



ENTRO
EASTERN NILE TECHNICAL
REGIONAL OFFICE



BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

*Design details for the Akobo-Gambella
floodplains transboundary development
programme*

Vfin July 2017



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LIST OF DELIVERABLES

The Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project has generated a set of deliverables which are summarised in the table below. This deliverable is highlighted in grey below.

THE BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT	
A. The Integrated Water Resources Development and Management Plan	
A.1	Inception report
A.2	Consultation and Communication Plan
A.3	Scoping report
A.4	Baseline, Development Potentials, Key issues and Objectives report
A.5	Strategic Social and Environmental Assessment
A.6	Integrated Water Resources Development and Management Plan
B. Medium and Long-term Projects: Terms of references for feasibility studies	
B.1	The Integrated BAS Hydropower, Irrigation and Multipurpose Development Programme - Phase 1. Baro-Sobat component
B.2	The Akobo-Pibor Transboundary Multipurpose Development Project
B.3	Livelihood-based Watershed Management - Taking to Scale for a Basin Wide Impact
C. Short-term Project: Feasibility studies	
C.1	Feasibility Study for the Kinyeti River Multipurpose Development Project
C.2	Feasibility Study for the Majang Multipurpose Project
C.3	Design Details for the Akobo-Gambella floodplains Transboundary Development Programme
D. Project brochure	
D.1	The Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project: General overview
D.2	The Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project: Medium and Long-term Projects

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BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

Design details for the Akobo-Gambella floodplains transboundary development programme

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ACRONYMS AND ABBREVIATIONS

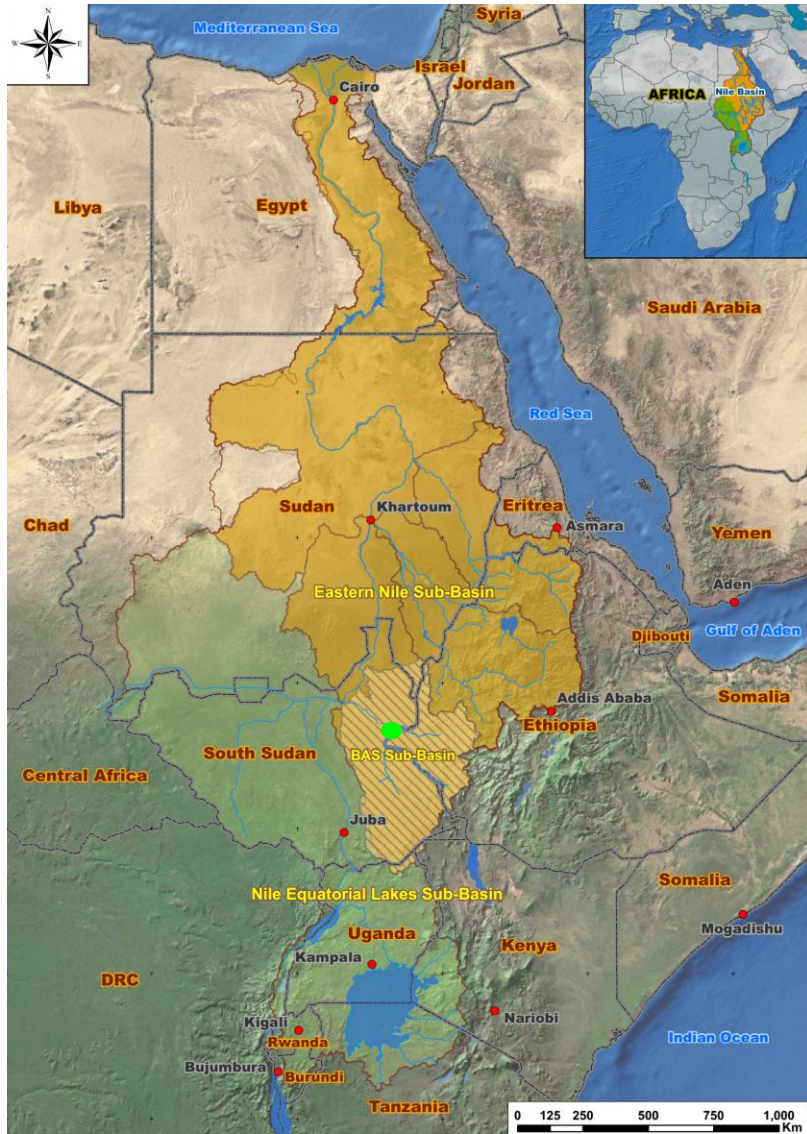
BAS	Baro-Akobo-Sobat
CSA	Central Statistical Agency of Ethiopia
EIA	Environmental Impact Assessment
ENSAP	Eastern Nile Subsidiary Action Plan
ENTRO	Eastern Nile Technical Regional Office (NBI)
EU	European Union
GWF	Global Water Facility
GWh/y	kiloWatt hour/year
IGAD	Intergovernmental Authority on Development
IUCN	International Union for Conservation of Nature and Natural Resources
IWRDMP	Integrated Water Resources Development and Management Plan
IWRM	Integrated Water Resource Management
MDG	Millennium Development Goals
kW	Kilo Watt
NBI	Nile Basin Initiative
NGO	Non-Governmental Organization
SSEA	Strategic Social and Environmental Assessment
WHO	World Health Organisation
WUA	Water Users Association
WWF	World Wild Fund

EXECUTIVE SUMMARY

The Akobo-Gambella floodplains transboundary development programme is one of the three short-term projects proposed as part of the Baro-Akobo-Sobat multipurpose water resources development study project. The three short-term projects are based on the sustainable development of water resources. They aim at providing inter-sectoral benefits and improving people's livelihoods in the sub-basin.

The Akobo-Gambella programme is designed around solar pumping and the provision of water for various uses. This programme is designed to reduce extreme poverty and improve livelihoods in an area of the BAS sub-basin which is highly vulnerable (conflicts over the resources, food insecurity, no access to a safe source of water, etc.). This area currently receives humanitarian aid and the programme focuses on the transition between aid and development.

The programme includes generic components such as potable water supply, sanitation, livestock watering, capture fisheries, aquaculture, small scale irrigation and capacity building. The implementation of the programme will include field work to select pilot areas, identify specific needs and refine these generic components.



Location of the Akobo-Gambella programme (green dot)

The Akobo-Gambella area is not easily accessible and there are currently no infrastructures (roads, electricity, etc.). The proposed programme is easy to implement and aimed at replication to allow economy of scale.

1. INTRODUCTION

1.1 CONTEXT

1.1.1 General Context

Work on the Baro-Akobo-Sobat (BAS) multipurpose water resources development study project commenced in March 2015. The overall objective of the study is to assist ENTRO in preparing an Integrated Water Resources Development and Management Plan (IWRDMP) based on a Strategic Social and Environmental Assessment (SSEA), and further develop investment packages for cooperative development in the Baro-Akobo-Sobat sub-basin. The study comprises 4 components:

- ▶ Component 1: Strategic Social Environmental Assessment (SSEA) and Integrated Water Resources Development and Management Plan (IWRDMP)
- ▶ Component 2: Identification and preparation of short-term projects, either small infrastructure projects or “soft-type” development projects.
- ▶ Component 3: Identification and profiling of medium and long-term projects.
- ▶ Component 4: Project implementation support.

The Akobo-Gambella floodplains development programme is one of the three short-term projects included in component 2. The two other projects are the following:

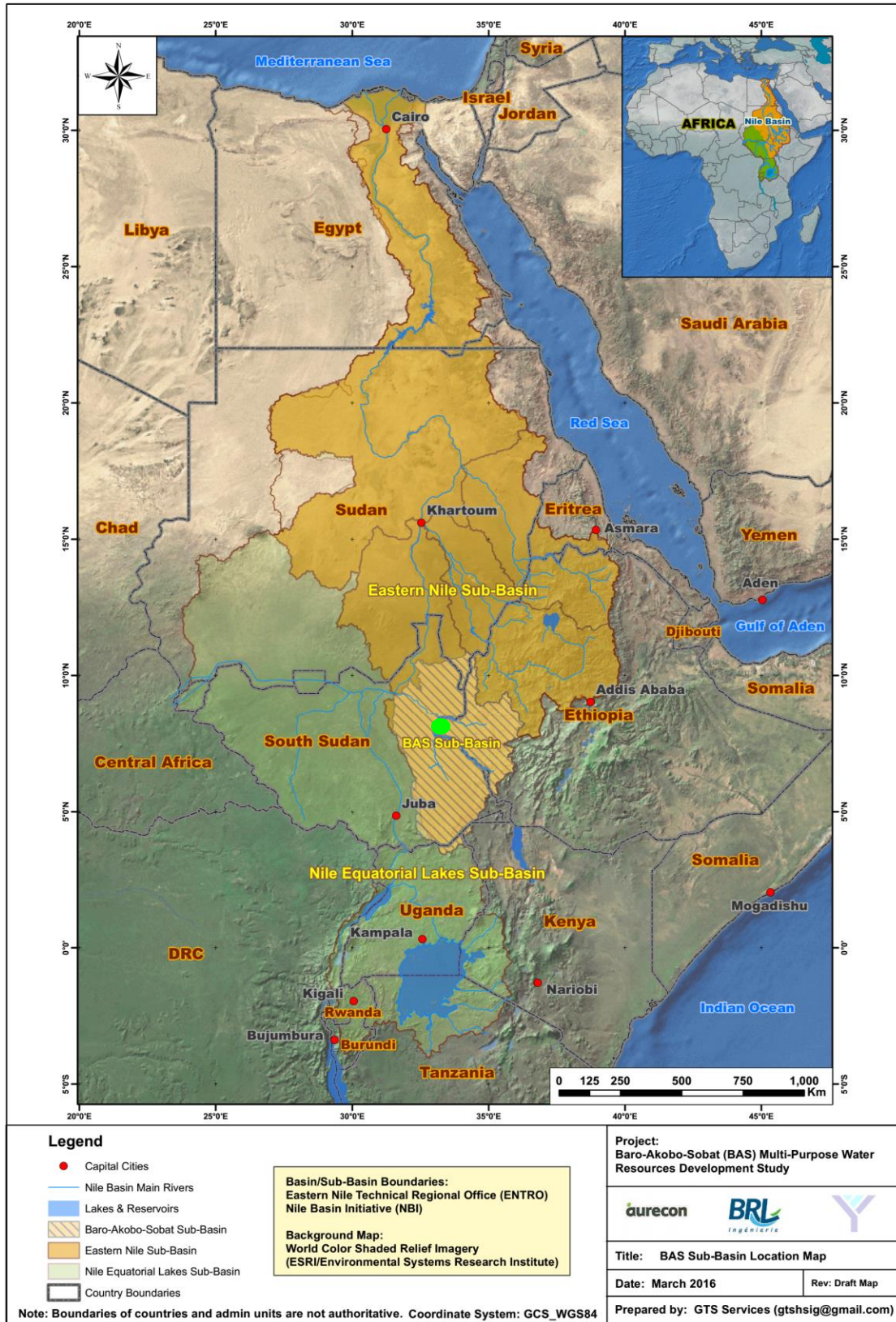
- ▶ The Majang multipurpose development project (located in Ethiopia)
- ▶ The Kinyeti river multipurpose development project (located in South Sudan)

The three short-term projects were selected during the baseline workshop held in Adama in April 2016 by the key stakeholders of the basin. Seven short-term projects were initially proposed in a concept note for discussion and selection during the workshop.

1.1.2 The BAS sub-basin

The BAS sub-basin is part of the Eastern Nile as shown in the location map hereafter. The location of the Gambella/Akobo programme is indicated with a green dot. This sub-basin is characterised by distinct wet and dry seasons and the spatial variation of precipitation across the basin is considerable.

Figure 1-1: Location of the Baro-Akobo-Sobat sub-basin within the Eastern Nile sub-basin



1.2 OBJECTIVES

1.2.1 Objectives and principles of the short-term projects

OBJECTIVES OF THE SHORT-TERM PROJECTS

As stated in the general context, the feasibility studies for the short-term projects form component 2 of the BAS multipurpose water resources development study project. The objectives of the short-term projects have been defined in accordance with the environmental and social work carried out in the baseline study and follow the guiding principles provided by the term of references for the study. The main considerations of the short-term projects are the following:

- ▶ Strategies to improve livelihoods and reduce poverty;
- ▶ Strategies to reduce conflicts over the resource;
- ▶ Strategies to implement an enabling environment, favourable for moving towards the vision of the basin in the future, especially when supported by the implementation of medium and long-term projects and the taking of short-term demonstration type projects to scale.

Furthermore, it should be noted that these short-term projects have been designated in accordance with the sustainable development goals (SDGs) and more particularly with the following goals:

- ▶ Goal 1. End poverty in all its forms everywhere
- ▶ Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- ▶ Goal 3. Ensure healthy lives and promote well-being for all at all ages
- ▶ Goal 5. Achieve gender equality and empower all women and girls
- ▶ Goal 6. Ensure availability and sustainable management of water and sanitation for all
- ▶ Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- ▶ Goal 13. Take urgent action to combat climate change and its impacts

PRINCIPLES BEHIND THE SELECTION OF THE SHORT-TERM PROJECTS

The perspective of IWRM principles is critical to ensure the sustainable use of water and the associated resources

IWRM principles have been central in the definition of these projects:

- ▶ Water resources development must be sustainable and integrate environmental, social and economic issues/potentials of the area.
- ▶ Water resources development must be based on local needs and include the consultation of key stakeholders.
- ▶ Water resources development must be coherent at the scale of the basin. Development upstream must not have harmful impacts on downstream water users and on the environment.
- ▶ Water resources development must provide shared benefits at basin scale.

The project must be designed in accordance with the vision defined for the basin as part of the IWRDM Plan

The vision represents the desired future state for the Baro-Akobo-Sobat sub-basin to be achieved by implementation of the IWRDM Plan. This vision was defined by key stakeholders from Ethiopia, Sudan, South Sudan and ENTRO during the baseline workshop held in Adama, Ethiopia on April 16th, 17th and 18th 2016. The three short-term projects must contribute to reaching the vision which is as follow:

“A sustainably managed and developed BAS river sub-basin with prosperous, connected, peacefully and mutually co-existing societies.”

The projects must provide inter-sectoral benefits

The three selected short-term projects are **multipurpose projects**: the proposed infrastructure can be shared by a number of development sectors (potable water supply, livestock watering, small scale irrigation, fisheries, hydropower, etc.).

The services provided by water resources depend on the well-being of the related ecosystems

Emphasis has been put on **ecosystem services** and the need to sustainably develop water-related projects. The definition of ecosystem services by the Millennium Ecosystem Assessment is the following: *“Ecosystem services are the benefits people obtain from ecosystems. These include provisioning of services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.”* The livelihood conditions of people in the basin depend directly or indirectly on the services provided by the ecosystems for potable water, sanitation, fisheries activities, agriculture, etc. In order to develop the livelihoods in the basin, it is thus essential to develop, optimize and ensure the sustainability of these ecosystem services. It should be stressed, therefore, that the concept of sustainability places emphasis on the economic self-sufficiency of the proposed project, since the environmental sustainability that the project should bring, can only be achieved if the economic sustainability is assured through the improved livelihoods of the beneficiaries.

1.2.2 Origin and justification for the project

The Akobo-Gambella area of the BAS sub-basin currently receives significant WASH (Water, Sanitation and Hygiene) and food humanitarian aid. Humanitarian projects target the crisis situation and propose emergency solutions, which are clearly short-term in nature.

The ODI (Overseas Development Institute, 2016) has shown that although humanitarian interventions are required to face emergency situations, medium/long-term projects need to be implemented in parallel for the development of sustainable solutions. The protracted crisis situation does not allow to focus only on short-term interventions as these solutions make people highly dependent on aid and vulnerable to changes.

There is thus a need to complement and eventually shift from humanitarian aid to development. The Akobo-Gambella floodplains development programme proposes sustainable solutions to meet basic needs: improve food self-sufficiency, access to water and to improve livelihoods, at the same time improving connectivity of isolated areas. This will eventually have a major role in the resolution of water related conflicts. There are indeed conflicts related to water as there is currently no reliable water access in that area.

This programme is ready to be developed as soon as the situation allows. Finally, it should be noted that part of the project will include the piloting of experience-sharing aimed at showing how scaling-up can be achieved rapidly.

1.2.3 Specific objectives of the Akobo-Gambella floodplains development programme

The main purpose of the programme was defined by the key stakeholders of the Baro-Akobo-Sobat sub-basin during the baseline workshop held in Adama in April 2016. The programme should help reduce transboundary conflicts associated with water, improve food security and lead to improved livelihoods. The following sectors are included in the programme:

- ▶ Potable water supply and sanitation
- ▶ Livestock watering
- ▶ Aquaculture
- ▶ Small scale irrigation
- ▶ Capacity-building/training programme cutting across all activities
- ▶ Experience sharing with neighbouring communities aimed at replication, taking to scale and improving economy of scale – hence access to markets

In Ethiopia, the programme applies essentially to the plains of Gambella region (Nuer Zone) and in South Sudan, it is located in Jonglei State (Akobo County) and Upper Nile State (Ulang County). The programme area should not be considered definitive as the needs and potentials encountered in these areas are not strictly included in these counties and zone. This delineation is important to describe the broad socio-economic context of the area.

For security reasons, the area could not be visited while this study and it was not possible to propose specific locations to implement the programme.

1.2.4 Objective of this report

This report presents the details for the proposed programme and describes guidelines for its implementation.

This programme has been presented to donors identified by ENTRO during a round table in 2017. It includes the following elements:

- ▶ Baseline analysis of the area where the programme will be implemented (chapter 2)
- ▶ Details of the programme components (chapter 3)
- ▶ Estimation of the benefits of the programme (chapter 4)
- ▶ Estimation of the costs to help decision making (chapter 5)

2. PROJECT AREA – GENERAL CONTEXT

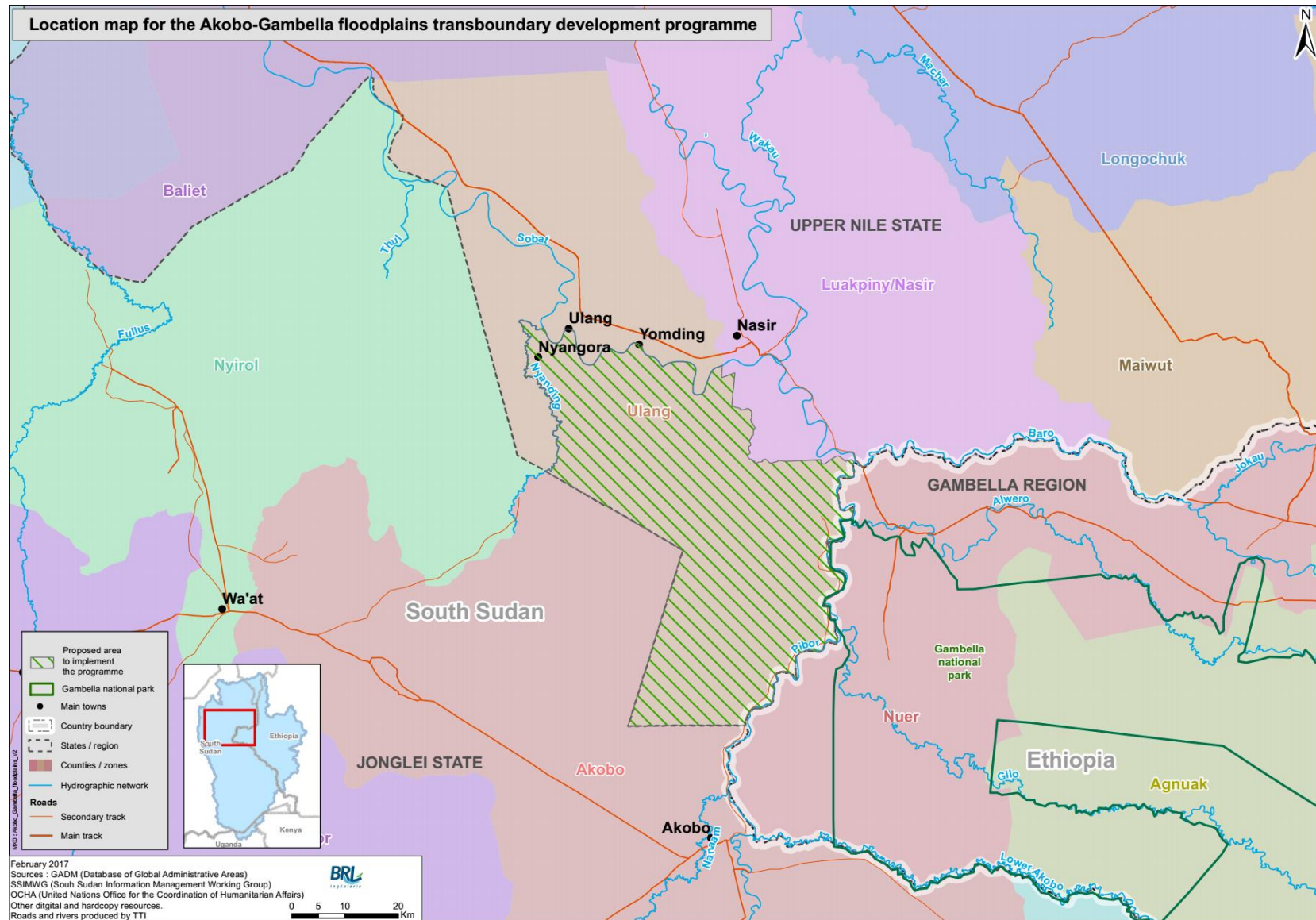
2.1 INTRODUCTION

This section provides the general environmental, socio-economic and institutional context to understand the situation in the area of the programme. Information is given for the following areas (relevant especially for the socio-economic analysis):

- ▶ Akobo county – Jonglei state (South Sudan)
- ▶ Ulang County – Upper Nile State (South Sudan)
- ▶ Nuer zone – Gambella Region (Ethiopia)

Having a clear picture of the current situation enables to identify the needs and potentials of the area and justify the proposed multipurpose programme. A location map is provided hereafter.

Figure 2-1: Location map for the Akobo-Gambella floodplains transboundary development programme



There is little available information on the bio-physical environment in the area. For the socio-economic environment, there is more information - especially for South Sudan - mostly released by humanitarian organisations.

2.2 BIO-PHYSICAL ENVIRONMENT

2.2.1 General overview

2.2.1.1 Physical environment

The programme area is located in the South Sudan and Ethiopian lowland floodplains (between 370 to 450 masl), at the crossroad between the following BAS sub-catchments: Baro, Alwero, Gilo, Lower Akobo, Lower Pibor and Sobat. This area receives between 750 to 1,000 mm of rainfall per year and the mean annual potential evapo-transpiration is significantly higher (superior to 1,900 mm). It is actually the hottest zone of the sub-basin with minimum temperatures of over 21°C and maximum temperature higher than 32°C.

2.2.1.2 Biological environment

According to the WWF (World Wild Fund) classification of ecoregions, the programme area includes two main ecoregions:

- ▶ The East Sudanian Savanna ecoregion with Tropical and subtropical grasslands, savannas and shrublands. This ecoregion is flat, lying between 200 masl and 1,000 masl. According to Tilahun (1996), the vegetation is dominated by the following species:
 - Woody vegetation: *Combretum* and *Terminalia* species, *Anogeissus leiocarpus*, *Boswellia papyrifera*, *Lannea schimperi*, *Stereospermum kunthianum*, *Oxytenanthera abyssinica*
 - Dominant grasses: *Hyparrhenia*, *Cymbopogon*, *Echinochloa*, *Sorghum*, and *Pennisetum*
- ▶ Saharan flooded grassland. This ecoregion supports a variety of plant species ranging from those adapted to wet environments, under water during several months in a year, to those adapted to drier environments, occasionally flooding or only by rainfall. *Cyperus papyrus* is dominant at riversides and in the wettest swamps. *Phragmites* and *Typha* swamps are extensive behind the papyrus stands, and there is an abundance of submerged macrophytes in the open waterbodies. Wild rice (*Oryza longistaminata*) and *Echinochloa pyramidalis* grasslands dominate the seasonally inundated floodplains. Wild rice supports a flooded period from 5 to 9 months, whereas *Echinochloa pyramidalis* is inundated during less than 3 to 4 months in a year.

Beyond the floodplain, *Echinochloa haploclada*, *Sporobolus pyramidalis* and *Hyparrhenia rufa* grasslands cover the rain-fed wetlands. Mixed woodlands of *Accacia seyal*, *Ziziphus mauritiana*, *Combretum fragans*, and *Balanites aegyptica* border the floodplain ecosystem (Denny, 1991 in Burgess & al., 2004). Riparian forests species include: *Celtis kraussiana*, *Ficus sycomorus*, *Mimusops kummel*, *Tamarindus indica*, *Maytenus senegalensis*, *Kigelia aethiopum*, *Syzygium guineense* and *Acacia* spp (ENTRO, 2007a).

The floodplains and the marshes form a rich ecosystem which includes over four hundred bird species and one hundred mammal species (according to the WWF). As described in the baseline study, this area of the BAS sub-basin is located in a major bird migratory corridor and wetlands constitute an essential stopover for the birds. The BAS also hosts **one of the major mammal migration of the world** (USAID, 2010b). The **main migratory species is the White-eared Kob** (*Kobus kob leucotis*). In this area of the sub-basin, there is also the **Nile lechwe** which is present only in the Sudd swamps, *Machar Marshes* and in Gambella region (Frost, 2014; IUCN SSC Antelope Specialist Group, 2008; Kingdon et al., 2013). Nile lechwe's primary habitat is swamps and marshes which are subject to seasonal inundation (Kingdon et al., 2013). **Local patterns of flooding have the most significant influence on the species** (Kingdon et al., 2013).

2.2.1.3 Land use and land cover

The programme area is still quite pristine and there is no major anthropogenic land pressure. The land cover is dominated by marshes, especially in the Ethiopian part (Gambella National Park) and by Savanna (generally dry and temporarily wet).

2.2.1.4 Areas with special status

Part of the programme area is located within the Gambella national park. This park is Ethiopia's largest national park. It covers an area of 5,061 km², with a unique ecosystem and wildlife composition. It should be noted that there is currently an attempt to prepare and legalize a land use and development plan for Gambella. This effort is led by the Horn of Africa Regional Environment Centre of Addis Ababa University. It is funded by the European Union (EU) through IGAD and relevant ministries. Both Federal and Regional governments are members of the steering committee that finally approves the Land use and development plan. Efforts have been made to obtain a copy of this plan but this has not been possible. The Plan is apparently still awaiting approval.

2.2.2 Key issues and challenges

This area of the BAS sub-basin is not well documented and field work is necessary to identify more precisely the key issues and challenges. However, it is likely that these key issues and challenges are related to the following:

- ▶ Depletion of wildlife populations due to:
 - Conflicts between livestock and wildlife for access to grazing lands and water
 - Poaching: the armed conflict in South Sudan has led to the proliferation of firearms and unsustainable hunting of wildlife in large numbers.
- ▶ Deforestation and unsustainable use of charcoal and timber
- ▶ Unsustainable fishing practices

Furthermore, the development of water resources upstream in the BAS basin could have impacts on the Gambella floodplains ecosystem (modification of the natural flow of the major rivers leading to the modification of the extent and duration of floods).

2.3 SOCIO-ECONOMIC CONTEXT

The two main sources of information for socio-economic analysis of the area are the following:

- ▶ For South Sudan: South Sudan Statistical yearbook (National Bureau of Statistics, 2011)

- ▶ For Ethiopia: Statistical data for SNNPR and Gambella region - socio-economic and demographic conditions (CSA, 2007)

Indicators used in these statistical analyses in South Sudan and Ethiopia are not the same. When possible, the same indicators are used to describe the baseline situation in the two countries. Otherwise, available indicators are used to describe the situation in the counties/zone.

2.3.1 General overview

2.3.1.1 Population demographics

Population demographic data in the programme area are given in Table 2-1. Information is at Payam level (for Akobo and Ulang counties) and woreda level (for Nuer Zone).

The total population in the programme area was around 430,000 people in 2015 and could reach 780,000 people in 2041. It should be noted that the population density is quite low in these counties/zones (refer to Table 2-2).

Table 2-1: Population demographics for the programme area

			2015			2020 (given for South Sudan)			2041 (2.5% growth rate per year in South Sudan and 1.68% in Ethiopia)		
			Total	Males	Females	Total	Males	Females	Total	Males	Females
Population demographics	Akobo county: population per payam	Alali	5,435	2,869	2,566	5,435	2,869	2,566	9,129	4,819	4,310
		Barmach	31,910	16,845	15,065	31,910	16,845	15,065	53,595	28,293	25,303
		Bilkey	46,111	24,341	21,770	54,298	28,301	25,997	91,198	47,534	43,664
		Buong	11,923	6,294	5,629	14,039	7,317	6,722	23,580	12,290	11,290
		DengJok	22,092	11,662	10,430	26,013	13,558	12,455	43,691	22,772	20,919
		Diror	17,182	9,070	8,112	20,232	10,545	9,687	33,981	17,711	16,270
		Nyandid	32,786	17,307	15,479	38,608	20,123	18,485	64,845	33,798	31,047
		Walgak	7,714	4,072	3,642	9,084	4,735	4,349	15,257	7,953	7,305
		TOTAL Akobo county	175,153	92,460	82,693	199,619	104,293	95,326	335,276	175,169	160,108
	Ulang county: population per payam	Doma	25,258	13,453	11,805	30,571	16,103	14,468	51,346	27,046	24,300
		Kurmuot	37,887	20,179	17,708	45,855	24,154	21,701	77,017	40,569	36,449
		Ulang	23,294	11,647	11,647	28,548	14,274	14,274	47,949	23,974	23,974
		Yomding	24,695	13,153	11,542	29,888	15,743	14,145	50,199	26,442	23,758
		TOTAL Ulang county	111,134	58,432	52,702	134,862	70,274	64,588	226,512	118,031	108,481
	Nuer zone: population per woreda	Lare	41,135	21,229	19,906	-	-	-	63,436	32,738	30,698
		Jikawo	44,077	23,744	20,333	-	-	-	67,973	36,617	31,356
		Wantawa	26,729	14,067	12,662	-	-	-	41,220	21,693	19,527
		Akobo	30,126	17,446	12,680	-	-	-	46,459	26,904	19,554
		TOTAL Nuer zone	142,067	76,486	65,581	-	-	-	219,087	117,952	101,135
	TOTAL Programme area		428,354	227,378	200,976				780,876	411,152	369,724

Source: National Bureau of Statistics (2011); CSA (2007)

Table 2-2: Population density in the programme area

County/Zone	population density (people/km ²)	
	Year 2015	Year 2041
Akobo	19	37
Ulang	23	47
Nuer	30	46

Source: National Bureau of Statistics (2011); CSA (2007)

2.3.1.2 Education

Information regarding literacy rate and school attendance in the programme area is given in Table 2-3 and Table 2-4. Detailed information about education should be collected during the first phase of the programme implementation (field work to select specific areas for project implementation).

This information should be obtained at kebele/payam level and updated as the situation can vary significantly at local level and between the years. For instance, in the Inter-Agency Rapid Need Assessment carried out in Ulang county (Inter-Agency Standing Committee, 2014), it is stressed that in Ulang county, there are 31 primary schools (7 with permanent structures, 2 with semi-permanent and 22 under trees) and 1 secondary school. These schools are not functional anymore due to the burning of the material during the crisis. This information is not reflected in the South Sudan Statistical Yearbook released in 2011 hence the importance of updating information.

Table 2-3: Literacy rate in the programme area

		Total population	Literacy rate	Male Population	Literacy rate	Female population	Literacy rate
Ethiopia: Population on 5 years old and older by literacy and sex (2007)	Gambella region - rural	197,324	42%	101,921	49%	95,403	36%
	Nuer zone - rural	87,550	40%	46,714	45%	40,836	34%
South Sudan: literacy rate by State population on 6 years old and older by literacy (2011)	Upper Nile State	813,481	50%	-	-	-	-
	Jonglei	1,151,178	19%	-	-	-	-
	National level	6,951,799	28%	-	-	-	-

Source: CSA (2007), National Bureau of Statistics (2011)

Table 2-4: Primary school pupil enrolment rate

			Total number of pupils	Of which male	Of which female
Primary school pupil enrolment rate in 2010	Akobo County	Number of pupils in primary school	45,676	29,794	15,882
		Pupil enrolment rate	100%	65,20%	34,80%
	Jonglei State	Pupil enrolment rate	100%	61,4%	38,6%
	Ulang County	Number of pupils in primary school	16,800	9,928	6,872
		Pupil enrolment rate	100%	59,1%	40,9%
	Upper Nile State	Pupil enrolment rate	100%	58,0%	42,0%

2.3.1.3 Sources of livelihood

The programme target area is mostly rural and the main source of income (both in Ethiopia and South Sudan) is farming, fishing and sale of livestock. Most information is available for the South Sudan side. However, the information given in the following paragraphs is representative of the situation in the Nuer zone as the livelihood activities are similar on both sides of the border.

FOOD CROP PRODUCTION

According to the Inter-Agency Standing Committee (2014), the main crops grown in Ulang (and more widely in the floodplains) are maize, sorghum and beans. The surface area cultivated and the observed yields are not significant enough to meet the food needs and almost all the crops are cultivated for self-consumption. Some respondents even reported eating seed stocks when they run out of food. This subsistence practice limits the number of seeds available for planting the following year.

In South Sudan, there are very few food commodities in markets and for those available, prices are very high as foodstuffs are mostly imported from Ethiopia. Information about livelihoods and food crop production in South Sudan is given in Table 2-5 hereafter.

Table 2-5: Livelihood information for Akobo and Ulang counties

Livelihood information in 2010		Households mid-2010	Percentage of farming households	No. of farming households	Average Cereal area (ha/hh)	Total Cereal area (ha)	Yield (T/ha)	Net cereal production in 2010 (T)	Estimated cereal deficit in 2011 (T)	Estimated cereal deficit (T)
	Akobo county	18,526	80%	14,821	0.85	12,598	0.8	7,559	8,434	53%
	Jonglei state	208,788	82%	168,928	0.84	142,705	0.7	83,874	74,259	47%
	Ulang county	12,050	80%	9,640	0.7	6,266	0.9	4,261	3,001	41%
	Upper Nile state	150,105	67%	100,560	0.8	77,790	0.8	48,985	37,443	43%

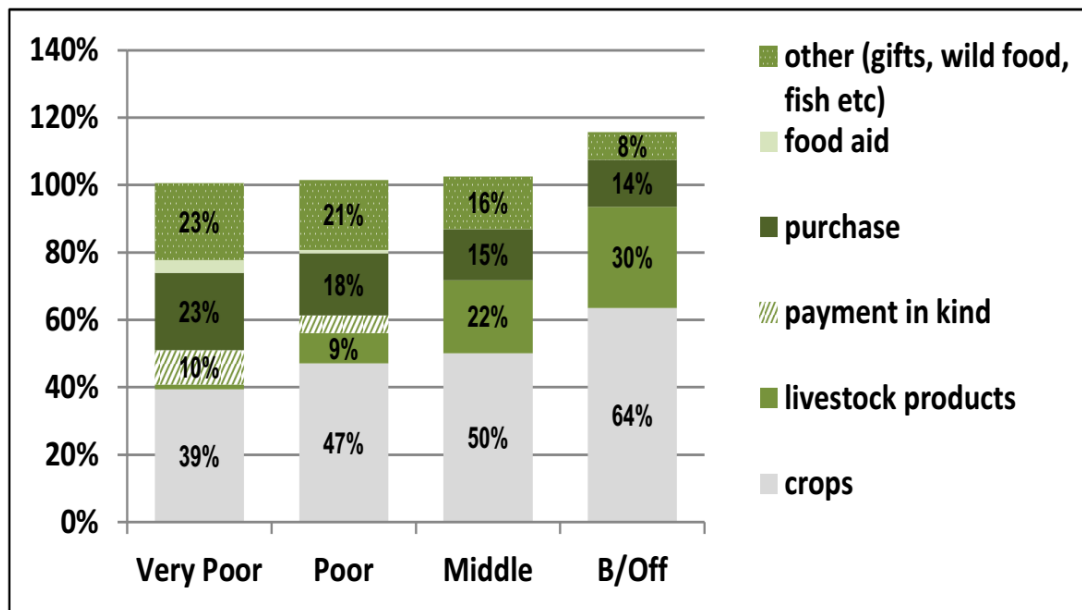
LIVESTOCK AND FISHERIES

River fishing takes place in rivers during the dry season and swamps during the rainy season. Fishing gear can be purchased in markets and can also be rented for people who cannot afford to buy this equipment. **Fishing is one of the main sources of livelihood for poor households, together with the sale of grass.**

Livestock production is a complement to fishing and farming. However, it should be noted that livestock is primarily a symbol of wealth and the consumption of meat is very low (from 0 to 1% of the annual food needs). Milk consumption is more significant, especially for better-off households where it represents 20 to 30 % of the overall calories intakes (1 to 10% for the poor households). **Milk and livestock sales are the main sources of livelihood better-off households.**

Figure 2-2 below gives the food sources for four categories of people based on wealth.

Figure 2-2: Food access as a percentage of minimum food requirement in South Sudan floodplains (2,100 kCals per person per day)



Source: Department for International Development, 2013

2.3.1.4 Health status

GENERAL OVERVIEW

Access to a safe source of water and use of toilet facilities are very limited in the programme area. This results in high rates of water borne diseases and watery diarrhoea. There is a high prevalence of malaria during the rainy season. Access to health facilities is quite limited due to the poor road infrastructure. In South Sudan, some drug dispensaries and health centres were destroyed during the conflict.

ACCESS TO WATER AND SANITATION IN NUER ZONE

In 2007 in Nuer zone, the access to a safe source of drinking water was very limited as shown in Table 2-6 and the use of toilet facilities almost non-existent (refer to Table 2-7)

Table 2-6: Housing units by source of drinking water in 2007 in rural Nuer zone

Housing Units by source of drinking water		All housing units	tap inside the house	tap in compound private	tap in compound share	tap outside compound	protected well or spring	unprotected well or spring	River lake pond
Nuer zone		16,516	439	45	243	724	877	1,322	12,866
		100%	2.66%	0.27%	1.47%	4.38%	5.31%	8.0%	77.9%

Source : CSA, 2007

Table 2-7: Toilet facilities in Nuer zone in 2007

Housing Units by type of toilet facility		All housing units	no toilet facility	flush toilet, private	flush toilet, shared	VIP latrine private	VIP latrine shared	Pit latrine, private	Pit latrine, shared
Nuer zone		2,481	2,378	6	0	6	6	22	63
		100%	95.85%	0.24%	0.00%	0.24%	0.24%	0.89%	2.54%

Source : CSA, 2007

ACCESS TO WATER AND SANITATION IN ULANG AND AKOBO COUNTIES

There is no extensive information with respect to access to water and sanitation in the South Sudan Statistical Yearbook of 2011. Information is given at state level (refer to Table 2-8) and further investigation is required to represent situation at local level. Moreover, the situation can vary greatly from one place to another and can change quickly due to the unstable situation. For instance in Nyangora and Barmach towns, people get their water from the Sobat river only, while in Ulang town (which is close to the other two towns), 7 boreholes were providing safe water before the beginning of the crises. Out of these 7 boreholes, two are solar pumping system with 5,000 L holding tanks. This system was installed by 'Nile Hope' a local NGO and is greatly appreciated by the communities.

Table 2-8: percentage of households using improved drinking water and improved sanitation

Use of improved drinking water and sanitation	State	Improved drinking water source	Improved sanitation	improved drinking and improved sanitation
	Upper Nile	61,8%	7,8%	7,2%
	Jonglei	77,8%	6,2%	5,8%

2.3.1.5 Gender relations

2.3.1.6 Ethnic groups

The Nuer is the most dominant ethnic group in the programme area but there are also Dinka, Shilluk, Maban and Burun people who live in the South Sudan eastern floodplains. In Nuer Zone in Ethiopia, the Nuer is also the most dominant ethnic group.

2.3.1.7 Infrastructure

Road infrastructure is very poor in the area and many villages are isolated during the rainy season. Travel is mostly by foot or by boat.

2.3.2 Key issues and challenges

Key issues in this area relate to food security, access to water, and conflicts:

- ▶ Food security is a major issue with high rates of malnutrition and many places depending on food assistance programmes. Different factors are involved, among others:
 - During the rainy season, floods can significantly damage crops
 - At the beginning of rains, delayed rainfall or dry spells during the rainy season can have adverse impacts on the production.
 - People cannot purchase food: market prices are high due to the poor infrastructure network and due to high rates of imported products (especially in South Sudan with products imported from Ethiopia and Sudan).
 - Population movements due to the conflict
- ▶ Access to a safe source of water is another key issue with high prevalence of waterborne diseases. Water is mostly collected by women who can spend hours on this burden every day. This issue has direct impacts on women and girls in communities: women do not get the chance to be involved in decision making and a very small number of girls do attend schools; but often drop out quickly in large numbers. This issue is related to the following factors:
 - Some villages use water from the river as a source of drinking water with no treatment
 - The closest source of water is sometimes quite far from the village
 - Several boreholes were either damaged during war or left in a state of disrepair and people can no longer access a safe source of water
- ▶ Conflicts related to water access for the livestock during the dry season can occur
- ▶ High levels of poverty and **lack of opportunities for livelihood enhancement** which are compounded by a lack of access to markets and to credit for initiating development.

2.4 INSTITUTIONAL BASELINE

ADMINISTRATIVE ORGANIZATION IN ETHIOPIA

In Ethiopia, there are 4 sub-national administrative levels which are the following (from the largest to the smallest):

- ▶ Region
- ▶ Zone
- ▶ Woreda
- ▶ Kebele

The project is centred on Nuer zone in Gambella region.

ADMINISTRATIVE ORGANIZATION IN SOUTH SUDAN

In South Sudan, there are 4 sub-national administrative levels which are the following (from the largest to the smallest):

- ▶ State
- ▶ County
- ▶ Payam
- ▶ Boma

The project is centred on Ulang county in Upper Nile State and Akobo county in Jonglei State.

2.5 NEEDS AND POTENTIALS

Needs can be deduced from the identified key social issues/challenges in the catchment. They are the following:

- ▶ **Improved food security:** this need will be addressed through the promotion of fisheries, the development of aquaculture, irrigation and livestock watering.
- ▶ **Reduced waterborne diseases and secure access to a potable source of water**
- ▶ **Reduced water related conflicts**
- ▶ **Provision and/or improvement of sustainable livelihood enhancement opportunities**

These needs will be addressed through the development of solar power based water pumping and storage. The programme focuses on primary needs to support the transition from humanitarian aid to sustainable development.

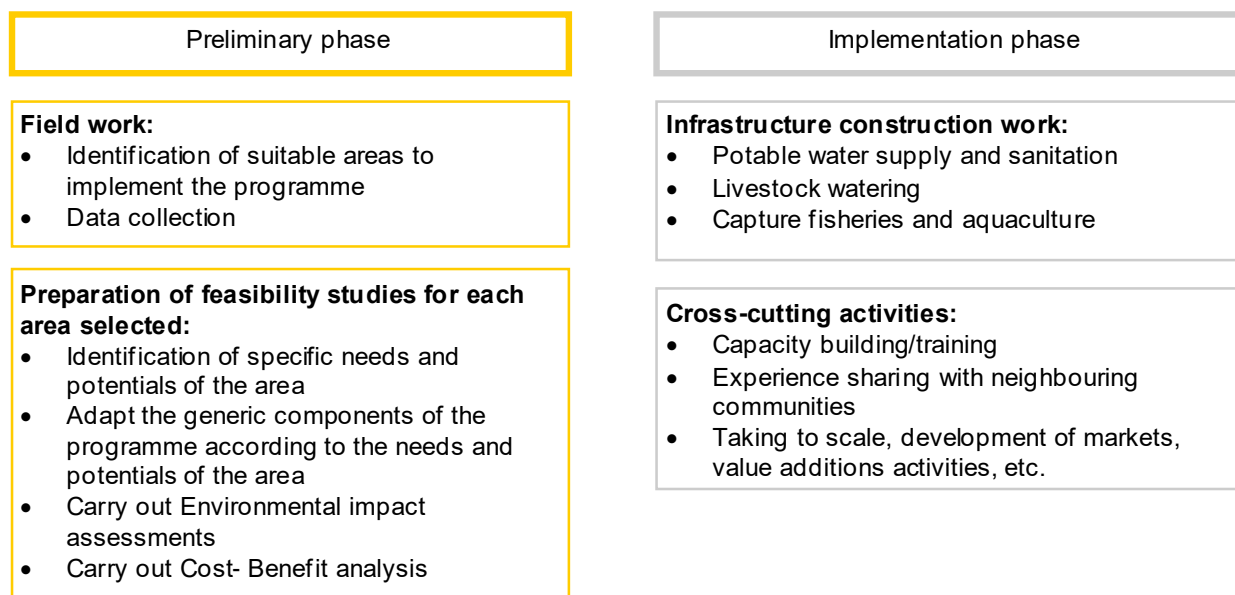
2.6 CONCLUSIONS

Chapters 1 and 2 provide the elements for understanding the baseline situation and show the relevance of this programme. The following sections present the technical details for implementing the programme. As already emphasized, this programme was designed in such a way that it is highly replicable within the Akobo-Gambella floodplains.

3. DETAILS OF THE PROGRAMME COMPONENTS

The programme includes two main steps: the preliminary and preparatory phase and the implementation phase. These two phases are featured in Figure 3-1 below.

Figure 3-1: main steps of the programme



3.1 PRELIMINARY AND PREPARATORY PHASE

3.1.1 Introduction

The “preliminary phase” includes extensive field missions to select suitable areas to implement the programme and adapt the generic components of the programme to the needs of the communities, depending on the available resources. The programme includes a set of development and management interventions which must be adapted to local needs. Consultation of the communities will be essential to refine the components of the programme.

In order to ease the selection of suitable areas, it is advised to look at **accessible areas** where there is **existing information**. There is a relatively recent report which was published by the Inter Agency Standing Committee in 2014 on the situation in Ulang county in South Sudan (refer to the location map Figure 2-1). This county suffers from severe food insecurity, there is a poor access to quality water improved sanitation and periodic conflicts related to cattle are reported. Ulang county is a suitable area for implementation of the programme.

Figure 3-2: Ulang County - 2014. On the left, children carrying water, on the right returnee planting crops



Source: (Inter-Agency Standing Committee, 2014)

The preliminary phase should be carried out by a consultant who will select suitable areas to implement the programme. Section 3.2 details the different components of the programme. An important task of the Consultant will be to assist in setting up a beneficiary-based project committee and to involve them in the preparatory work and provide capacity building. If there is a water user association or committee already in place, this organization would do the work of a local project committee.

It is advised that the same Consultant is in charge of:

- ▶ Supervising implementation of the infrastructure work in close cooperation with the project committee.
- ▶ Carrying out capacity building and training. It is important that the beneficiaries feel that they own, and are capable of managing the project.

The security situation should be monitored throughout the project time frame and the programme should be planned and implemented in close cooperation with local communities. Moreover, due to their knowledge of the area, of the current and past situation, it is advised that the programme **involves humanitarian partners** to share their knowledge/experience or even involve them as key actors. If Ulang county is found suitable for implementation of a pilot project then, it is advised to involve the Inter Agency Standing Committee as they have a good knowledge of the area.

3.1.2 Groundwater availability

There is a potential for groundwater in this area and communities are already using boreholes as shown in Figure 3-3. This figure shows the different water points identified in the BAS sub-basin (spring wells and water harvesting points, hand-dug wells and boreholes). The programme area is highlighted on this map with a green circle. Pumping test to assess the performance of the aquifer and the potential of boreholes must be carried out during the preliminary phase. Water quality tests are also required to ensure that water is suitable for human and animal consumption. Estimates of the sustainable yield of the borehole and the determination of the number of boreholes for each village is the first step to define more precisely the scale of the project.

3.1.3 Water demand per sector

Pumping tests are important to define more precisely the potential for development in the selected area. Then, the priority given to the different sectors should be defined with the communities.

In this study, a tank of 250 m³ is envisaged (or several tanks with a total capacity of 250 m³) and the potential development that can be reached with this available quantity of water is assessed. Water requirements per sector (potable water, small scale irrigation (vegetables and fruit tree gardening), livestock watering, and aquaculture production) and preliminary cost estimates are given. It is assumed that priority is given to potable water, to provide a safe access to water to all the population (demand has been estimated for a village of 1,000 inhabitants, for the population in 25 years' time). The following water requirements were estimated for the peak demand:

- ▶ Potable water supply: 58 m³/day
- ▶ Sanitary and hygiene facilities at public and institutional places (included in potable water supply)
- ▶ Livestock watering: 15.2 m³/day
- ▶ Aquaculture: 28 m³/day
- ▶ Small scale Irrigation: 120 m³/day

3.2 IMPLEMENTATION PHASE: DESCRIPTION OF THE DIFFERENT COMPONENTS

3.2.1 Introduction

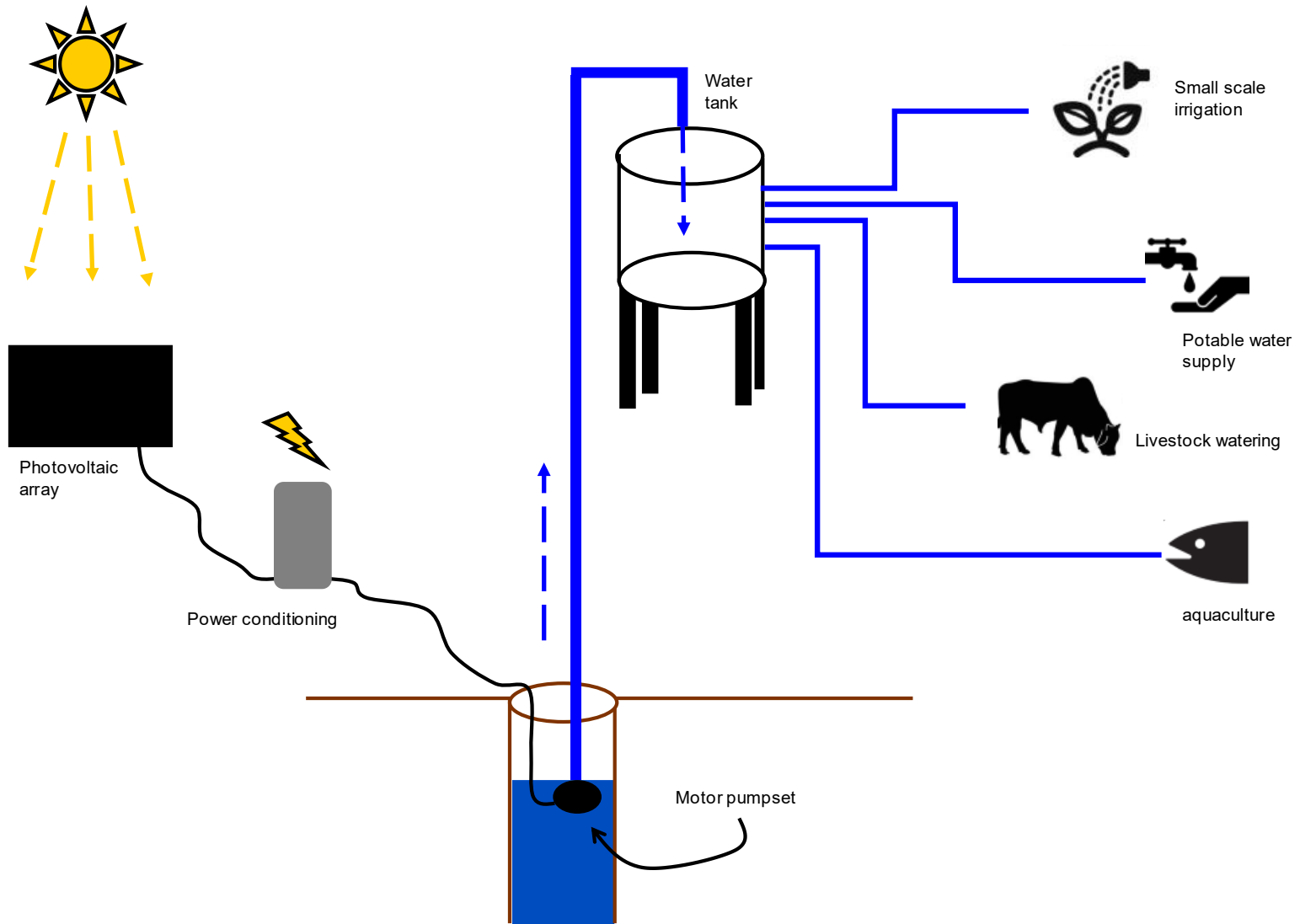
The programme is quite straightforward as it is centred on the pumping and storage of water to guarantee water availability for several sectors:

- ▶ Potable water supply
- ▶ Improved sanitation and hygiene services
- ▶ Livestock watering
- ▶ Aquaculture
- ▶ Small-scale irrigation

Water will be pumped using solar energy and will be stored in a raised reservoir. The key components are presented in Figure 3-4. The programme is complemented by the following activities:

- ▶ Capacity-building/training programme cutting across all activities, including aspects such as financial management, access to credit and access to markets.
- ▶ Experience sharing with neighbouring communities aimed at replication, taking to scale and improving economy of scale – hence access to markets. This is a key objective of the overall programme. Without improved access to markets and communication in general, the sustainable improvements of livelihoods will not be possible.

Figure 3-4: Key components of the programme



3.2.2 Installation of solar equipment

3.2.2.1 Solar pumping

Solar pumps are already used in some areas in South Sudan. They offer numerous advantages and are usually appreciated by local communities as emphasized by the Inter-Agency Standing Committee (2014) after a field work in Ulang county. *“This system (solar pumping) was greatly appreciated by the community. It was installed by Nile Hope in partnership with PACT.”*

The advantages and disadvantages commonly recognized for solar pumping are the following (Practical action, s.d.):

Advantages

- ▶ Unattended operation
- ▶ No fuel costs
- ▶ Low maintenance
- ▶ Easy installation
- ▶ Long life (20 year)

Disadvantages

- ▶ High capital costs, although it recognised that these costs are reducing
- ▶ Water storage is required for cloudy periods
- ▶ Repairs often require skilled technicians

Sizing of the tank is crucial to guarantee that the storage of water is sufficient to meet the needs. This will be defined during the preliminary phase of the project by:

- ▶ Assessing groundwater potential
- ▶ Assessing the needs in the area and the associated water requirements

In the case of Ulang county, the volume of water abstracted and the capacity of the tanks were quite low (two tanks of 5 m³ each). It is proposed to develop where possible this system with greater abstractions to support potable water supply but also livestock watering, small scale irrigation and aquaculture development (where relevant).

One important consideration with solar pumping is that pumping is not possible when there are clouds and it is sometimes advised to store twice the demand to make sure that there is no water shortage. In the development envisaged, the peak demand will be during the dry season (for irrigation) when there are no clouds so no water shortage. During the rainy season, the main use of the tank will be for potable water supply and the tank will store more than twice the demand.

3.2.2.2 Solar panels

The opportunity to install solar panels should be studied as part of the preliminary phase. There were solar panels in Ulang County which were destroyed during the conflict. There is currently no access to electricity and solar energy could be used, **at least** for the following:

- ▶ Lighting for facilities and compound,
- ▶ Refrigerators for medicine,
- ▶ Charger for mobile phones

The average solar irradiation in the programme area is between 1,850 and 2,000 kWhrs/m²/annum (average annual sum for the period 1994-2010, source GeoModel Solar, 2014). With these conditions, a 4kW solar panel could produce between 6,000 and 8,000 kWhrs of energy per annum. The approximate cost for a 4 kW solar kit is between 7,000 and 10,000 USD. The production of 8 MWHrs would not be enough to supply the whole village but it could already provide energy for the uses presented above.

Depending on the existing infrastructure in the programme implementation area and depending on the needs of the community, more solar panels could be installed.

3.2.3 Potable water supply and sanitation

POTABLE WATER SUPPLY

As a first step, it is proposed to have few water points in the village where people will go and collect water. Water will be distributed to these points by gravity. In order to assess the water demand, it is proposed to follow WHO (World Health Organization) guidelines and target a volume of 40 litres per day for domestic use. Water requirements over a 25 years horizon are presented in Table 3-1.

Table 3-1: Potable water supply - Water requirements

Population (year 0)	Population (Year 25, population growth: 1.5%/annum)	Per capita provision (L/day)	Total water demand (year 25, m ³ /day)
1,000	1,451	40	58

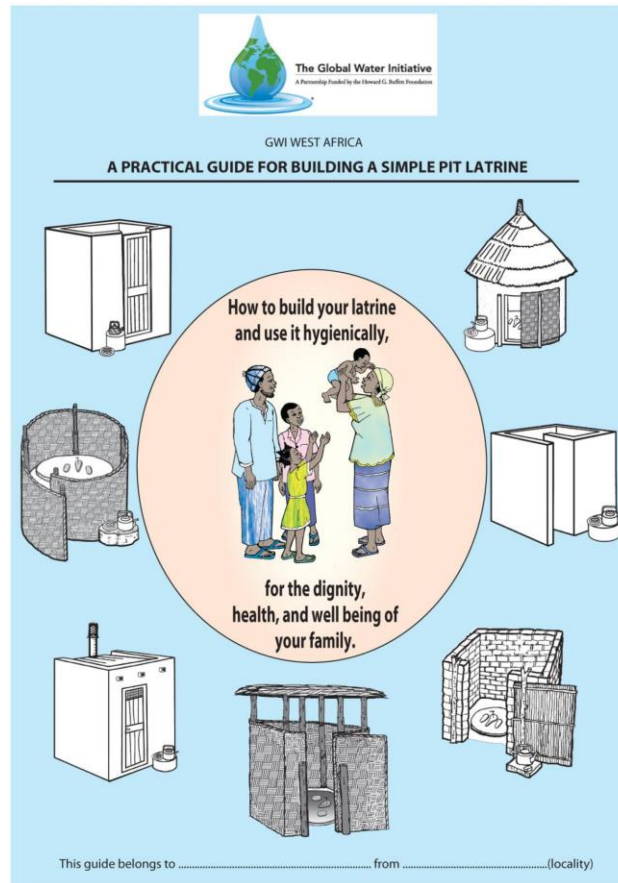
SANITATION

Water supply should be complemented by a sanitation programme to have greater impacts on health and limit hygiene-related diseases. The following are required:

- ▶ Sensitization to explain the importance of hygiene and using latrines;
- ▶ Technical training on how to build pit latrines;
- ▶ Incentives so that people can afford to build latrines ;
- ▶ Implementation of a sanitation and hygiene operation and maintenance (O and M) committee in charge of spreading information, technical skills, etc.

It is proposed to write and distribute a guide explaining how to build and maintain pit latrines. This guide must be a highly pedagogical instrument. A cover page of such a guide which was produced by the Global Water Initiative for West Africa is given hereafter for illustration purpose.

Figure 3-5: Practical guide for building pit latrines



Source: GWF, 2011

3.2.4 Livestock watering

It is proposed to have few water points at the edge of villages where people could go with their livestock. Water will be distributed to these points by gravity. Estimation of water needs per day must be done according to the number of cattle and water availability in the village. The water required for all the livestock in the programme area may not be available depending on i) the availability of groundwater and ii) the priority uses defined with the community. The role of the water users' association will be essential to make sure that livestock water points are well managed and do not create conflicts with neighbouring communities.

An example of water requirements is given hereafter for the following livestock:

- ▶ 50 dairy cattle
- ▶ 100 beef cattle
- ▶ 100 sheep

Table 3-2: Livestock water requirements

Livestock	Number of heads	Water requirements ¹ (L/day/head)	Total water demand (m ³ /day)
Dairy cattle	50	173	8.6
Beef cattle	100	57	5.7
Sheep	100	9	0.9
TOTAL	-	-	15.2

Source: water requirements of livestock given by the Canadian ministry of agriculture

3.2.5 Capture fisheries and Aquaculture

It is proposed to develop capture fisheries and aquaculture. Communities in this area are already engaged in fisheries: river fishing takes place in rivers during the dry season and swamps during the rainy season. Providing fishing gear, especially to poor fishermen would improve greatly this activity.

Aquaculture is also highly recommended to improve food security and foster economic development and exchanges between villages. Moreover, it should be noted that water will not be an issue as the ponds can be filled in during the rainy season when there is no constraint for the livestock and irrigation.

The size of each pond should be about 200 m² (a rectangular pond with length of 20 m and width of 10 m and a depth of 1.5 m). The dikes on all sides of the ponds could be strengthened by plants/fruit trees on the embankments. For extensive aquaculture, a yield of 4 to 5 tonnes/ha (around 90 kg per pond) should be considered. If the activities are intensified, the yields can be considerably higher. This may be possible as capacity and experience increases. There must be separate ponds for hatchery purposes, where parent stock could be kept and the fingerlings would be introduced into the nursery ponds.

The number of ponds to be developed should be defined with the community. For 20 ponds, water requirements are 6,000 m³ to fill in the ponds. As mentioned earlier, this can be done during the rainy season. Water needs during the dry season will be lower, just enough to maintain the level of water. The maximum evaporation in this area is around 7 mm/day. For the 20 ponds, it represents 28 m³/day to be provided during the dry season.

CONSTRUCTION COSTS OF A 200 M² POND WITH A DEPTH OF 1.5 M

The major cost is labour cost, which could be on the average about US\$ 45 for about 10 m² area with a depth of 1.5 m. So, construction of a 200 m² pond may cost up to US\$ 900. Some pipes and plumbing works may be required for inlets and outlets of the water to and from the ponds but these will be simple in design and construction.

Geo-membrane lining may be required if the soil is not clay and the pond cannot retain water. Geo-membrane lining can cost US\$ 2.25/m² and the total would be about US\$ 455.

The anticipated cost to build 20 ponds is between 18,000 to 32,000 USD.

¹ Livestock water requirements data are from the Canadian Ministry of agriculture. As recommended, an increase of 50% has been applied to the demand to take into account the differences of climate.

BENEFITS ASSOCIATED WITH THE DEVELOPMENT OF AQUACULTURE

1 kg of fish is currently sold for around 1 USD (fresh). For an annual production of 1,800 kg of fish, benefits associated are around 1,800 USD.

3.2.6 Small scale irrigation

It is proposed to develop small scale irrigation, to make water available for horticulture, including vegetables and fruit tree gardening in the villages. As such, no specific infrastructure is proposed and no major costs are anticipated.

In order to select the proper size for the tank, it is important to determine the surface area that will benefit from irrigation and the daily peak water demand. Peak water demand was estimated for an area of 1 ha according to estimates from the other two feasibility studies and is rounded to 120 m³/ha/day. Depending on the availability of groundwater, a greater surface could be irrigated. This should be determined during assessment of groundwater availability.

3.2.7 Capacity building and training programme cutting across all activities

Capacity building and training is required for different sectors. The main requirements are given below.

ORGANIZATION OF A WATER USER ASSOCIATION

A water users' association should be organized with representatives of the different sectors. The association will be in charge of coordinating the programme on the long-term. Among others, its responsibilities will be the following:

- ▶ Water allocation between the different sectors and within the sectors.
- ▶ Collect fees that will be used for operation and maintenance of the water supply system, especially the solar-based pumping system
- ▶ Resolution of water related conflicts
- ▶ Experience sharing with neighbouring communities

MAINTENANCE OF THE DIFFERENT INFRASTRUCTURES

There should be training sessions which include the development of skills to operate and maintain the infrastructures. Some people of the community should be trained to have basic knowledge on the functioning of the solar system and be able to do basic maintenance and require assistance whenever needed.

TRAINING AND SENSITIZATION FOR THE DIFFERENT WATER RELATED ACTIVITIES

- ▶ Potable water supply: Information on the importance to use potable water instead of unclean water to avoid many diseases should be given to the community (although the risks associated to the consumption of unclean water are already widely known).
- ▶ Installation of pit latrines: Information and sensitization to explain the importance of hygiene and using latrines should be given to the community. This should be complemented by a technical training on how to build these pit latrines.

- ▶ Small scale irrigation/horticulture: depending on the quantity of water available and depending on the selected crops, training should be given to the community.
- ▶ Aquaculture: training is required on how to manage the ponds and the fishes regularly; use of fishing gears.

INVOLVEMENT OF WOMEN IN THE IMPLEMENTATION OF THE PROGRAMME

Implementation of the programme will provide wider opportunities to women who will not spend hours to collect water every day. The programme should be the opportunity to involve women in the development of the proposed activities in order to address gender inequality at household and community level.

4. ASSESSMENT OF THE BENEFITS OF THE PROGRAMME

The benefits of the programme, per sector, are summarised below:

- ▶ Access to a safe source of drinking water
- ▶ Promotion of sanitation and hygiene through a dedicated programme
- ▶ Access to water for the livestock during the dry season
- ▶ Promotion of fisheries and development of aquaculture
- ▶ Development of small scale irrigation, eg vegetables and fruit tree gardening

This programme does not include implementation of large and expensive infrastructures. A realistic approach is proposed to support the transition from humanitarian aid to sustainable development of the area and more precisely:

- ▶ Enhance food self-sufficiency
- ▶ Provide alternative sources of livelihood
- ▶ Reduce conflicts associated with water in particular due to livestock watering
- ▶ Reduce daily burden of accessing water which is on women and thus reduce gender inequalities

These benefits should participate in reaching the main objectives of the short-term project which are recapped below:

- ▶ Strategies to improve livelihoods and reduce poverty;
- ▶ Strategies to reduce conflicts over the resource;
- ▶ Strategies to implement an enabling environment, favourable for moving towards the vision of the basin in the future, especially when supported by the implementation of medium and long-term projects and the taking of short-term demonstration type projects to scale.

This programme is also consistent with the sustainable development goals, especially the following: goal 1 “End poverty in all its forms everywhere”, goal 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”, goal 3 “Ensure healthy lives and promote well-being for all at all ages”, goal 5 “Achieve gender equality and empower all women and girls”, goal 6 “Ensure availability and sustainable management of water and sanitation for all”.

5. ESTIMATION OF THE COSTS AND SCALING OF THE PROGRAMME

A general case was studied to estimate the budget required. Characteristics of the different components and estimated budget are summarized in Table 5-1 below. To implement the programme in a village of 1,000 inhabitants, with the components as described above, a rapid estimation gives an investment cost of **113,000 to 170,000 USD for the main infrastructure** plus around **20,000 to 30,000 USD for capacity building**. The costs associated to the consulting services will most probably be the major part of the budget. Economies of scale could thus be achieved by implementing the programme in few places from the beginning.

Table 5-1: Anticipated costs of the different components of the programme

Components	Characteristics	Anticipated cost
Solar powered water pumping and storage	Capacity of the tank(s), based on the peak demand: 250 m ³	Investment is around 80,000 USD to 120,000 USD according to the Global water initiative (2012) Operation and maintenance is around 2,000 USD/annum
Solar panel	4 kW solar panel to produce between 6,000 to 8,000 kWh/annum	Investment costs are around 7,000 to 10,000 USD for a complete solar kit.
Potable water supply	Water supply for a population of 1,451 people (current population is 1,000 with a population growth of 1.5% over the next 25 years)	Supply from the tank to few water points in the village (cost included in the costs associated to "solar water pumping and storage")
Sanitation	<ol style="list-style-type: none"> Sensitization and training on how to build pit latrines + distribution of a guide to households of the village Incentives to people 	<ol style="list-style-type: none"> An initial target of 50 pit latrines seems realistic. Sensitization and training should be carried out for 10 people per session. As such, 5 sessions of 1 week are proposed. These costs should be included in the overall envelope "consulting services" Although pit latrines are affordable, it is still a significant investment for poor people who cannot afford to build them. An incentive of 50 USD per household is recommended. Considering the construction of 50 latrines as a start, it represents an investment of 2,500 USD.
Livestock watering	Livestock watering for 50 head of dairy cattle, 100 of beef cattle and 100 of sheep.	Supply from the tank to few water points in the village (cost included in the costs associated to "solar water pumping and storage")
Capture fisheries	Provide fishing gear	Cost of fishing material is around 100 USD/net. Considering the purchase of 50 nets, it represents an investment of 5,000 USD
Aquaculture	Build aquaculture ponds	Cost to build 20 ponds is between 18,000 and 32,000 USD

Components	Characteristics	Anticipated cost
Small scale irrigation	Make water available for vegetable and fruit tree gardening in the villages	No major costs associated
Capacity building programme	Organization of a water users' association	Costs should be included in "consulting services". As capacity building will be a major component of the programme, a preliminary envelope of 20% of the all programme costs is proposed, this would be around 20,000 to 30,000 USD.
Consulting services	<p>Selection of one or several locations to implement the programme (includes field missions and assessment of groundwater potential through test drillings)</p> <p>Design more precisely the programme according to the needs and potentials of the selected area(s).</p> <p>Oversee the programme implementation</p> <p>Carry out capacity building and training as part of the programme</p>	This will be the main cost of the programme and economies of scale can be achieved if it is decided to implement the programme in several areas.

6. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 INTRODUCTION

The objectives of identifying potential environmental and social issues are to:

- ▶ Describe the baseline (current state) of the environment and socioeconomics,
- ▶ Describe what will change with the Project from the current state (positive and negative impacts),
- ▶ Propose enhancement and mitigation measures.

The baseline situation is presented in section 2 of the report. The description of anticipated changes, enhancement and mitigation measures is included in Table 6-1.

6.2 IMPACTS OF THE PROPOSED GAMBELLA-AKOBO PROGRAMME

The expected positive and negative impacts of the programme, based on the components described above, are summarized by sector in Table 6-1.

This should be considered as a first assessment of the potential impacts related to implementation of the programme. Further studies will be required to identify more precisely the positive and negative impacts of the programme, at project level.

Table 6-1: Summary of Environmental and Social impacts and proposed mitigation and enhancement measures

Impact Description	Proposed Mitigation & Enhancement Measures	Responsible Agency/ Organization	Cost in USD
POTABLE WATER SUPPLY			
Positive Impacts and Enhancement Measures			
Improved access to water supply	<ul style="list-style-type: none"> - Locate water supply scheme for each community to avoid conflict on water use, - Train local operators on how to maintain the infrastructures - Establish water use association with clear mandate and responsibilities 	water supply and sanitation offices	N/A
Improved sanitation and reduction of water born disease	<ul style="list-style-type: none"> - Conduct water quality test before commissioning and intermittently at the interval of three months - Conduct activities reinforcing behaviour change and hygienic practices before commissioning and intermittently at intervals through the year 	water supply and sanitation offices	Part of their routine budget
Improve livelihoods of people and saving of time currently dedicated to water collection from unprotected sources	<ul style="list-style-type: none"> - Create awareness among the beneficiaries about the benefit of protected source of water; - Ensure that households/communities with unsafe sources are priority beneficiaries of the scheme; - Ensure active participation of women in the selection of the site and in the implementation of the programme. 	water supply and sanitation offices	N/A
Adverse Impacts			
If water supply schemes are located at common boundaries of two and more ethnic groups, it may cause conflict.	<ul style="list-style-type: none"> - Water points should not be located at common boundary of different ethnic groups. The selection of water points should involve local decision makers. 	water supply and sanitation offices	N/A
LIVESTOCK WATERING			
Positive Impacts and Enhancement Measures			
Improve livestock productivity	<ul style="list-style-type: none"> - Livestock water points should be carefully located to avoid conflict over the resource - Water points should be located near major grazing fields - Train local operators on how to maintain livestock water supply structures, etc. 	Local pastoralists offices/community groups if existing	N/A

Impact Description	Proposed Mitigation & Enhancement Measures	Responsible Agency/ Organization	Cost in USD
Reduce potential conflicts associated with livestock watering	<ul style="list-style-type: none"> - Livestock water points should be implemented for different communities to reduce water related conflicts. - Establish conflict resolution committee or mechanism involving traditional leaders and elders. 	Local pastoralists offices/community groups if existing	N/A
Adverse Impacts and Mitigation Measures			
Concentration of water points may have adverse impacts on the soil due to compaction and erosion with livestock movements in a limited area.	<ul style="list-style-type: none"> - Livestock water points should be carefully located in different areas to avoid excessive livestock trampling 	Local pastoralists offices/community groups if existing	N/A
AQUACULTURE			
Potential Positive Impacts			
<ul style="list-style-type: none"> - Improved food security - Improved diversity and nutritive value of the food production (proteins and balanced diet) - Improved utilization of natural resources - Diversification of local communities livelihoods 	<ul style="list-style-type: none"> - Provide training to the beneficiaries of the project (on pond construction, application of fertilizers, aeration of ponds and harvesting and storing of aquaculture products). 	Fishery and aquaculture development office, NGOs working in the area	Part of the project budget
Negative Impacts of Aquaculture Farm			
Pollution of local ground water	<ul style="list-style-type: none"> - Properly manage the aquaculture wastewater - Recycle the water used in fish ponds; - Avoid use of toxic and long-lasting chemicals. 	Project owners/beneficiaries; environmental protection office; fishery and aquaculture development office	Part of the project operation cost
SMALL SCALE IRRIGATION			
Positive Impacts and Enhancement Measures			
<ul style="list-style-type: none"> - Increased food production - Reduced food insecurity - Increased nutrition; 	<ul style="list-style-type: none"> - Select suitable crops adapted to the local conditions; - Promote consultation and participation of the targeted communities during the selection of crop type and seeds; 	<ul style="list-style-type: none"> - Agriculture office - NGOs operating in communities. 	Part of the project management cost

Impact Description	Proposed Mitigation & Enhancement Measures	Responsible Agency/ Organization	Cost in USD
	<ul style="list-style-type: none"> - Ensure targeting food insecure households/vulnerable groups; - Provide training as how to schedule the farm products essentially for subsistence - Reduce product waste during the harvest - Training of beneficiaries 		
<ul style="list-style-type: none"> - <i>Improved livelihood of the local community;</i> - <i>Direct and indirect employment opportunities.</i> 	<ul style="list-style-type: none"> - Promote an economic use of the products; - Involve women in the planning and implementation of project activities; - Training of beneficiaries - Assist communities in establishing water users associations (WUAs) for irrigation. 	<ul style="list-style-type: none"> - Agriculture office - NGOs operating in communities. - Land administration and environment office. 	N/A
<i>Infrastructure development in the area such as improved access roads.</i>	Access between the different villages and to the closest market place should be considered as part of the project	Rural road construction office at zonal, county and woreda level.	Part of their annual budget
Negative Impacts of the Irrigation Component and Proposed Mitigation Measures			
<i>Increase in malaria and other water related diseases</i>	<ul style="list-style-type: none"> - Avoid excess water when irrigating; - Drain out water holding spots; - Wear boots while working in irrigation fields to prevent Schistosomiasis larvae penetration in feet; - Provide mosquito nets to people 	<ul style="list-style-type: none"> - Health office in collaboration with project owners 	Part of Farm management cost

7. CONCLUSIONS AND RECOMMENDATIONS

The targeted areas are amongst those with the highest levels of poverty and food/nutrition insecurity in the sub-basin. They are also areas in which conflict over natural resources is a major problem, and one which also contributes to poverty. The areas are also very isolated with poor communications and levels of provision of services. This limits opportunities for development.

The programme, through:

- a) the implementation of small-scale IWRM style projects at the village/community level, aimed at “win-win” for the communities and the natural resources they depend on
- b) replication of the project by adjacent communities through the use of experience-sharing – creation of an economy of scale
- c) Motivation of improved access to services (electricity, communications etc) which will support further economic development and opportunities for livelihood enhancement

will support a generalised reduction in poverty and provide the communities to become increasingly self-reliant. Improved access to services will result in better health and higher school attendance rates.

For programme implementation to proceed it is important to fully involve local decision-makers and the potential beneficiaries in project design. This is the next step.

ANNEXES

Annex 1: Bibliography

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