did not have a clear sense of roles and responsibilities, except for two *haffirs* in Jonglei State (as per the project report). Part of the training for the management committee members in Jonglei State even included exposure visits to similar facilities in one of the neighboring countries.

Contribution of money as fees for water use has not yet been established at any of WH structures. Members of management committees at some *haffir* sites contributed live small livestock, such as sheep or goats, to buy fuel and spare parts when necessary. This could be an appropriate method in areas where there is no rural banking system.

South Sudan, as a young nation, has not yet established local government structures across all states with fully equipped, adequate and required technical manpower. The current capacity of county administration in terms of technical support is limited, despite the efforts of the state and national governments and development partners. One such difficulty is that purchasing fuel for generators or diesel driven pumps for some *haffirs* requires an eight hours drive by a four-wheel vehicle to the headquarters of county administration in EES and more than eight hours drive to state headquarters in Jonglei State.

7.2.3.2 Gender issues

Capacity building of all stakeholders is crucial for the sustainable management of WH facilities. However, this was lacking in all the management committees that were assessed. The management committees for the *haffirs* had not received any training on operation and maintenance except for one out of the five assessed. In the one case where training was provided, three elders (all male) had been trained in pump operation; women did not benefit from the training.

Only two management committees demonstrated some level of management. However, among the committee members, there was lack of understanding of water management and environmental issues.

Gender training to raise awareness among male and female committee members on the need to improve attitudes and practices in the social relations between men and women had not been conducted for any of the committees. Consequently, gender-differentiated needs and constraints were not taken into account and *haffir* management is generally seen exclusively as men's affairs and women are not actively involved in decision making.

No peacebuilding and conflict resolution training had been conducted. Such training would have aided in: understanding the sources, causes and types of conflicts; conflict prevention, resolution and peacebuilding processes/methods; how to apply conflict prevention and resolution methods to all types of conflicts including resource-based conflicts; and how to effectively prevent conflicts before they occur.

No exchange visits had been conducted for committee members to other locations with successful community-based water management. All assessed *haffirs*, except for one (Jie), lacked any sort of maintenance; most of them were silted as silt traps were lacking or blocked. Although Nakrumai (Eastern Equatoria), Abiriu and Nyankot (Lakes State) had a provision for potable water collection by women, the water pumping system was not operational for several months. Women and children suffer the most from lack of water, which places an additional burden on women and girls who must look for alternative sources of water. In Nakrumai women and girls are forced to collect water directly from the same *haffir* used by livestock, which poses a risk of disease. Inadequate access to safe water contributes significantly to high incidences of morbidity and mortality, particularly among women and children in the states visited. Moreover, water collected directly from the *haffir* is not safe for drinking and causes water-related sickness and diseases such as diarrhea, bilharzia, typhoid and infection from Guinea worm. Women bear the burden of providing care to family members if they suffer from water-borne diseases. In addition, the presence of crocodiles in Nakrumai *haffir* poses a disproportionate risk to the lives of women and girls.

There are no formal directives (policies) on management of *haffirs* at the state and community levels. Movement of livestock is not regulated and this creates over-crowding at water points resulting in a lack of access to water during the dry season. In Eastern Equatoria for instance, although the *haffirs* are meant for dry season livestock watering, communities water livestock in the *haffir* even during the rainy season. Consequently, the *haffirs* run out of water before the season begins. As pointed out during the community meeting in Nyankot village (Rumbek Centre), Nyankot *haffir* in Lakes State, though centrally located and accessible to five payams, could be a source of conflict because of livestock congesting around the *haffir*. This type of resource-based conflict poses a greater risk to women and children.

7.2.3.3 Natural resource management issues around WH structures

The analyses of natural resource issues at the assessment sites were carried out through numerous phases, which included: participatory inventorying of key resources around the *haffirs*; identifying user groups; and assessing the extent of resource use by the user groups and sustainability of resource use practices. The analyses are detailed in the following sections.

Natural resource inventory

A comprehensive list of key natural resources in the assessment areas were developed during the participatory assessment phase. The resources identified and common to all the assessment areas included agricultural and grazing land, grasslands, marshland, forests/woodland, wildlife and underground water.

Woodland/forest

It is imperative to differentiate between woodlands and forests. Ecologically, woodland is an area covered with trees, and is not necessarily a forest.

A forest has a largely closed canopy – the branches and foliage of trees interlock overhead to provide extensive and nearly continuous shade. Woodland on the other hand, allows sunlight to penetrate between the trees, limiting shade. Woodlands support an understory of shrubs, herbs, or grasses.

The ecology of the assessment area in Lakes State is predominantly woodland. This report will make reference to woodland as an important natural resource in the area.

The areas surrounding all of the *haffir* sites are dominated by acacia trees interspersed with other tree species. An exception to this is Western Equatoria, located at the green ecological belt, which has vegetation consisting of mainly broad-leaf woodland savannah comprised of both annual and perennial crops. It has an annual rainfall of 900-1 600 mm spread over 6-9 months. The belt's lateritic soils are prone to leaching and soil erosion. The green belt is suitable for agricultural production suitable for palm oil, tea, coffee, fruits, vegetables and forestry. A further assessment of the land cover of the assessment territory is required to determine the species composition of wild plants that are suitable for human consumption.

The main groups accessing and utilizing the identified natural resources included pastoralists, farmers, women, craftsmen, charcoal burners and hunters among many others. In all the assessment locations, use of natural resources was not static, but rather dynamic and depended on the needs of the communities; some resources were more exploited than others. The extent of use of the natural resources is not homogenous; it tends to take on spatial and temporal dimensions.

The grazing lands, water points, woodlands and wetlands in Lakes and Kapoeta are considered common resources that can be accessed by individuals or households in the community. Community members have inalienable rights to use the resources, participate in determining the mode and extent of use and benefit fully from the resources that are within the community's territorial management area as long as the resources are utilized according to the agreed upon rules and practices.

In general, the assessment areas are predominately composed of savannah woodland comprised of shrubs and herbaceous vegetation on seasonally flooded land, closed shrubs and acacia species and scattered high trees with shrubs on the higher grounds.

Key natural resources management issues

The woodlands and forests in the assessment area are home to diverse flora and fauna and are important source of livelihood for members of the communities. From the woodlands and forests, communities collect firewood, building materials, wild-food and game meat. Such land is also used for grazing. The assessment noted increased encroachment into the woodlands owing to the presences of the *haffirs*, especially in Kapoeta North and Kapoeta East, which have the only functional *haffirs* in the area. The overgrazing around the *haffirs* and nearby land has resulted in degraded land and diminished grazing areas.

The communities where the *haffirs* have been constructed practice a transhumance lifestyle dominated by cattle rearing. The greatest constraint to cattle keeping in the areas visited was the availability of pasture and water. Nevertheless, a trend to reduce herds off take and build herd size has been the norm amongst the Dinka and Toposa communities. This trend is likely to result in an explosive growth in livestock numbers with serious implication for the pressure exerted on the remaining rangeland resources. The construction of the *haffirs* in most cases has resulted in massive clearance of tree covers and, as a result, the soils are left prone to erosion as shown in Figure 27. Another primary cause of this degradation is overgrazing of pastures that are naturally vulnerable to erosion due to poor soil quality and low rainfall.

The cycle of cut and burn has been accelerated with the high density of livestock around the *haffirs*. This is purposely done to encourage the re-sprouting of pasture and, in most cases, has left the soils susceptible to erosion. This degradation was mainly observed around the *haffirs* visited in Kapoeta East and Kapoeta North. Similar trends are expected to occur around the *haffirs* in Lakes, which were not functional at the time of the visit. Herders set fire to the dry grass to remove old inedible growth, fertilize the soil with ash and promote new shoots that are more suitable as fodder.

There is no doubt that annual burning succeeds in its purpose of short-term pasture regeneration, but it also has a number of negative impacts even when timed and executed with care. When done poorly or with hostile intent, it is highly destructive for the environment, the rural economy and society. Regular burning destroys young trees and shrubs, thus maintaining much of the areas as open plain instead of its undisturbed natural state of open woodland savannah¹⁸. One of the long-term negative effects of very regular burning is the loss of nutrients and soil organic matter, which are lost to combustion and water and wind erosion. Pasture burning can also be used as a weapon to destroy competing livelihoods among communities with intermingled land usage.

The communities interviewed suggested that climate change has made it very unpredictable for herders to plan their efforts as the rain patterns have become uneven over the years. Areas that were once traditionally grazing areas during December and January have dwindled, making the resources around the *haffirs* susceptible to overgrazing. The effects of climate change are affecting both the quality and quantity of pasture and water in Lakes and EES with Kapoeta in EES experiencing much of the impact of climate change as per one of the elders in Kapoeta East.

In Lakes, insecurity has made some parts of the grazing areas inaccessible, thus limiting the community's ability to cope with droughts and other climate related disasters by making mobility impossible. This restriction has resulted in overcrowding of both livestock and humans, thereby increasing the loss of vegetation covers and soil degradation resulting from grazing.

Furthermore, the unmanaged extraction of woodland resources for charcoal, firewood and building/fencing materials continues because of high demand for these items in the main markets of Rumbek, Cueibet and the two towns of Kapoeta in EES. If this continues unchecked, it could result in a rapid depletion of the woodland. Associated negative consequences include: increased soil degradation; and obstacles to the re-establishment of non-pioneer vegetation and the restoration of the fauna and wildlife habitat.¹⁹ Furthermore, the situation could constitute a potential trigger for conflicts at the local level as a result of dwindled grazing areas.

Rangeland degradation resulting from the overuse of shrinking resources is the most prominent environmental problem associated with livestock husbandry in South Sudan. Although there is no systematic and quantitative inventory of rangeland conditions or rangeland carrying capacity on a national scale, discussions with national experts and various studies point to three negative trends: an explosive growth in livestock numbers; a major reduction in the total area of available rangelands; and widespread deterioration of the remaining rangelands, caused largely by drought, climate change and overstocking. Extensive annual rangeland burning is another important environmental challenge, as this practice degrades and alters the natural environment in low rainfall savannah regions²⁰.

Institutional arrangement for natural resources management around WH structures

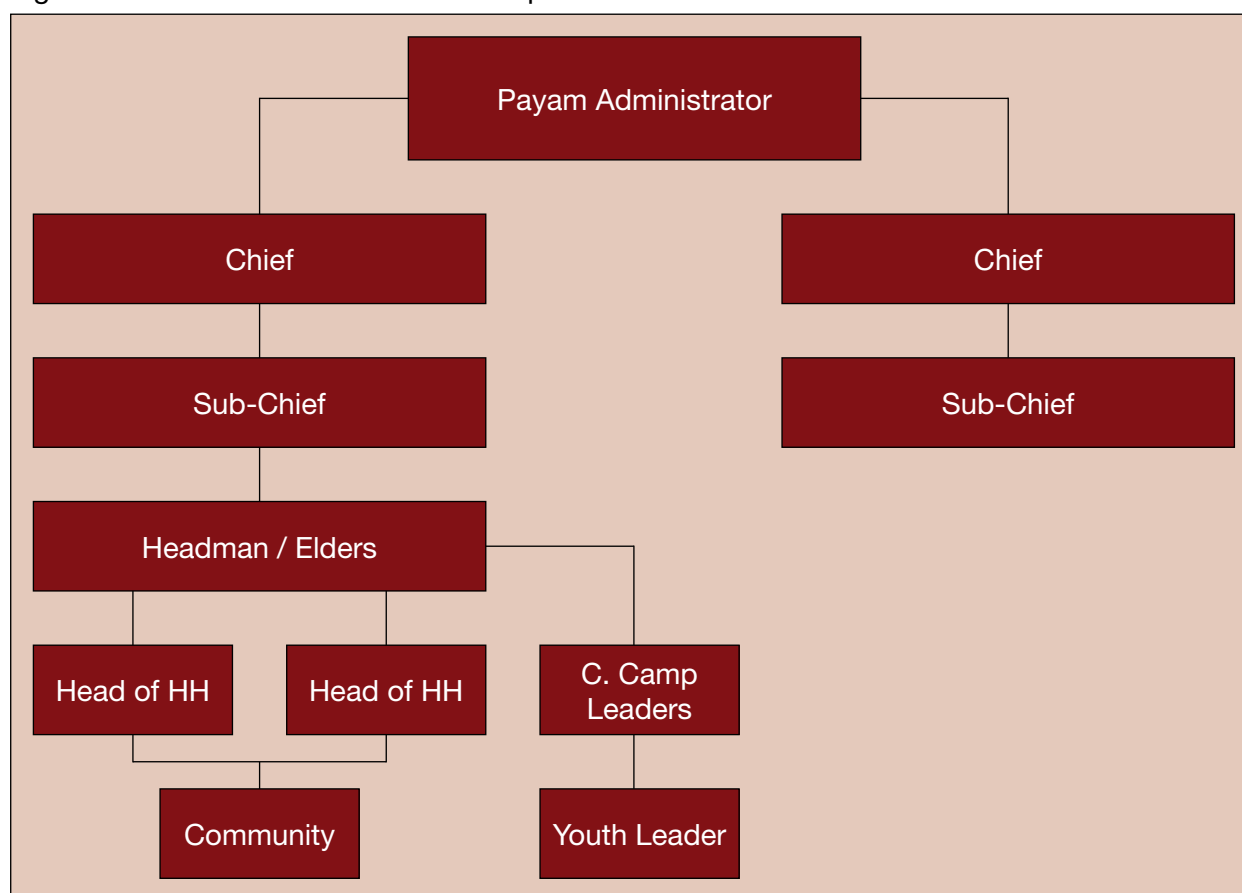
In all of the states where *haffirs* have been constructed there exists both traditional and political structures of governance. At the county level, the Commissioner is both the political and administrative head of the county. A payam is administered by Payam Administrator (appointed civil servants who answer directly to the County Commissioner). It was observed that at the payam level, parallel traditional and civil administrative structures exist; the two complement one another in terms of roles and responsibilities for administering communities at the payam, boma and village levels. The civil and traditional leadership structure is illustrated in the Figure 29 below.

18 http://postconflict.unep.ch/publications/sudan/08_agriculture.pdf

19 UNEP 2007: Sudan Post-Conflict Environmental Assessment.

20 UNEP 2007: Sudan Post-Conflict Environmental Assessment.

Figure 16. Civil and traditional leadership



The *haffirs* visited have management committees but with no clearly defined terms of reference. Members of the existing committees have not received any training in management of the *haffir* and the nearby natural resources except for training on the operation of the pumps. The communities interviewed were involved in the selection of the sites where the current *haffirs* have been constructed. Thereafter, their participation in the day-to-day management of the WH structures was not clearly defined. However, traditional set ups in the respective states continue to provide general guidance on the usage of the structures and management of natural resources around the water points.

Traditionally, the control of grazing area rests with the cattle camp chiefs who, in consultation with community leaders, decides on the timing, location and extent of the use of the pastures by community members and sanctions access to pastures and water in the territory under their control for an agreed upon period of time. Building on the existing traditional institutions/structures and improving their effectiveness might be a more realistic approach than establishing a new one. They can be improved by making the existing institutions more inclusive (including women, youth, etc.) and providing training and exchange visit. A good example is the Uror Natural Resources Management Committee, (NRMCM) which is effectively functioning despite the prevailing conflict in the country.

Conflicts associated with livestock use of the WH structures

Incidences of disputes or conflicts among the community members over access and use of resources are resolved by the chief with the support of elders. In situations in which mediation efforts fail to resolve conflicts, the matter would be referred to the civil authority for further mediation. Court is often the last resort when the traditional and administrative channels have failed to resolve the disputes. There was no serious conflict associated with use of the existing *haffirs*.

Although conflicts between cultivators and herders do occur, there are rules and guidelines for herding during the cultivation season so as to minimize the destruction of crops by animals and to ensure amicable settlement of complaints over crop destruction. It is, therefore, noted that farming and livestock activities co-exist in the assessment areas; conflicts are to be handled using the existing mechanisms. The reason for the co-existence is that the cultivators and herders are of the same community. The only difference is that farming is done mainly by women and the elderly, who not involved in the transhumance activities.

There has been another type of conflict, in Lakes State, that is not necessarily connected to access and use of natural resources. Lakes State has been experiencing inter-clan fighting over the years and these conflicts often result in the loss of human life and destruction of property. Some people interviewed claimed that the presence of the *haffirs* might even escalate these conflicts, especially when cattle camp youths get close to one another. The conflict between the different clans and counties in Lakes State is anticipated to render certain areas of grazing along the *haffirs* inaccessible, creating tensions and insecurity. These conflicts in Lakes State pose significant difficulties to the traditional grazing patterns because they disrupt nomadic grazing movement patterns and restrict the communities' coping strategies against adverse climatic condition like drought, thereby increasing their vulnerability to shocks. This conflict has also hindered farming activities, which: contributes to poverty and food insecurity; constrains social development; and undermines the rule of law and the functioning of the traditional institutions in conflict management. In EES, particularly the two counties of Kapoeta, where there are functional *haffirs*, both the local and state government authorities believe that water related conflict, which has been responsible for food insecurity, would be reduced to some extent by *haffirs*. Also, conflict may not necessarily be associated with access and use of natural resources, but rather, theft and abduction, which are often well addressed by the state and local authorities.

It is believed that as herders begin to access water resources in safe areas within their localities, the situation will be conducive for farmers and herders to engage in various livelihoods activities without fear of being killed or intimidated by the other party. More importantly, a reduced movement of livestock will also allow the youth to participate in various skills training and income generating activities²¹.

In Western Equatoria, where livestock does not play a significant role in livelihoods, the presence of cattle keepers who fled into the state because of an incident in Jonglei on 15 December 2013 have been a source of conflict. The local authority accused the cattle keepers of grazing their animals on cultivated land and causing insecurity. Furthermore, their presences limited the local people's ability to collect honey, which is a key livelihood activity in the area. Other than community-managed fish ponds supported by NGOs, there are no *haffirs* in Western Equatoria. Any initiative for WH structure in WES should be considered for livelihood diversification (asset building) through fish farming and not for conflict mitigation.

21 UNIDO and FAO, 2011, Sustainable Food Security through Community-Based Livelihood development and Water Harvesting Jonglei and Upper Nile States South Sudan (Project Document).

8 Conclusion, lessons learned and recommendations

The assessment has shown that *haffirs* serve both humans and livestock, particularly in Eastern Equatoria where surface water is a serious problem for the community. Access to traditional grazing land and water remain fundamental challenge to peacebuilding and livelihoods development in the assessment areas. The inequitable distribution and lack of access to water will remain a driving force behind poverty and hunger, as well as the root cause of conflict among the communities. Poor farming practices and overstocking has set into motion a cycle of environmental degradation that will ultimately lower productivity and increase vulnerability. Soil erosion and infertility, damaged watersheds, floods and a host of other disasters have frequently undermined communities, threatening their health, livelihoods and security around the *haffirs*. Action is required to ensure that natural resources are used in a sustainable manner and that communities are guaranteed access to water and natural resources to ensure their livelihoods security.

8.1 Conclusion

Despite a number of technical and management problems, the *haffirs* and water barrier in EES are being used by pastoralists. Community discussions and the UNDP report on Jie *Haffir* indicated that the Toposa communities in Jie did not migrate in search of water in 2012 and 2013 and that the prospect of violence associated with pastoral livelihoods has been reduced. The Lokoges *Haffir* has also reduced the migration period from five months to two months. This is due to an increase in the number of users as other neighbouring Toposa communities outside of Lokoges were allowed to access the water. This is a positive trend towards a reduction of conflicts and contributes to peacebuilding efforts. Despite all this, *haffirs* and water barriers have similar sustainability issues like any other WH facilities in neighbouring countries of the Horn of Africa (HOA) region.

There are a number of lessons to be learned from WH facilities in drylands of the HOA²². A recent assessment carried out in the drylands of Ethiopia, Kenya and Uganda stated that reckless water development is one of the main constraints to resilience in the dry lands of HOA. Many development partners, including Governments, have implemented water development interventions in the dry lands for domestic and livestock use with varying degrees of success. Pressure to meet national domestic water service level targets and attempts to accelerate the opening up of potential rangeland have seen an emphasis on hardware construction at the expense of environmental and social considerations and sustainable management. This is particularly prevalent in short-term donor and Government supported emergency relief and recovery water interventions.

The assessment further outlined that emphasis on hardware and physical water development comes at the expense of water governance, improving operations, maintaining skills, installing financial management and providing technical backstopping. This leads to the unsustainable management of water services. Numerous problems that contribute to unsustainable financing/development of water provision and services in pastoral areas include:

- inadequate infrastructure, which is often unfairly distributed owing to inadequate financing;
- environmental degradation as a result of inappropriate placement of permanent water sources, which causes degradation of the fragile rangeland environment, loss of grazing areas, conflicts and increased vulnerability of pastoral communities to drought;

²² Good Practice Principles – Water Development in the dryland of the Horn of Africa, FAO and Regional Learning and Advocacy Programme for Vulnerable Dryland Communities, November 2011.

- inappropriate technological choices, which the community cannot sustainably manage and which encourage environmental degradation;
- poor design and construction of water structures resulting from the limited number of skilled persons in pastoral areas;
- poor capacity of beneficiary communities in management, operation and maintenance resulting from poor skills, unwillingness to pay for water, poor accountability/financial mismanagement, gender imbalances in the management of water systems, cultural barriers and political interferences;
- limited capacity of lead agencies, like line Government departments, to provide the required technical support to community water supply systems; and
- development actors (including governments) undermining sustainability through haphazard donations to communities that hamper plans towards self-reliance. This is often the result of an incoherent and uncoordinated approach to water development, which is seen by many water actors as the overall impediment to development of sustainable water supply systems in the pastoral areas.

The government, therefore, needs to look critically at its policy on *haffirs*. *Haffirs* should not be considered as the only source of water for livestock.

Table 4. State Distribution of Livestock in South Sudan (In thousands)

State	Cattle	Goats	Sheep	Total Number	Share (%)
Upper Nile	990	651	447	2 088	5.4
Unity	1 189	1 511	1 784	4 484	11.7
Jonglei	1 475	1 423	1 227	4 126	10.7
Northern Bahr el Ghazal	1 590	1 306	1 658	4 554	11.9
Western Bahr el Ghazal	1 256	1 184	1 139	3 579	9.3
Lakes	1 320	1 252	1 489	4 061	10.6
Warrap	1 539	3 131	1 392	6 061	15.8
Central Equatoria	883	1 286	1 173	3 342	8.7
Eastern Equatoria	895	1 042	1 152	3 088	8.0
Western Equatoria	680	1 189	1 152	3 020	7.9
Total	11 817	13 975	12 613	38 403	100

Source: FAO, South Sudan, 2010

The construction of *haffirs* is expensive. To provide water for the entire cattle population in South Sudan (estimated to be 11.8 million heads), a total of about 2 300 *haffirs* would need to be constructed, costing about USD 1.15 billion to USD 2.07 billion. But 100 percent coverage of water needs is unrealistic. Even covering 25 percent will require about USD 300 million to USD 500 million. Providing water for livestock in one county, for example, in Rumbek Center County of Lakes State, would require the construction of about 10 *haffirs* across the county, costing about USD 5 million to USD 9 million. The number of livestock in Rumbek Center County is currently estimated to be about 50 000 heads.

Strategies for sustainable natural resources management

To increase water availability at the household level, it is critical to support rain WH and surface water storage through the use of impounding structures where appropriate. WH structures managed by households and groups have been successfully implemented by FAO in Ethiopia. FAO and other organizations interested in the promotion of *haffirs* can borrow such technologies and promote those that: are suitable to poor rural people (e.g. WH systems), provide water at low cost, are sustainable over the long term and improve the resilience of pastoral communities, as was the case in Ethiopia, Somaliland and the Sudan.²³

Market integration of pastoral livestock production is an important buffer for increasing climatic variability. Improved access to a combination of financial, insurance and early warning services can offer alternatives to storing capital “on the hoof” and is a precondition for increasing commercial livestock off-take from pastoral systems.²⁴

Haffir embankment needs to be protected both upstream and downstream. The protection can be achieved by covering the embankments with topsoil and planting spreading grasses like couch and bermuda to protect against erosion. In arid and semi-arid areas where grasses may not grow without irrigation, it has been suggested to cover the embankment with graded rocks (riprap) with maximum size of 600 mm.²⁵

Ultimately, existing *haffirs* and future construction would benefit from a natural resource governance regulatory framework that promotes a regulated rather than open-access regime for natural resources. Simultaneously, the user rights of all stakeholders in the project area (pastoralists, agro-pastoralists, transhumant communities and residents) must be recognized. There is also a need to support the development of cost-recovery mechanisms based on benefit-sharing for the operation and maintenance of the *haffirs* and rangeland.

Natural resources management issues around the WH structures

The woodlands and forests in the assessment area are home to diverse flora and fauna and are important sources of livelihood for the communities. From the woodlands and forests, communities collect firewood, building materials, wild food and game meat. Such land is also used for grazing. The capacity of government institutions and local organizations to educate communities in sustainable resource use remains a major issue for sustainable natural resources management in the assessment area. It was observed that there was a big technical and administrative capacity gap in tackling issues of water and natural resources management in the assessment locations. As WH structures are a totally a new approach to addressing water scarcity in the assessment areas, they requiring new methods of natural resources management. In the two functional *haffir* sites visited in the counties of Kapoeta East and Kapoeta North, increased encroachment into the woodlands and degradation of the rangelands were observed. The overgrazing around the *haffirs* and nearby land has resulted in degraded land and a reduction of grazing areas. Furthermore, the situation could constitute a potential trigger for conflicts at the local level owing to dwindling grazing areas. It is, therefore, important that future *haffir* planning consider tree planting as an integral part of the dry season water provision process to avert the negative impacts of soil erosion and siltation. The communities need to be trained in basic tree nursery techniques in order to raise quality tree seedlings for planting around the *haffirs* for shade provision and protection of the environment. It would be beneficial to carry out enrichment planting of the *haffirs* sites with gum Arabic trees and consider introducing Neem trees (*Azadirachta indica*) in these areas.

23 http://www.ifad.org/english/water/innowat/topic/Topic_2web.pdf

24 <http://www.rural21.com/english/a-closer-look-at/detail/article/rangelands-sound-management-strategies-for-a-vulnerable-resource-0000829/>

25 Danida, 2006, A handbook for technicians, farmers and others on site investigations, designs, cost estimates, construction and maintenance of small earth dams.

Institutional arrangement for natural resources management around WH structure

In all the areas visited the responsibility for controlling grazing areas rests with the cattle camp chiefs who, in consultation with the community leaders, decide on the timing, location and extent of the use of the pastures and sanctions access to pastures and water in the territory under his control for an agreed period of time. The *haffirs* visited have management committees, but with no clearly defined terms of reference; the existing management committees have never received training except in the operation of pumps. In areas with *haffirs* both traditional and political governance structures exist, whereby the County Commissioners and Payam Administrators are the political and administrative heads at the county and payam levels respectively.

Increasing community understanding of natural resource issues starting from the design stage is very important. Community members must be involved in more than just the selection of suitable sites for construction of the *haffirs*. A clear understanding of natural resource issues from the onset of the design phase will allow communities to develop natural resources management plans for sustainable use and management of the resources around the *haffirs*. This can be achieved by establishing inclusive NRMCs from the village level up to the county level and ensuring that by-laws detailing the scope of work at different levels are also developed. Once established and functional, NRMCs should be provided with trainings on how to manage natural resources and on how the different linkages within the local government framework for natural resources management can operate in order to have legally recognized water and range management institutions.

Conflicts associated with livestock use of the WH structures

Land tenure systems in the assessment areas can be classified as either customary/communal or public land. Both systems have direct implications for natural resource use and management. Customary land tenure is the most widespread and dominant system. Among the pastoral Dinka and Toposa communities, land is held and used as a collective asset, the control of which is vested in a social unit like the clan or sub-tribe. The only exception is the management of settlement and cultivation areas, which are controlled by individual households/families, which, in some ways, amounts to private property ownership. This type of tenure arrangement ensures equal rights of use and access to natural resources, thus reducing the incidences of conflicts around the communally used *haffirs*.

As mentioned earlier, although conflicts between cultivators and herders do occur, there are rules and guidelines for herding during the cultivation season so as to minimize such conflict.

A conflict resolution mechanism should also be part of any WH structure throughout the planning, site selection, construction, usage and management phases in order to address conflicts, which might emerge as a result of the new dynamics in natural resource use and management brought on by the WH structure. This can be done by involving the traditional authorities in the respective states. Traditional authorities have always played a great role in conflict resolution and management in these states. Their involvement in conflict management at the *haffir* sites alongside the NPMC will be crucial. Customary conflict resolution mechanisms such as mediation, compensation and restitution are some of the mechanisms used amongst the Dinka and the Toposa people.

8.2 Lessons learned

The overall purpose of the assessment was to enhance the knowledge base on WHs by conducting analysis and proposing strategies and guidelines for sustainable natural resources management to ensure sustainable water use in South Sudan, effectively contributing to peacebuilding while preserving the natural resource base in these areas. Although the rationale behind the investment of the Government and the international community in WH structure has been for water provision as a means to mitigate conflicts arising from dry season water demand by livestock, the assessment has established that *haffirs* serve both humans and livestock needs, particularly in Eastern Equatoria where household access to water is a serious problem. Therefore, future planning, designing and construction of *haffirs* should ensure that these aspects of mixed-use water points serving both livestock and household needs are considered when siting *haffirs*. Locating the WH structures far away from homes adds an additional burden on women and children who must often trek long distances in search of water for domestic use. During the design phase of such *haffirs* serving both humans and livestock it is important to consider mitigation measures against waterborne diseases and malaria. The Carter Center is already involved in the control of the Guinea worm, which is a serious health problem in Greater Kapoeta.

The existing traditional management structures should be used or alternative structures should be formed with clearly defined terms of references to manage the *haffirs* and the surrounding natural resources. The traditional institutions have their own unique way of regulating the use of communal resources like pasture and water, which is crucial to ensuring that pastures and water resources are not overexploited, resulting into degradation.

8.3 Recommendations

Although there are technical guidelines for the design and construction of most types of the water structures for human use, there are no clearly written general guidelines on the development of water sources in the pastoral areas. Lessons learned from this assessment need to be considered for future activities in WH during normal times and during emergency interventions in pastoral areas. All stakeholders concerned with WH development/financing need to consider the following recommendations at different phases of implementation.

Existing WH facilities are coupled with different types of problems associated with initial design, construction, operation and maintenance issues that affect their sustainability as described in the previous sections. In this regard, all stakeholders including the national/state/local governments are presented with the following recommendations :

- 1. Consider rehabilitation of existing water points/facilities before embarking on the construction of new structures.**
This will help in understanding the shortcomings of existing facilities that could contribute to the design of similar facilities in the future as well as open opportunities for policy dialogue among all stakeholders.
- 2. Consider management, operation and maintenance from the very beginning.**
The software component should not be overlooked. It should be given as equal priority as the hardware component. Roles and responsibilities of stakeholders should be clearly identified and acted on throughout the project.
- 3. Ensure a sound understanding of the socio-economic and political context that influences the selection of areas where WH structures are constructed.**
This will assist in designing appropriate strategies for sustainable use and management of WH structures, particularly if the WH structures are intended to address livelihoods and conflicts.

4. Environmental and socio-economic assessment of the initiatives should be a major component of the feasibility assessment in order to determine the likely effects of the project on the target communities.
5. Adequate design storage capacity must be ensured through carefully estimated demand levels, water losses accounted for and consideration of unforeseen variations with the seasonal rainfall, etc.
6. Site selection should be carried out with good consideration of equity, optimal inter-spacing with other related facilities (i.e. avoid overstocking) and constant attention to environmental and socio-economic effects.
7. The participatory planning process should be applied in its real sense by including all key stakeholders in the entire process from inception to site selection through implementation and management.

8. Explore alternative WH options other than *haffirs*.

There are, in other countries, different types of WH facilities for livestock watering other than *haffirs*. These include various types of ponds such as *birkas* (privately or communally owned), water pans, and subsurface dams. *Birkas* are found in the Somali communities of Ethiopia, Somaliland and Puntland. The water in privately owned *birkas*²⁶ is properly managed and both the demand and the supply are well regulated by families. Normally, women manage the water in the *birkas*, since they are more available at the sites while men do the maintenance. Women participate in the decision-making of water supply and demand for domestic use.

Wherever feasible, stakeholders should consider ground water development. It is also possible to construct subsurface dams at seasonal rivers. The river beds should have thick sand layers to accumulate water for livestock watering. The river banks need to have a hard and impermeable formation. Comparisons of construction, operation and maintenance costs should be part of the investigation for different sources.

The recent appearance of roadside dugout pits that are serving as additional sources of water for livestock in Lakes State should be recognized as an alternative if they could be planned properly. With the coordinated efforts of the concerned water and road construction departments, these dugout pits could be designed and utilised safely by the pastoralists. Otherwise, they could be a source for Guinea worm infestation under their current situation. Refer to Annex 3 for the appropriateness of different types of WH structures,.

9. Evaluate the existing standard designs of *haffirs* and review them to fit to the needs and capacity of users.

The current typical designs for 30 000 m³ and 40 000 m³ capacity *haffirs* that were prepared by the national Government need to be critically evaluated and revised as they have technical problems in their implementation, operation and maintenance. Although every design is site specific, the minimum design components should consider needs and be agreed upon by all stakeholders. The design option should be based on choice of technology, cost considerations, needs and capacity of the communities.

Integrate the design of livestock watering with other pastoral and natural resources management and development interventions.

Construction of *haffirs* could positively or negatively impact the natural resources around it. It also attracts wildlife. Linking the design with development efforts of other sectors for the improvement of pastoral livelihoods should be a standard policy for maximum impact.

²⁶ The Experience of Water Harvesting in the Drylands of Ethiopia: Principles and Practices, December 28-30 2001, Mekelle, Ethiopia, Mitiku Hailu, Mekelle University, Sorssa Natea Merga, CARE Ethiopia, Report No. 19, February 2002, DCG (Drylands Coordination Group).

11. Consider seasonal effects in South Sudan for planning, construction and implementation of WH facilities.

The locations, where WH facilities are implemented, are usually very remote and inaccessible during the wet season, which lasts for eight to nine months in some locations, as in Jonglei State. In order to complete a project (*haffir* construction) in such remote areas, proper planning is required. Stakeholders need to clearly identify when to carry out the feasibility studies, construction, training, etc. within the limited timeframe (dry season). Otherwise, the implementation schedule becomes unrealistic and unnecessary delays are encountered, resulting in additional project costs.

12. Establish proper supervision and monitoring mechanisms before starting any construction with defined and clear responsibilities at national, state and county levels.

In order to avoid poor quality work that may affect the sustainability of the facility, the implementers need to put in place proper capacity for supervision at the national, state and county levels so that contractors do the job according to the specifications of the contract agreement. Lack of proper supervision leads to problems like those identified during this assessment mission. There is a need to work towards establishing/strengthening local capacity for this purpose.

13. Promote water use service fee in cash or in kind where possible.

Charges for a water use service fee should be agreed upon by the community and management committee and the initial charges should be small so as to encourage users to pay. The fees can be gradually increased once the community develops the sense of ownership. Such fees can be used to purchase fuel for generators, for maintenance of *haffirs* and accessories where necessary.

14. Establish a simple business plan for operation and maintenance of WH facilities.

Maintenance that requires heavy-duty machinery cannot be handled by the community. Therefore, the state/county should budget for such major maintenance. The community may focus on preventive and minor maintenance such as de-siltation of inlet structures and feeding channels, grassing of embankments, etc. Training of community members and local technicians is necessary for proper maintenance/repair. Such roles and responsibilities should be clearly put in the business plan. Also, gender considerations must be taken into account.

15. Do not promote technologies that the users are not able to maintain.

The appropriateness of any technology depends on how the community is organized and prepared to absorb, accept and adopt it. The pastoral way of life is coupled with so many challenges. Selecting the appropriate technology that goes with this type of livelihood is of utmost importance for the sustainable use of facilities. For instance, electromechanical components of WH structures should not be introduced if spare parts are not available within or near to communities or if costs are too high.

16. Establish/strengthen trained and equipped management committees for the facilities and for the broader management of natural resources.

A functional management committee with clear mandates is one of the requisite factors for the sustainability of facilities. The management committee needs to reflect gender/minority needs.

The management committee needs to be trained on: how to manage user fees according to its by-laws; minor maintenance/repair of electromechanical components; and how to deal with mitigation plans of the environmental impact assessment.

17. Promote community co-management approach to monitor vegetation and grazing pressure.

Different animals prefer different plants and select and compose their diets accordingly. It is, therefore, important to monitor vegetation and ensure that grazing pressure is spread out to warrant an even utilization of all vegetation strata. This is best achieved with systems using different livestock species

with different feed preferences and integrating wildlife. On communal land, this could be achieved through community-based co-management approaches. Co-management can take a variety of forms, including group tenure over a large area (Fernandez-Gimenez, M.E, 2002), combination of pasture land use with protected area management (Bedunah and Schmidt, 2004), or institutional arrangements at the local level with Community Based Natural Resources Management (CBNRM) approaches (Berkes 1991; Jentoft 1989; Pinkerton 1989). CBNRM is a main form of co-management, which is the sharing of authority and responsibility among government and stakeholders. The key stakeholders include individual herders, groups of herders, local governments, central governments, civil society, NGOs and neighborhoods. Co-management groups, which are charged with the management of pastureland and other resources, need to be formalized and supported; they must also include all stakeholders.²⁷

18. Water sector development partners need to continue their efforts of peacebuilding in South Sudan.

Water sector development partners need to continue their assistance to communities and local governments to enable management of WH facilities for some time after completion of the project in order to consolidate the ongoing peacebuilding effort. The assistance could be in the form of training, capacity building of government officials and community members, knowledge sharing from research/assessment findings/recommendations and policy dialogue with the government.

19. Water sector development partners need to agree on common approaches/guidelines for development/financing to ensure the sustainability of WH facilities.

This assessment revealed different approaches employed by different implementing partners towards *haffir* construction. Most of them conducted feasibility studies and some did not. Some employed constant supervision team, while others did not. Some established management committees right from the beginning and others did not. The different approaches highlighted a number of issues related to sustainability. These different approaches need to be streamlined in order to deliver sustainable services to the users.

20. Provide alternative livelihoods options for the communities in order to reduce dependence on fuel-wood and charcoal production for income generation.

The areas where *haffirs* have been constructed are predominantly covered by gum Arabic in Eastern Equatoria and Lakes States. It is, therefore, important for the communities to be trained on gum Arabic collection and marketing. Other non-timber forest products like palms, *balanites Egyptica* (*Ialop*), *tamarindus Indica* and *lulu vitellaria paradoxa* can be considered, especially in Lakes as the state is well endowed with *vitellaria paradoxa*, which has both domestic and international markets.

Local inhabitants around the major town areas where charcoal and wood fuel consumption is greatest should be trained in making improved traditional mud stoves to reduce the use of charcoal and wood in cooking, which is one of the driving forces of biomass energy collection.

21. Water policies should focus on the sustainable management of WH facilities, taking into account not just the provision of water, but also gender. The Government and local stakeholders (including men and women) should be key actors in the sustainable management of WH facilities.

Policy directives or guidelines for the management of WH structures should be put in place and enforced to ensure water availability, quantity and quality. These directives should: stipulate ownership, access and when to start and stop watering livestock in *haffirs*; detail the roles and responsibilities of management committee members, the governance structure and their modes of operation; specify how the *haffirs* should be managed, operated and maintained; and specify how conflicts will be prevented, mitigated and resolved in various contexts within South Sudan.

²⁷ <http://www.rural21.com/english/a-closer-look-at/detail/article/rangelands-sound-management-strategies-for-a-vulnerable-resource-0000829/>

Given the low literacy levels and language barriers in South Sudan, the directives should be translated into local languages and presented in simple language in order to maximize awareness in local communities.

It is imperative to create awareness among government and development partners on the magnitude of dry season livestock and human water needs in arid areas as well as the need for more commitment and funding to scale up investments in appropriate water infrastructure. This awareness should focus on the rationale for the construction of more *haffirs* and the benefits of gender mainstreaming in WH, which will consequently reduce conflict and promote peacebuilding. Migration of youth in search of water and pasture for livestock will be minimized, thus enabling them to engage in more productive and peaceful activities. Providing access to water resources in safe areas within their localities and engaging them (men and women) in the management of the *haffirs* will provide alternative livelihood activities without fear of displacement, losing livelihoods assets or being intimidated or killed.

Gender mainstreaming should be seen as a continuous, non-linear and open social dialogue that identifies gender concerns through participatory approaches and recognizes the different types of stakeholders involved in WH (including men and women) and how they all relate to each other. For gender mainstreaming to be effective, all stakeholders must actively engage in the policy discourse on WH and demonstrate an understanding of how a gendered approach to WH and related management can contribute to livelihood improvements, conflict reduction and peacebuilding in South Sudan.

Annex 1 – Water Harvesting Inventory Report – 22 April 2014

Introduction

The Ministry of Electricity, Dams, Irrigation and Water Resources (MEDIWR) intends to improve the lives of those living in the ten states of the Republic of South Sudan by providing safe and clean water for domestic and cattle use. This will be accomplished by constructing water harvesting (WH) structures at viable sites selected by the communities and assessed technically by the MEDIWR. The WH structures will also reduce conflict that arises among pastoralists as a result of water shortages during the dry season.

Many WH structures in the country were constructed by the Government and development partners without proper feasibility studies and with small design capacities, which led to the failure of most of these structures.

In response, the MEDIWR contracted GIZ to carry out assessments of the WH structures and developed construction implementation concepts to be used for subsequent constructions.

The Food and Agriculture Organization of the United Nations (FAO), in collaboration with the United Nations Environment Programme (UNEP) and financed by the United Nations Peacebuilding Fund (PBF) in South Sudan, undertook a socio-economic and environmental assessment of WH structures constructed over the preceding decades by the Government, UN agencies, non-governmental organizations (NGOs) and other development partners to inform the Government and other development partners on strategies and approaches for cost-effective and environmentally sound WH interventions contributing to conflict reduction and peacebuilding. In order to support peacebuilding, there was a need for FAO/UNEP to carry out mapping/inventory of WH structures, mainly for livestock, in the project areas.

A mapping of the existing WH structures was undertaken in Eastern Equatoria, Lakes and Western Equatoria States to determine the sample WH structures for detailed socio-economic and environmental assessment. The results of the assessment will be used for developing guidelines and recommendations for sustainable WH construction in the country.

Objectives

- Collect as much relevant information as possible on the existing WH structures such as *haffirs* and ponds that are mainly used for watering livestock within Eastern Equatoria, Lakes and Western Equatoria States.
- Carry out a detailed assessment of the *haffirs* to be led by an International Consultant assisted by a National Consultant and MEDIWR Engineers.
- Analyze the past and present WH practices and develop guidelines and recommendations for *haffir* assessment and implementation.
- Train the MEDIWR engineers on assessment and implementation of *haffirs* and other relevant issues

Description of Methodologies

To successfully carry out the inventory/mapping of WH structures in Eastern Equatoria, Lakes and Western Equatoria States, a team comprised of FAO staff, MEDWIR staff and State Ministry of Physical Infrastructure in the three states took active part in collecting as much information as possible on the existing WH structures by visiting the *haffir* locations in the counties, payams and bomas of the three states and holding meetings with the community leaders, youth and representatives of the areas.

An inventory checklist was developed containing information on the location, type and purpose of structures and a description of the project area environment.

Findings

The three teams carried out the inventory/mapping of WH structures in the three states came out with the following findings:

1) Lakes State

Checklist / Number of haffirs		1	2	3	4	5
Location of structures	Name of structure	Nyangkot haffir	Ngokjak	Adekdit haffir	Bar Jak Community Water Distribution System	Abiru haffir
	State	Lakes	Lakes	Lakes	Lakes	Lakes
	County	Rumbek Central	Rumbek North	Rumbek North	Cueibet	Cueibet
	Payam	Matangai	Alor	Malueeth	Chitchok	Abiriu haffir
	Boma	Nyangkot	Makuei	Kak	Bar Jak	
	GPS	N	06056'49.2"	07044'15.3"	07038'12.4"	07014'55.4"
		E	029042'08.8"	029041'27.5"	029040'10.4"	029010'40.6"
		Elevation (m)	420	403	398	433
	Year constructed	2012	2012	2012	2012	2011
	Contractor	RA-International South Sudan	Zhonghao	Zhonghao	Obaki Foundation	Zhonghao
	Implementing agency	UNOPS/UNDP	UNOPS/UNDP	UNOPS/UNDP	Obaki Foundation	UNOPS/UNDP
	Funding Agency	UK-DFID and Netherlands Government				
	Type of structure	Haffir	Haffir	Haffir	Deep underground water well	Haffir

The team in Lakes State visited four *haffirs*, which were implemented by the United Nations Office for Project Services (UNOPS). These *haffirs* had no water and had incomplete components (as shown in the table above). The relevant authorities had no documents regarding the assessments carried out before the implementation and design. The team has observed that:

- The main WH structures for watering livestock constructed over the past decades are four *haffirs* and one community water distribution system constructed by the Obaki Foundation. There were also burrow pits created as a result of roads construction within the state that provided sources of water for livestock.
- Swamps, locally known as *toic*, are the only sources of water for livestock during the dry season.
- The Greater Yirol (Yirol West, Yirol East and Awerial Counties) and Rumbek East do not have any mechanized WH structures such as *haffirs*.

2) Western Equatoria

Although the WH structures in the state are for domestic use and not for livestock, the following observations were made:

- Most of the cattle come from neighboring states especially Lakes and Central Equatoria.
- Communities in Western Equatoria depend mostly on agriculture production.
- WH structures do not exist in Western Equatoria State because some of the streams contain water throughout the year in the areas where cattle are kept.

3) Eastern Equatoria State:

Although there are many *haffirs* in the state, only five were visited by the team - two in Kapoeta East and three in Kapoeta North. The following observations were made:

- Shearing of soil on the side slopes of the basin and subsequent depositing has decreased the depth of the *haffirs*.
- Siltation has decreased the usable capacity of *haffirs*.
- Evaporation and infiltration has led to water loss.
- The *haffirs* are located far from the communities and, as a result, routine maintenance of generators and other implements are not carried out.

County	Payam	Boma	Project Type	GPS coordinates
Kapoeta East	Jie	Napusiriet	Water - <i>haffirs</i> / Jie <i>haffir</i>	N 5°23'21.1", E 33°41'40.2"
Kapoeta East	Kauto	Nawoyatom	Water - <i>haffirs</i> / Nawoyatom <i>haffir</i>	N 4°58'04", E 34°12'49.6"
Kapoeta North	Wokobu	Lokoges	Water - <i>haffirs</i> / Lokoges <i>haffir</i>	N 5°11'48.8", E 33°29'50.7"
Kapoeta North	Lomeyen	Naminitoit	Water - <i>haffirs</i> / Lokoal <i>haffir</i>	N 4°59'26.5", E 33°20'39.1"
Torit	Hiyala	Oguron	Rock catchment / <i>haffir</i>	

Recommendations

It is recommended that WH inventory be carried out in the remaining counties of Lakes State to get an in-depth understanding of WH structures that have been constructed over the previous decades.

UNOPS/United Nations Development Programme (UNDP) are to be consulted for further details such as funding, feasibility studies carried out, design and contract documents for the *haffirs* constructed by them.

In order to avoid logistical challenges in undertaking the comprehensive socio-economic and environmental assessment and analysis it is imperative that FAO arrange for its own vehicles for the mission.

It is very important to restore peace among the pastoralist communities by constructing *haffirs* along the borders where the cattle migrate from one state to another as mentioned by the authorities and communities in Mvolo County.

Assessments should target pastoralist areas where WH structures exist. Eastern Equatoria should be given more attention because it has many *haffirs* that have not been properly implemented.

Conclusion

The inventory/mapping of the WH structures is essential for measuring their benefits, particularly the impact of these structures on eradicating conflict between communities. This will guide the Government and development partners in evaluating the use of WH structures as well as increasing or decreasing their prevalence.

Therefore, the development of the guidelines and training of the staff working with *haffirs* will be an added value for the management of water resources in the country.

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Water Harvesting Mapping

FAO South Sudan

Annex 2 – List of assessed Water Harvesting facilities in Lakes and Eastern Equatoria states

No	WH type	Name of the WH structure	Capacity	Purpose of the WH structure	Location		Components of the WH structure	Current status	Remarks
					State	County			
1	Haffir	Nyankot Haffir	30,000 m ³	Livestock watering	Lakes	Rumbek Center	· Inlet · Embankment · Reservoir · Solar panels · Surface pump · Perimeter fence · Cattle troughs	Not functional	Corrective actions were in progress after MWRI's recommendations.
2	Haffir	Abiriu	30,000 m ³	Livestock watering	Lakes	Cuebiet	· Inlet · Embankment · Reservoir · Solar panels · Surface pump · Perimeter fence · Cattle troughs	Not functional	Corrective actions were in progress after MWRI's recommendations.
3	Haffir	Jie Haffir	30,000 m ³	Livestock watering	Eastern Equatoria	Kapoeta East	· Inlet · Embankment · Reservoir · Surface pump · Perimeter fence · Cattle troughs	Functional	No available diesel for surface pump operation. People were accessing water using a pair of hand pumps. Livestock watering was manual.
4	Haffir	Lokoges Haffir	30,000 m ³	Livestock watering	Eastern Equatoria	Kapoeta North	· Inlet · Embankment · Reservoir · Solar panels · Surface pump · Perimeter fence · Cattle troughs	Functional	Livestock watering was manual as the water level in the reservoir was below the intake level as shown on the cover page picture.
5	Water barrier	Nakrumai Water Barrier	80,000 m ³	Livestock watering	Eastern Equatoria	Kapoeta East	· Embankment · Reservoir · Solar panels · Submersible pump · Perimeter fence · Cattle trough	Functional	Both human and livestock directly access the water in the reservoir as the submersible pump and solar system were not operational

Annex 3 – Comparison of existing types of WH structures in South Sudan

No	Type of WH structures	Appropriateness for livestock watering	Advantages	Disadvantage	Cost effectiveness
1	Community ponds	Appropriate where surface and ground water source is limited like in EES and where communities are committed and ready to do the de-siltation regularly	- Could be constructed and managed by communities - Community participation could be easily promoted - They could be replicated in other communities	- Could become silted unless they are constructed with soil and water conservation features in their catchments. - Could be a source of Guinea Worm if not fenced in	- Could be done with less capital investments - Community contribution could be significant
2	Haffirs	If managed properly, they are appropriate where surface water sources are limited	Could serve many heads of livestock for longer periods	- Require machinery for their constructions. - Community participation is limited during construction - Could be affected by siltation if they are not designed properly - Require proper community management training - Abstraction of water requires the use of different sources of energy	Require significant amount of capital investment for construction (per capita cost is high)
3	Rock catchments	Appropriate where there are barren rocks for catchment and other water sources are limited like in southern parts of EES	- Siltation problem is limited - Quality of water is relatively good - Water can be delivered by gravity	- Cannot be replicated everywhere - Require proper community management training - Capacity is limited and depends on surface areas of barren rocks	Per capita cost is low to medium
4	Water barriers/pans	Appropriate where impounding is required and topography and geology of the terrain is suitable and where surface water source is limited	Could serve many heads of livestock for longer period like haffirs	- Require machinery for construction - Could be a source of Guinea Worm if not fenced in - Community participation is limited during construction - Could be affected by siltation if they are not designed properly - Require proper community management training - Abstraction of water may require the use of different sources of energy	Require significant amount of capital investment for construction (per capita cost is high)
5	Roadside dugout pits	Appropriate where water sources are limited	Could serve as additional sources of water for pastoral/agro-pastoral communities	- Their locations depend on the availability of selected materials for road construction. - Cannot be constructed where they are needed most - Could be a source of Guinea Worm if not fenced in	Do not require any capital investment to the community

Annex 4 – Checklist for the technical assessment WH structures

- Type of WH structure: *Haffir* size m³
Pond size m³
- Use/purpose of the WH facility: _____
- What were the selection criteria for the counties with such facilities? Who selected them?
- Was there a feasibility assessment that was carried out before the construction? If yes, refer to the document(s) (if available) to explore the process of who and how it was carried out, whether the meteorological data have been considered/referred or not, etc.
- Are there proper designs/drawings for the WH facility? Were there any modifications of the designs?
- How was the construction supervised? Who supervised it?
- Costs of facilities.
- Observation at the site
 - catchment area
 - feeding channels
 - reservoir
 - embankment
 - trough/s
 - fence
 - water delivery system to the trough/s
- Observed factors affecting the sustainability of the WH facility: For how long has the facility been serving the community? Does it have any management system?
- Any observed impact/reduction of conflict as a result of the WH facility.

Annex 5 – Environmental Problems, Impacts and Mitigation Measures in Water Harvesting Projects for Livestock Water

Problems	Possible Impacts	Possible Causes	Mitigation Measures
Depletion of freshwater resources	- Overall loss of water resources; loss of aquatic life; greater use of poor quality water; and increased energy expenditure on pumping turbid water - Inadequate water sources for sustenance of the livestock during the critical period of the dry season - Forces pastoralists to resume undesirable seasonal migration in search of water for livestock - Increases chance of conflict among competing users at water points - Contributes to emerging conflicts leading to deterioration of the peacebuilding process	Water withdrawals exceed the safe storage levels of the surface water storage facilities (haffirs/ponds) as a result of one or more of the following: - Underestimation of water demand, i.e. limited storage size and/or too many users - Over-pumping of water sources - Lack of data/information on user population and related aspects - Waste and leakage of water while abstracting - Excessive use of the common resource resulting from lack of or inadequate control mechanisms - Evaporation and seepage losses - High sedimentation rates (reduction in storage capacity)	- Limit water uses to the safe limits of the source (storage) and effective demand of the users - Appropriate design considerations for optimal provisions - Ensuring effective operation and maintenance arrangement with user communities/NRMCs; - Use clay materials and adequate compaction to seal the bottom of the haffir - Catchment treatment or watershed management
Bacteriological, chemical and physical degradation of the stored water in haffirs	- Adverse health effects on aquatic life, animals and humans (if used for domestic purposes) - Increased cost of water treatment	- Discharge of chemical fertilizers, pesticides, human and animal waste into surface waters - Uncontrolled access to the haffirs by humans and animals causing contamination	- Sound technical designs - Proper operating practices of water supply systems
Creation of stagnant water (near water points, troughs and other system facilities)	- Contamination of water source - Increase in water-related diseases in animals and humans - Soil erosion and site degradation	- Inadequate drainage system - Poor construction practices - Unsanitary behavior near water collection points	- Proper drainage system - Good construction practices - Hygiene education
Degradation of ecosystem	- Soil erosion, loss of wildlife and plant habitat - Loss of biodiversity - Increased disease transmission through vectors and contaminated water - Greater need for water treatment	- Incorrect siting of surface water storage facilities - Poor design and construction practices - Improper use of water storage facilities	- Proper construction and maintenance of storage facilities and surroundings - Refilling/leveling burrow pits - Spreading and leveling soil excavated from the haffir - Environmental awareness raising - Hygiene education
Land degradation	- Soil erosion and sedimentation - Water losses	- Too many users on limited water points - Livestock trampling and trekking - Lack of land cover - Overgrazing and overstocking - Conveyance channels and catchment surfaces being untreated	- Catchment treatment - Scheduled watering of livestock - Balanced distribution of haffirs with the number of livestock - Awareness raising of pastoralists on improved range management and limiting livestock size (i.e. destocking) - Creating market linkages to increase takeoff

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