**ENTRO**
**EASTERN NILE TECHNICAL REGIONAL OFFICE**

# BARO AKOBO SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

## *INCEPTION REPORT*

*V.4 February 2016*

BRL Ingénierie

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# BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

## Inception report

# TABLES AND FIGURES

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# ACRONYMS AND ABREVIATIONS

| | |
|---|---|
| AfDB | African Development Bank |
| ACORD | Association for Cooperative Operations Research and Development |
| ACTED | Agency for Technical Cooperation and Development |
| BAS | Baro-Akobo-Sobat |
| CAMP | Comprehensive Agriculture Development Master Plan |
| CBA | Cost Benefit Analysis |
| CMA | Catchment Management Association |
| CRA | Cooperative Regional Assessment |
| DEM | Digital Elevation Model |
| EEPCO | Ethiopian Electric Power Corporation |
| EIA | Environmental Impact Assessment |
| ENID | Eastern Nile Irrigation and Drainage |
| ENCOM | Eastern Nile Committee Of Ministers |
| ENPM | Eastern Nile Planning Model |
| ENPT | Eastern Nile Power Trade |
| ENSAP | Eastern Nile Subsidiary Action Plan |
| ENTRO | Eastern Nile Technical Regional Office (NBI) |
| EPA | Environmental Protection Authority |
| FAO | Food and Agriculture Organization |
| GDEM | Global Digital Elevation Model |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GIS | Geographic Information System |
| GTP | Growth and Transformation Plan |
| GWh/y | GigaWatt hour/year |
| IDEN | Integrated Development of Eastern Nile |
| ILWRM | Integrated Land and Water Resources Management |
| IPCC | Intergovernmental Panel on Climate Change |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| IWMI | International Water Management Institute |
| IWRDMP | Integrated Water Resources Development and Management Plan |
| IWRM | Integrated Water Resource Management |
| JMP | Joint Multipurpose Project |
| MAFCRD | Ministry of Agriculture, Forestry, Cooperatives and Rural Development |
| MASL | Meters Above Sea Level |
| MCA | Multi Criteria Analysis |
| MDG | Millennium Development Goals |
| MEDIWR | Ministry of Electricity, Dams, Irrigation and Water Resources |
| MERET | Managing Environmental Resources to Enable Transitions |
| MLFI | Ministry of Livestock and Fisheries |
| MoA | Ministry of Agriculture |
| MoEN | Ministry of Environment |
| MoWIE | Ministry of Water, Irrigation and Energy |

| | |
|---|---|
| MSIOA | Multi Sector Investment Opportunity Analysis |
| MTR&B | Ministry of transport, roads and bridges |
| MW | Mega Watt |
| MWC&T | Ministry of Wildlife Conservation and Tourism |
| NB-DSS | Nile Basin Decision Support System |
| NBI | Nile Basin Initiative |
| NCORE | Nile Cooperation for result project |
| NDVI | Normalized Difference Vegetation Index |
| NELSAP | Nile Equatorial Lakes Subsidiary Action Program |
| NGO | Non-Governmental Organization |
| Nile-COM | Nile Council of Ministers |
| PIM | Project Implementation Manual |
| PLSPP | Policies, Legislation, Strategies, Plans, and Programs |
| PPP | Private Public Partnership |
| PMU | Project Management Unit |
| PRSP | Poverty Reduction Strategy Program |
| RATP | Regional Agricultural Trade and Productivity Project |
| RPSC | Regional Project Steering Committee |
| RSS | Republic of South Sudan |
| RUSLE | Revised Universal Soil Loss Equation |
| SAP | Subsidiary Action Program |
| SEA | Strategic Environmental Assessments |
| SIS | Soil Information System |
| SLMP | Sustainable Land Management Program |
| SNNPR | Southern Nations, Nationalities and Peoples' Region |
| SRFE | Satellite Rainfall Estimates |
| SRTM | Shuttle Radar Topographic Mission |
| SSEA | Strategic Social and Environmental Assessment |
| SVP | Shared Vision Program |
| SWAT | Soil and Water Analysis Tool |
| SWOT | Strength Weakness Opportunity Threat |
| SWSC | Soil-Water Storage Capacity |
| UNDP | United Nations Development Program |
| UNHCR | United Nations High Commissioner for Refugees |
| UNICEF | United Nations Children's Fund |
| USAID | United States Agency for International Development |
| WaSH | Water Sanitation and Hygiene |
| WB | World Bank |
| WBISPP | Woody Biomass Inventory and Strategic Planning Project |
| WCYA | Women, Children and Youth Affairs |
| WEES | Water for Eastern Equatoria |
| WFP | World Food Program |
| WRMA | Water Resources Management Authority |
| WRMD | Water Resources Management and Development |
| WSS | Water Supply and Sanitation |
| WUA | Water Users Association |

# EXECUTIVE SUMMARY

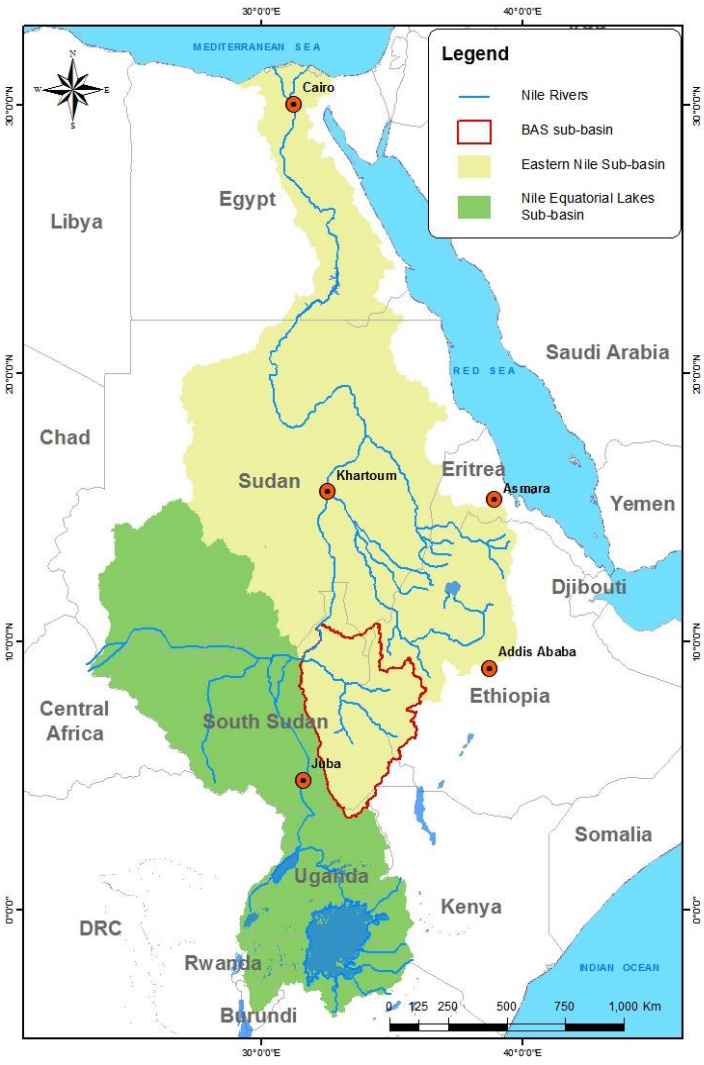
## Introduction

### THE NILE BASIN INITIATIVE (NBI) AND INTEGRATED DEVELOPMENT OF THE EASTERN NILE (IDEN)

The **Nile Basin Initiative (NBI)**[1] seeks to **develop the river in a cooperative manner, share substantial socio-economic benefits, and promote regional peace and security.** The NBI has a shared vision to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources," and a Strategic Action Program to translate this vision into concrete activities and projects.

The **Eastern** Nile **Subsidiary Action Program** (ENSAP) of the NBI has the aim of initiating **concrete joint investments and action on the ground** in the Eastern Nile sub-basin in the areas of power generation and interconnection, irrigation and drainage, flood preparedness and early warning, watershed management, development of planning models and joint multipurpose programs. ENSAP is governed by the Eastern Nile Council of Ministers and implemented by the Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa, Ethiopia.

ENTRO is responsible for managing the Eastern Nile Subsidiary Action Program (ENSAP), whose overall objective is the cooperative development of the water resources of the Eastern Nile Basin, which include the Baro-Akobo-Sobat River Basin, in a sustainable and equitable manner to ensure prosperity, security, and peace for all its peoples.




*Location of the Baro-Akobo-Sobat Basin with the Nile basin*

In pursuit of this objective, ENTRO has formulated the **Integrated Development of the Eastern Nile (IDEN)** as a suite of integrated development projects including hydropower, irrigation and drainage, flood control, watershed management, and water resources management. Because of its regional water and land resources potentials and the role it can play in regional peace, stability and security, the **Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project became one of the seven (7) projects identified in the IDEN**.

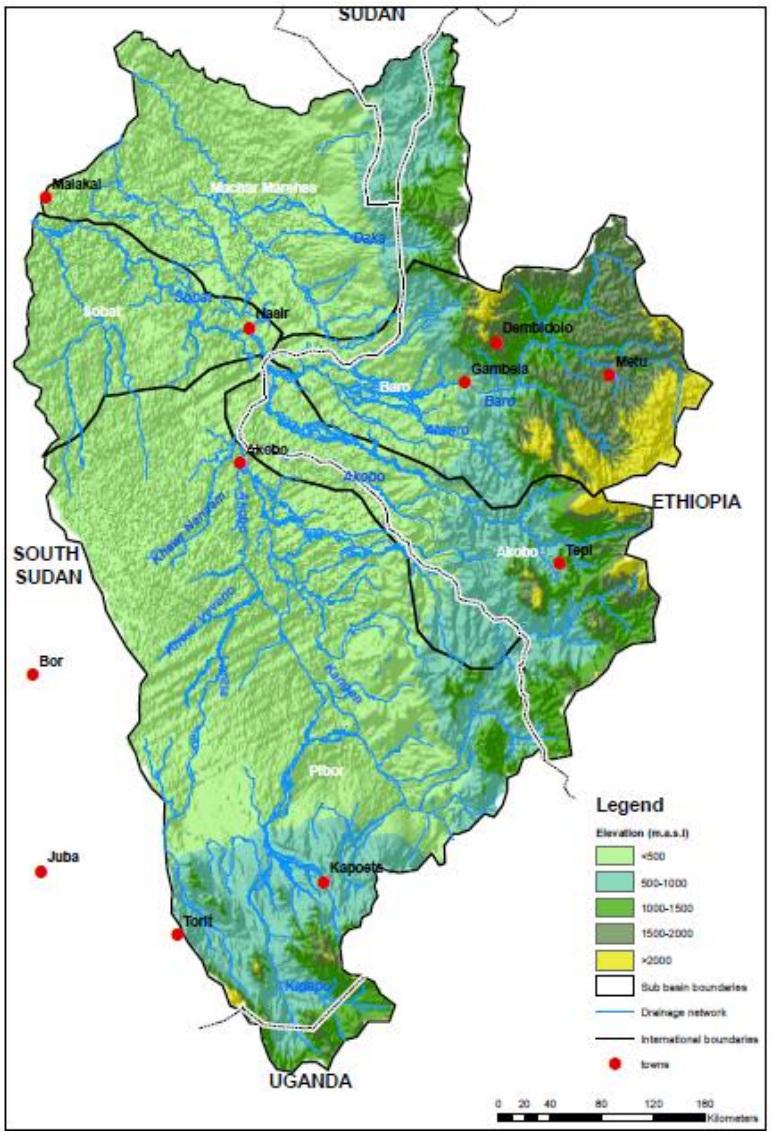
[1] The NBI is a partnership between the riparian states of the Nile River: Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania and Uganda

The objective of the IDEN Project is **to initiate a regional, integrated, multipurpose development project through a first set of investments that confer tangible, win-win gains and demonstrate joint action between the Eastern Nile countries.**

## BARO-AKOBO-SOBAT SUB-BASIN

The Baro-Akabo-Sobat sub-basin, with its catchment area of more than 205,000 km$^2$, consists the Baro, the Akobo and the Pibor rivers. The Baro River originates in the highlands of Ethiopia (2,000 – 3,500 masl); from the eastern parts of BAS sub-basin, draining west wards through Gambella plain (450 masl) into the Republic of South Sudan. The Pibor River with its tributaries originates from the Imatong Mountains in Eastern Equatoria state Republic of South Sudan, draining northwest through grassy flat plain. The Pibor is joined on its way by the Akobo, Gilo and Alwero Rivers originating from the Ethiopian highlands. Pibor River continued its northwest flow direction; at the confluence of Pibor and Baro Rivers the Sobat River is formed.

The mean annual flow of the Baro River at Gambella is around 12.4 billion m$^3$. In its lower course, the flow spills into the *Machar marshes*, with annual spillage estimated to be in excess of 3 billion m$^3$.and the mean annual flow is recorded to be 9.53 billion m$^3$ (1905-1955) at the mouth of the Baro River. Once contributions from the Pibor, Akobo, Gilo and Alwero Rivers are taken into account the average annual contribution of the Sobat River is estimated to be 13.687 billion m$^3$ .




Rain fed crop cultivation, largely based on traditional cultivation methods, is the principal livelihood activity in most of the basin where adequate rainfall is available. In the semi-arid to arid areas of the sub-basin pastoral livestock farming is predominant. The main livelihood strategies in the sub-basin are a combination of crop and livestock production followed by 'crop only' farming and 'livestock only' production. Fishing is also an important to the livelihoods of communities living along the rivers and wetlands in the sub-basin. The Baro-Akobo-Sobat sub-basin has a high potential for flood plain **aquaculture**, but lacks efficient aquaculture technologies.

There is a dearth of infrastructure in the sub-basin, specifically in terms of road networks, water supply and sanitation facilities, health and education services, provision of credit and extension services. At the same time, there is major potential for the expansion (from current very low levels) of both agriculture (commercial rainfed and irrigated) and hydropower, but it is clear that this could have significant socio-environmental impacts.

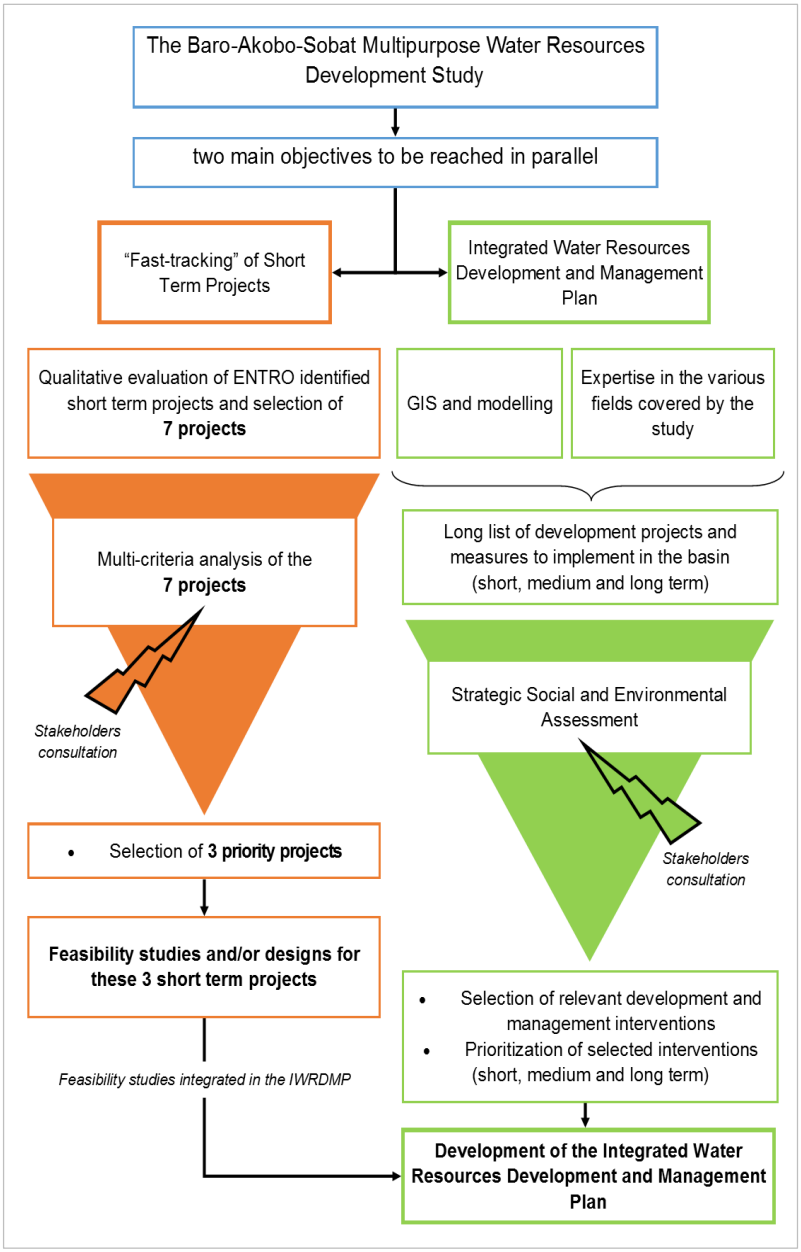
*Topography and hydrography of the Baro-Akobo-Sobat Basin*

## THIS STUDY

The study, which kicked off on 19th March 2015, is being carried out by the BRLi and AURECON Joint Venture, with YERER, a consulting company with its Headquarters in Addis Ababa as sub-consultants.

The objective of the consultancy services 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 Consultant has taken note of the following specific objectives:

- Preparation of a participatory Strategic Social and Environmental Assessment (SSEA) to facilitate identification of investment options that take into account social, environmental, economic and institutional considerations.
- Formulation of an Integrated Water Resources Development and Management Plan (IWRDMP) to identify sustainable investments and provide a framework for long term water resources development and management.
- Identification and preparation of feasibility studies, in a participatory and consultative manner with relevant basin stakeholders, for short-term investment ready projects.
- Identification with participation and engagement of relevant stakeholders in the sub-basin, of medium and long-term projects and initiate project preparation activities.
- Provision of an objective and effective framework for stakeholder consultation and engagement in cooperative development and management of water resources of the Baro-Akobo-Sobat sub-basin, and support to ENTRO in mobilizing funds for the implementation of the prepared projects.




*Main steps of the study*

# Inception Phase

The Inception Phase has seen a number of activities undertaken. These are summarised in the following paragraphs

## KICK-OFF MEETING

The period of the kick-off meeting (19th March 2015) allowed the Consultant and Client to discuss i) staffing and the mobilisation of experts, ii) sources of information and storage of documents and data, iii) milestones, iv) organisation of field visits, v) preliminary identification of key stakeholders.

## FIELD VISITS

Seven field visits took place during the Inception Phase. The main purpose of these visits was to give a first overview of the basin to the different Experts and to meet key stakeholders in Ethiopia and South Sudan. The visits are summarized in the following table.

*Summary of Field Visits*

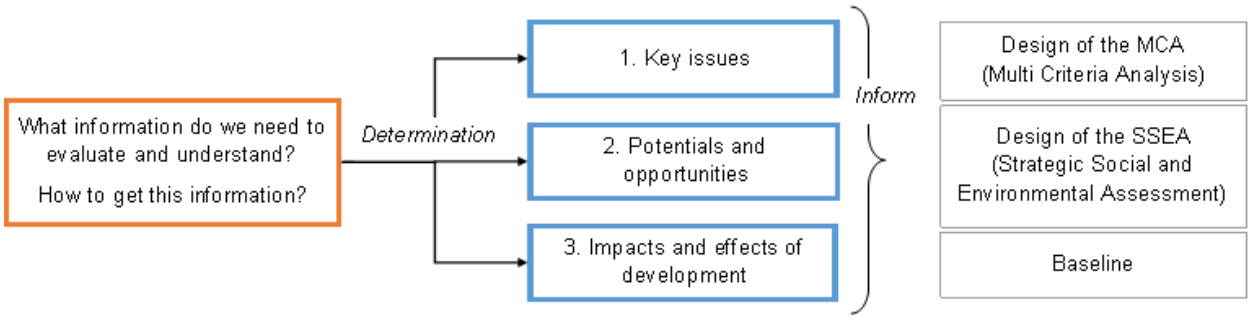
| From / to | Itinerary | Participants | Purpose |
|---|---|---|---|
| 28 April – 2 May 2015 | ETHIOPIA: Addis Ababa – Nekemte – Metu – Gambella and area – Jima – Addis Ababa | • Consultants<br>• ENTRO<br>• MWR, Ethiopia | • General reconnaissance of the basin within Ethiopia<br>• Meetings with stakeholders in Oromia and Gambella regions |
| 6 May – 11 May 2015 | SOUTH SUDAN; Juba | • Consultants<br>• ENTRO<br>• MEDIWR, South Sudan | • Meetings with the relevant Ministries<br>• Meetings with Members of Parliament for Jonglei State, Eastern Equatoria and Upper Nile State |
| 7 May – 10 May 2015 | SOUTH SUDAN; Torit – Kapoeta | • Consultants<br>• ENTRO<br>• MEDIWR, South Sudan | • General reconnaissance of the basin within South Sudan and meetings with stakeholders from Kapoeta |
| 16 June – 21 June 2015 | ETHIOPIA; Addis Ababa - Jima - Mizan Teferi – Tepi - Gimbi | • Consultants<br>• MWR, Ethiopia | • Reconnaissance field work<br>• Meetings with stakeholders |
| 18 June – 20 June | ETHIOPIA; SNNPR – Gambella | • Consultants | • Meetings with stakeholders |
| 22 June – 27 June 2015 | ETHIOPIA; Awassa – Gambella | • Consultants<br>• MWR, Ethiopia | • Data Collection in SNNPR & Gambella<br>• Interviews with Key Government Officials |
| 28 June – 4 July | SOUTH SUDAN; Juba | • Consultants<br>• ENTRO | • Meetings with selected stakeholders from government institutions and individual informants on the WSS |

## DISCUSSIONS WITH STAKEHOLDERS

During the missions summarised above and in other meetings held largely in Addis Ababa and Juba, the team has met with a wide range of stakeholders and this has provided both valuable insight into the issues, challenges and opportunities and has allowed the Consultant to collect a considerable number of useful documents and data. Minutes of meetings with stakeholders are being maintained and abbreviated versions are annexed to the main report.

## PRELIMINARY SCOPING

The aims of the scoping exercise are summarised in the figure below.

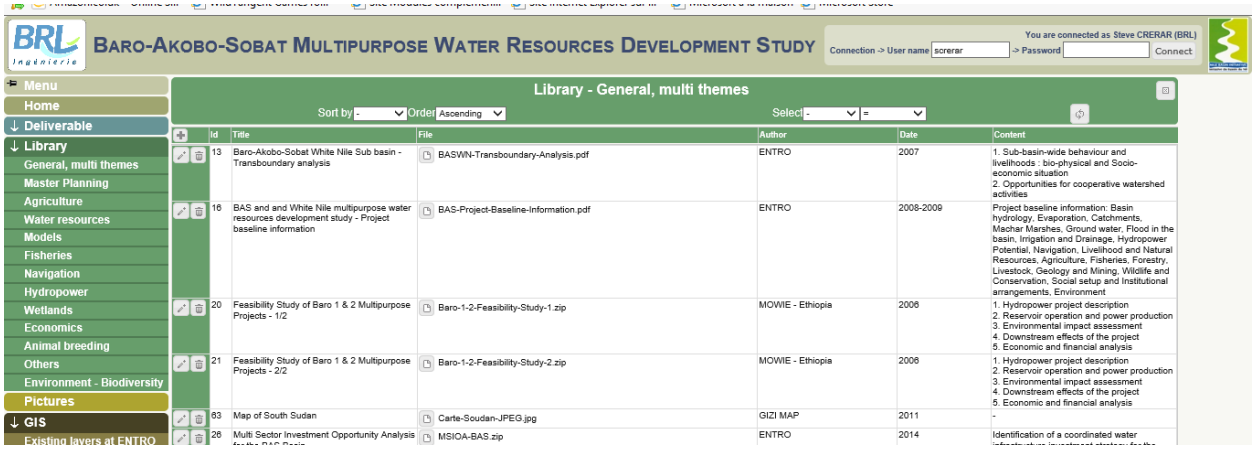



*Aim of the scoping exercise*

Preliminary scoping has been an integral part of the Inception Phase. Apart from being the first step for the full scoping and the baseline for the Strategic Social and Environmental Assessment (SSEA) it also allowed the team to us to review and revise the methodology in a much more informed manner than would otherwise have been possible. Scoping is being carried out using several parallel and overlapping approaches. These include:

- Analysis of the available documentation
- Discussions with stakeholders, in particular information-holders, decision-makers and experts
- Analysis of available datasets, rapid review and gap analysis
- Field reconnaissance
- Application of remote sensing

A large number of studies have been carried out by ENTRO, ENSAP and the NBI. These documents have been collected by the Consultant during the Inception Phase. During visits to South Sudan further key documentation has been collected. These documents have been shared with all the Experts on the project extranet and will be highly valuable for the expertise.




*A project extranet has been set up and is currently hosted at BRL*

Consultation with stakeholders is well underway and will continue into September before finalising the Scoping Exercise. The exercise will also continue to be informed by the remote sensing work being carried out by BRLi's specialist sub-contractor.

The preliminary scoping echoes what is already understood – that that the basin provides excellent development opportunities. Several large-scale hydropower projects have already been identified and studied in the highland source areas. In addition to providing electricity, these schemes would i) regulate flows, supporting the development of irrigation schemes downstream and ii) provide the schemes with protection from floods through flood attenuation. They would also provide a source of gravity-fed water supply to settlements downstream and opportunities for the development of fisheries. However, reduced seasonality of flows and an overall reduction in flows will have a significant impact on the *Machar marshes* and other wetlands whose ecology depends not only on adequate inflows but also on the natural seasonality of flows with wetter and drier periods.

From a transboundary water resources perspective, there is pressure to develop the water resources of the Baro-Akobo-Sobat because the impact of major irrigation expansion in the sub-basin on flows in the White Nile, is subdued by the presence of the *Machar marshes*.

Development in the basin is currently at a very low level but there is a very real prospect of rapid change. A high rate of economic growth in Ethiopia has been sustained for several years now and there is a rapidly growing need to increase both energy and agricultural production. The feasibility study for the largest of the hydropower schemes, Tams, has already been completed and private investors are showing real interest in the development of the floodplains downstream of Gambella for both rainfed and irrigated agriculture. The presence of the Gambella National Park would seem to have little significance in terms of ensuring conservation.

Development is currently not coordinated, but since development levels are currently low, the negative impacts of this are currently neither too significant or extensive. However, once development starts to snowball, and there is a real chance of this happening, especially on the Ethiopian side of the border, a continued lack of coordinated development would be disastrous.

A number of issues, challenges and opportunities can be highlighted:

- **Poverty and development:** Poverty is a common thread, both in Ethiopia and in South Sudan. Social development is seen as the major objective in both countries.
- **Potential Environmental and Social Impacts**: During the first field missions, emphasis was put on the Gambella-Boma area which is one of the richest areas in term of biodiversity in the basin. While there are no major projects at the moment in the Boma national park, major large irrigation schemes have been proposed in Gambella region (those within and those located outside of the Gambella National Park). These projects will result in the loss of natural vegetation and biodiversity in one of the last relatively undisturbed catchments in the EN Region and have a negative impact on the ecological functioning of the Baro-Akobo-Sobat sub-basin.

  The low lying western areas of the Baro-Akobo-Sobat sub-basin have high concentrations of wildlife and are also home to the second largest animal migration in the world, namely the annual migration of the white eared kob antelope. The establishment of large scale irrigation schemes in the catchment of the key rivers that make up the sub-basin is likely to impact negatively on the wildlife that rely on the flow of water from the Ethiopian Highlands in the east..
- **Need for coordinated and well-managed development:** The basin is shared by very different areas from a physical and socio-economic perspective. Some of these zones present physical similarities but very different socio-economic patterns and related level of development. While management and development priorities and opportunities are very different, the level of interdependency is critical and will require a coordinated and well-managed development approach.
- **Need for a basin-wide and integrated approach:** While the maximisation of irrigation upstream of the Machar wetlands has a relatively lower impact on the overall water resources of the Eastern Nile system, the potential negative impacts on the Machar wetlands should be carefully investigated and mitigation measures proposed. Given the potential value of economic development, both in terms of hydropower production and irrigation, a large-scale and detailed environmental impact assessment is required, not on a scheme by scheme basis, but for the possible combined development options.

- **Need for better information:** There are some significant information gaps and while these should stop the planning process from moving forward there will always be a number of caveats until better data allows a more accurate understanding of the systems. The accuracy and usefulness of water resources models, for example, is currently limited by a dearth of rainfall data and river flow data. In particular, an accurate understanding of the functioning of the *Machar marshes* is not possible without better data.

  Continued and improved monitoring of levels and discharges is important throughout the EN basin. However, given the environmental sensitivity of the *Machar marshes* and the Twalor wetlands, it is considered very important to improve hydrological monitoring both upstream of the wetland and within the wetlands themselves.

- **Benefits of multipurpose projects:** The multipurpose projects should provide tangible benefits to the entire population in the basin and bring:
  - Food security through the development of agriculture and irrigation;
  - Access to potable water through the development of boreholes and water treatment works;
  - Access to water for livestock during the dry season through the development of water points;
  - Access to electricity through the development of hydropower and electrification;
  - Improvement of livelihood through the limitation of the flooded areas during the rainy season etc.

All these issues shall be kept in mind throughout the project and will be deepened to ensure that multipurpose projects respond to the needs which have been identified with stakeholders.

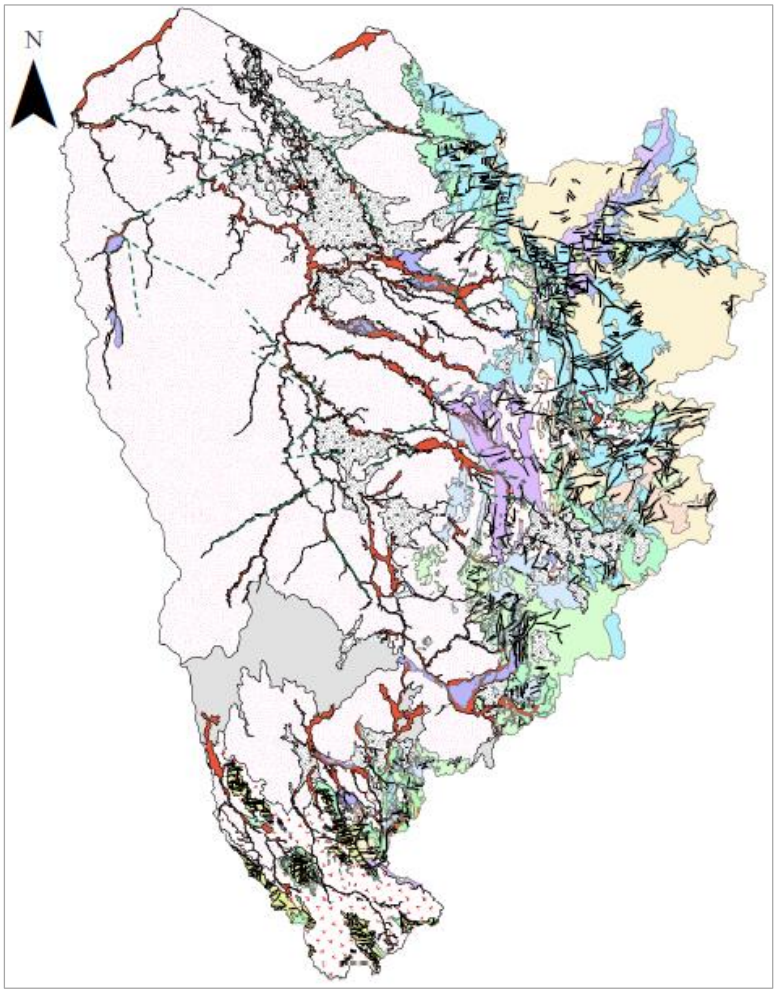
Development in the BAS is inevitable and needed. This is the context that provides the need for the IWRDMP. This development has to be based on a well-founded integrated design and operational plan to consider the impact of projects on the development of the basin but also on the availability of water resources further downstream the projects. As stated before, the importance of *Machar marshes* and other wetlands as a complex ecosystem rich in biodiversity is undeniable and should be considered at all stages of this study.

Thus the successful design of the Baro-Akobo-Sobat IWRMDP depends on:

- Improved understanding of the hydrological system;
- Consultation of stakeholders to define the priorities in the basin;
- Improved understanding and incorporation of the environmental constraints;
- Cross-sectoral cooperation and coordination between the different experts for planning.

### APPLICATION OF REMOTE SENSING

The application of remote sensing is planned **throughout** the study, both for large-scale planning and for the development of the selected short-term projects. During the Inception Phase work has already started on mapping the basin at a scale of 1:100,000. Landsat 8 (LCDM) images taken in 2013 (and early 2014) have been be obtained from the organization in charge of their distribution, along with Palsar SCN radar coverage. All the Landsat 8 images with less than 10% cloud cover available have been collected, and are being analysed and assembled in order to obtain two sets of cover, one as close as possible to the high waters period and one as close as possible to the low waters period.




To cover the entire Baro-Akobo-Sobat sub-basin, 16 Landsat 8 scenes are necessary. To date 52 scenes recorded in 2013 are available with less than 10% cloud cover.

Although there are a few outstanding issues, the **mapping of the whole basin at a scale of 1:100,000 has already been carried out during the Inception Phase.**

Draft maps of the basin, geology, topography, rivers and wetlands, land use have already been developed using satellite imagery.

An improved more precise DEM has also been developed and has highlighted some of the question marks over the hydrographic basin limits.

*Surface geology mapped for the entire basin*

## SUB-BASIN LIMITS

The precise definition of the basin boundaries is challenging in some parts of the basin, in particular the flatter areas where the direction of flow is not always clear. It should be stressed that the basin boundary shown on the maps in this report should be considered as preliminary. However, a technical note in this regard has been developed to follow this study and is provided as an annex to this report. Work is still ongoing with the aim of finalizing a definitive basin boundary. However, it is important to recognize that hydrographic limit of the basin is not fixed in some places. Direction of flow (into or out of the basin) at some locations depends on relative water levels in the adjacent basins. A good example of the sort of uncertainty is the Kineti River which takes its source in the Imatong Mountains. On some maps this river is shown as being within the Pibor catchment. In the analysis of the DEM and other imagery carried under this study this is not so clear. This is why the Consultant has developed a technical note (annex attached) in this regards for follow up in the due course of this study.

## REVIEW AND REVISION OF THE METHODOLOGY

During the Inception Phase the proposed approach and methodology has been carefully reviewed. This exercise has actively involved many of the experts in the Consultant's team, some of whom have been in the field and met with key stakeholders during the Inception Phase.

### INCEPTION REPORT

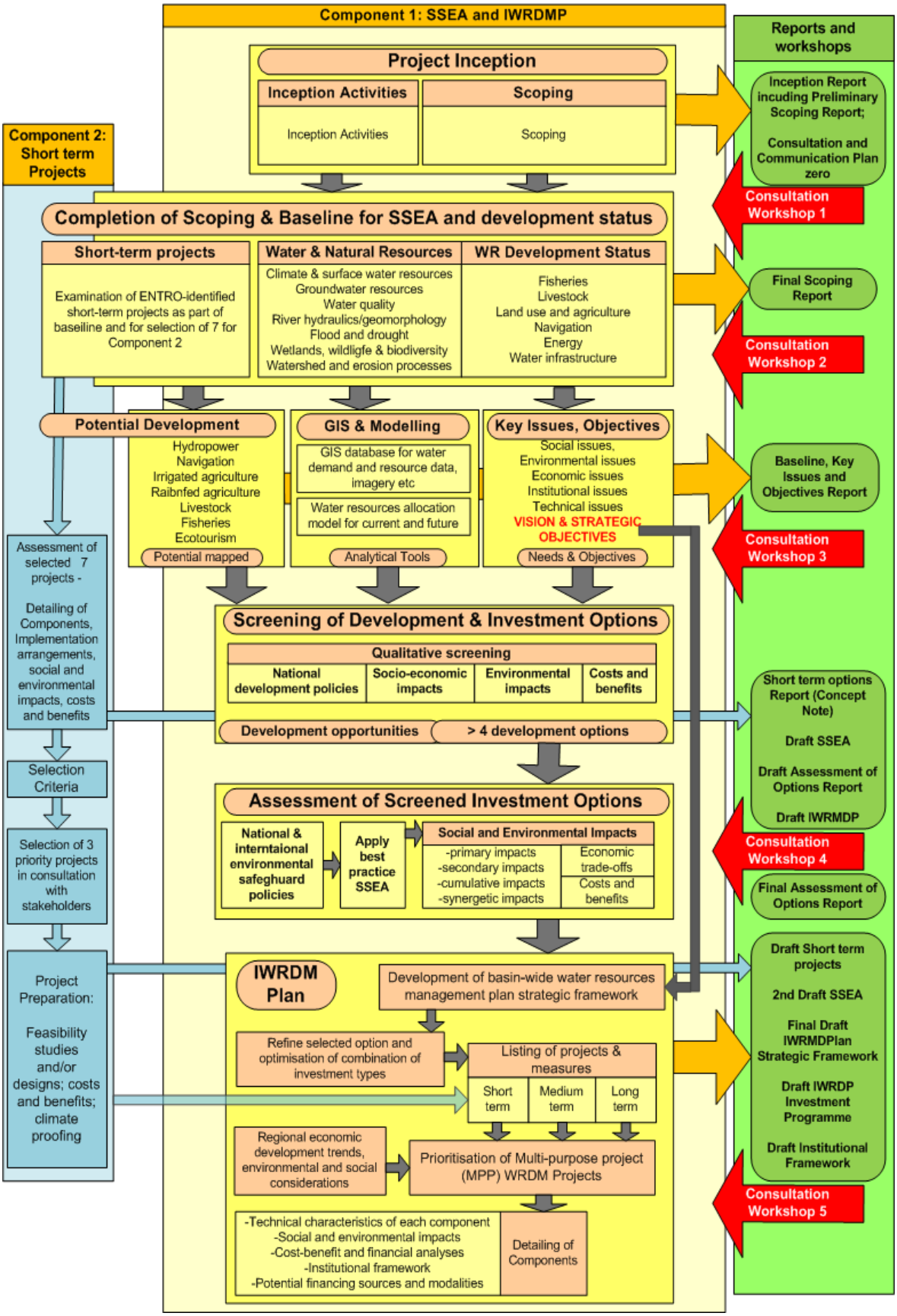
This draft Inception report has been prepared for submission to the Client on 27 July 2015 with the intention of presenting it to stakeholders for comment at the Inception Workshop in Addis Ababa planned for 11 August 2015. Discussion points and comments at the workshop as well as those received following the workshop are incorporated into this final version of the report.

# Revised Methodology

No major revisions of the methodology are proposed. As indicated in the Consultant's proposal, the use of remote sensing is already and will continue to play a major role. Large parts of the basin are inaccessible and there will be a heavy reliance on remote sensing in these areas. Another key feature of the approach is the inclusion of several stakeholder workshops. These have various purposes and are not limited to the review of deliverables. The idea is to actively involve the stakeholders in building the plan. The main steps of the methodology for Components 1 and 2 are indicated in the flow chart overleaf. The study comprises 4 components in total:

- **Component 1** is the largest of the study components and will see the production of several deliverables. It runs for most of the duration of the study and culminates in the production of the Integrated Water resources Development and Management Plan (IWRDMP). The methodological steps can be summarised as follows:
  - Scoping and establishment of a baseline, including the identification of potential development interventions (identified and otherwise)
  - Understanding of issues, challenges and opportunities
  - Development of a Vision for the basin and associated strategic objectives. This will be achieved at one of the planned workshops and will be agreed by stakeholders
  - Screening of development and management options through a SSEA developed as part of the study
  - Stakeholder-driven development of an Integrated Water Resources Development and Management Plan (IWRMDP) with multipurpose projects and enabling and cross-cutting interventions that support implementation of the Plan.
- **Component 2** echoes one of the core aims of Eastern Nile Subsidiary Action Program (ENSAP) of the NBI – the aim of initiating concrete joint investments and action on the ground. While a sound IWRDMPlan is essential for sustainable development, past experience has shown that there is a need to demonstrate that implementation of the IWRDMP should be seen to be starting as soon as possible after the end of this study, the concept of fast-tracking. Some of the short-term actions should be of the type that can be replicated elsewhere in the basin as the IWRDMP is rolled out. The following steps are envisaged:
  - Development of a long list of potential projects
  - Criteria-based Project selection and drawing up of a Concept Note for the best seven multipurpose projects
  - Screening of projects
  - Project preparation for 3 short-term projects
  - Climate proofing

Work during the baseline, including the application of remote sensing already introduced under Component 1 will be used to assist in the identification and detailing of short-term projects. Allowance has even been made for high resolution imagery at the identified potential sites bearing in mind that many will be in inaccessible parts of the basin.




*Flow chart summarising the methodology for Components 1 and 2*

- **Component 3** comprises the identification and profiling of medium and long-term projects. This activity will follow directly on from the development of strategic actions and will be in line with the strategic objectives. Medium to long-term projects are seen as mainly large infrastructure projects that will require a significant amount of preparation and associated cost. In general the projects will be:
  - Regional in nature and/or transboundary in scope
  - Offer win-win benefits to the Eastern Nile countries
  - Contribute to improvement of access to drinking water and improved sanitation
  - Enhance food and energy security and reduce poverty
  - Promote peace and stability
  - Promote health and security

  The steps to be followed include:
  - **Comprehensive analysis of candidate projects** which will make use of a multi-criteria analysis to take into account social, environmental, economic and institutional aspects.
  - **Compilation of terms of reference (ToR),** comprising ToR for feasibility studies and ToR for Environmental Impact Assessments (EIA) of three medium to long term projects
  - **Roadmap for project preparation**, which will include i) a list of tasks to be carried out to ensure the project preparation and its funding, ii) institutional arrangements, iii) organizational setup of the project management, iv) communication and consultation plan, v) resource mobilization plan and vi) the schedule.
  - **Training needs assessment** which will cover ENTRO and the organisations that will be responsible for implementation will be carried out.
  - **Preparation of a comprehensive Training Plan** covering all aspects of project implementation
- **Component 4 concerns the provision of Project Implementation Support.** The inclusion of a participative approach is a central part of IWRM. Stakeholder consultation will play a key role throughout the course of this study and as important, beyond this study into implementation. Ensuring that adequate support is in place will be achieved through the:
  - Stakeholder Consultation Plan and the
  - Stakeholder Communication Plan

# Work Programme and Staffing

The Consultant's team includes both international and locally-based experts. For most of the technical positions there are both international and local/regional experts on the team. The Team is led by Jean-Michel Citeau of BRLi with support from senior team members including Steve Crerar (river basin planner), Gilles Pahin (environmental expert), Charles Pendley (social development expert) and Verno Jonker (hydrologist and options analyst). Expertise and local knowledge is provided by Zeleke Chafano (environmental expert), Ali Hassan (social development expert), Yilma Seleshi (hydrologist), Yemarshet Yemane (water supply and sanitation), Erneo Peter (agriculture and fisheries) and others.

# 1. INTRODUCTION

The main purpose of this report is to provide:

- A demonstration of a clear and complete understanding of the objectives, scope and tasks,
- A thorough methodology for the remainder of the study,
- The schedule of activities, reporting and review procedures and schedule of deliverables.

**Chapter 2** provides the **overall context** for the Baro-Akobo-Sobat study in the frame of the NBI, ENTRO and ongoing initiatives. Objectives and limitations of the study are briefly discussed.

The purpose of **Chapter 3** is to provide an **overview of the work that has been carried out during the Inception Phase**. Due to the extended nature of the Inception Phase to allow stakeholder consultation and work on preliminary scoping, some of the areas introduced in this chapter are revisited in more detail later in the report.

**Chapter 4** provides an overview of some of the **initial findings of the scoping exercise** and informs on:

- The work ongoing to complete the scoping,
- How the findings of the scoping report will be used to inform the Strategic Social and Environmental assessment.

**Chapter 5** is the core chapter of the report and provides the **detailed methodology.** This methodology is based on that provided in the Consultant's proposal but has been refined in line with findings during the Inception Phase. A key area which has been detailed in the refined methodology is the proposed approach and methodology for the Scoping exercise, work on which is already well advanced.

**Chapter 6** outlines the draft **Consultation and Communication Plan.** This chapter was lacking in the draft version of this report. The Plan covers the consultation and communication during completion of this study and for implementation of the IWRDM Plan.

**Chapter 7 provides** the **work programme** and the **proposed staffing and staff deployment.**

The draft version of this report was submitted to the Client on 28 July 2015 and subsequently presented at the Inception Workshop in Hawassa on 10 and 11 August 2015. Based on the discussions that took place at this workshop and comments received from the Client, the report has been restructured in parts and significant improvements and additions made.

# 2. CONTEXT

## 2.1 THE NILE BASIN INITIATIVE (NBI)

The **Nile Basin Initiative (NBI)** is a partnership between the riparian states of the Nile River: Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania and Uganda. The NBI seeks to **develop the river in a cooperative manner, share substantial socio-economic benefits, and promote regional peace and security.** The NBI started with a participatory process of dialogue among the riparian countries that resulted in an agreement on a shared vision, namely, to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources," and a Strategic Action Program to translate this vision into concrete activities and projects.

The **Eastern Nile Subsidiary Action Program** (ENSAP) of the NBI was launched by Egypt, Ethiopia and the Sudan (with South Sudan joining in 2012) to **initiate concrete joint investments and action on the ground** in the Eastern Nile sub-basin in the areas of power generation and interconnection, irrigation and drainage, flood preparedness and early warning, watershed management, development of planning models and joint multipurpose programs. ENSAP is governed by the Eastern Nile Council of Ministers (ENCOM) and implemented by the Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa, Ethiopia. Funding for ENSAP accrues from Eastern Nile countries and varied bilateral and multilateral development partners.

## 2.2 INTEGRATED DEVELOPMENT OF THE EASTERN NILE (IDEN)

The Eastern Nile Technical Regional Office (ENTRO), established by the Eastern Nile Council of Ministers (ENCOM) of water affairs in the Eastern Nile countries, is responsible for managing the Eastern Nile Subsidiary Action Program (ENSAP), whose overall objective is the cooperative development of the water resources of the Eastern Nile Basin, which include the Baro-Akobo-Sobat River Basin, in a sustainable and equitable manner to ensure prosperity, security, and peace for all its peoples.

In pursuit of this objective, ENTRO has formulated the **Integrated Development of the Eastern Nile (IDEN)** as a suite of integrated development projects including hydropower, irrigation and drainage, flood control, watershed management, and water resources management. Because of its regional water and land resources potentials and the role it can play in regional peace, stability and security, the Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project became one of the seven (7) projects identified in the IDEN.

The objective of the IDEN Project is to initiate a regional, integrated, multipurpose development project through a first set of investments that confer tangible, win-win gains and demonstrate joint action between the Eastern Nile countries.

## 2.3 BARO-AKOBO-SOBAT SUB-BASIN

The location of the Baro-Akobo-Sobat sub-basin with respect to the Eastern Nile and the whole Nile Basin is shown in Figure 2-1.

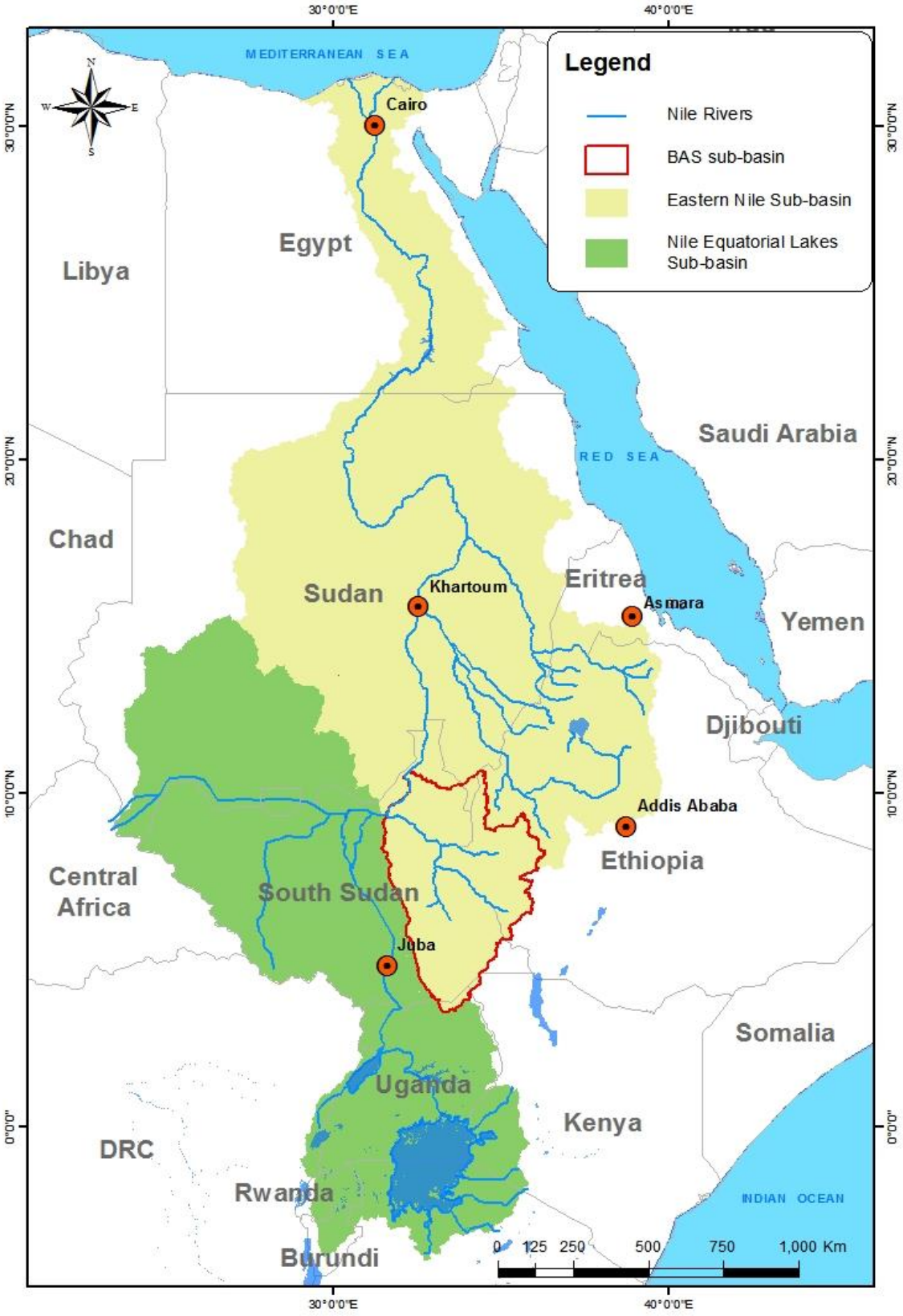



*Figure 2-1: Location of the Baro-Akobo-Sobat sub-basin within the Nile Basin*

As shown in Figure 2-2, the Baro-Akabo-Sobat sub-basin, with its catchment area of more than 205,000 km$^2$) consists of the Baro, the Akobo and the Pibor rivers. The Baro River originates in the highlands of Ethiopia (2,000 – 3,500 masl); from the eastern parts of BAS sub-basin, draining west wards through the Gambella plains (450 masl) into the Republic of South Sudan. The main tributaries of the Baro river are the Birbir, Geba and Sor rivers. For the Alwero River, the main tributaries are the Gecheb, Bitun and Beg rivers. The Pibor River with its tributaries originates from the Imatong Mountains in Eastern Equatoria State, Republic of South Sudan, draining northwest through grassy flat plains. The Pibor River is joined on its way by the Akobo, Gilo and Alwero Rivers originating from the Ethiopian highlands. Pibor River continued its northwest flow direction; at the confluence of Pibor and Baro Rivers the Sobat River is formed. In South Sudan, the Sobat River forms a defined channel flowing northwestwards through grassy flat plains giving numerous backwater swamps and lagoons and of prominence is the *Machar marshes* wetlands; until its confluence with the White Nile 15km south of Malakal town. The topographic conditions here offer steady flow to the White Nile until it joins the Blue Nile at Khartoum, Sudan.

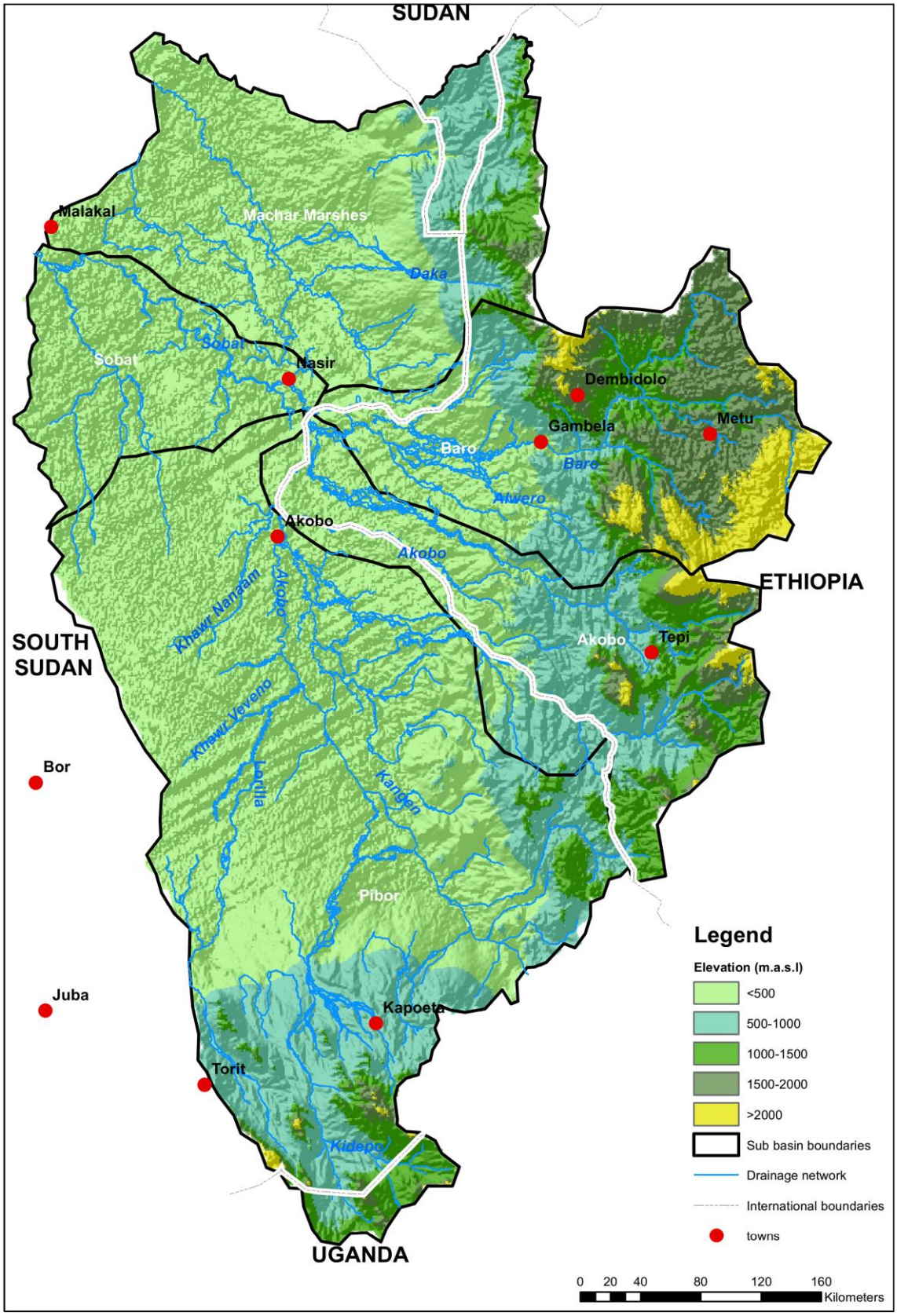



*Figure 2-2: Hydrography of the Baro-Akobo-Sobat basin*

The seasonal rainfall pattern and large flat areas have resulted in the formation of many wetlands that have been a defining influence on the activities of the people of the sub-basin. The *Machar marshes* are located north of the Baro River upstream of its confluence with the Pibor River. This wetland system in a depression has a hydrology primarily driven by evapotranspiration and local rainfall. Hurst, 1950 and the Jonglei Investigation Team (1954) followed by the work of El-Hemry & Eagleson (1980) and Sutcliffe (1993) revealed that the hydrology of Sobat River after Baro is characterized by over bank spills into the *Machar marshes* and other wetlands on the western Bank. The seasonal stream of Adar at the northern end of the *Machar marshes*, flows through extended grassy flat plains and would appear to be the only channel connecting the marshes to the White Nile, although it is not gauged.

The mean annual flow of the Baro River at Gambella is around 12.4 billion $m^3$ (1980-2000). In its lower course, the flow spills and a large amount of spillage enters the *Machar marshes*. Annual spillage is estimated to be in excess of 3 billion $m^3$ (1980-2000) and the mean annual flow is recorded to be 9.53 billion $m^3$ (1905-1955) at the mouth of the Baro River. Once contributions from the Pibor, Akobo, Gilo and Alwero Rivers are taken into account the average annual inflow of the Sobat River at the Doleib hill located upstream of Malakal is estimated to be 13.687 billion $m^3$ (1905-1955). It should be noted that these figures come from the literature and are quoted in order to provide context. During the course of this study the hydrology will be investigated in detail and may result in some revisions to these estimates.

Rain fed crop cultivation is the principal livelihood activity in most of the basin where adequate rainfall is available. The economy, which is largely based on traditional cultivation methods, is subsistence oriented. Production is dominated by cultivating crops such as maize and sorghum for local consumption. The lowland population practise shifting cultivation, mainly for growing sorghum. In South Sudan more than 95% of households are categorized as subsistence-level rain-fed farmers cultivating small areas using simple manual agriculture implements.

In the semi-arid to arid areas of the sub-basin pastoral livestock becomes predominant. Livestock as a source of livelihood is more important for the South Sudan side of the basin where there is a high concentration of cattle, sheep, and goats. The main livelihood strategies in the sub-basin are therefore a combination of crop and livestock production followed by ‘crop only’ farming and ‘livestock only’ production.

Farm employment (combining crop and livestock production) constitutes the primary form of employment for the population. The communities in the sub-basin basin (both in Ethiopia and Sudan) appear to have very limited experience in accessing cash income due to the remoteness and inaccessibility of the region from regional market centres

Fishing is also an important component of the livelihood strategies of communities that live along the rivers and the wetlands in the sub-basin. The Baro-Akobo-Sobat sub-basin has a high potential for flood plain **aquaculture**, but lacks efficient aquaculture technologies.

Overall, there is a dearth of infrastructure in the sub-basin, specifically in terms of road networks, water supply and sanitation facilities, health and education services, provision of credit and extension services.

The high rainfall, fertile lands, and rivers of the basin offer significant potential for agricultural growth. The potential for large-scale hydropower development has already been identified in the highland areas of the basin in Ethiopia.

## 2.4 THIS STUDY

### 2.4.1 Contract Award and start up

Following negotiations between ENTRO and BRLi, which took place in December 2014 in Addis Ababa, the contract was awarded to the BRLi and AURECON Joint Venture in March 2015. YERER, a consulting company with its Headquarters in Addis Ababa are sub-consultants to BRLi.

The project was formally kicked off at a meeting at ENTRO offices on 19th March 2015.

### 2.4.2 Objectives of the Study

The objective of the consultancy services 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 Consultant has taken note of the following specific objectives:

- Preparation of a participatory strategic social and environmental assessment (SSEA) of the sub-basin to facilitate identification of investment options that take into account social, environmental, economic and institutional considerations.
- Formulation of an Integrated Water Resources Development and Management Plan (IWRDMP) informed by the SSEA to identify sustainable investments and provide a sound framework for long term development and management of water resources.
- Identification and preparation of a feasibility study, in a participatory and consultative manner with relevant basin stakeholders, short-term investment ready projects.
- Identification with participation and engagement of relevant stakeholders in the sub-basin, medium and long-term projects and initiate project preparation activities.
- Provision of an objective and effective framework for stakeholder consultation and engagement in cooperative development and management of water resources of the Baro-Akobo-Sobat sub-basin, and support to ENTRO in mobilizing funds for the implementation of the prepared projects.

It is important to stress the fact that the title of this project is Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project. As such, it is clearly stated in the terms of reference that “the Consultant shall develop a priority sequence of the multipurpose water resources development projects” as part of the IWRDMPlan.

### 2.4.3 Main Steps

The study is both complex and challenging. It is complex because there is clearly a need for development to support social upliftment and there are the land and water resources to support this. At the same time, most of the environmentally sensitive areas are downstream of these potential developments and could be irreversibly impacted if development is not well planned and, once implemented, well monitored. It is especially challenging because there is a dearth of the critical data that is really required to the necessary planning. There are a lack of historical hydrological data and an absence of operational surface water river gauging stations in the areas of the system where the hydrology is most complex. To complicate matters further, access to the parts of the basin where knowledge is particularly limited (*Machar marshes* and other wetlands in South Sudan) is very limited due to the unfavourable security situation. The Consultant proposes to mitigate both this complexity and the challenges through the use of remote sensing and associated modelling techniques. Details of the methodology are presented in Chapter 5, but the simplified flow chart presented in Figure 2-3 provides an overview of the main steps of the study.

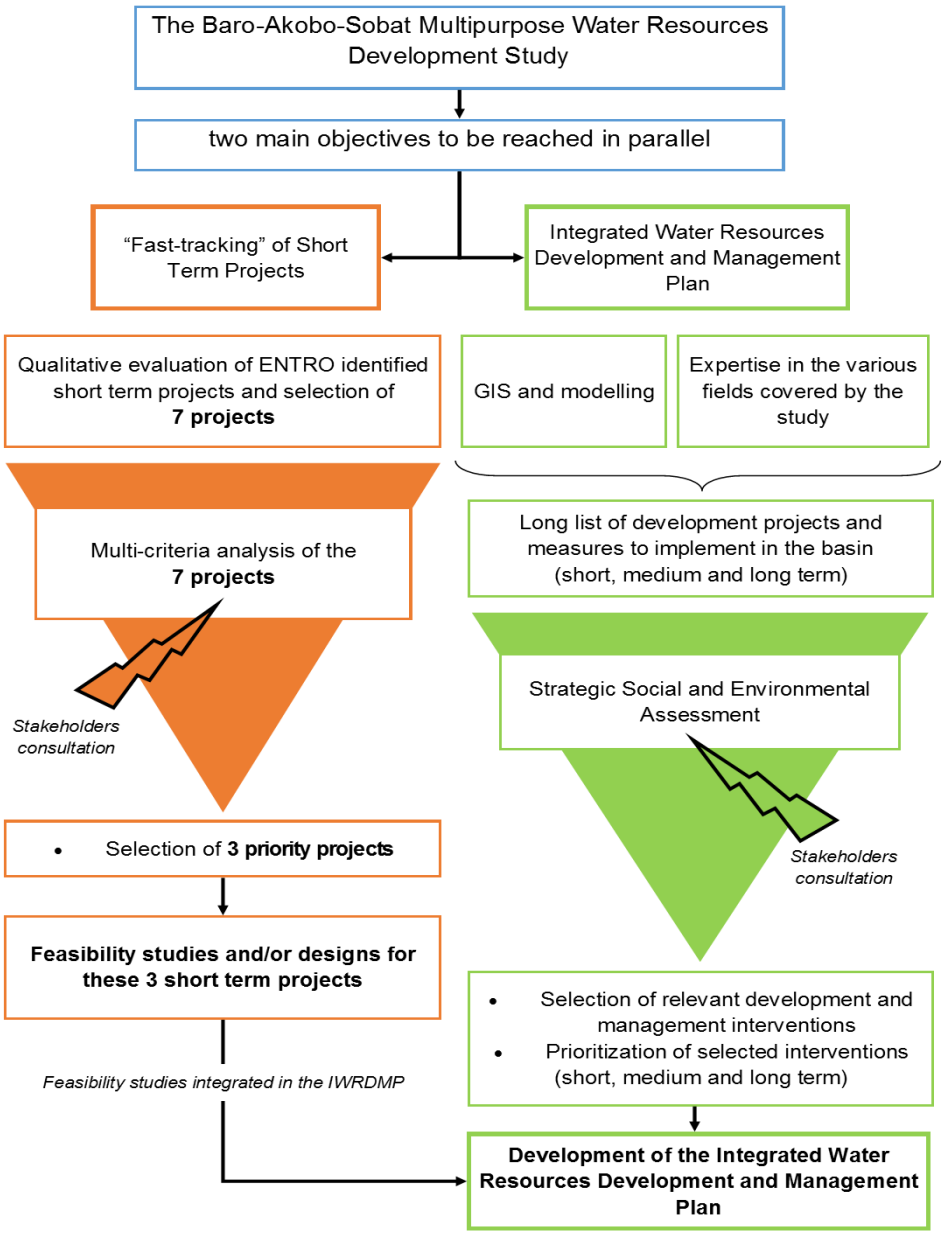



*Figure 2-3: Flow chart showing key steps of the study*

### 2.4.4 Limitations of the Study

The Baro-Akobo-Sobat basin is large and inaccessible in places. In addition, there are security concerns in many parts of the basin within South Sudan. These constraints mean that field reconnaissance will not be possible in most parts of the basin. The Consultant was aware of this when drawing up the proposal and will make use of extensive remote sensing applications in order to overcome this problem. Nevertheless, this is not the ideal solution and will reduce the accuracy of the baseline. It may also pose some problems in getting stakeholder inputs for short-term projects.

In addition, the Consultant will make specific efforts to rely to previous/older studies describing the functioning of the basin, as well as referring to key informants/stakeholders in the view of confirming or detailing the remote sensing data and interpretation.Inception phase.

# 3. INCEPTION PHASE

## 3.1 INTRODUCTION

The Inception Phase has been longer than it is usually the case for this type of study. This is in line with the terms of reference and has been necessary in order to:

- Gather enough information and data for the proposed methodology to be properly re-assessed and refined accordingly.
- Allow time for the baseline remote sensing work to start and provide some initial results, important to inform the methodology, establishment of a baseline and the scoping work.
- Allow sufficient time for work on the scoping task to start. It has also allowed work on the establishment of a baseline and even the identification of issues, challenges and development opportunities to be identified.
- Meet with a sufficient number of stakeholders in both Ethiopia and South Sudan.

The main output of the Project Inception task is this Inception Report. It includes an annotated table of contents of the Scoping report and presents some of the preliminary findings. This report will be completed during the 2.5 months following the Inception Workshop. Much of the work done to inform the scoping has also provided important inputs to deliverables 4a) the Baseline, 4b) Key Issues and Objectives and 4c) Potential Development reports.

In the rest of this section an overview of the main activities of the Inception Phase is provided.

## 3.2 KICK-OFF MEETING

The kick-off meeting was held on 19th March 2015. The meeting was preceded by a number of activities during the period 16 – 18 March including:

The following areas were discussed in detail:

- Staffing and the mobilisation of experts,
- Documentation, sources of information and storage of documents and data,
- Milestones,
- Organisation of field visits,
- Key stakeholders.

Minutes of the meeting and related aspects are provided in Annex 1.

## 3.3 ACTIVITIES CARRIED OUT DURING THE INCEPTION PHASE

### 3.3.1 Field visits and Discussions with Stakeholders

Discussions with stakeholders took place both as part of the field visits and during time spent by the team in Addis Ababa and Juba. Four field visits have taken place during the Inception Phase. The main purpose of these visits was to give a first overview of the basin to the different Experts and to meet key stakeholders in Ethiopia and South Sudan.

The following field visits took place:

- 28 April – 11 May 2015: General overview of the basin and meetings with stakeholders
  - Ethiopia: Addis Ababa – Nekempte – Gambella – Metu – Jimma
  - South Sudan: Juba
  - South Sudan : Torit and area
- 16 June – 21 June 2015: Watershed Management
  - Ethiopia: Addis Ababa - Jima - Mizan Teferi – Tepi – Gimbi
- 18 June – 20 June : Environmental and Social assessment
  - Ethiopia: SNNPR – Gambella
- 22 June – 4 July: Water Supply and Sanitation
  - Ethiopia : Awassa – Gambella
  - South Sudan: Juba

The first field mission had very broad objectives and launched the Inception Phase. This mission was really of importance for the Consultant to understand the main challenges in the basin and present the project to the stakeholders in the basin. The other three field missions were largely focused on one field of expertise and brought material for the scoping and baseline phases. Figure 3-1 hereafter localizes the different areas of the basin that have been visited during the Inception Phase.

More information on these field visits is provided in Chapter 4 – Preliminary Scoping but a few of the main observations, in terms of challenges and opportunities, made during these visits are highlighted as follows:

#### Food and water security

Food and water security is far from attained in most parts of the basin. Irrigation is seen as the main potential driver to reach food security, in both the highland areas and the lowlands. At the same time it was already clear during the visits that there had already been some failures in recent attempts to introduce large-scale commercial irrigation and rainfed farming in the plains downstream of Gambella. These failures were largely due to the absence of preliminary studies. With few exceptions, agricultural expansion in the Gambella plain has been adhoc and unplanned. Little, if any attention has been paid to the situation of the Gambella National Park and the need to balance agricultural development against conservation. This will be of importance during elaboration of the SSEA.

With respect to water security, the need to develop groundwater was stressed on a number of occasions. Gambella in Ethiopia, despite its size and rapid growth does not have a proper water supply system. The situation is almost the same in Torit, South Sudan where there is no proper water supply and sanitation. In this area, a detailed design study, including bid document preparation for Torit town water supply was carried out in 2013. Water security in rural areas is of major concern in particular in the areas characterised by semi-nomadic livestock farming where a lack of perennial water for livestock makes the establishment of settlements with assured access to water a challenge.

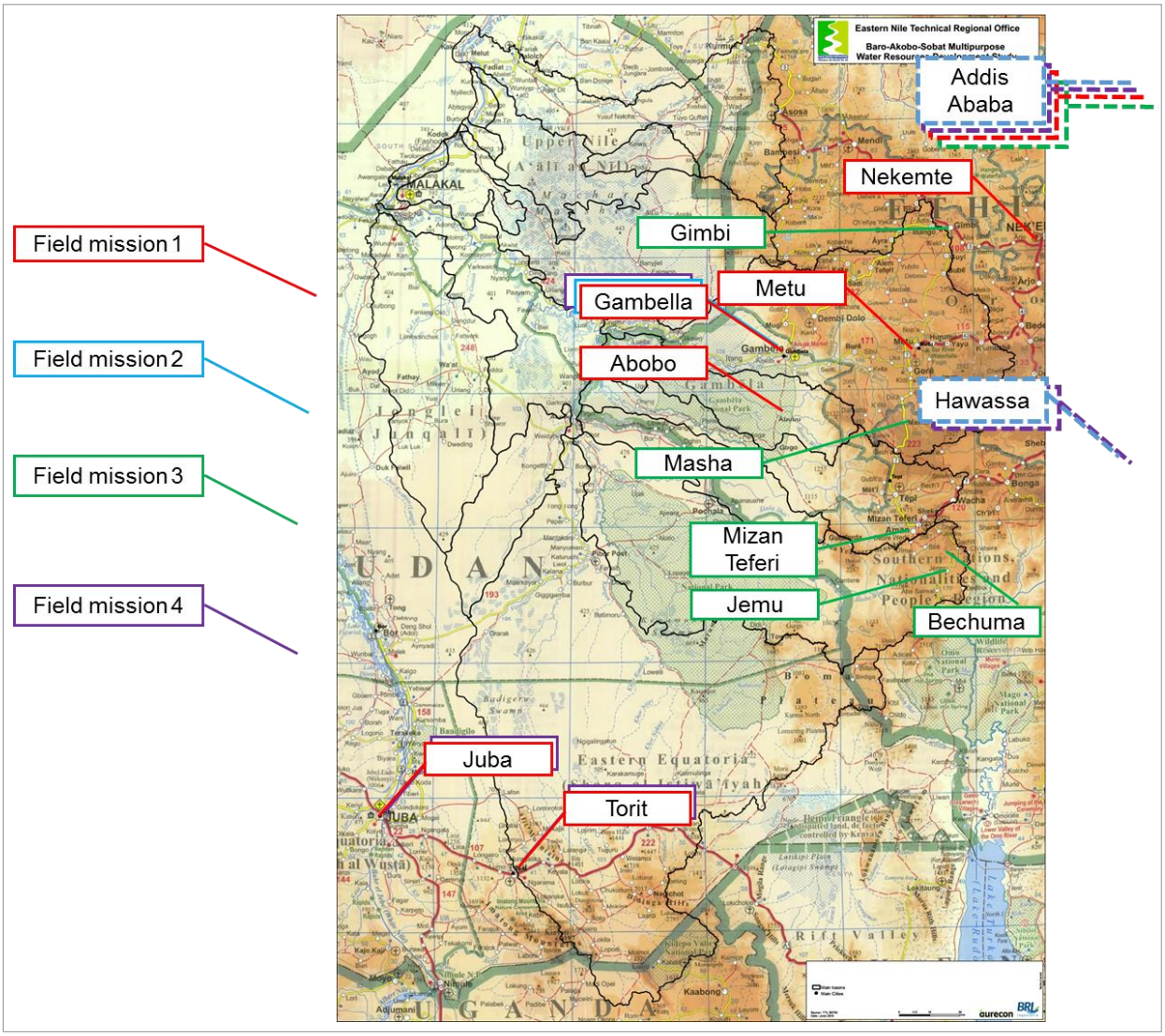



*Figure 3-1: Areas visited during the Inception Phase*

## Floods

Floods have significant impacts on communities in the flatter areas of the basin. It is clear that the development of storage in the upper parts of the basin (in particular in the Ethiopian part of the basin) offers opportunities to mitigate floods and at the same time generate hydropower and provides water for other purpose. At the same time, such large storages would significantly alter the seasonality of the hydrological regime in the wetlands further downstream and this would impact on both biodiversity and livelihoods. Indeed, during discussions with stakeholders it became increasingly clear that the biggest unknown for the study is the degree to which upstream development would negatively impact on the wetland systems such as the *Machar marshes*.

## Livestock watering

Livestock watering during the dry season and grazing are two drivers of conflict between local communities. Discussions with stakeholders, including members of Parliament from the Kapoeta area (one of the most affected in this respect) indicated that there is a strong desire to provide more permanent watering points and in so doing gradually transform the pastoralists into sedentary farmers in recognition of the fact that this would support commercialisation of their activities and at the same time provide a better standard of living in terms of access to services (health, education etc.). The opportunity to develop reservoirs (valley dams) and/or groundwater in the driest areas of the basin should be studied.

## Environmental issues and biodiversity loss

There are in general gaps between environmental laws and their application. This was pointed out in the Gambella region where there is no management plan implemented in the Park (although a land-use planning study is being carried out). There is also competition between livestock and wild animals for access to land and water. Poaching is also practised, especially in Boma National Park. All these factors have a negative impacts on biodiversity and on the migration of species in the Boma-Gambella region. Given the potential for upstream development, it is clear that the fullest possible consideration of environmental issues has to be part of the IWRMDPlan.

## Watershed management

Land degradation and soil erosion are two main challenges, especially in the highlands. Programmes are already implemented through the Sustainable Land Management Program (elaborated at national level in Ethiopia). During meetings with stakeholders on both sides of the border, the importance of a livelihood-based approach to watershed management was stressed on a number of occasions. Essentially, this means that efforts to reduce erosion should be seen as efforts to reduce loss of valuable topsoil. Measures should be designed with the livelihoods of the farmers uppermost. In this way both ownership and sustainability can be assured.

## Lack of Data

There is undoubtedly a shortage of data with respect to many of the issues around the basin. The hydrology of some areas, including the *Machar marshes* and other wetland areas, is not well-known and there are none or almost no data being collected in some areas today. While development of the IWRMDPlan should not be unduly hindered by this lack of data, it should be built in such a way that it can easily be updated and refined as hitherto missing data becomes available. In order to ensure that this is possible, the Plan itself should include actions focussed on improving the availability and/or the collection of critical data.

## Opportunity for well-planned development

With the exception of parts of the highlands in Ethiopia, the level of development in the basin is extremely low. The level of water resources development through the construction of reservoirs and other water infrastructure is even lower. Only 5MW of hydropower has been developed in the basin out a potential of several thousand MW. Some large scale irrigation are under implementation but there are not yet operational although large tracts of land would appear to have been allocated to privates investors[2] The urgent need for development has been expressed by many stakeholders and this is inarguable in order to solve pressing problems such as food security and access to basic services. At the same time, the need to properly plan in an integrated way, especially for the larger-scale developments has come out very strongly. The lack of water resources development today presents an opportunity for things to be done properly and with sustainability issues kept at the forefront.

2 In "Governance for Effective and Efficient Conservation in Ethiopia" 2013, it is stated that "Two large Indian and Saudi commercial plantations, Karuturi (300,000ha) and Saudi Star (100,000ha), are currently clearing land and conducting trials within the park". Representatives of these two projects close to Gambella were visited during the Inception Phase. If these 400,000 ha were really to be irrigated, with a coarse estimate of 10,000 cm/ha crop requirement, this would mean abstraction of 4 billion cm/year, i.e. 1/3 of the Baro annual flow at Gambella.

### 3.3.2 Methodology going forward

During the Inception Phase the proposed approach and methodology has been carefully reviewed. This exercise has actively involved many of the experts in the Consultant's team, some of whom have been in the field and met with key stakeholders during the Inception Phase. The reviewed and updated methodology is presented in Chapter 5 of this report. No major changes are proposed. However, it has been possible to refine and improve focus for the methodology during the work on the preliminary scoping report. Text has been included in the appropriate parts of the methodology to reflect on how improved understanding obtained during the preliminary scoping has enriched the methodology.

As already mentioned earlier, the study is complex and will require inputs from a large number of different experts. Careful programming and management of inputs will be required and there will have to be some flexibility in this since precise staff deployment requirements will, in some cases, depend on choices (which short-term projects, what priorities in development options, etc.) that cannot be made at this stage. The Schedule of activities and corresponding indicative staff deployment programme has been carefully reviewed and detailed. It is provided in Chapter 7 of the report.

### 3.3.3 Work on the Consultation and Communication Plan

Several components of the study require the significant participation of stakeholders:

- The Strategic Social and Environmental Assessment (SSEA) aims at identifying investment options that take into account social, environmental, economic and institutional considerations; this will be heavily based on stakeholder consultation.
- The identification and preparation of feasibility studies for short-term/long term investment projects will be realised in a participatory and consultative manner with relevant basin stakeholders.
- The identification of medium and long term projects will be realised with participation and engagement of relevant stakeholders in the sub-basin.

An effective framework for stakeholder consultation is required to work on these components. **However**, it is important to stress the fact that this study concerns the drawing up of a IWRDMPlan and a limited number of feasibility studies and **not** implementation of the Plan or the short-term projects. This will follow as a next step. This implementation (for the plan in the short, medium and long term and for the identified priority short-term projects) will require a clear strategy and plan for communication with concerned stakeholders. Thus the Consultation and Communication Plan has two clear components:

- A plan for the required consultation during the course of this study,
- A plan for consultation and communication for the implementation of the outputs of this study.

The draft Consultation and Communication Plan is discussed in Section 6 of this report and key elements are included as Annex 5.

### 3.3.4 Work on the Preliminary scoping

Preliminary scoping has been an integral part of the Inception Phase. It has allowed the Consultant to better appreciate how the methodology will be applied and to appreciate the challenges in implementing this study. The preliminary scoping is the first step for the full scoping exercise, which is aimed at clearly setting out what has to be done in the baseline and where efforts will be focussed in order that the required information is available for the critical Strategic Social and Environmental Assessment (SSEA).

An introduction to the Scoping exercise as well as overview of the preliminary scoping phase is presented in Section 4 of this report. An annotated table of contents for the Scoping Report is provided as Annex 4.

### 3.3.5 Preliminary Work on remote sensing

The use of remote sensing will play a critical role in completion of the baseline and also in the determination of potential development opportunities. It will also be used when looking at some of the short-term projects. Details on the methodology as they apply to the different parts of the study are included in Chapter 5 of the report.

Starting to apply the proposed remote sensing methodology at this early stage in the study is important as an essential part of the scoping exercise; the work done will also obviously provide important inputs to the baseline. During the Inception Phase the following work has been carried out:

- Digital mapping of surface geology using remote sensing images and GIS technics,
- Digital Elevation Model (DEM) using SRTM DEM at 30 m resolution,
- Manual hydrographic network mapping using Landsat 8 satellite images at 1:75,000 scale and hierarchisation of the tributaries using Strahler classification methodology,
- Update of the BAS boundary as a result of the hydrographic mapping,
- Sub-basins delimitation at different scales:
  i. 780 sub-basins have been identified using Strahler order 3
  ii. 12 sub-basins have been identified using Strahler order 5
- Mapping of flooded areas based on the hydrographic network and satellite images (visible and radar). Analysis at 1:100 000 scale,
- Land use mapping based on photo-interpretation of Landsat 8 images (2014-2015) at 1:100 000 scale and mapping of the basin burnt areas for the years 2014-2015.

The implications of this work as it relates to the scoping exercise (and ultimately the baseline), are introduced and discussed in Chapter 4.

Preliminary results on delineating the BAS boundary are provided in chapter 4 Preliminary Scoping. It should be stressed that the precise definition of basin boundaries is challenging in some parts of the basin, in particular the flatter areas where the direction of flow is not always clear. The basin boundary shown on the maps in this report should be considered as preliminary. Work is still ongoing with the aim of finalizing a definitive basin boundary. However, it is important to recognize that hydrographic limit of the basin is not fixed in some places. Direction of flow (into or out of the basin) at some locations depends on relative water levels in the adjacent basins.

### 3.3.6 Inception Workshop and Report

This draft Inception report was prepared for submission to the Client on 28 July 2015 and presented to stakeholders at the Inception Workshop in Hawassa August 10$^{th}$ and 11$^{th}$ 2015. The attendance list is provided in Annex 7.

Discussion points and comments raised at the workshop, together with the comments formally received by the Client on 24 August 2015 have been taken into account in this fully revised version of the Inception Report. Annex 8 provides a complete list of the comments received together with an explanation from the Consultant as to how these comments have been dealt with in this revised version of the Inception Report.

# 4. PRELIMINARY SCOPING

## 4.1 INTRODUCTION

Preliminary scoping has been an integral part of the Inception Phase. Apart from being the first step for the full scoping exercise and the baseline for the Strategic Social and Environmental Assessment (SSEA) it also allowed the team to review and refine the methodology in a much more informed manner than would otherwise have been possible.

The work of the preliminary scoping is guided by the overall framework for the Scoping Report. The annotated table of contents for this report is provided in Annex 4.

## 4.2 OVERVIEW OF THE APPROACH ADOPTED

"Preliminary" scoping can be seen as the first step of the overall scoping exercise and should be understood within this context. The scoping exercise is aimed at **determining the relevant information to be collected to complete the baseline** in order to determine the "key issues and potentials related to water resource development and management in the river basin". In other words, the scoping exercise concerns the definition of what has to be done and how it should be done in the baseline. The details of the methodology being applied for the scoping exercise are provided in the methodology (see Section 5.2.3), but it is important to highlight a few key points in order to appreciate the actions that have been taken as part of the preliminary scoping, effectively the initial steps of the overall scoping exercise.

It is important to note that this study has a clear focus on the **identification and development of projects**. At the same time, this development of projects (large and small) has to take place within a coherent strategic framework for the management and development of water resources basinwide. For this reason the baseline (and hence the scoping exercise) has to be carried out at two levels:

- **Basinwide (BAS)** (and to a certain extent the **whole Eastern Nile/Nile** in order to take downstream impacts of identified projects into account). Although this includes consideration of the impacts of individual projects it will be particularly important to look at the cumulative impacts (including benefits) of combinations of development projects and management interventions (cumulative impacts/benefits). This will provide some of the key inputs for the SSEA framework which has to be able to understand and assess the relative merits of different development options from the environmental and social perspective at the strategic level.
- **Project/intervention level.** The level of detail that is required at this level is too detailed to be assessed/collected at the basin-wide level. The challenge here is that many projects/interventions are yet to be identified so - **how to know where to do the baseline work?** Our approach to the baseline and the related scoping at the intervention/project level will be based on the fact that interventions can be:
  i. the development of already identified projects (from masterplans, existing studies, etc.)
  ii. as a result of identifying a need and/or a potential. For example there may be a specific need for development (or a type(s) of development in a specific part of the basin) or there may be a specific potential for a certain type of development (irrigable land, hydropower potential, etc.)

  The baseline work (around identification of issues, objectives and potential should therefore be focused on these two areas. For i), the already identified projects it is clear and the scoping effort will focus on establishing an inventory of all these identified interventions. For ii), it will be necessary to identify both areas of **need and potential** (opportunity).

Much of the approach in the scoping exercise is about **metadata.** The team needs to understand what information should be available and how they can use it. The assessment of the information has come from the examination of reports, maps, models, data sets and through consultation with stakeholders, especially informed parties. The identification of potential types of projects and interventions and where they may have potential for development has also come from the examination of maps and reports and through consultation with stakeholders. However, some limited field reconnaissance carried out by the team and the application of remote sensing have also played an important role.

The three main objectives of the scoping report are the following:

- Identification of water resources development and management projects and areas of potential for the development and management actions
- Clear definition of the work to be carried out in the baseline and for the SSEA
- Assessment of information available, identification of gaps and implications, suggestions for mitigating critical gaps.

In line with the approach briefly outlined above and with these objectives in mind, several activities have been carried out during the inception phase and they are briefly reviewed in Section 4.3.

## 4.3 ACTIVITIES CARRIED OUT DURING THE INCEPTION PHASE FOR THE SCOPING EXERCISE

### 4.3.1 Gathering and assessing the available documentation to be analyzed during the baseline study

One of the main activities of the preliminary scoping has been the collection and assessment of documentation concerning the basin. This is one of the key tasks of the scoping exercise and a complete chapter of the Scoping Report is devoted to this. The chapter will provide an overview/details of the information sources that have been used to do the scoping and which are seen as key documentation/sources of information for the baseline.

The documentation is being used in two ways:

- In order to write the scoping report: Identification/listing of projects and identification of potential developments (by geographic area and/or need),
- To know what is in the documentation to help us complete the baseline.

During the Inception Phase much of the documentation has already been collected and a preliminary assessment carried out in order to both refine elements of the methodology and to identify what are the most important documents for the baseline.

In order to provide a clear overview of the available documentation the “Sources of Information” Chapter in the Scoping report will be laid out as follows:

- **Bibliography relevant for the study.** The list of all potentially relevant documents will be provided. For example:
  - Shahin, Hydrology of the Nile basin, 1985
  - Sutcliffe & parks, Hydrology of the Nile, 1999
  - Selkhozpromexport, Baro-Akobo basin master plan study of the gambella plain (annex 1: climatology and hydrology), 1990
  - Ardco-Geoserv, survey and analysis of the upper Baro-Akobo-Sobat basin: final report, volume ii: water resources, 1995
  - TAMS-ULG, Baro-Akobo river basin integrated development master plan study, annex 1: water resources , 1997
  - Etc.

  This list will be useful for discussion with stakeholders, including ENTRO, in order to identify if anything has been missed.
- **Assessment of the** information **currently available in reports;** A brief review of each document, emphasizing its importance for the study will be presented in this section along the following lines:

## SUTCLIFFE & PARKS, THE HYDOLOGY OF THE NILE, 1999

This report provides an overview of the Nile Basin surface water hydrology in terms of the drainage network, early studies, the hydrometric network, water balance calculations, land use and climate and the operation of existing dams. It includes a chapter on the Baro-Akobo-Sobat Basin and provides a detailed analysis of the water balance of the *Machar marshes*, while the links and spills between different rivers and channels on the Gambela Plains are also described.

## ENSAP-ENTRO, BARO-AKOBO-SOBAT WETLANDS KNOWLEDGE BASE CONSULTANCY, 2012

Hydrology & Water Quality: The swamp is flooded during the rains to depths in excess of 1 m. The 9 rivers feeding it are seasonal, but some retain pools of water in their beds during the dry season. A small lake forms in the swamp after the rains at a point 4°59'N/34°41'E in Sudan, but disappears during the dry season. Precipitation over the swamps is 250-500 mm/yr, but reaches 650 mm in the Ugandan catchments and 800 mm in those of Ethiopia.

Altered hydrology, water flow and water quality are likely to affect the vast extent of wetlands found in the region. An important aspect of the potential lost from environmental degradation is the likely negative impact on the local fisheries. The combined yield from the Baro, Alwero and Gilo Rivers make up the largest fisheries in Ethiopia (Abrha and MoWR 2005).

Wetlands control floods by storing water and they trap and remove sediments which come with the water. The natural ways water would enter into wetlands from the river banks will be altered and the regulated flow consisting of a changed water quality and probably less sediments will impact the habitats to which ecological adaptation has evolved.

Some of the wetlands have been documented in previous inventory studies using GIS. But there is need to study their ecology since wetlands depend on the amount of on the quality and amount of water in them together with the nature of their topographical basins.

The entire ecosystem of BAS is dependent on its hydrology, hence, developments which might alter water flow regimes and water quality are likely to affect the wetlands and the ecosystem found in the BAS.

Emphasis should be to examine the influence of the physical environment and hydrology on the existence of the wetlands and other ecosystems and their role in modifying water quality from the catchments by removing pollutants presumably from sediments and suspended solids, agricultural pesticides and fertilisers.

These short assessments/summaries are being written up for all key documents and will be provided in the Scoping Report. However, the large majority of the key documents have been analysed by the team members and have provided useful information as well as a clearer picture of what information and data are available. There are some **notable exceptions** however. A key document that the Consultant had not time to review is the **Consolidated Agriculture Master Plan (CAMP)** for South Sudan nor the **Irrigation Development Master Plan** (IDMP) for South Sudan. A final draft of this document was only received from South Sudan not earlier than the 22nd October 2015, due to formal approval considerations. It is understood that release of the CAMP document is pending approval of the National Legislative Assembly although it has already been passed by the Council of Ministers as a working document. As for Irrigation Development Master Plan (IDMP) on which project related irrigation can be found, unfortunately the document is still under finalization for presentation to Council of Ministers and thereafter the National Legislative Assembly. Access and thorough review of these documents is absolutely critical. Without them the Scoping exercise and the ensuing baseline will be incomplete.

Annex 6 provides a bibliography of the documents that have been obtained so far, although the list is continuously evolving. The bibliography that will be provided in the Scoping report should be the one regarded as definitive for the study.

### 4.3.2 Analysis of available datasets, rapid review and gap analysis

The aim of this part of the scoping exercise is to state:

- What data exists (according to documents and feedback from stakeholders),
- What data has been obtained (or can be easily obtained),
- What data we don't have (of the data that apparently exists).

As part of the scoping exercise, a gap analysis is being carried out based on the understanding of what data is available and what data is needed to perform the different elements of the study. "Data" is taken to include both numerical data and spatial (GIS) data sets (raster files such as DEM and vector files such as shape files).

A key area of focus during the preliminary scoping has been on the examination of what data sets exist with respect to climate and water resources and the team already has a very good picture of what data exists.

The analysis is being carried out by development sector and for the main baseline thematics (water resources, environment/biodiversity, social development and a number of cross-cutting and enabling areas). This is detailed in the annotated table of contents for the Scoping Report (see Annex 4).

### 4.3.3 Discussions with stakeholders, in particular information-holders, decision-makers and experts

The main findings of these field trips are reflected in the preliminary scoping report (see Section 4). In this sub-section only an overview of the field missions (person/organisations met and main discussion areas) has been provided. For more details, refer to Annex 2 (minutes of meetings) and Annex 3 (list of stakeholders met).

#### 28 April – 11 May 2015: Field mission 1

This tour was organized to have a first contact with people concerned by the study (key stakeholders) in Ethiopia and South Sudan. This was the first chance to exchange views with people aware of the situation and to involve them in the process. The tour was also the opportunity to collect data and information on projects implemented in the basin.

Table 4-1 summarizes the meetings held during this field mission.

*Table 4-1: Summary of Stakeholder Meetings – Field mission 1*

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| 28 April 2015 | Nekemte | Department of statistics, Land and environment office, Women Association Affairs, Zonal office | • Improved farming practices and development of irrigation<br>• Opportunity to create farmers<br>• Deforestation and land degradation |
| 29 April 2015 | Metu | Irrigation office, Finance and Economic, Women and child affaire, Zonal health department, Water, Mineral and Energy, Zone Agricultural office, Livestock | • Agricultural extension and the role of irrigation<br>• Hydropower potential<br>• Potential for the enhancement of forests in the area. |

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| | | department and health office planner | • Deep water wells to provide a safe potable water. |
|  *Metu* | | | |
| 30 April 2015 | Gambella | Water and energy resources development bureau, EPA, WCYA | • Water safety: Development of groundwater use<br>• Food safety and Irrigation<br>• Potential for fisheries<br>• Market potential for agricultural products |
| 30 April 2015 | Abobo | Manager in the Plantation Group | • New Horizon Plantation Group: project consisting in the cultivation of 10 000 ha of irrigated and rainfed rice |
|  *Abobo* | | | |
| 6 May 2015 | Juba - Ministry of water | MEDIWR representatives | • Meeting to discuss the field mission in South Sudan |
|  *Juba Ministry of Water* | | | |
| 6 May 2015 | Juba - Ministry energy and dams | MEDIWR – Electricity and dams representatives | • Demand projection for electricity in South Sudan:<br>• Hydropower potential in the BAS basin |
|  *Juba Electricity and dams* | | | |

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| 6 May 2015 | Juba - Ministry of Agriculture, Forestry, Cooperatives and Rural Development | MAFCRD representatives | • Development of storage for the livestock<br>• Elaboration of the CAMP (Comprehensive Agriculture Development Master Plan) |
| 6 May 2015 | Juba – Ministry of Environment | MOEN representatives | • Environment issues (poaching, access to resources, etc.) and sensitization of communities<br>• Transnational park between Gambella and Boma<br>• Flooding information System (early warning system) |
|  *Juba MOEN* | | | |
| 7 May 2015 | Juba - Ministry of fisheries and livestock | MLFI representatives | • Water harvesting for cattle during the dry season to reduce conflict between people.<br>• Market development through a milk collection Centre<br>• Aquaculture development and conservation techniques<br>• Spreading of information (through cellphones for example) |
| 7 May 2015 | Juba - Parliament | Honorable Members of Parliament - Upper Nile State | • Water availability and use *"South Sudan is rich of water resources but is not benefiting of it"*<br>• Potential for irrigation<br>• Development of boreholes for potable water |
| 8 May 2015 | Juba - Parliament | Honorable Members of Parliament - Jonglei State | • Agriculture extension and potential for irrigation<br>• Forest exploitation and its impact on the wildlife (specially the migration corridor)<br>• Boreholes and water reservoirs for cattle watering |
| 8 May 2015 | Juba - Parliament | Honorable Members of Parliament – Eastern Equatoria | • water storage for the livestock<br>• Education on how to use water (treatments and use) |
| 9 May 2015 | Torit | Kapoeta representatives | • **Kapoeta East**: water storage for the livestock |

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| | | | • **Kapoeta South**: floods during the rainy season and necessity to improve the storage of water |
|  *Torit area* | | | |
| 11 May 2015 | Juba - Ministry of transport, roads and bridges | MTR&B representatives | • River transportation: attractive mode of transport and should be dominant in the future<br>• BAS study must assess if it is feasible to connect Gambella to Malakal with a navigational road (long term project) |
| 11 May 2015 | Juba – Meteorology Office | Meteorology Office representatives | • One big challenge in the study will be the lack of data |
| 11 May 2015 | Juba – Wildlife conservation and tourism | MWC&T representatives | • Prevention of poaching and preservation of wildlife is essential to develop tourism |

## 16 June – 21 June 2015: Field Mission 2 – Water management

The reconnaissance field trip took place between 16-21 June travelling between Addis Ababa, Jimma, Mizan Teferi, Jammu, Tepi, Masha, Metu and Gimbi before returning to Addis Ababa. The main objective of the trip was to gain an overview of conditions in the upper basins of BAS and to meet with zone officials regarding land and watershed management issues in their area.

Table 4-2 hereafter summarizes the meetings held during this field mission.

*Table 4-2: Summary of Stakeholder Meetings – Field mission 2*

| Date | Location | Organization | Discussion area |
|---|---|---|---|
| 17/06/15 | Mizan Teferi | Bench Maji Zonal Agriculture and Rural Development Office<br>Zonal Natural Resources Experts | The overall watershed management efforts of the zone specifically in BAS sub-basin with emphasis on the existing projects and major constraints of natural resources management of the watersheds |
| 18/06/15 | Bachuma | Menit Goldia Woreda Agriculture Development Office<br>Belayneh Damte,<br>Woreda Office Representative | Watershed boundaries and tributaries of BAS sub basin within the Woreda and major issues of natural resources management in relation to land degradation and land use and associated constraints and the efforts being made for watershed management in the woreda |
| 18/06/15 | Jammu | Menit Shasha Agriculture Development Office<br>Tesfaye Woldemariam, office representative | Major tributaries and extensions of the watershed leading to BAS and the overall natural resources issues of the woreda in terms of rate of degradation and challenges as well as current interventions/project being implemented in the woreda |
| 19/06/15 | Masha | Sheka Zone Agriculture and rural Development Office<br>Representative and other experts consulted for more needed information | The overall watershed management efforts of the zone specifically in BAS sub-basin with emphasis on the existing projects and major constraints of natural resources management of the watersheds |
| 20/06/15 | Gimbi | West Wellega Zone Agriculture and Natural Resources Development Office | Issues of the watershed areas in BAS and efforts made by the government to manage the natural resources and associated constraints related to land use and land certification in the zone |
| 22/06/15 | Addis Ababa | ENTRO | Debriefing Meeting on the field visit to the BAS Regions. |
| 22/06/15 | Addis Ababa | Ministry of Agriculture, SLM Project Coordination Office | On SLMP 2 coverage and major components of the project in BAS sub basin and overall contribution to water management |

## 18 June – 21 June 2015: Field Mission 3 – Social and environmental assessment

Discussions with several Officers and Experts were conducted in the Southern Nations, Nationalities and Peoples Regional State:

- Water and energy office,
- Land use and environmental protection office,
- Tourism and culture office,
- Economic and finance bureau,
- Investment agency

The discussion was focused on identifying environmentally and socially sensitive areas, issues and challenges in the Baro-Akobo basin and possible solutions for the identified issues and challenges. In addition, availability of ongoing and planned projects in the basin were assessed.

Similar to SNNPRS, discussions were conducted with Officials and Experts of sectorial Offices of the Gambella Regional State. The consulted offices include:

- Water and energy office,
- Land utilization and environmental protection office,
- Tourism and culture office,
- Economic and finance bureau,
- Gambella National Park Office.

## 22 June - 4 July 2015: Field Mission 4 – water supply and sanitation

In Ethiopia the water supply and sanitation team was accompanied by staff members of the Ministry of Water Irrigation and Energy on visits to various bureaus and project offices in the Southern Nations Nationalities and Peoples (SNNP) Region and in the Gambella Region. The bureaus of Water, Health and Agriculture were visited in both regions. In the SNNP Region the team also visited the offices of the Pastoralist Community Development Project and Pastoralist Affairs, as well as the rural water supply scheme for Midere Genet village which is situated near the regional capital Hawassa. In Gambella? the team also visited the intake structure and treatment plant for the Gambella Water supply scheme.

During the visit to South Sudan the water supply and sanitation team was accompanied by the project manager from ENTRO and the national project coordinator from the Ministry of Electricity, Dam, Irrigation and Water Resource. While in Juba the team visited the Central Ministries of the Water Sector and of Animal Resources and Infrastructure, UNICEF, the Urban Water Corporation and the water treatment works. In Torit meetings were held with the Eastern Equatoria Ministry responsible for Urban and Rural Water and with the Eastern Equatoria Watershed Team. The currently inoperable water treatment works at Torit was also visited as well as three rural water supply schemes along the Juba- Torit route (Refer Annex 3: List of persons consulted).

The discussions with officials enabled the team to better understand the existing water supply and sanitation situation and the needs of the various regions, the existing and future development programs, the planning, implementation and operational capacities, the availability of resources, and the main stakeholders. Relevant study documents were also identified and where possible collected, either as hard or soft copies.

The main findings of the meetings are summarized in Table 4-3 below.

*Table 4-3:* Summary of Stakeholder Meetings – Field mission 4

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| 23 June 2015 | Head Bureau for Water, Mines and Energy - SNNPR | • Representatives of the Bureau<br>• WaSH Coordinator | • Two main issues identified for potable water: iron content in water and excessive pumping lowering the ground water level |
| 23 June 2015 | Bureau of Health - SNNPR | • Representatives of the Bureau<br>• UNICEF WaSH specialist | • Poor sanitation conditions in town |
| 24 June 2015 | Irrigation Development & Scheme Administration Agency - SNNPR | • Representatives of the Agency | • A number of small scale irrigation projects have already been identified, studied, tendered and constructed |
| 24 June 2015 | Pastoralist Community Development Program Office - SNNPR | • Project coordinator in the Office | • Community Development Programs are implemented in 10 Woredas |
| 24 June 2015 | Office of Pastoralist Affairs - SNNPR | • head of Infrastructure/Building/Technology | • Food insecurity in the area → projects of semi-pastoralism |
| 25 June 2015 | Bureau of Water Resources Development - Gambella | • Representatives of the Bureau of Water Resources Development | • Low water supply and sanitation coverage – Existence of the Gambela town water supply rehabilitation and expansion project |
| 26 June 2015 | Bureau of Health - Gambella | • Representatives of the Bureau of Health | • Low latrine facility coverage (39.4%) and no vacuum truck to empty septic tanks<br>• Program for coverage of latrine is included in GTP II |
| 26 June 2015 | Bureau of Agriculture - Gambella | • Representatives of the Bureau of Agriculture<br>• Veterinarian Expert | • Focus on livestock watering and potable water for human consumption |
| 29 June 2015 | Ministry of Electricity, Dams, Irrigation & Water Resources - Juba | • Representatives of the MEDIWR | • Focus was on:<br>• Integrated water shed management,<br>• Water for productive use,<br>• Taking Water supply and Sanitation Initiatives |
| 29 June 2015 | Office of Water Supply and Sanitation - Juba | • Representatives of the Water Supply and Sanitation Office | • Focus was on the low water supply (about 40%) and sanitation coverage (14%),<br>• |

| Date | Location | Organisation/ persons met | Discussion areas |
|---|---|---|---|
| 30 June 2015 | Office of Urban Water Cooperation - Juba | • Representatives of the Urban Water Cooperation | • Many of the old schemes that are operated by the Corporation require major rehabilitation and expansion<br>• In Juba the collection of revenue is not undertaken by the Corporation and is inefficient.<br>• The Water Corporation is not financially autonomous and would not be without a change in policy |
| 30 June 2015 | Office of animal resources - Juba | • Office of animal resources representatives | Two urgencies identified:<br>• Making water available for livestock to improve production and to control overgrazing<br>• Understanding and mapping the movement patterns of livestock in search of grazing and water, and understanding tribal boundaries |
| 1 July 2015 | Office of Director General for Ministry of Physical Infrastructure - Torit | • Director General for Ministry of Physical Infrastructure | • No fee paid for water from the service users<br>• Huge financial constraint as budget allocated from the government to the water sector (urban & rural water supply & sanitation) is just sufficient to cover salaries and basic running costs.<br>• High incidence of open defecation practice, particularly in Torit because of the hard formation. |
| 1 July 2015 | Torit Hotel | • Director General of Ministry of Physical Infrastructure,<br>• Urban Water Supply and Sanitation at MPI<br>• WEES - ILWRM counter part<br>• Project manager for African Wildlife Foundation | • About 50% of UNICEF drilled wells are not functional due to lack of spare parts<br>• Conflict amongst the pastoralist communities while moving in search of water<br>• Concentration of animals in one place because of water<br>• Lack of budget for maintenance and repair work |
| 2 July 2015 | Office of NIRAS - Torit | • Director General of Ministry of Physical Infrastructure<br>• Director of Urban Water Supply and Sanitation at MPI<br>• WEES ILWRM<br>• WEES - team leader | • Lack of historical meteorological data<br>• Lack of hygiene awareness<br>• Low access to protected water supply source |
| 3 July 2015 | UNICEF - WASH section- Juba | • Water Sanitation and Hygiene Officer | Two important issues identified:<br>• Unreachable areas because of vandalism<br>• Sustaining water schemes |

### 4.3.4 Field reconnaissance

Table 4-4 summarizes the field visits together with some of the main observations relevant to the study. Further detail can also be found in the report back on discussions with stakeholders during these field visits (see Section 4.3.3).

*Table 4-4: Summary of Field Visits*

| From / to | Itinerary | Participants | Purpose | Main Observations |
|---|---|---|---|---|
| 28 April – 2 May 2015 | ETHIOPIA<br>Addis Ababa – Nekemte – Metu – Gambella – Gambella area – Jima – Addis Ababa | • **Consultants:** Jean-Michel Citeau, Steve Crerar, Gilles Pahin, Juliette Fradet, Molla Zewdu,<br>• **ENTRO:** Jackson Elisoma, Omer Elawad<br>• **MoWIE, Ethiopia:** Asmamaw Kume, Kifle Alemayehu | **Overview of the basin**<br>• General reconnaissance of the basin within Ethiopia<br>• Meetings with stakeholders in Oromia and Gambella regions, including regional and zonal offices and private stakeholders | • Intense rainfed farming in upper parts of the basin. Continuous expansion of rainfed farming into virgin areas and onto steeper slopes. Development projects on the Gambella plain for large-scale irrigation schemes and commercial rainfed agriculture. Some large scale schemes have already had major failures (mainly due to flood damage)<br>• Irrigation is seen as the main driver to reach food security and to mitigate climate change effects. This sector must be carefully studied with proper preliminary studies.<br>• Development of groundwater use is promoted to reach water security |
| 6 May – 11 May 2015 | SOUTH SUDAN<br>Juba | • **Consultants:** Jean-Michel Citeau, Steve Crerar, Gilles Pahin, Zeleke Chafamo, Juliette Fradet<br>• **ENTRO:** Jackson Elisoma<br>• **MEDIWR, South Sudan:** Thomas Jang Kan, Chut Isaac Chol | **Overview of the basin**<br>• Meetings with the relevant Ministries<br>• Meetings with the Honorable Members of Parliament for Jonglei State, Eastern Equatoria and Upper Nile State | • Livestock management and watering during the dry season are two key elements to reduce conflict between the different communities<br>• One of the biggest challenge in the South Sudanese part of the basin concerns flood mitigation during the wet season<br>• Competition between wildlife and livestock for water and poaching are two major issues |
| 7 May – 10 May 2015 | SOUTH SUDAN<br>Torit - Kapoeta | • **Consultants:** Steve Crerar, Gilles Pahin, Zeleke Chafamo<br>• **ENTRO:** Omer Elawad<br>• **MEDIWR**, South Sudan: Chut Isaac Chol | **Overview of the basin**<br>• General reconnaissance of the basin within South Sudan and meetings with stakeholders from Kapoeta | • The importance of livestock in local conflicts was stressed<br>• Flood mitigation was also pointed out as a big challenge<br>• Ongoing initiatives on watershed management led by NGOs.<br>• Need for improved potable water supply and water for livestock |
| 16 June – 21 June 2015 | ETHIOPIA<br>Addis Ababa - Jima - Mizan Teferi – Tepi - Gimbi | • **Consultants:** Mark Hopkins and Tariku Alemu<br>• MoWIE, Ethiopia: Ato Getachew | **Watershed Management**<br>• Reconnaissance field work<br>• Meetings with stakeholders | • The optimal size for project implementation is between 200 to 2000 ha (generally 350-500 ha is recommended)<br>• The Sustainable Land Management Program is the main program of watershed management and experience has focused primarily on soil and water conservation (especially physical structures), water harvesting, and hillside closures |

| From / to | Itinerary | Participants | Purpose | Main Observations |
|---|---|---|---|---|
| 18 June – 20 June | ETHIOPIA<br>SNNPR - Gambella | • **Consultants:** Zeleke Chafamo, Ali Hassan | **Environmental and Social assessment**<br>• Meetings with stakeholders | • Major challenges raised in the SNNPR were the following:<br>- Land degradation and soil erosion, deforestation for agricultural lands expansion → no organized land use plan<br>- Gaps between existing environmental laws and their implementation<br>- Conflicts between communities who are sharing the forest resources: use of charcoal as main energy source and income by the community and unplanned grazing in the forest which is affecting the forest and<br>- Cross-border conflicts due to competition for grazing land and fish farming between local communities and communities of South Sudan.<br>• In Gambella, additional issues were raised:<br>- Water pollution by solid and liquid waste: absence of liquid waste treatment plant for Gambella town and trucks to collect and dispose solid waste at the designated disposal<br>- No management plan implemented in the National Park |
| 22 June – 27 June 2015 | ETHIOPIA<br>Awassa – Gambella | • **Consultant:** Mike Shand, Yemarshet Yemane<br>• MoWIE, Ethiopia: Asmamaw Kume | **Water Supply and Sanitation**<br>• Data Collection in SNNPR & Gambella<br>• Interviews with Key Government Officials | • Major challenges raised in the SNNPR were the following:<br>- Poor sanitation conditions in town<br>- Two main issues identified for potable water: iron content in water and excessive pumping lowering the ground water level<br>• In Gambella, additional issues were raised:<br>- Low latrine facility coverage (39.4%) and no vacuum truck to empty septic tanks (Program for coverage of latrine is included in GTP II) |
| 28 June – 4 July | SOUTH SUDAN<br>Juba | • **Consultant:** Mike Shand, Yemarshet Yemane<br>• **ENTRO:** Jackson Elisoma | **Water Supply and Sanitation**<br>• Meetings with selected stakeholders from government institutions and individual informants on the WSS | • The following issues were raised:<br>- Focus was on the poor water supply situation (about 40%) and sanitation coverage (14%). In Juba the collection of revenue is not undertaken by the Corporation and is inefficient. This Corporation is not financially autonomous and will not be without a change in policy<br>- Regarding livestock, two urgencies identified:<br>- Making water available for livestock to improve production and to control overgrazing<br>- Understanding and mapping the movement patterns of livestock in search of grazing and water, and understanding tribal boundaries |

Minutes of discussions with stakeholders have been maintained and provide the critical source of information for the scoping exercise.

## 4.3.5 Application of remote sensing to define the appropriate boundaries during the scoping phase

### *4.3.5.1 Different boundaries currently exist for the BAS basin*

Different boundaries currently exist for the BAS basin, especially for the southern part of the basin. The figure here after illustrates these differences with three existing boundaries for the southern part of the basin. The map on the left is extracted from the Atlas of map of the MSIOA study (ENTRO, 2015), in the middle, the map is extracted from the hydrological study of the BAS basin (ENTRO, 2011) and, on the right, the map is extracted from the State of the river Nile Basin (NBI, 2012).

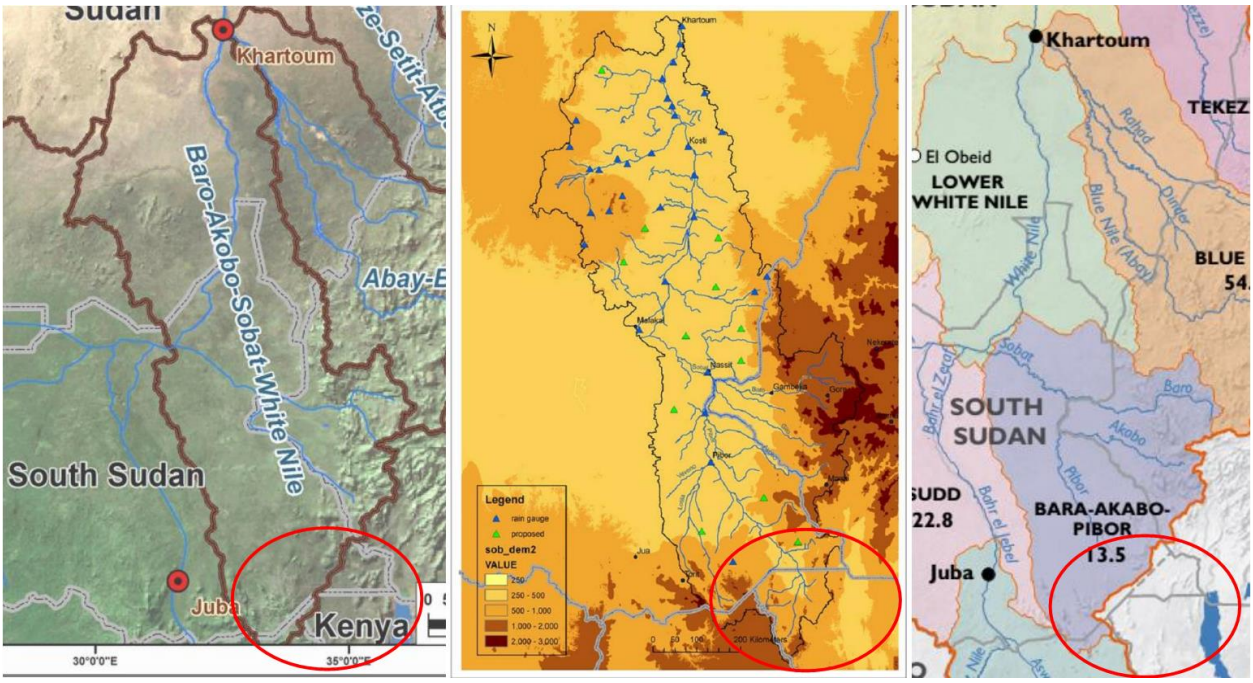



*Figure : Comparison of the existing boundaries for the BAS basin*

Figure 4-1 shows the three boundaries superimposed.

- The black boundary is the one mostly used in previous studies (for example in the MSIOA study);
- The green boundary is based on the DEM (Digital Elevation Model) analysis. For the southern part, this is the one used in the hydrological study of the BAS basin;
- The blue boundary is a synthesis based on DEM and satellite observations except in the north. For the southern part, the limit is the same than the one used in the study State of the river Nile Basin.

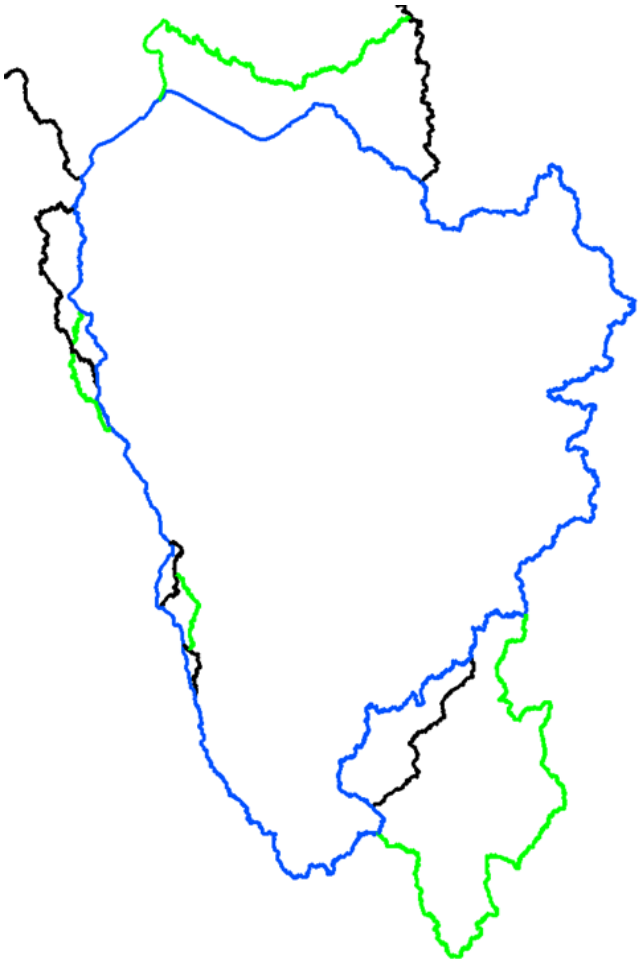


*Figure 4-1: Existing boundaries for the BAS basin*

This illustrates the need to further study the limits and update the existing boundary to better reflect the hydrographic reality. As part of the work on the hydrographic network, photo-interpretation shows that some streams were “cut” by the existing BAS boundary and other streams seem to be out of the basin. Delineating correctly the basin seems essential at this early stage of the study, in order to scope the work for the baseline. In this section of the Inception report only the preliminary results on basin delineation are provided in order to give the reader some idea of the challenge and potential solutions. Further work will be carried out as part of the scoping exercise and covered in the Scoping Report.

**Work on remote sensing during the Inception phase has shown that the blue boundary is the more accurate for the south-eastern part of the basin. On the other parts of the basin, work is still ongoing and results will be presented in the Scoping report.**

### 4.3.5.2 Results validated by photo-interpretation

#### FOCUS ON THE NORTH-WEST LIMIT

In this area, rivers draining directly to the Nile have been identified within the black and green limits thus the modification of the boundary.

#### FOCUS ON THE SOUTH-EAST LIMIT

The DEM analysis is illustrated in the figure below. The river flows in the constricted area (between dotted lines). It usually drains the north (1) but it can also flow to the south (2) when the water level is high.

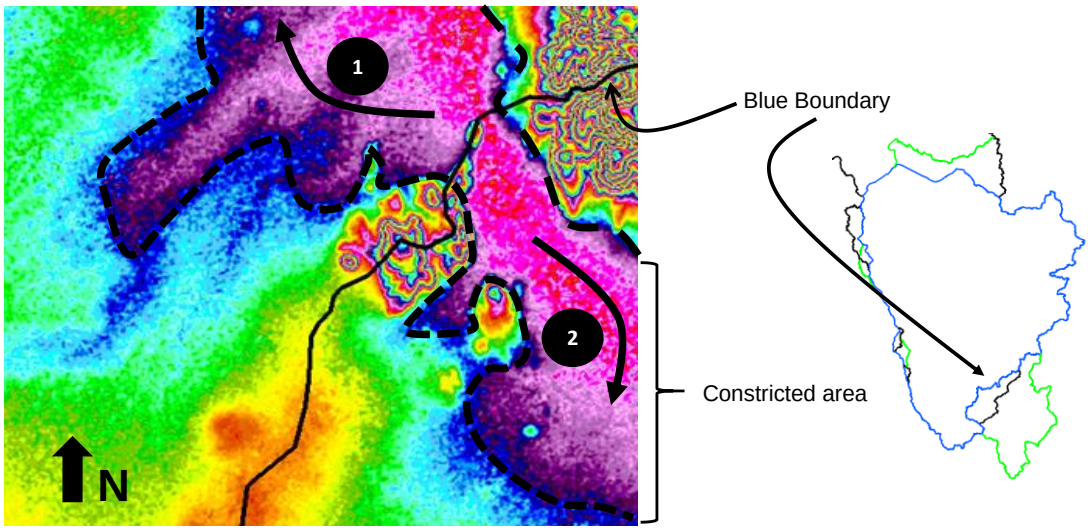



*Figure 4-2: DEM analysis in the South East part of the basin*

An historical analysis shows that the constricted area was closed by a road between 1990 and 1994 (see Figure 4-3). Now, the flow can no longer go to the south except when the water level is very significant which means that there is an overflowing. This is demonstrated with a series of images from google earth presented here after (Figure 4-4).

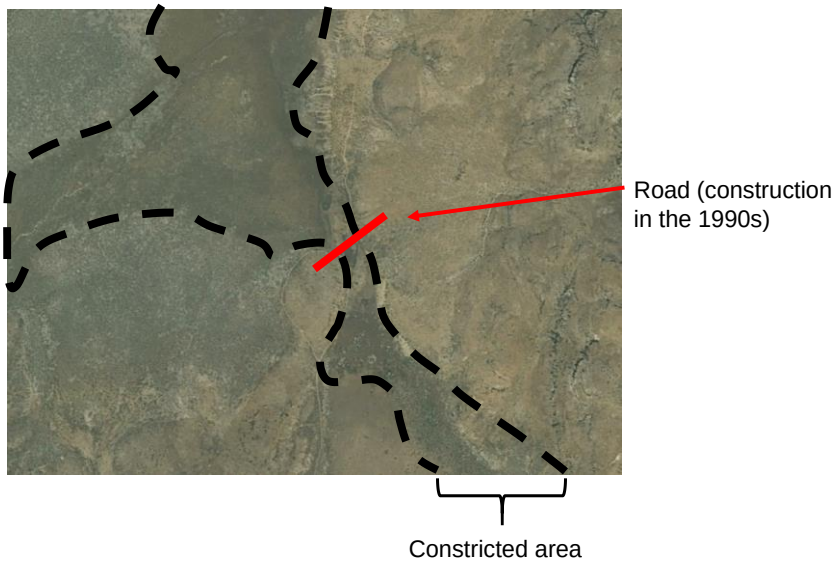
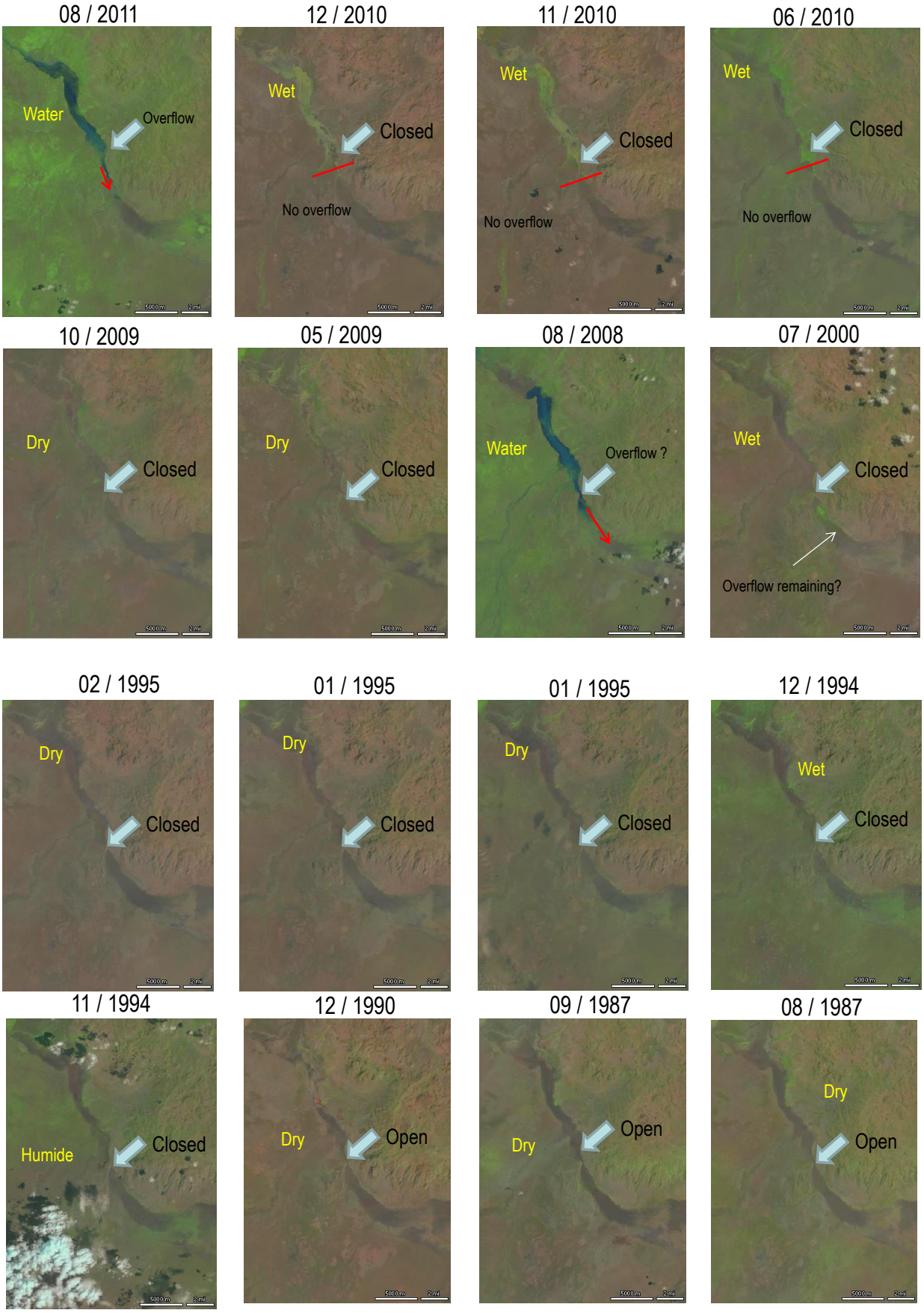



*Figure 4-3: Construction of a road in the constricted area in the south-eastern part of the basin*


08 / 2011
Water
Overflow
12 / 2010
Wet
Closed
No overflow
11 / 2010
Wet
Closed
No overflow
06 / 2010
Wet
Closed
No overflow
10 / 2009
Dry
Closed
05 / 2009
Dry
Closed
08 / 2008
Water
Overflow ?
07 / 2000
Wet
Closed
Overflow remaining?
02 / 1995
Dry
Closed
01 / 1995
Dry
Closed
01 / 1995
Dry
Closed
12 / 1994
Wet
Closed
11 / 1994
Humide
Closed
12 / 1990
Dry
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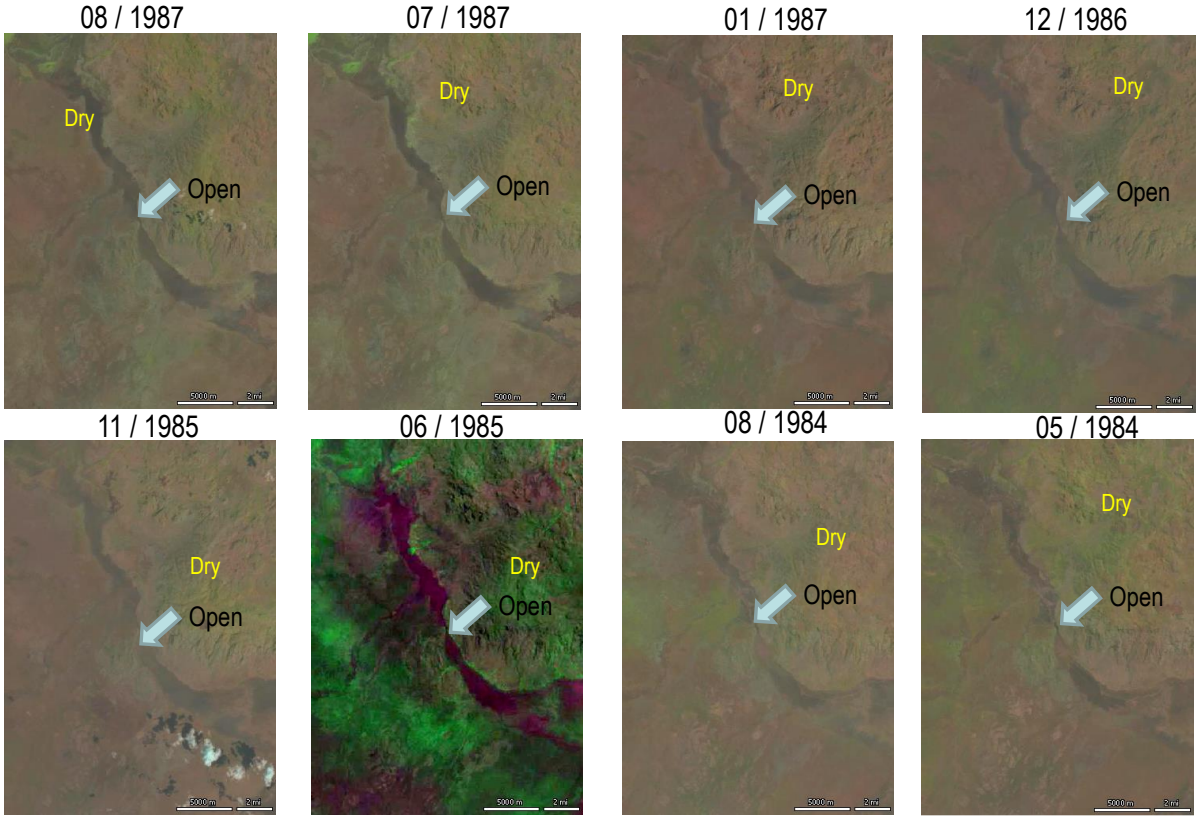



*Figure 4-4: Change in the flow in the southern part of the basin following construction of the road in the early 1990s*

This fact clearly explains why the boundary was the black boundary (refer to Figure 4-1) in the past, before construction of the road. We need to update this boundary (with the blue limit) in order to consider the modification of the flow due to the new infrastructure. Indeed, water flows southwards only in very rare exceptions, notably to unload excess water during heavy floods.

### *4.3.5.3 Gaps and proposed methods to bridge the gaps*

#### THE NORTHERN BOUNDARY

The thorough analysis done for the northern part of the basin has revealed that the current northern boundary (blue boundary on Figure 4-1) corresponds to an artefact of the DEM due to the low difference of height in this area of the basin. For this part of the basin, the DEM is not sufficient to accurately delineate the boundary. A precise mapping of the hydrographic network is thus required and work is still ongoing.

#### FOCUS ON THE SOUTH-WEST LIMIT

There is still uncertainty regarding the Kineti River which takes its source in the Imatong Mountains. On some maps this river is shown as being within the Pibor catchment. In the analysis of the DEM and other imagery carried under this study this is not so clear.

This information will be reworked again by remote sensing and should be complemented by key informants being able to describe the qualitative functioning of the said areas, especially confirm the hypothesis of possible double direction of flow according to the water level.

This uncertainty is illustrated in Figure 4-5 below.

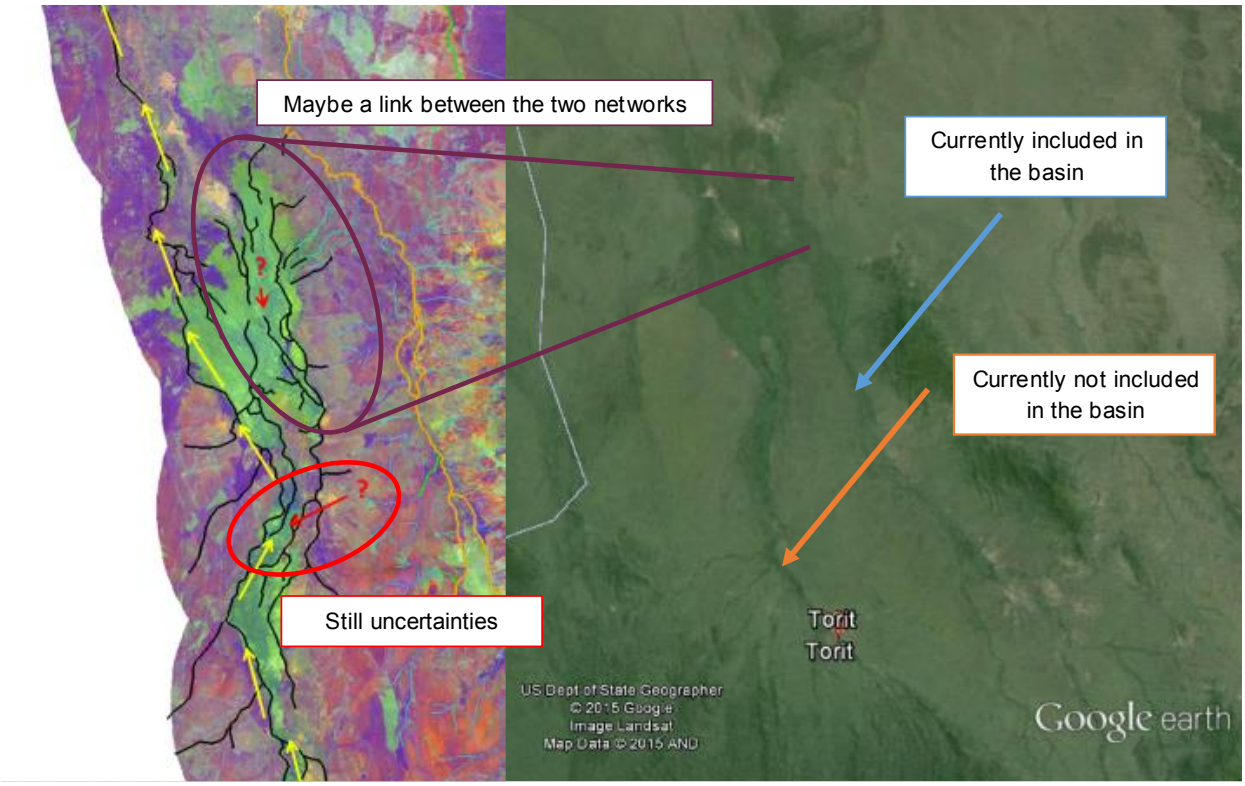



*Figure 4-5: Uncertainty regarding the limits of the basin – Example of the Kineti river*

The figure above shows (with google earth imagery) that the two networks (blue and orange arrows) may be linked. With the Landsat imagery we can see that this link could be in the area represented by the purple circle. Nevertheless, the red circle shows no certainty and might drain water to the BAS basin or discharge water to the networks represented with yellow arrows which is not part of the BAS basin.

### *4.3.5.4 Finalization and agreement on the basin limits*

In the preceding sub-sections of this report only the preliminary results on basin delineation have been provided in order to give the reader some idea of the challenge and potential solutions. In the Scoping Report the issue will be dealt with fully using the following step-by-step approach:

i. Present the existing ENTRO boundary as used in the most recent studies (the shapefiles for the recent MSIOA have been provided by the Client as the most official version), noting that the resolution of the available shapefiles is quite coarse.

ii. Overlay the possible variations that have been discovered during the course of the scoping work, case by case, and present the technical arguments for whether there should be a change or not.

iii. Draw conclusions for discussion with the Client and stakeholders.

iv. Although the arguments and conclusions will be presented concisely in the main body of the Scoping Report, a specific annex and/or separate concept note will be drawn up with the aim of detailing the analysis and providing the details of how the accuracy of the present study is much better than previous mapping, thanks to remote sensing with a resolution of 1/100,000 and better.

## 4.4 PRELIMINARY FINDINGS

### 4.4.1 Overview

It is already well understood that the basin provides excellent water resources development opportunities. Several large-scale hydropower projects have already been identified and studied in the highland source areas. In addition to providing electricity, these schemes would i) regulate flows, supporting the development of irrigation schemes downstream and ii) provide the schemes with protection from floods through flood attenuation. They would also provide a source of gravity-fed water supply to settlements downstream and opportunities for the development of fisheries. However, reduced seasonality of flows and an overall reduction in flows will have a significant impact on the *Machar marshes* and other wetlands whose ecology depends not only on adequate inflows but also on the natural seasonality of flows with wetter and drier periods.

From a transboundary water resources perspective there is pressure to develop the water resources of the Baro-Akobo-Sobat because the impact on flows in the White Nile of major irrigation expansion in the sub-basin is subdued by the presence of the *Machar marshes*. When less water spills over into these wetlands there is also a reduction in the total water evaporated from the system.

Development in the basin is currently at a very low level but there is a very real prospect of rapid change. A high rate of economic growth in Ethiopia has been sustained for several years now and there is a rapidly growing need to increase both energy and agricultural production. The feasibility study for the largest of the hydropower schemes, Tams, has already been completed and private investors are showing real interest in the development of the floodplains downstream of Gambella for both rainfed and irrigated agriculture. The presence of the Gambella National Park would seem to have little significance in terms of conservation. In South Sudan, the current security situation is challenging when proposing development projects. However, the need to provide water to the livestock during the dry season has been identified as a factor which would promote the settlement of pastoralists and reduce the potential for conflict over resources. During the visit in South Sudan, the importance of providing potable water and to mitigate floods was stressed. There are also opportunities to develop hydropower in the Imatong mountains and irrigation schemes further downstream. These opportunities should be studied.

Development is currently not coordinated, but since development levels are currently low, the negative impacts of this are currently not too evident and quite limited. However, once development starts to snowball, and there is a real chance of this happening, especially on the Ethiopian side of the border, a continued lack of coordinated development would be disastrous.

## 4.4.2 Water resources

As it is detailed in the methodology in Chapter 5, the water resources modelling will be re-done for this study. Nevertheless the work by Sutcliffe and Parks provides a good point of departure which shows a schematic of the initial water balance of the Baro-Akobo-Sobat system downstream of Gambella based on available information at the time.

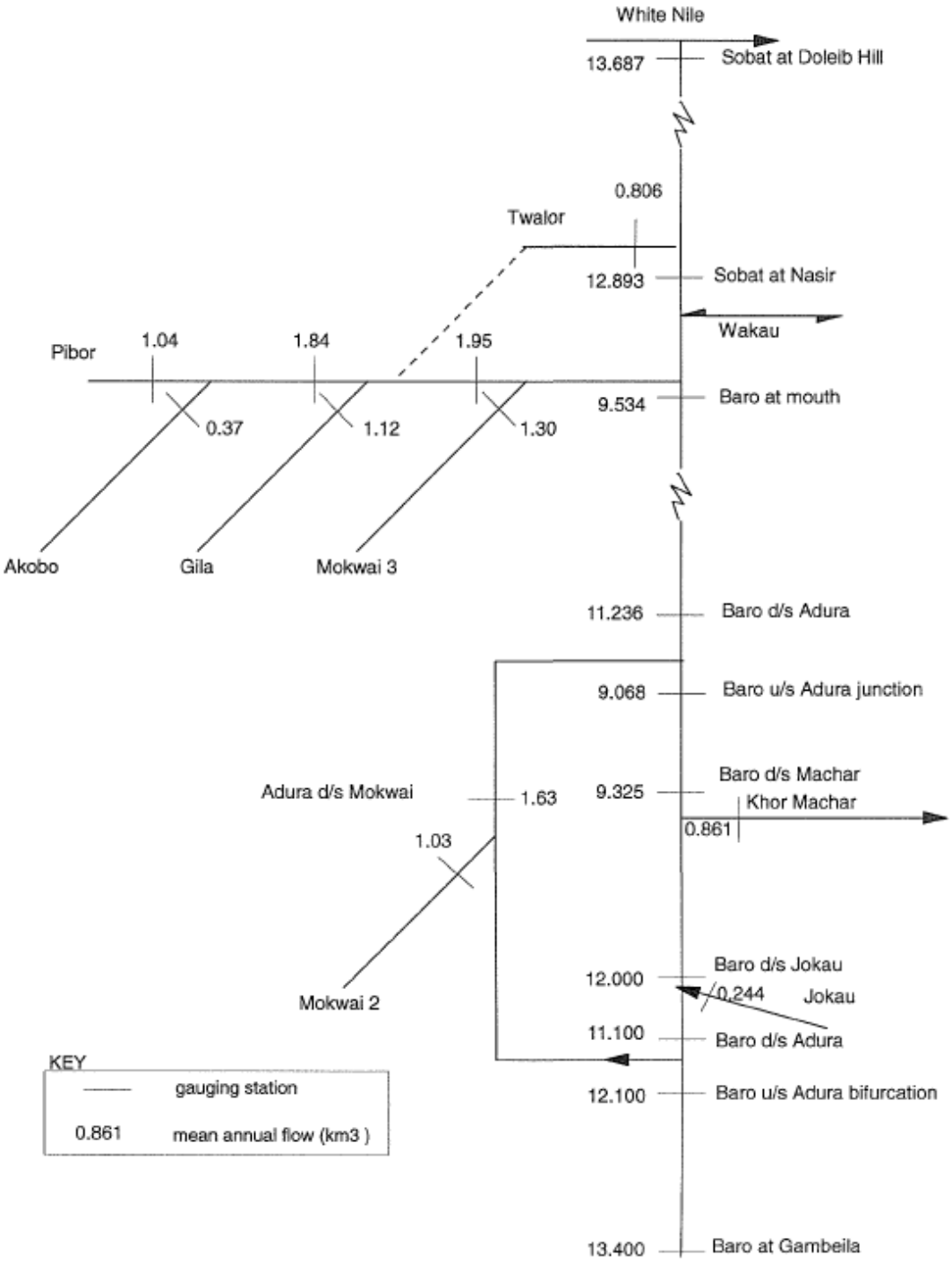



*Figure 4-6 Water balance of the Baro-Akobo-Sobat system (Sutcliffe and Parks, 1999)*

## 4.4.3 Issues, Challenges and Opportunities

### *4.4.3.1 Poverty and development*

Poverty is a common thread, both in Ethiopia and in South Sudan. Social development is seen as the major objective in both countries.

### *4.4.3.2 Environmental and Social Impacts*

During the first field missions, emphasis was put on the Gambella-Boma area which is one of the richest areas in term of biodiversity in the basin. While there are no major projects at the moment in the Boma national park, major large irrigation schemes have been proposed in Gambella region (those within and those located outside of the Gambella National Park). These projects will result in the loss of natural vegetation and biodiversity in one of the last relatively undisturbed catchments in the EN Region. This will impact negatively on the ecological functioning of the Baro-Akobo-Sobat sub-basin.

The low lying western areas of the Baro-Akobo-Sobat sub-basin have high concentrations of wildlife and is also home to the second largest animal migration in the world, namely the annual migration of the white eared kob antelope. The establishment of large scale irrigation schemes in the catchment of the key rivers that make up the sub-basin is likely to impact negatively on the wildlife that rely on the flow of water from the Ethiopian Highlands in the east. Wildlife core areas have been determined using aerial surveys in the region of Gambella in 2010 (WCS-HoA, 2010) and are shown in the figure here after. Studies in the Gambella national park are still carried out through the Biodiversity Management Program in the Horn of Africa Region. These studies will be followed to assess the impact of new irrigation schemes in Gambella national park and around.

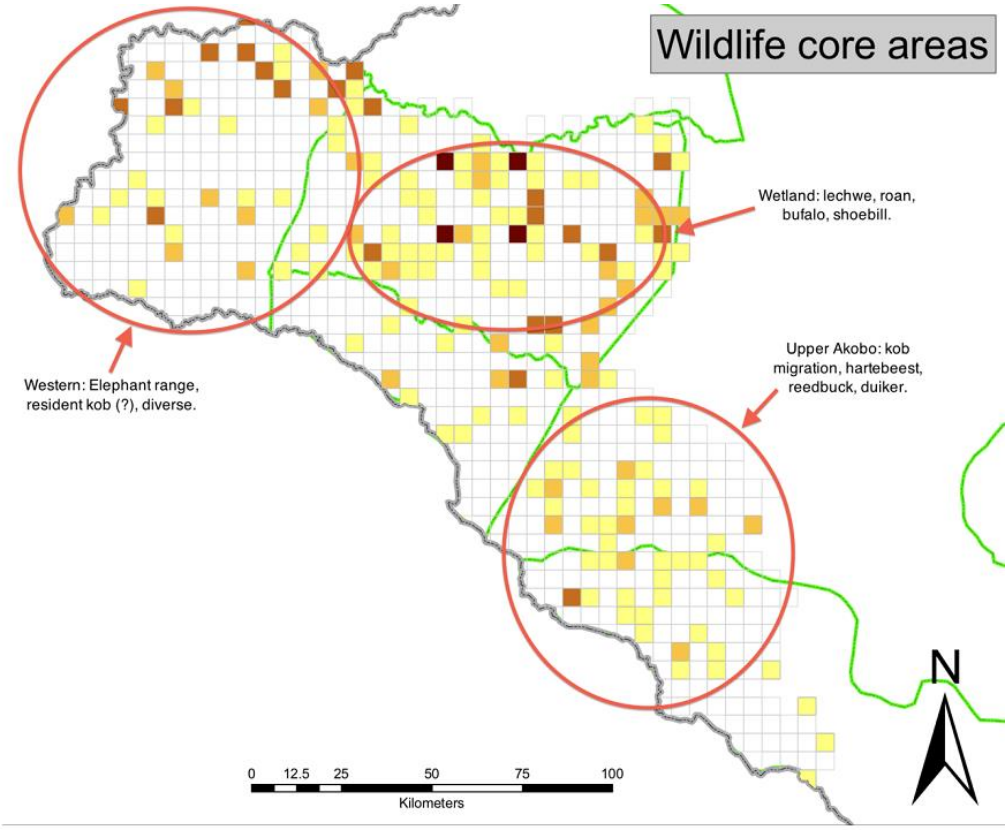



*Figure 4-7: Wildlife core areas in Gambella national park*

The livelihoods of the local communities in the area downstream of the proposed irrigation schemes and the Gambella National Park are also closely linked to the use of and availability of natural resources, especially water and grazing. Any impact on the availability and water quality, specifically during the dry season, would increase the potential for conflicts over scarce resources. Though upstream reservoirs are expected to regulate and increase dry season flows, operational studies need to take these factors into account with detailed impact assessments.

### *4.4.3.3 Need for coordinated and well-managed development*

This section aims at addressing the various issues and opportunities in the basin. This is the very first part of a more detailed institutional approach. The basin is shared by at least four different areas from physical and socio-economic perspective:

i. The mountain ranges in Ethiopia
ii. The highlands of Ethiopia and Southern South Sudan
iii. The lowland of Gambella
iv. And the lowlands of South Sudan

Some of these zones present physical similarities but very different socio-economic patterns and related level of development. For instance, the South Sudanese highlands have not yet been studies for HEP development despite some clear potential for production and corresponding demand in electricity energy. The key issue for these areas are proper watershed management and fight against erosion.

Another major difference lies in the gap between Gambella Regional National State and the South Sudanese part of the basin. Despite the fact that the features of lowlands are quite close or even similar, the process of development is very different. Gambella is experiencing a huge rush of agriculture development, widely based on agri-business with large industrial farms (which is the source of a specific concern with the Gambella national park). On the contrary, the South Sudanese part of the basin is facing a long crisis, which is strongly hampering all initiatives for development. A large share of people in South Sudan are much poorer than in Ethiopia (see above) and rely mainly on animal husbandry for their livelihood, with major challenges (security, access to water, to grazing areas, etc.).

In general, the basin must be considered as highly vulnerable because of opportunities and population pressures, economic growth levels etc. including the ongoing crisis in South Sudan which deeply impacts on the population and probably on the Boma national park (poaching, deforestation, etc.).

Institutional/organizational aspects may be considered for each of the two countries (their internal organization and strategic planning) and also for cooperation between the two of them.

**FOR ETHIOPIA, SOME ITEMS MAY BE MENTIONED SUCH AS:**

- Better planning of agriculture development in large industrial farms in the lowlands; ensure that out growers are really involved,
- Intensify the watershed management and fight against erosion in the highlands,
- Ensure and examine into detail the economic feasibility of irrigation before embarking on large investments in an area benefiting from high rainfall.

**FOR SOUTH SUDAN:**

- Develop a clear and complete master plan for drinking water and cattle watering,
- Start to introduce small scale agriculture to be irrigated during the dry season,
- Obviously, pay the necessary efforts in order to bring peace back in the country.

**FOR THE TWO COUNTRIES TO COOPERATE:**

- Build a master plan of coordinated HEP to be interlinked,
- Closely evaluate the potential impact of large dams and reservoirs on the *Machar marshes* and other wetlands with the aim of seeing if there is an opportunity to mitigate downstream floods without significantly harming the marshes,
- Think and pay efforts to share a transboundary national park between Boma and Gambella,
- Check whether the international navigation is relevant and profitable, in the medium and long term.

### *4.4.3.4 Need for a basin-wide and integrated approach*

While the maximisation of irrigation upstream of the Machar wetlands has a relatively low impact on the overall water resources of the Eastern Nile system, the potential negative impacts on the Machar wetlands should be carefully investigated and mitigation measures proposed. Given the potential value of economic development, both in terms of hydropower production and irrigation, a large-scale and detailed environmental impact assessment is required, not on a scheme by scheme basis, but for the possible combined development options.

Operation rules for the reservoirs associated with hydropower in the upper parts of the sub-basin should be optimised and synchronised in order to allow some degree of mimicking of the natural seasonality of flows entering the Machar wetlands, while at the same time providing adequate water for irrigation.

Continued and improved monitoring of levels and discharges is important throughout the EN basin. However, given the environmental sensitivity of the *Machar marshes* and the Twalor wetlands, it is considered very important to improve hydrological monitoring both upstream of the wetland and within the wetlands themselves.

### *4.4.3.5 Need for better information*

Four main sources of information will be used during this study:

**KNOWLEDGE OF STAKEHOLDERS**

This information will be obtained during meetings and workshops with key stakeholders. For areas where it is currently not possible to go, remote sensing will be used to assess development possibilities. This will be completed with discussions with people who know the area (as it was initiated during the meetings with the Honourable members of Parliament in Juba).

**REMOTE SENSING**

As it has been emphasized before, there are still uncertainties concerning the hydrological functioning of the basin especially in wetlands areas. A large number of previous studies are based on qualitative assessments and review of previous studies as field measurements are not always possible due to the inaccessibility in some parts of the basin. Work has been carried out with satellite imagery analysis and is still in progress to better understand the BAS network. The complete understanding of the hydrological system is essential to develop an integrated management plan of water resources.

#### REVIEW OF DOCUMENTS

Some ongoing studies in South Sudan and in Ethiopia are highly valuable for the project. In Ethiopia, the Growth Transformation Plan (GTP) has been published and has recently been made available in English. In South Sudan, the CAMP (Comprehensive Agriculture Development Master Plan) which is a 25 years plan for agriculture development but also fisheries, livestock, forestry is currently being finalized. The final draft has just been received by the Consultant and will be reviewed for the Scoping report.

#### MODELLING AND AVAILABILITY OF DATA

One of the main issues raised during the first mission in Juba was the availability of meteorological data in South Sudan. These data are very limited and might be difficult to obtain. Nevertheless it is maybe possible to find data such as rainfall, temperature (air and soil), humidity, number of rainy days for Malakal and Renk from the 1940s to the 1970s. These data, if available should be collected during the next steps of the study.

### *4.4.3.6 Benefits of multipurpose projects*

The multipurpose projects should provide tangible benefits to the entire population in the basin and bring:

- Food security through the development of agriculture and irrigation;
- Access to potable water through the development of boreholes and water treatment works;
- Access to water for livestock during the dry season through the development of water points;
- Access to electricity through the development of hydropower and electrification;
- Improvement of livelihood through the limitation of the flooded areas during the rainy season;
- Etc.

All these issues shall be kept in mind throughout the project and will be deepened to ensure that multipurpose projects respond to the needs which have been identified with stakeholders.

### *4.4.3.7 Conclusions*

Development in the BAS is inevitable and needed. This is the context that provides the need for the IWRDMP.

This development has to be based on a well-founded integrated design and operational plan to consider the impact of projects on the development of the basin but also on the availability of water resources further downstream the projects. As stated before, the importance of *Machar marshes* and other wetlands as a complex ecosystem rich in biodiversity is undeniable and should be considered at all stages of this study.

Thus the successful design of the IWRMDP depends on:

- Improved understanding of the hydrological system;
- Consultation of stakeholders to define the priorities in the basin;
- Improved understanding and incorporation of the environmental constraints;
- Cross-sectoral cooperation and coordination between the different experts for planning;
- The putting in place of a development and management framework that is endorsed by both decision-makers and stakeholders and which would become a monitoring and evaluation framework during implementation of the plan.

## 4.5 ACTIVITIES TO BE CARRIED OUT TO COMPLETE THE SCOPING PHASE

Some missions by international experts are still planned in order to ensure that the required information for the design of the baseline work is complete. These will include visits by the following international staff:

- River Basin Planner; Steve Crerar (September 2015);
- Power Economist and Hydropower Expert; Charly Cadou (September 2015);
- Environmental Expert; Gille Pahin (October 2015)
- Social Development Expert, Charles Pendley (October 2015)
- Irrigation Expert ; Eric Verlinden (October 2015)

Work on the scoping report based on the annotated table of contents provided to the Client is well advanced and the draft report will be submitted to the Client for preliminary review at least one week prior to circulating to stakeholders. The Scoping Report Workshop is planned for 24 and 25 November in Khartoum.

## 4.6 PROPOSED ANNOTATED TABLE OF CONTENTS FOR THE SCOPING REPORT

A draft table of contents with detailed annotation explaining the logic that the document will follow and indicating the content of each section and sub-section has been compiled. It is included as Annex 4 to this report. It was submitted to the Client on 23rd September 2015 for comments. In the meantime the team continues to work on filling the contents of the report with the intention of submitting the draft report in advance of the planned workshop on 24 and 25 November 2015.

# 5. METHODOLOGY GOING FORWARD

## 5.1 INTRODUCTION

### 5.1.1 Study Components

The study comprises 4 components. It is important to note that these are not phases and aspects of some of the components run concurrently.

**Component 1** provides the backbone of the study and comprises the Strategic Social and Environmental Assessment (SSEA) and Integrated Water Resources Development and Management plan (IWRDMP). It effectively runs for the length of the study and is focussed around the following elements:

- Preparatory work (including the Inception Report and scooping exercise)
- Establishment of the baseline (human and biophysical environment, status of sectoral development), understanding of issues, challenges etc. Identification and agreement on objectives. Identification of development potential.
- Preparation of the Strategic Social and Environmental Assessment (SSEA) framework to allow the evaluation of water resources development and management options at the strategic level.
- Definition of different water resources development and management options in line with overall strategic objectives and testing of options against SSEA framework and mutlicriteria analysis
- Development of an Integrated Water Resources Development and Management Plan (IWRDMP) for the sub-basin with short, medium and long-term interventions

**Component 2** is aimed at identifying a limited number of "short-term" considered as relatively small) projects that could be fast-tracked for early implementation. During the course of the study these projects would be taken to feasibility study level. Work on these feasibility studies would be carried out in **parallel with Component 1.**

**Component 3** will focus on the preparation of medium and long-term projects but only to the level of preparation of terms of reference for feasibility study. This component depends on at least the preliminary findings and orientations of the Component 1 work being completed.

**Component 4** concerns a number of activities aimed at facilitating both implementation of the study itself and the projects and plan that will be drawn up during the study. There are, therefore, elements of this component that run in parallel with the other 3 components and elements which depend on the Plan being completed and ready for implementation.

The methodology for Components 1 and 2 is illustrated in more detail in Figure 5-6.

### 5.1.2 Project Inception

The Inception Phase kicked off during the week 16th March 2015. Work was completed with the submission of the Inception Report on 27th July 2015. Details of activities carried out during the Inception Phase are provided in Chapter 3 of this report.

## 5.1.3 The key role of remote sensing

### *5.1.3.1 Added value brought by remote sensing*

The BAS study requires a significant number of maps as inputs for several parts of the study. The uses for these maps include:

- Understanding various aspects of the (especially) physical context within the basin (hydrology, land use, geology, etc.),
- Location of the different projects and interventions,
- Assessment of the existing and potential impacts of projects within the basin (impacts on wetlands, national parks, etc.),
- etc.

**Review of draft methodology**

A considerable amount of work on the application of remote sensing has already been carried out during the Inception Phase. This is according to plan since the first part of the remote sensing work, carried out at the basin-wide level is focussed on supporting the scoping exercise and planning the baseline work.

The methodological approach remains as originally planned although some areas, such as the definition of basin limits, are requiring more work than anticipated.

The creation of all these maps is based on the same principle:
creation of a common cartographic reference to locate all of the available data. Some existing maps of the basin were drawn with old data. Old data are usually based on aerial photography and photogrammetric restitution. At the country scale, the mapping was done with series at 1:200,000 scale (or 1:250,000). This work has been done post World War II (generally 1960 to 1975) and calibration was done by field missions that did not have access to modern methods and equipment such as GPS. This often induced wrong position for aerial photos and therefore incorrect or approximate mapping. In contrast, recent data are based on satellite images (such as Landsat 8 images) positioned by GPS coordinates.

**The digital mapping is therefore more reliable than old mapping and allows a cartography at 1:500,000 to 1:25,000 scale.**

#### ADDED VALUE FOR TOPOGRAPHIC MAPPING

Old topographic maps were treated by stereo with contour lines at 50 m spacing. In the South Sudan area of the basin, the difference of elevation between the North and the South (with the exception of mountain ranges at the basin limits) is less than 75 m so the stereo method is not precise enough to understand the flows and thus the hydrology in this section of the basin.

Modern technology, including satellite topographical models like GDEM (Global Digital Elevation Model) or SRTM, (Shuttle Radar Topographic Mission) make it possible to get a measured elevation point each 30 m metres with an exhaustive result, non-interpolated as with contour lines. Thus, the quality of new 1:100,000 mapping is much more accurate than old mapping works and the new maps provide more details (as can be seen in Figure 5-1 and Figure 5-2).

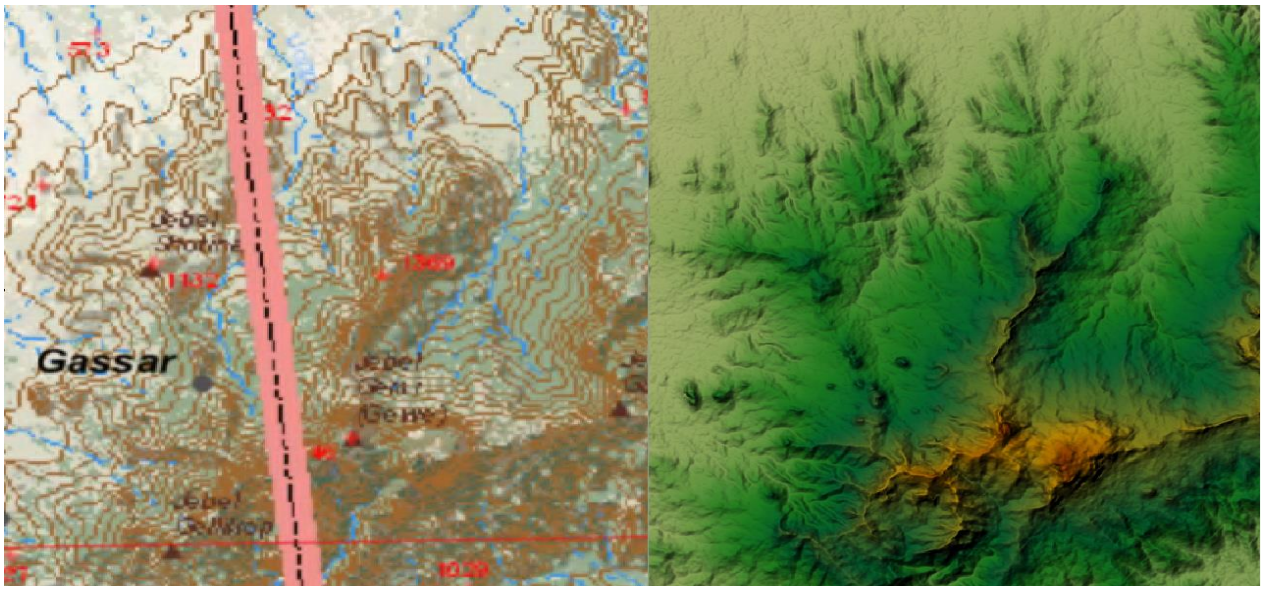



*Figure 5-1: Elevation data on old map and modern exhaustive satellite information*

## ADDED VALUE FOR HYDROGRAPHIC NETWORK MAPPING

Figure 5-2 provides a comparative example between an old map at 1: 200,000 scale and the new digital map at 1: 100,000 scale. With recent data, mapping of the hydrographic network is much more precise and accurate. Old mapping errors have been corrected which improves understanding of the basin and its sub-basins.

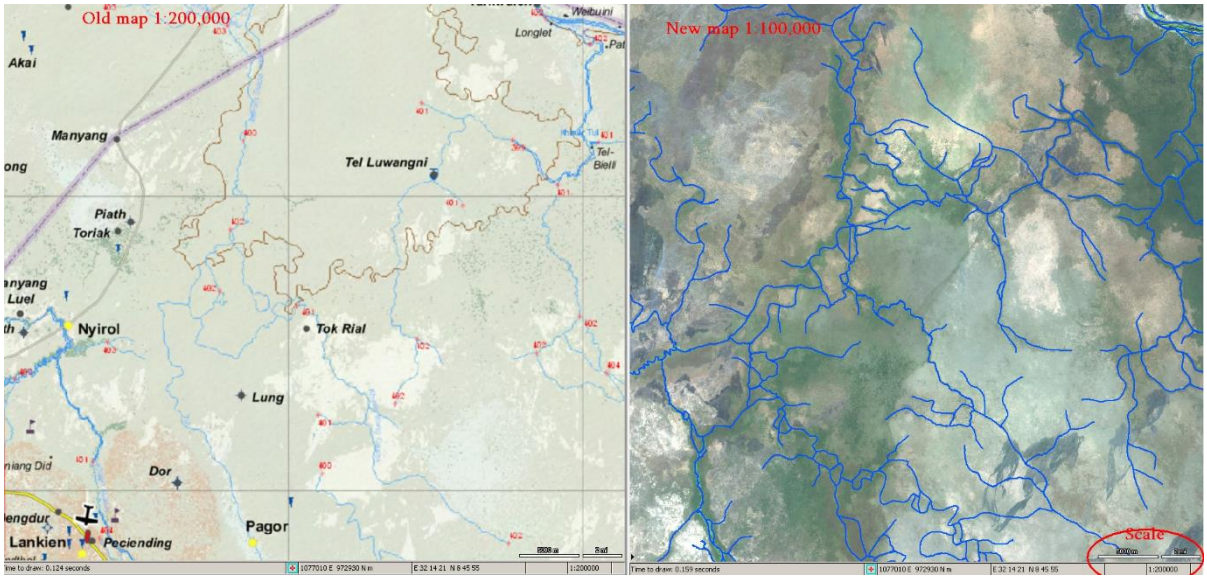



*Figure 5-2 : Comparative example of a hydrographic network mapped with old techniques and new digital method*

Examples and explanations have been presented for elevation and hydrography but it should be noted that it is the same for geology maps, land use maps and all the other maps prepared for the BAS study. These maps are more precise and more accurate. They will allow an improved understanding of the basin and an informed assessment of the identified projects.

**HOW RECENT ARE THE DATA USED ?**

As indicated later in this report, new infrastructure in the basin can have a significant influence on the principal features of the basin. This is why it is of high importance to use recent data when available. The images analyzed in the present study are from 2014 and 2015.

### *5.1.3.2 Key elements of the methodology*

In order to perform this study, the Consultant proposes to carry out multi-scale mapping of the various typologies required, as suggested in the terms of reference (baseline completion).

- At a scale of 1:100,000 - Updating the existing map work on the whole river basin (approximately 245,000 km$^2$).
- At a scale of 1:25,000 - producing maps of the 7 short term project sites.
- At a scale situated between 1:5,000 and 1:25,000, depending on their respective sizes - producing maps of the 3 priority project sites.

In parallel, additional Landsat 8 satellite images taken in 2013 (and early 2014) have been be obtained from the organization in charge of their distribution, along with Palsar SCN radar coverage (see Figure 5-4).

All the Landsat 8 images with less than 10% cloud cover available have been collected, and are being analysed and assembled in order to obtain two sets of cover, one as close as possible to the high waters period and one as close as possible to the low waters period.

Landsat 8 —also known as LCDM— is ideal for this particular job. Launched in February 2013, it covers the whole earth every month. With its new OLI sensor —more efficient than ETM+ sensors— it offers a wide range of radiometric precision that enables analysis of all themes (see Figure 5-3). Each Landsat scene gives coverage of a surface area measuring 170 x 180 km.

To cover the entire Baro-Akobo-Sobat River basin, 16 Landsat 8 scenes are necessary. To date 52 scenes recorded in 2013 are available with less than 10% cloud cover.

Although there are a few outstanding issues, the **mapping of the whole basin at a scale of 1:100,000 has already been carried out during the Inception Phase.**

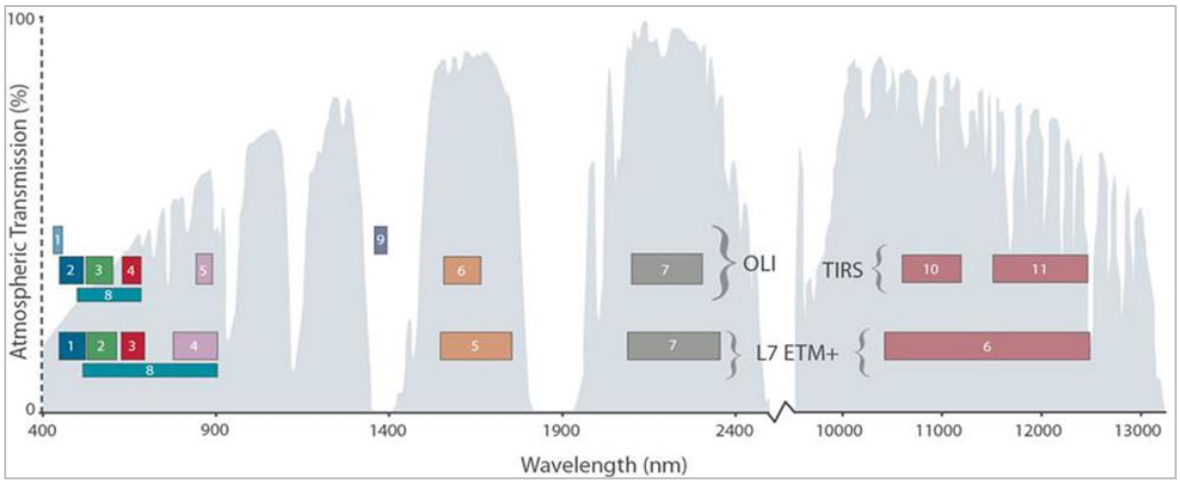



*Figure 5-3: Landsat 8 sensor spectral bands*

*Figure 5-4: Excerpt from a Landsat 8 image recorded in 2013 (White Nile)*

Palsar SCN images will also be selected, orthorectified, processed for speckle removing to improve legibility and assembled to obtain the best possible cover for wetland area analysis.

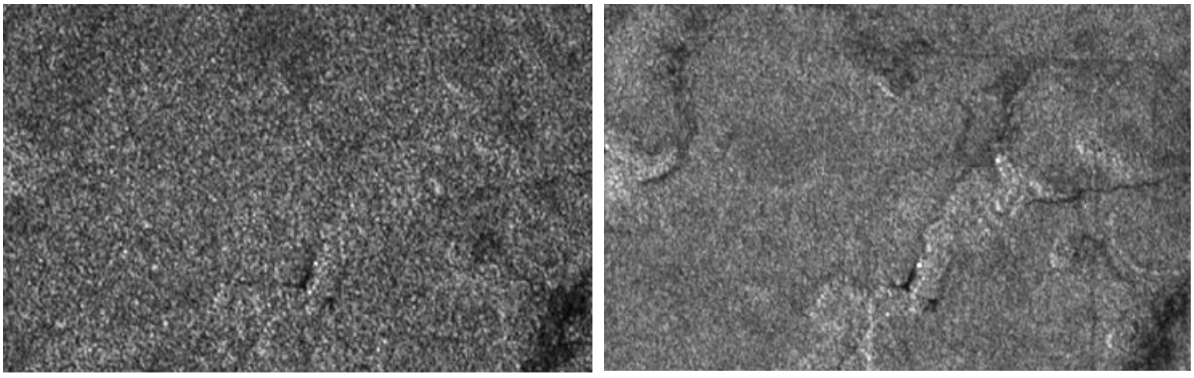


*Figure 5-5: A radar image before (left) and after (right) speckle removing*

For very flat areas where the natural drainage system changes quickly, it is also useful to use old imagery. For this reason Landsat MSS and Landsat TM cover, which started in the 1980s, and covers a period of over 30 years, will be used. The analysis of these images will:

- Help define the limits of the largest floods although imagery is often affected by cloud cover during the rainy season
- help demarcate the alluvial plains of the rivers and streams in the areas concerned.

To analyse the relief in the South and East of the study area, in particular erosion, hydrology and geology, a 30m Digital Elevation Model (DEM) has been be created using world GDEM (30 metres) and SRTM (90 metres) data. The SRTM altimetric data were collected during a space shuttle mission in 2000 using radar interferometry (C-band).

The GDEM was made from ASTER stereo images. It is a digital elevation model produced in 2009 by the USA and Japan using the satellite, ASTER. All of the images available for this zone were used to produce a DEM for each image. The DEMs were then combined and assembled to form the global DEM. Theoretically, the more scenes, the better the quality of the results. This DEM is at a resolution of 30m. However, it still contains quite a lot of anomalies and its quality varies from one region to another.

In the study area, the quality is generally good compared to certain other very flat regions. However, the noise on the images due to the production methods used needs to be eliminated by means of statistical processing.

At each level of study detail, in addition to the data already collected, the team specialist will thus be in possession of all the information required to complete their spatial analysis tasks on the various themes specified in the terms of reference. The applications of remote sensing will contribute to the different thematic areas as follows, depending on the images used and their resolution. The most detailed information which can be accessible at scales between 1:25,000 and 1:5,000 is:

- For Hydro-meteorology:
  - Flooded area limits
  - Hydrographic system
  - Amount of human impacts to estimate the demand
  - Perennial nature of the streams
- Groundwater resources:
  - Analysis of fracturing (in areas with outcropping rocks)
- Water infrastructure:
  - Cartographic survey of existing infrastructure that is visible on the different scale images
- Flood and drought:
  - Proportion of human impacts
  - Flooded area limits
  - Limits of potentially flooded areas
  - Urban maps
  - Natural area maps
- Hydraulic characteristics of major rivers and river morph-dynamics:
  - River morphology
  - Bank classification
  - Areas naturally storing alluvium
  - Shape of the deposits, sediment particle size
- Fisheries:
  - Presence of traditional boats

- Land use and agriculture
  - Proportion of human impacts in rural areas
  - Proportion of human impacts in urban areas
  - Irrigation infrastructure that is visible on the different scale images
  - Spatial dependence on the river
- Livestock
  - Intensive slash-and-burn area
- Wetlands, wildlife and Biodiversity
  - Areas of major ecological interest: wetlands, forest...
  - Assessment of ecosystems: size, type, preservation/degradation
  - Proportion of human impacts
- Watershed and erosion processes
  - Watershed boundaries
  - Type of banks
  - Mapping of bare ground, eroded areas and bare ground texture
  - Use of slopes and DEM
- Navigation
  - Depth and shape of riverbed as related to river morphology
  - Alluvium storage zones (deposits, banks)
  - Floating vegetation
  - Depending on the images available, the regularity of the watercourses
  - Presence of traditional boats
  - Existence of ferries
  - Rapids

The mapping of the whole basin will be updated at a scale of 1:100,000. The existing data base will be updated by means of photo-interpretation of existing Landsat 8 and Palsar Radar coverage.

#### *5.1.3.3 Conclusions*

From the work already carried out during the Inception Phase, the inputs of remote sensing have already proved indispensable. Even without consideration of the security issues it would be impossible to get an adequate understanding of many basinwide aspects without this input. As the focus shifts towards more localised development and related issues, the role of remote sensing will remain central, especially in areas where access is limited.

## 5.2 COMPONENT 1 : SCOPING, SSEA AND IWRDMP

### 5.2.1 Overview

Component 1 of the study can be seen as the main thread that carries the logic of the study from beginning through to the end. The main sequence of actions can be summarised in simple terms as follows:

- Scoping
- Establishment of the baseline
- Understanding of key issues, challenges, threats and opportunities
- Development of the SSEA framework
- Development and detailing of the IWRDM Plan
- (medium and long-term projects, implementation.

The deliverables to be produced under this component of the study are summarised in Table 5-1

*Table 5-1: Summary of deliverables to be produced under Component 1*

| ID | Deliverable Title | Target Date | Notes |
|---|---|---|---|
| D2 | Consultation and Communication Plan | 31 Oct 2016 | A zero draft version of this report will be completed by end of May 2015 |
| D3 | Scoping Study Report | 15 Oct 2016 | A preliminary version of the report will be distributed during the Inception Phase |
| D4 | Baseline, key issues and objectives and potential development reports | 28 Feb 2016 | These are defined as 3 separate reports: D4a: Baseline Report; D4b: Key Issues and Objectives Report, D4c: Potential Development Report |
| D5 | Strategic Social and Environmental Assessment | 30 Jun 2016 | Draft SSEA framework to be **operational earlier (**around end January 2016) |
| D8 | Integrated Water Resources Management and Development Plan (IWRDMP) | 31 Aug 2016 | Draft report for 30 June 2015 |

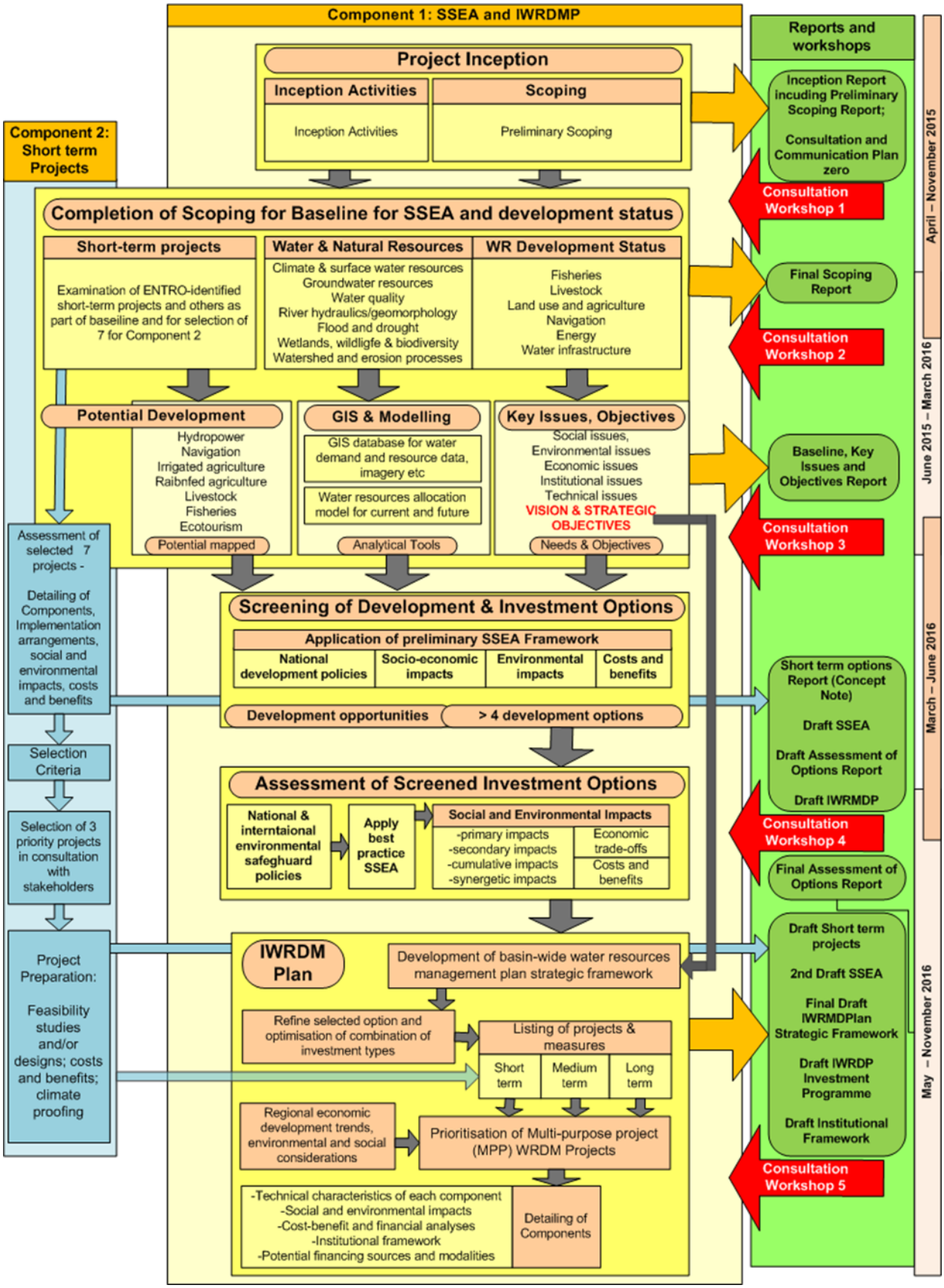



*Figure 5-6: Flowchart showing methodology for Project Components 1 and 2*

## 5.2.2 Consultation and Communication Plan - D2

### *5.2.2.1 Stakeholder analysis and Consultation Plan: C1.1a*

This first task is primarily aimed at the successful completion of the baseline and in deciding the limits of the scoping work. Work on this step is nearly complete and the results have already been used to facilitate the collection of data, documentation and stakeholders opinion. A rapid stakeholder analysis has been carried out as it is explained in Chapter 6 which introduces the Consultation and Communication plan.

**Review of draft methodology**

In the original draft methodology the significance of the role of the Consultation and Communication Plan during the implementation of the study was understated. This was due to some misinterpretation of the terms of reference in which the Consultation and Communication Plan are presented as an output of Component 4 of the Study. However, it is now clear that Consultation and Communication is both concerned with implementation of the study and of the Plan to be drawn up. This is now clearly reflected in the methodology and in the preliminary draft of the Consultation and Communication plan (see Chapter 6 and tables attached as Annex 5).

At this stage the focus of the stakeholder analysis has been made at a geographic level:

- International level organizations;
- Basin/Sub-basin level organizations;
- National and regional (Ethiopia) / Sate (South Sudan) level;
- Local level:
  - Woreda (Ethiopia) / County (South Sudan) level;
  - Kebele (Ethiopia);
  - Landscape, hydrological unit;
  - Other local institutions.

The stakeholder analysis is the first chapter of the Consultation and Communication Plan (see Chapter 6). Results of this analysis are presented in the form of a table in Annex 5 and will be discussed with the Client for validation. It should be noted that the results presented in the Inception report are preliminary as work is still ongoing as part of the scoping phase.

The output of the stakeholder analysis is a database which includes proposed stakeholders to be involved during the study. **This plan is for implementation at a number of different levels:**

- During the Inception period, although not formalised, the plan already allows for a considerable level of consultation, which in itself has informed the stakeholder analysis as well as the scoping;
- For presentation and workshopping of a number of interim products during five workshops;
- Focussed stakeholders meetings at the strategic level, especially when it comes to building the IWRDM Plan;
- A detailed stakeholder consultation programme for the short-term projects designed to allow these projects to be taken to feasibility study level.

### *5.2.2.2 Identification of development Communication Needs – C1.1b*

The ENSAP focus since around 2003 has been on pre-investment planning, establishment of frameworks for cooperation at sub-basin level, building sub-regional capacity and resource mobilization for investment. ENSAP has also been a vehicle for diagnostic and project preparation studies in the fields of power trade, natural resources management, development and, oversees, implementation of the jointly identified projects to promote cooperative inter-country and in-country investment projects related to the common use of the Nile Basin water resources.

The aim of conducting studies and preparing projects is to set a stage for addressing socio-economic and water resources challenges which undermine sustainable utilization of the water resources in the Eastern Nile region. However there is a need to **translate the studies /outputs into concrete actions on the ground in order to realize the overall goal of ENSAP of poverty alleviation, economic growth, and the reversal of environmental degradation in** the basin. Despite numerous achievement ENSAP's regional profile remains low and there is a need to change the status quo if ENSAP is to fully play its role in catalysing development.

A step that has perhaps been lacking in the past is a clear plan for communication with stakeholders at the end of the project planning phase so there is an increased risk of projects not being taken forward and implemented. This study involves the putting in place of a plan and there will have to be a modality for ensuring that it is taken forward.

The communication plan will be built throughout the study by identifying communication needs. This has already started with identification of the stakeholders to inform during implementation of the IWRDMP plan (see Annex 5).

### *5.2.2.3 Consultation and Communication Plan – C1.1d*

The Plan will only be finalised at the end of the study once the IWRDMP is complete. The **final part of the consultation and communication plan will be aimed at:**

- ensuring that the plan is widely understood and accepted and that implementation can go ahead unhindered and
- clearly mapping out which stakeholders should be consulted with during the implementation of the overall plan and the specific projects (especially the short-term projects) AND the modalities of the consultation process.

### *5.2.2.4 Task Summary*

The activities and outputs for Task C.0 are summarised in Table 5-2.

*Table 5-2: Summary of activities and Outputs for Task C1-1.*

| **TASK C1-1: Consultation and Communication** | | | | |
|---|---|---|---|---|
| **Expected outcome(s):** | Consultation Plan for the different stages of the study in place. Consultation and communication plan in place for implementation and monitoring and evaluation of the IWRDMPlan | | | |
| **Task Leader**: | River Basin Planner | **Team members**: | Local project coordinator and senior team members | |
| **Start date**: Month 1 | **End date**: Month 3.0 | | **Task duration**: 2.0 months | |
| **Main activities** | **Duration (months)[1]** | **Outputs** | | **Meetings, workshops** |
| C1.1a: Stakeholder analysis and Plan for consultation during the study | 3.0 | Stakeholder database and plan for consultation beyond Inception Phase. Plan for i) consultation during scoping and ii) consultation during remainder of study including short term interventions | | Present annotated table of contents |
| C1.1c: Identification of development communication needs | 0.75 | Stakeholder database and Consultation Plan | | |
| C1.1d: Consultation and Communication Plan Draft zero | 2.25 | **D2: Draft Consultation and Communication Plan** | | |
| Finalisation of the Communication Plan falls under C-4 | See D11 | | | |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.3 Scoping Study Report

### *5.2.3.1 Introduction*

The scoping exercise is aimed at determining the relevant information ***to be*** collected **to complete the baseline** in order to determine the "key issues and potentials related to water resource development and management in the river basin"[3]

The objectives of the scoping exercise are shown in Figure 5-7.

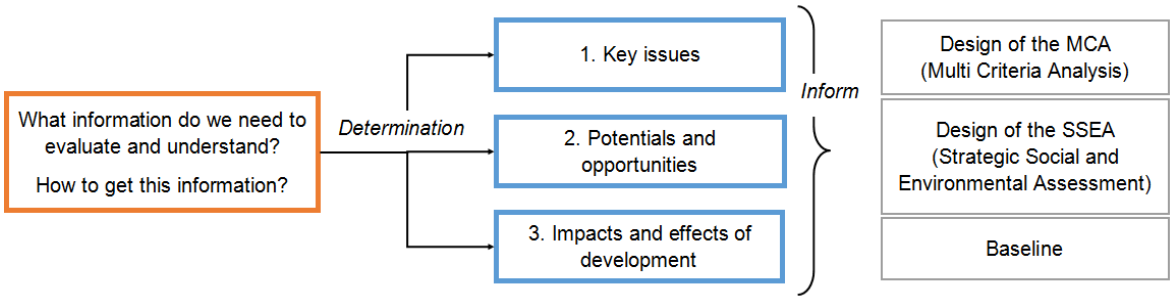



*Figure 5-7: Objectives of the Scoping Exercise*

It is important to note that this study has a clear focus on the **identification and development of projects**. At the same time, this development of projects (large and small) has to take place within a coherent strategic framework for the management and development of water resources basinwide. For this reason the baseline (and hence the scoping exercise) has to be carried out at two levels:

- **Basinwide (BAS)** (and to a certain extent the **whole Eastern Nile/Nile** in order to take downstream impacts of identified projects into account). This is especially necessary for:
  - water resources especially surface water,
  - the environment (existing and potential issues are both basinwide and localized),
  - Certain policy, strategic and institutional aspects (some are quite high level related to sectoral development, water resources and environmental management, socio-economic issues/aspects such as poverty alleviation etc.),
- **"Project" level.** The level of detail that is required at this level is too detailed to be assessed/collected at the basin-wide level. The challenge here is that many projects/interventions are yet to be identified so - **how to know where to do the baseline work?** Our approach to the baseline and the related scoping at the intervention/project level will be as follows:

  Interventions can be:

  a) the development of already identified projects (from masterplans, existing studies etc)
  b) as a result of identifying a **need** and/or a **potential.** For example there may be a specific need for development (or a type(s) of development in a specific part of the basin) or there may be a specific potential for a certain type of development (irrigable land, hydropower potential etc)

  The baseline/issues/objectives/potential should therefore be focused on these two areas. For a), the already identified projects it is clear. We need to make sure that we inventorize all of the projects. This is a **clear goal** and output of the scoping exercise. For b), we need to identify both areas of need and potential (opportunity) (NB this is at the project/intervention level). The focus (need or opportunity) will depend on the sector or thematic area. For example:
  - Hydropower – based on potential
  - Interconnection/transmission – need (and opportunity)
  - Water supply – based on need (for human and livestock)
  - Irrigation – large-scale is mainly on potential. Small-scale on need and/or potential

[3] The baseline report comprises i) baseline, ii) key issues, iii) development potentials and iv) management/development objectives

- Fisheries – capture fisheries mainly on potential; aquaculture need and potential
- Tourism – mainly potential
- Etc.

The methodology for the scoping exercise at project level is shown in Figure 5-8. It is important to remember that the scoping exercise will also be realised at basin level in order to define the limits of the study and that application of the SSEA at the project level has to fit within the basin-wide context and limits.

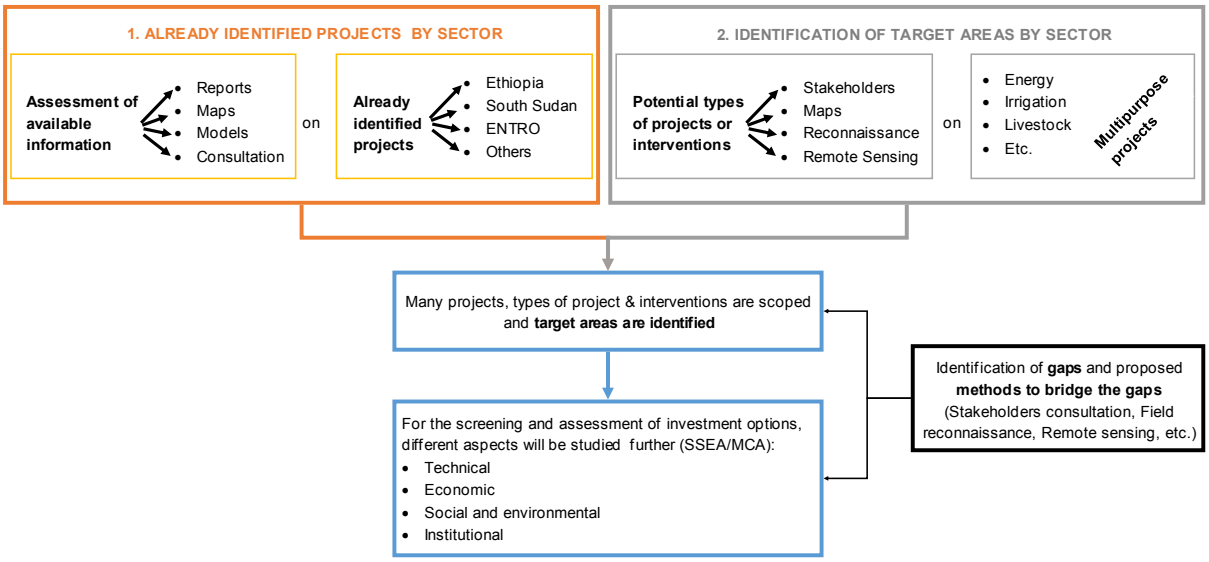



*Figure 5-8: Methodology for the Scoping exercise at project level*

In conclusion, it is important to stress that the scoping exercise is not about the actual collection of this information but getting clarity on what information should be collected and how it will be (is being) achieved. Thus, the two main objectives of the scoping report are the following:

- Clear definition of the work to be carried out in the baseline and for the SSEA
- Assessment of information available, identification of gaps and implications, suggestions for mitigating critical gaps.

### *5.2.3.2 Scoping and the SSEA*

A Strategic Social and environmental Assessment (SSEA) is an instrument that assesses environmental and social influences associated with a proposed policy, strategy, plan, or program, particularly those targeting a specific region (regional ESA) or a sector (sector specific ESA). In the case of this study we are concerned with a **plan**, the IWRDMPlan, the Baro-Akobo-Sobat basin (the region) and a number of development sectors all related to water.

The SSEA is a process that promotes the inclusion of environmental and social considerations **upstream** in policy-making and planning. In the case of this study, it is an instrument that will be used to assess environmental and social influences associated with the proposed development and management strategy and the plan that is built to implement the strategy. By assessing, social, economic, environmental, and institutional impacts associated with potential development options, it must be designed so that it can facilitate screening out inappropriate or unacceptable projects at an early stage, thus, minimizing the risk that projects would have encountered due to environmental and social inappropriateness.

An effective SSEA works within a structured and tiered decision framework, aiming to support more effective and efficient decision-making for sustainable development and improved governance by providing for a substantive focus regarding questions, issues and alternatives to be considered in policy, plan and programme making.

With respect to the basin, the strategic Socio-Environmental Assessment will need to address the following sorts of key questions:

- What are the biophysical and social conditions of the basin?
- What are the main environmental and social issues prevailing in the basin?
- What is the economic situation and the associated driving forces in the basin?
- What are current environmental management practices and capabilities?

Clearly the baseline work will have to provide all the information necessary to answer these questions. The role of the scoping report will be to define what information is required for the questions to be adequately answered in an adequate manner. In other words, it is important that the collection of information for the baseline is guided by a clear picture of what is required to answer the sort of questions indicated above, and in so doing, to build the SSEA framework.

Once the SSEA framework is in place it will be used to answer questions such as:

- What are the potential direct and indirect outcomes of the development proposals?
- How do these outcomes interact with the environment?
- What is the scope and nature of these environmental interactions?
- Can the adverse environmental effects be mitigated?
- What is the overall potential environmental effect of the proposal after opportunities for mitigation have been incorporated?

While it is not for the scoping report to develop these questions, it is useful to keep the nature of these questions in mind since they will also have an influence on the scoping for the baseline and the information that has to be collected. This can include the following:

- At basin wide level:
  - Available quantity of water in the basin including temporal and spatial distribution
  - Existing water use within the basin (irrigation, hydropower, water supply, livestock water, navigation, etc)
  - Current land use around the basin,
  - Size and location of protected forests, national parks, wildlife reserves,
  - Size and seasonality of wetlands of the basin,
  - Water requirements for the sustainability of wetlands of the basin,
  - Amount of water lost due to evapo-transpiration from the *Machar marshes* and other wetlands of the basin
  - Amount of water overflow from *Machar marshes* into White Nile,
  - Current and projected population size of the basin
  - Current and projected water supply demand of the basin
  - Current and projected size of livestock in the basin
  - Areas of the basin affected by the reoccurring flood risk,
  - Water born and water related health problems of the basin,
  - Fishery potential of the basin and type of fish species
  - etc
- At project level:
  - Size of proposed irrigation projects,
  - Water requirement of irrigation projects ($m^3$/ha/d)
  - Suitability of water quality for drinking and irrigation
  - Suitability of soil for irrigation

- Type of crops to be grown using irrigation at each project site
- Area of hydropower reservoirs in ha,
- Volume of each reservoir in $m^3$,
- Operation rules for each dropower scheme
- Amount of downstream ecological flow from each reservoir, etc
- Environmental and social impacts of each project

It is important to stress that the focus of the SSEA, as a strategic "regional" instrument is not on individual projects. The **main benefit of a regional or basin-wide strategic SEA is that it allows for the consideration of more far-ranging and cumulative impacts and broader types of alternatives than provided by project specific SEA.** Sectoral or regional SEAs can facilitate the preparation of project-specific ESAs at later stages of development.

### *5.2.3.3 Structure and Contents of the Scoping Report*

During the Inception Phase a detailed annotated table of contents for the Scoping Report has been compiled. This has been submitted to ENTRO for comments and also serves as a clear guide for the Consultant team which is currently working on finalising the details of the Scoping Report and preparing the baseline. The team is now clear on what needs to be done to complete the baseline work, and also aware of the various gaps that exist. There are many gaps, especially within the portion of the basin within South Sudan. In most cases there are "workarounds" that will be proposed to mitigate against these gaps, but in some cases it will be necessary recommend actions to fill these gaps properly in the future.

**Review of draft methodology**

A weakness of the draft methodology was the lack of clarity on the scoping exercise. This has now been addressed, largely through the development of an annotated table of contents for the Scoping Report which has been built by most of the team members in a consultative manner.

The annotated table of contents is included as Annex 4 to this report.

### *5.2.3.4 Literature Review, collection of available data and information – C1.2a*

An important part of the Scoping report is an in-depth look into the available data and information. A large number of documents have been collected and analysed. Many have been made available during meetings with stakeholders in both Ethiopia and South Sudan.

All documentation has been organised on the project extranet site.

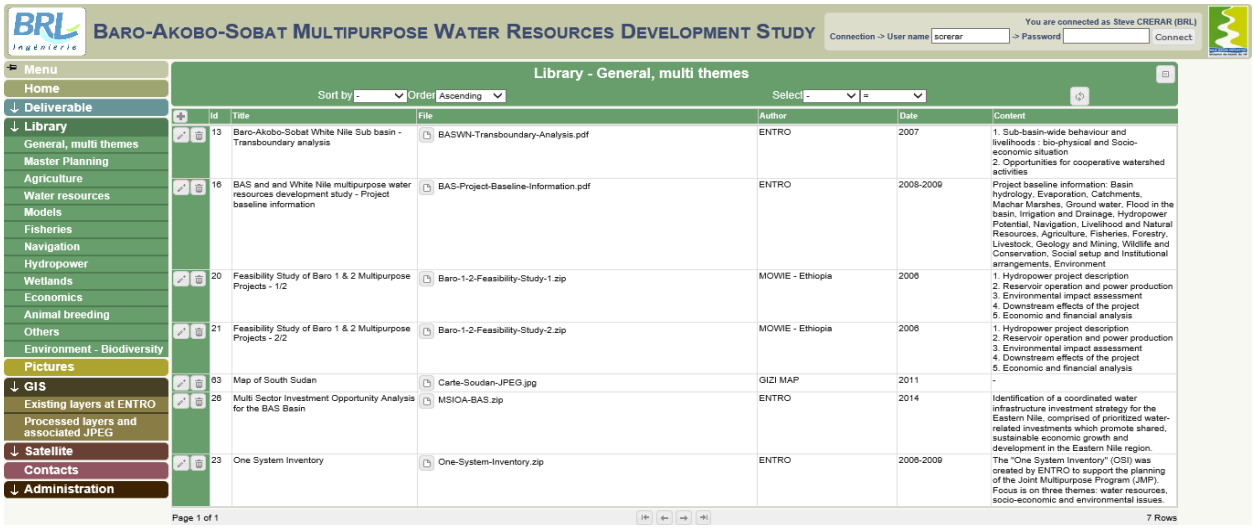



*Figure 5-9: Screen print from project extranet*

#### 5.2.3.5 Task Summary

The activities and outputs for Task C1.2 are summarised in Table 5-3.

*Table 5-3: Summary of activities and Outputs for Task C1-2.*

| **TASK C1-2: Scoping** | | | | |
|---|---|---|---|---|
| **Expected outcome(s):** | Clear scope of work in place for i) the completion of the baseline in order to carry out the SSEA; and ii) selection of short-term projects. | | | |
| **Task Leader**: | Team Leader | **Team members**: | Team leader, river basin planner, environmental and social experts, water resources modeller and hydrologist, watershed management and WSS experts | |
| **Start date**: Month 1 | | **End date**: Month 2.5 | | **Task duration**: 2.0 months |

| Main activities | Duration (months)[1] | Outputs | Meetings, workshops |
|---|---|---|---|
| C1.2a: Literature review, collection of available data and information | 2.5 | Literature review section of Scoping report | |
| C1.2b: Consultation with stakeholders | 2.5 | Series of meeting notes | FOcussed meetings, formal and informal |
| C1.2c: Development of focus (type and geographic area) | 1.5 | Section of Scoping report | |
| C1.2d: Methodology for fine-tuning and scope for SSEA | 1.5 | Section of Scoping report | |
| C1.2e1: Preliminary Scoping study report | 1.0 | **Preliminary Scoping Report** | Inception meeting/workshop |
| C1.2e2: Final Scoping Study report | 3.0 | **D3: Scoping Report** | Presented at Workshop 2 (8 months) |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

### 5.2.4 Baseline Report

#### 5.2.4.1 Introduction

The Baseline Report (D4a) is closely linked with:

- D4b: Key Issues and Objectives Report,
- D4c: Potential Development Report

Much of the information concerning all three deliverables is being collected simultaneously. These three sub-deliverables are closely related within the logic of Component 1 of the study.

The completed baseline will provide the information to allow:

- Identification of key environmental, social and developmental issues and challenges and **definition of water resources development and management objectives.** This is an important cornerstone of the SSEA and therefore of the IWRMDMPlan.
- Development of the SSEA framework for application at progressive levels of detail.
- The establishment of a point of departure for looking at future sectoral development and/or management pathways.

It would be incorrect to think that the baseline study areas can be conveniently compartmentalised into clearcut thematic areas. Environmental and development challenges can be entirely intertwined or at least closely linked. However, a thematic approach is still useful as long as these constraints are kept in mind. The organisation of the baseline has been modified slightly from that presented in the Consultant's proposal. This has been done in order to conserve the best analytical logic possible.

The thematic areas are now didvided up into three categories as illustrated in Figure 5-10.

The three categories are, as shown in the following figure as 1) Cross-cutting themes, 2) Economic Sectors and 3) Service Sectors.

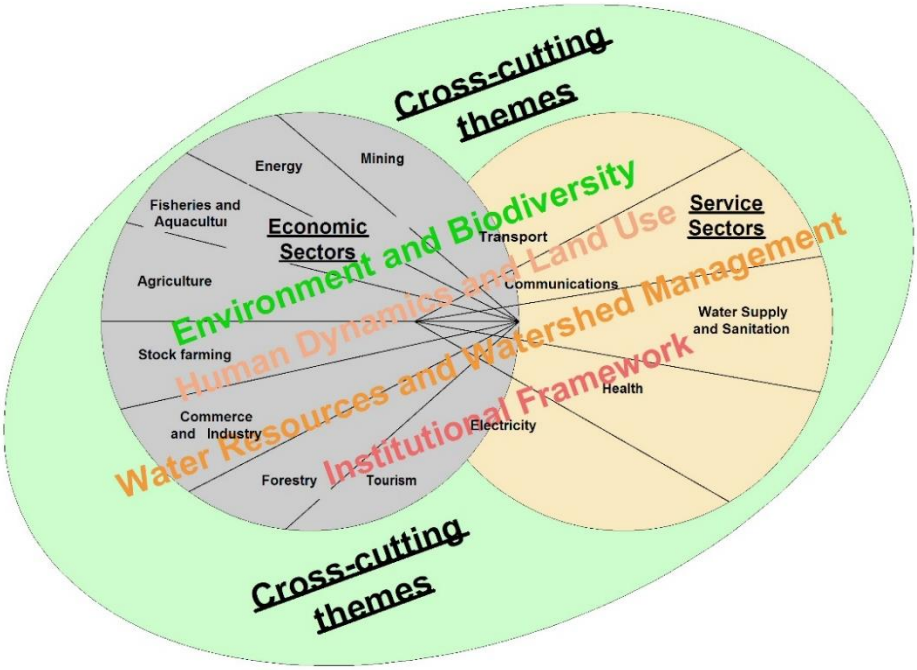



*Figure 5-10: Categorisation of Themes*

The economic sectors are affected by cross-cutting themes such as the Environment (environment and biodiversity, human dynamics and land use, water resources and watershed management) and the Institutional framework.

This categorisation is useful because it highlights the fact that development cannot be achieved only by concentrating efforts in what appear to be the most important areas of economic activity, or those which would seem to generate the highest economic benefits. Development of the economic sectors, which can be seen as the primary engines of economic growth, must be supported by the service sectors and indeed development of these service sectors will catalyse progress in the different economic sectors.

For all of this to be sustainable, due attention must be paid to the cross-cutting themes which include environmental conservation and protection issues, watershed management and the appropriate utilisation of the river and the land. All development actions must fully integrate the necessary measures and actions associated with the cross-cutting themes.

The baseline is therefore being carried out through the assessment of:

- Cross-cutting themes:
  - Water resources and watershed management,
  - Environment and biodiversity,
  - Human dynamics and Land-use;
  - Institutional framework

- Economic sectors:
  - Agriculture,
  - Livestock,
  - Fisheries and fish-farming,
  - Energy,
  - Mining,
  - Forestry,
  - Trade and industry,
  - Tourism.
- The basic services sectors:

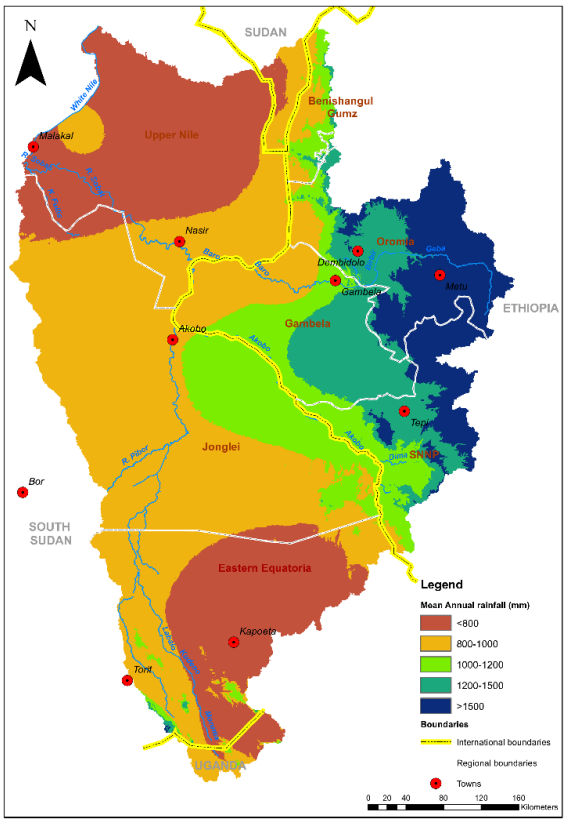
The analysis of these areas is being carried out through a combination of stakeholder consultation, further review of documentation, the extensive use of remote sensing and visits to the field.

### *5.2.4.2 Climate and (natural)/water resources – C1-3a*

#### CLIMATE

The need for information and understanding of climate cuts across many sectors. The natural variations of climate have implications for both natural resources and development sectors.

The need for accurate and representative (both spatially and temporally) climate data is particularly essential for the water resource modelling task. Climate data typically refer to historical (recorded) rainfall, evaporation and temperature data. Spatially, the data should cover the full extent of the study basin and temporally, the data should cover a significantly long period in order to allow climate trends and variability to be captured.




The usefulness of long-term rainfall and evaporation data within the context of water resource modelling, primarily relates to deterministic catchment rainfall-runoff modelling which requires climate data as input. In conjunction with a calibrated rainfall-runoff model, long term rainfall data will be used for the extension and/or gap-filling of observed flow records in gauged catchments and the simulation of synthetic flow sequences in ungauged catchments. In addition, direct rainfall and evaporation data are used for water balance calculations in reservoirs, lakes and wetlands as well as for the estimation of crop water requirements. By assessing the impacts of future climate change scenarios on key climate variables such as rainfall and temperature, rainfall-runoff and crop models could also be used to evaluate the sensitivity of catchment response (runoff, evapotranspiration, irrigation water requirements etc.) to climate change.

Flow, rainfall, temperature and evaporation data across the basin have been sourced from previous study reports, ENTRO databases, existing regional datasets, relevant government departments and global databases e.g. NOAA and FAO. An effort will be made to review the data in terms of data availability and quality. Data gaps will be identified and recommendations made on appropriate measures on how to address the gaps, including the use of regression tools, satellite based rainfall and gridded meteorological

datasets. Monthly flow and rainfall data will be scrutinised in order to identify outliers, non-stationarity and periods of missing data. Where feasible, suspect and missing data will be infilled (patched) by means of cross-correlation with neighbouring stations. All infilled values will be flagged in order to ensure that their effect on simulated flows may be monitored. Mean Annual Precipitation (MAP) isohyets for the study catchments will be confirmed or adjusted if necessary, while time series of areal catchment rainfall for each of the hydrological model sub-catchment discretisations will be calculated. Uncertainties associated with data quality could influence water balance modelling, hydrodynamic modelling of the floodplains and the evaluation of impacts associated with development interventions. Checks will be done to assess the sensitivity of model results to data quality and to highlight possible uncertainties.

There are two areas which are receiving particular attention with respect to climate and water resources modelling:

- **South Sudan rainfall data paucity**: Although a large proportion of the runoff in the Baro-Akobo-Sobat basin is generated in the high lying parts of the Baro subcatchment in Ethiopia, significant runoff is also generated in the Pibor and Akobo subcatchments in Sudan. However, there is **a paucity of rainfall stations in the South Sudan** part of the basin. In order to overcome this challenge, the possibility of using gridded satellite-based rainfall estimates (SRFEs) for hydrological modelling in areas characterised by a poor spatial representation of rainfall stations and/or unreliable rainfall data quality will be investigated. When using SRFEs for hydrological modelling it is important to be aware that uncertainties associated with SFREs would propagate through the downstream models. It is therefore essential to evaluate a combination of different SRFE products (e.g. ARC2, CMORPH, TRMM, PERSIANN etc.), which would be calibrated (model cross-calibration, sophisticated interpolation methods based on ground observations e.g. Kriging) and corrected for bias.

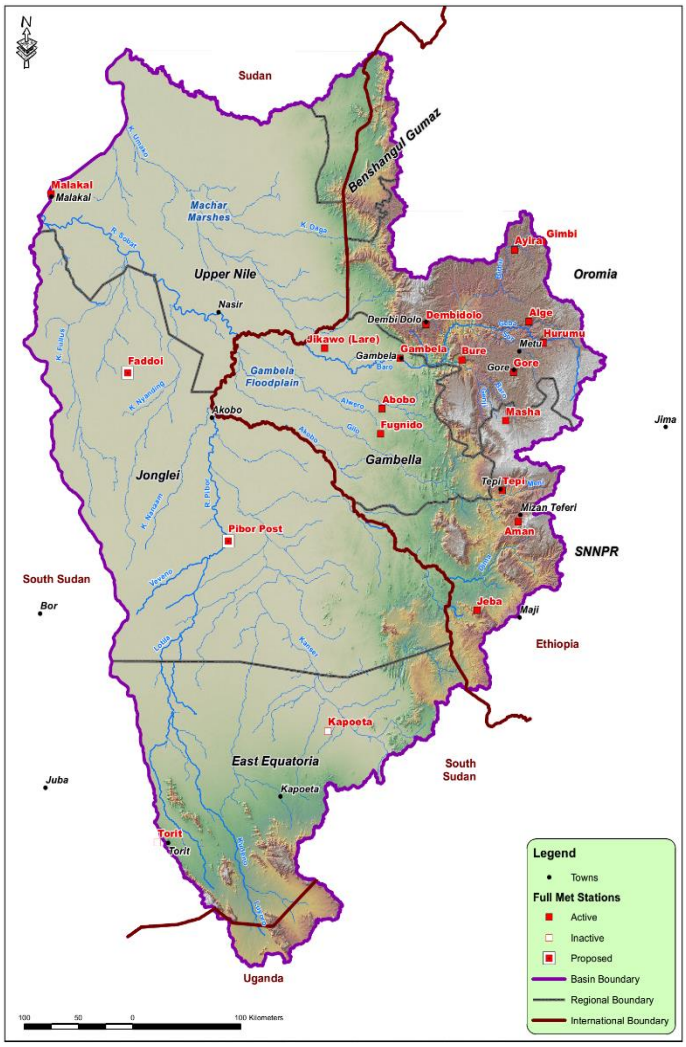



*Figure 5-11: Rainfall stations in the basin (locations shown in red)*

- **Climate change**: An important consideration during the water resource modelling component of this project relates to the assessment of climate change impacts on the feasibility and long-term sustainability of the proposed investment options (schemes) as well as the degree of response of key indicators to climate change. In order to assess these impacts, it is proposed to use the calibrated rainfall-runoff model in conjunction with climate induced changes in rainfall and increased evapotranspiration and open water evaporation linked to higher temperatures. . In consultation with the Client, first order projections of climate change modified rainfall, temperature and evaporation scenarios will be based on readily available global CMIP5 model datasets for different Representative Concentration Pathways (RCPs)..

A recent study of the potential impact of climate change on the water resources of the Baro-Akobo-Sobat basin was undertaken as part of a PhD thesis in 2013 (Kassa, 2013). An important finding of the Kassa study was the projected changes in mean annual precipitation, which show a general increase across all stations up to around 22% by 2050 except for a potential slight reduction in the MAP for the Mettu and Bure stations.

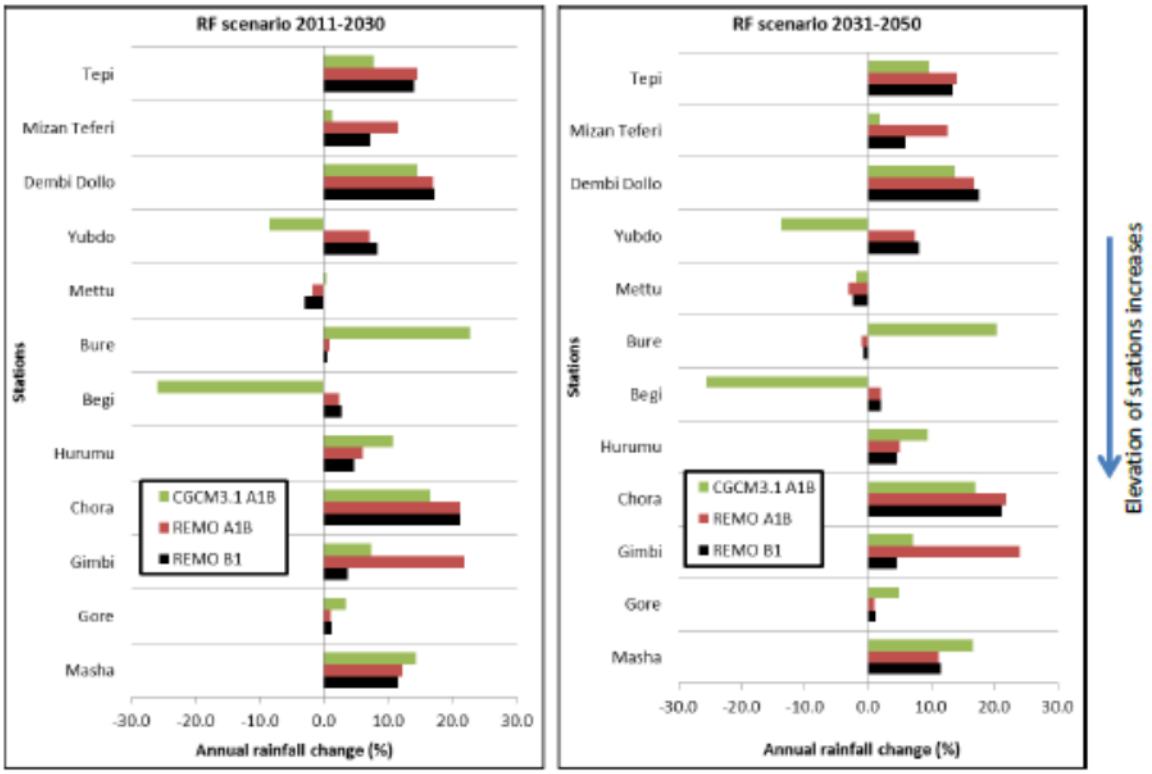



*Figure 5-12: Projected percentage change in mean annual rainfall in the Baro-Akobo-Sobat basin from base period for REMO A1B and B1 scenarios and CGCM 3.1.*

NB: Stations are ordered by increasing elevation. (Source: Kassa, 2013)

## SURFACE WATER RESOURCES

The rainfall sets (see section on climate) will be used for rainfall-runoff modelling in order to generate the runoff sequences necessary for water resources modelling. Preliminary investigation has identified the key gauging stations and these are shown as red triangles in Figure 5-13. Details are provided in the Scoping Report.

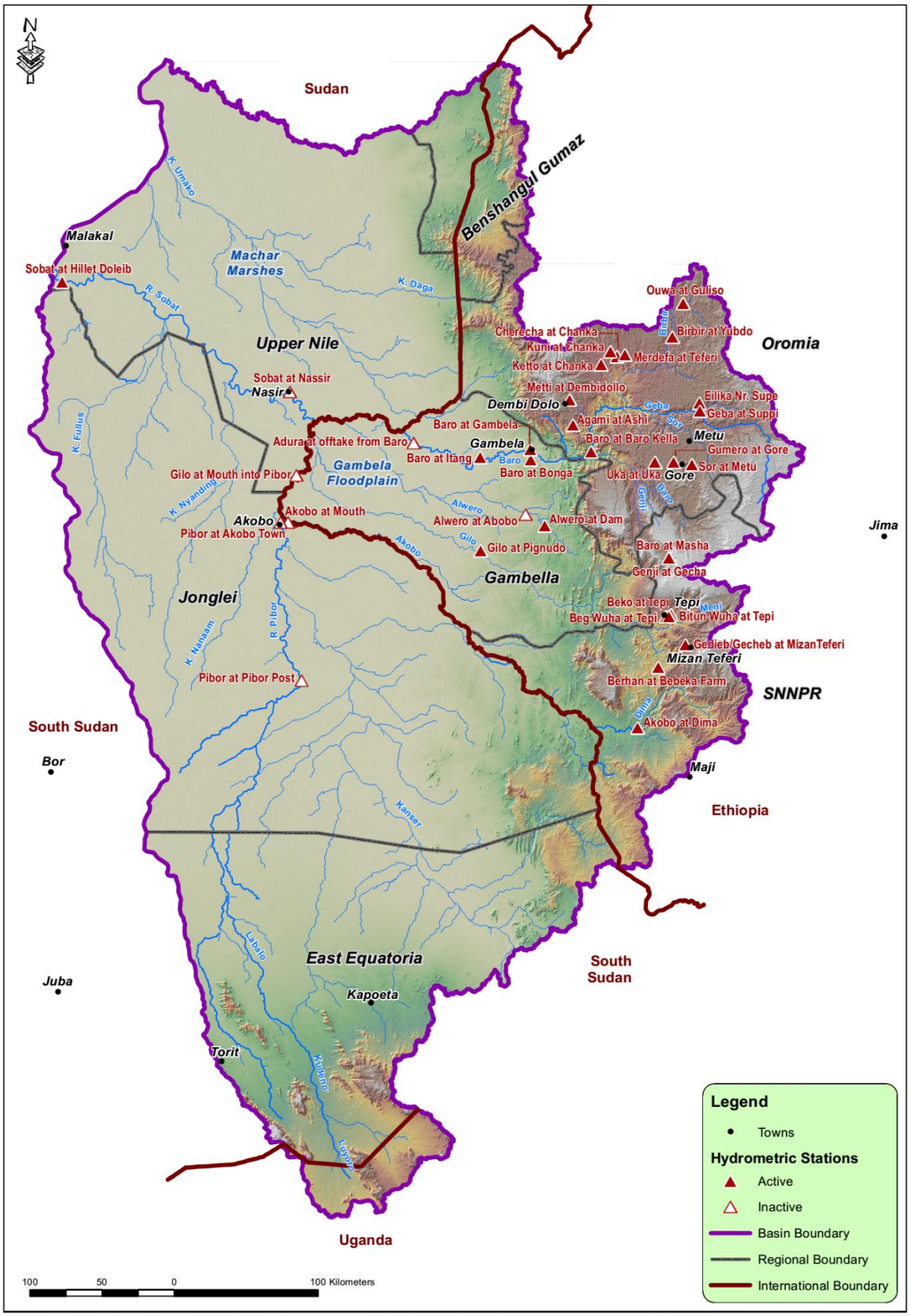



*Figure 5-13: Location of key flow gauging stations in the Baro-Akobo-Sobat Basin*

The distribution of surface water gauging stations and their status in terms of:

- Whether they are operating or not
- The level of confidence in the water stage/discharge rating
- Length of record and presence of gaps

is currently being investigated. Considerable progress with this task has been made and will be detailed in the Scoping Report.

Since the 1980s, various studies which are relevant to the water resources of the Baro-Akobo-Sobat basin have been conducted, either as part of Nile Basin studies, country specific master plan studies, feasibility level studies, or specific hydrological, transboundary and modelling studies. Many of these have already been investigated during the Inception Phase.

### GROUNDWATER RESOURCES

## Geological Context

The high plateaux with table land denudational landform (1300 – 2300 m a.s.l) are comprised of basalt and granites. In the westward direction, are the crystalline basement mountains known as Masengo ranges (about 800 m to 1400 m a.s.l). These range gradually plunge north and southwards down to elevations of 550 m.

The Baro-Akobo-Sobat project area is made of three general types of rocks (TAMS, 1996). These are the Precambrian, meta igneous and metasedimentary (pi), the tertiary (Ti) and the undifferentiated Quaternary (Q). The Precambrian rocks are reported to out crop South of Guraferda plateau in the Akobo River valley and extend northwards following the Mesango ranges to the extreme northern part of the project area.

For the most part of the study area, in the mountains and plateaux in the upper basin of the project area are covered by tertiary Igneous rocks. These include: Akobo basalt, rhyolit, trachyte and ignimbrite, the Maji flood Basalt and stratoid volcanic, and the Maji Silicics, Makonen Basalt, Surma Basalt, Dembidolo Trachytes and Hypabasal Intrusive rocks.

Quaternary rock formations exposed in the project area include the Holocene Tepi Basalt and Holocene – Pleistocene Undifferentiated Alluvium. Tepi formation flows and pyroclastic features are scattered throughout the southern sector of the project area. The Alluvium is generally comprised of undifferentiated stream and lake deposits.

The Alwero formation (sedimentary) is not exposed in the project area, but it is present in the sub-surface of the Gambela plain (TAMS, 1996).

The objectives of the groundwater component of the project is to provide the basic (baseline) information on the resource base and identifications of the potentials, constraints or limitations regarding the groundwater resources development for the use of planning and formulation of projects

## Data Gaps and Limitations

Despite the large extent of the study area, and the geological and hydrogeological complexity, the data/information available on the groundwater resources is very limited.

The following major data gaps, constraints and deficiencies can be mentioned regarding the availability of data and its quality.

- Lack of detailed groundwater study supported by proper exploratory drilling and testing especially for the deep groundwater system.

- Some of the exploratory drilling programmes in the past were left without proper implementation, such as at the time of ARDCO-GEOSERVE study (1995), where 17 exploratory wells were scheduled and only three of them were executed with their cases of partial completions. This indicates the problems with the capacity of performing exploratory drilling operations.
- Groundwater studies in the past rely mostly on the qualitative analysis and conclusions based mainly on geological information due to lack of data from the actual drilling and testing results to support the work. This would make the studies shallow and in some cases could result failures in obtaining the required results.
- As a result of differences in the approach, methodology and details of the studies, the geological, geomorphological and hydro classifications or descriptions presented in the previous studies varies from one to the other for the same geological/hydrogeological environment. This could pose complications in harmonizing the descriptions or maps provided by different sources to produce a single product for a wider area in this case Baro-Akobo-Sobat area.
- Data from boreholes /water points provide vital information for the groundwater resources studies and evaluations. However, the limited available data of this type have several limitations and need to be used with care and in conjunction with other supporting evidences. Some of the gaps/limitations on these data sets are:
  - Partial penetration of aquifers due to limitations in drilling operations/terminations and other factors (do not represent the aquifer potential)
  - Problems with proper well designs and aquifer tests (Pumping test only in the production well, no observation well, in some cases pumping limited only to the capacity of the pump not to the aquifer)
  - Inconsistency in data recording (incomplete records, coordinates missing)
  - Lack of information on important well parameters (such as yield, draw down etc.)
  - Missing water quality information

A Hydrogeological map that covers the entire study area or the Baro-Akobo basin has not yet been obtained, although it has been possible, through the application of remote sensing, to produce a geological map for the whole basin. Other available maps are the map produced during the Russian study (1990) for the Gambella plain (Geological Tectonic scheme map at a scale of 1:750,000) and the geological map produced by the Ethiopian Institute of Geological Survey at 1:250,000 (Gore sheet) and photo-geological maps at 1:100,000 for Gamble sheet, Begi sheet. The rest are small scale thematic maps contained in the reports for supporting analysis including the geological and hydrogeological maps obtained for the South Sudan part of the study area.

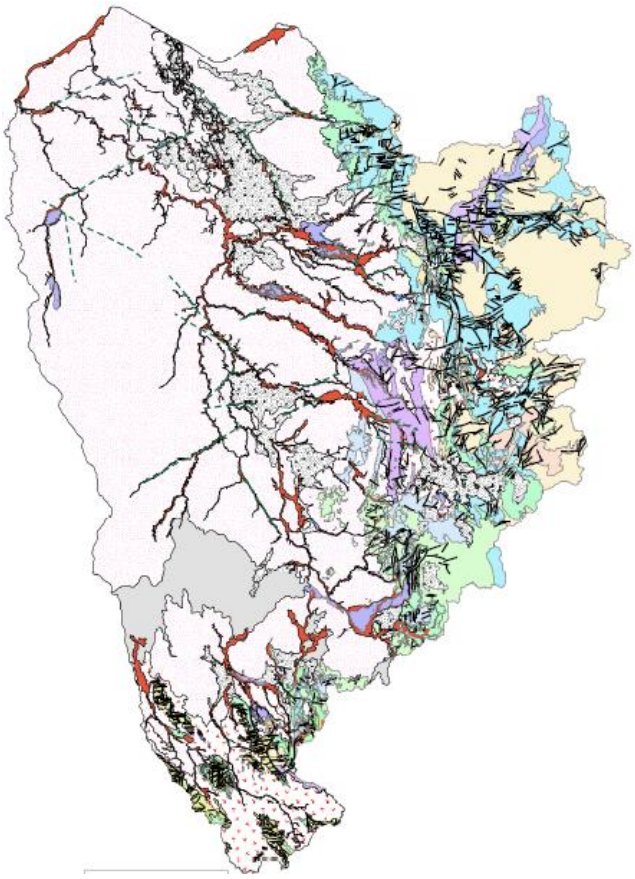


*Figure 5-14: Map of surface geology prepared during the Inception Phase*

The major constraints mentioned during the previous master plan studies were the absence of sufficient sub-surface information and access problem due to dense forest cover. The inability of the then Client (EVDSA) to undertake the drilling and testing of the proposed exploratory wells was mentioned as one of the limitations.

## Methodology

### *General*

Based on the main objectives of the groundwater component of the project to provide the basic (baseline) information on the resource base and identifications of potentials, constraints or limitations regarding the groundwater resources development, it is proposed to conduct the following main works.

a) Detailed review, field verifications, assimilation of data and Preparation of groundwater availability report.

b) Select target/focus areas based on the objectives of the project for more detailed observations and investigations (hydrogeological/water points inventory and sampling)

c) Preparation of project oriented groundwater database for planning and project identification purpose

d) Prepare operational map for groundwater development on target areas at appropriate scale

e) Data processing, analysis and Reporting

### *Details of activities and expected outputs*

- Detailed review, field verifications, assimilation of data and Preparation of Groundwater availability report.

  It is well understood that due to the vast size of the study area, the scale and scope of the previous studies, there is a big challenge in harmonizing the classifications and descriptions made on the geology/hydrogeology and aquifer systems over this large area. Similarly, sorting and verifications of the databases from different sources for assimilations and use of this project needs great effort. Therefore, during the next stage, among others the following major activities will be conducted.

  - Further to the present data collection and review activities, more data/previous works especially from the Sobat side of the project area will be collected and detailed review works will be conducted.
  - The descriptions, mapping, analysis and interpretations presented in the previous works will be checked and verified in the field together with additional observations on geology, hydrography, morphology and structures, water points, groundwater use and abstraction, etc. (ground thruthing works).
  - Characterize/harmonize geological/hydrogeological/aquifer units in a broader/regional context.
  - Previous/new data/information will be assimilated, and together with the project hydrologist, attempt will be made to validate the groundwater recharge estimates made by previous works (groundwater resource potential assessment).
  - As an output of the validation and assimilation of results, an updated groundwater availability report for the study area and that can serve as a basis for the regional planning exercise will be prepared.

- Select target/focus areas based on the objectives of the project for detailed observations and investigations

  Within the main framework and scope of the project, target groundwater prospective areas will be identified for more detailed observations and investigations. The work shall include:

  - Identify groundwater potential priority areas, and make a link with the water supply team to tie with the identified priority demand canters
  - Hydrogeological survey and mapping
  - Water points inventory
  - Data processing, interpretations, analysis and reporting

- Preparation of project oriented groundwater database for planning and project identification purpose
  - Intended use of groundwater data/information

    In a situation where there is no structured and organized central groundwater database system, it would be mandatory to create a project based database for use of the intended purpose. In this regard, the intended use of the project database that should be compiled/created may be outlined as follows:
    - Input for water resources development planning exercises (project formulations and cost estimates)
    - For the choice of alternatives or conjunctive uses
    - Selection of priority groundwater development areas/sites
    - Planning for water supplies or possibility of large scale groundwater development for irrigation
    - Preparation of thematic map showing groundwater potential priority areas (operational map)
    - For the use of groundwater data as an indicator for resource evaluation and could be used as a layer for different analysis together with other layers such as: topography/slope, drainage, geology, soils, land use, infrastructures etc.
    - To be used as decision support tool for technical justifications on the issues arising in relation to the resource base (trans-boundary issues).
  - Database formats and compilations

    In order to avoid redundancy and unnecessary efforts, it is required to design a workable format that can provide the needed planning parameters for the project. It is also known that in general, there is a scarcity of groundwater data and that no structured and accessible database exist. It would therefore be advisable to organize a purpose-oriented groundwater information system/database that can provide quantitative, semi-quantitative or brief and concise qualitative information regarding the resource base of the study area or localities, so that these could be interpolated to some similar areas to fill data gaps as the case may be. The experience during the ESP-C3 project, where attempt was made to create a project based water resources data base for the input of the two water supplies and sanitation planning models (urban and rural), for which water sources development costing parameters were required, may be exemplary.
- Preparation of operational map for groundwater development for Target areas

  Groundwater information depicted on maps is the useful tool for planning and development of the resource as well as for future users. During this project, based on the assimilations of works done previously, as well as, present additional surveys and investigations, operational groundwater maps will be prepared for selected target areas at appropriate scale
- Data Processing, analysis and Reporting

  As a result of the detailed review work, field surveys and verifications as well as additional investigations to be conducted over selected target areas, it is expected that data/information relevant to better understanding of the groundwater resources over the study area, together with the related likely problems and limitations will be available. These data will be organized and processed accordingly for analysis and input to the integrated planning work and final reporting.

### WATER QUALITY

## Data availability

Water quality appears to be poorly monitored in the Baro-Akobo-Sobat sub-basin. Surface and groundwater quality data have been collected on an *ad hoc* basis for various studies but these have not been collated into a central database that is accessible to water resources managers and to consultants alike.

The BAS Master Plan Study that was conducted in 1986 – 1988 (Selkhozpromexport, 1990) reported on water quality of some 95 water samples that were collected during the study. The samples were collected mainly at gauging stations depending on the availability of flow at the sites. These samples were analysed for 18 constituents and the raw data were tabulated in Appendix III of the Master Plan Report.

The National Nile Basin Water Quality Monitoring Baseline Report for Ethiopia (Merid, 2005) refers to the data that were collected during the BAS Master Plan Study and in addition lists a total of 64 surface and ground water physico-chemical and 25 bacteriological quality datasets, generated from 1972 to 2001, that were available from the Ministry of Water Resources database. However, the author was concerned that "*In Ethiopia, comprehensive and regular water quality monitoring and surveillance activities are lacking at all levels. In general, the level of emphasis provided for water quality management issues is very low when compared with the level of attention given to other aspects of water development*".
The National Nile Basin Water Quality Monitoring Baseline Report for Sudan (Anon, 2005) concluded that "both the Nile water quality and the technical capacities of laboratories have deteriorated" but that highly qualified and experienced staff were available to implement a national plan for water quality monitoring. The report listed a number of institutions involved in monitoring, including the Ministry of Irrigation and Water Resources Ground Water and Wadis Directorate (GWWD). It appears that there are no routine monitoring points in the Baro-Akobo-Sobat sub-basin although there is a regular sampling point on the White Nile at Malakal. Here the sampling frequency is approximately monthly although this was not always achieved. Water quality variables include physical and chemical constituents, pH, turbidity, electronic conductivity, total dissolved solids, hardness, alkalinity, major cations and anions and nitrogen inorganic compounds.

The project to design a Regional Nile Basin Hydromet Service (currently being conducted) has recommended that seven (7) hydrometric stations be established for monitoring in the sub-basin. The seven stations are located at:

- Geba near Suppi for monitoring the upstream contribution of the Baro;
- Baro at Itang as the last downstream location capable of conducting discharge measurements before the Gambeila/*Machar marshes*, monitor water quality for transboundary purposes;
- Alwero at Dam/Dumbong Village to monitor downstream releases from the Abobo dam;
- Akobo River at mouth;
- Pibor River at Akobo Town;
- Sobat River at Doleib Hill; and
- Sobat River at Nasir

The study proposed that flow and sediment data be collected at all the proposed sampling points, and that water quality data be collected at three sites, namely the Baro at Itang, Akobo at mouth, and Nasir. All of the sites in Ethiopia are proposed to conduct sediment monitoring as this is a notable issue within the Ethiopian highlands, while the Baro at Itang is also proposed to monitor water quality for transboundary purposes.
A literature review on water quality has been carried out and will be included in the Scoping Report**.**

## Surface water quality

The ENTRO (2007) One System Inventory report concluded that water quality in the Baro-Akobo-Sobat sub-basin was not threatened. Merid (2005) undertook a high level assessment of water quality in the Baro-Akobo-Sobat sub-basin using water quality data collected within the basin from 1986 to 1988 obtained. Twelve surface water sites were sampled for 84 observations and 9 groundwater sites for 109 observations. This was complemented with 28 results generated from 1972 to 2000 obtained from the Ethiopian Ministry of Water Resources database. The results were interpreted and evaluated within the context of guidelines and standards pertaining to Ethiopia for the following parameter areas:

- Turbidity, suspended sediments and colour
- Iron and Manganese
- pH and SAR
- TDS and EC
- Nitrates and Nitrites
- Waterborne diseases

## Groundwater quality

Hydrosult Inc (2007) concluded that, except for a few isolated localities, groundwater was free from impurities for drinking and irrigation requirements. Merid (2005) used a total of 43 physico-chemical water quality data of bore-holes, springs, shallow-wells and hand-dug-wells generated from 1986 - 1988 and 1972- 2000 obtained from Baro-Akobo Basin Study Report (1996) and from MoWR database respectively. The results have been analyse and conclusions drawn for the following parameter areas:

- Turbidity and Colour
- Pesticides and Metals
- Iron and Manganese
- pH and SAR
- Hardness, TDS & EC
- Nitrate and Nitrite

## Potential sources of pollution

### *Industrial wastewater and impacts*

Concerns have been expressed about oil extraction in the *Machar marshes* (ENTRO. 2007). The One System Inventory stated that exploration (cutting of seismic traces, test drilling, access road construction) and drilling and extraction (road construction, new towns, pipelines, oil wells) have already had severe environmental and social impacts. Two potential problems related to oil extraction and transport within the *Machar marshes* were identified: The first was that the oil was pumped together with water and the two had to be separated. At this point the water was heavily contaminated and had to be treated before disposal. If this was not done effectively then severe pollution problems would occur. Given the importance of the marshes in terms of water supply and fishing this would have a serious impact on the livelihoods of the local inhabitants. A second potential problem was the construction of all-weather roads without effective drainage and adequate culverts. In these cases a road would acts as a dam and could cause serious flooding on the upstream side and dry conditions on the downstream side. Given the very complex drainage systems within the marshes any disruption in water flow could have very serious impacts on the distribution of the important "toich" grazing areas (ENTRO, 2007). Hydrosult Inc (2007) also concluded that “given the importance of the marshes in terms of water supplies and fishing this would have a serious impact on the livelihoods of the local inhabitants”.

Seman (2011) reported that oil exploration and artisanal gold mining occurred in the basin. Both these activities disrupted the natural forest and vegetation in the mining areas, clearing land for the exploration and using wood for timber reinforcement of open pit mines and other construction activities. Artisanal gold mining can lead to severe increases in the suspended sediment loads and chemical contamination such as mercury pollution if this was used in the gold extraction process. Mercury contamination of drinking water sources is a serious concern in countries such as Zimbabwe where artisanal gold mining and mercury extraction methods are in widespread use.

### *Domestic wastewater*

ENTRO (2009) identified dumping of industrial waste and wastewater, and sewage in urban areas as a major concern. The report also identified dumping of domestic waste and wastewater at sub-basin household settlements as greatly affecting the quality of water and the health of populations dependent on river and groundwater for domestic supplies. Merid (2005) concluded that the lack of data about domestic solid waste and effluent volumes constrained the assessment of pollution of water supply sources and, hence, knowledge about domestic waste management was identified as a gap to be filled in the future.

### *Agricultural runoff*

Concerns about agricultural runoff are generally associated with fertiliser washoff in the runoff, and pesticide and herbicide residues in the runoff water. Merid (2005) found that there were no data available on pesticide residues in Ethiopia and that Ethiopia had been one of the lowest fertilizers users among ASARECA member states in the region until the mid 1970s (FAO data for the period from 1991 to 2000, cited by Tsedeke, 2004). Ethiopia's per capita fertilizer consumption for the above period (12.4 kg/ha/yr) was less than that for Kenya (27.4 kg/ha/yr). It was his opinion that the absence of water quality data for fertilizer and pesticides severely constrained an assessment of agricultural impacts and that it was important to establish baselines for such parameters. ENTRO (2009) expressed the opinion that agricultural runoff was not yet regarded as a serious source of surface water contamination in the Baro-Akobo-Sobat sub-basin.

### *Erosion and sediments*

One of the major water quality issue identified in all the Baro-Akobo-Sobat sub-basin was suspended solid loads in surface waters as a result of erosion. The high sediment loads in the rivers were the results of high topographic slopes, strong rain-fall pattern and deforestation as a result of population pressure and commercial exploitation of wood resources. The Baro-Akobo River has an average elevation difference of 2300m between the origin of the river in the Ethiopean highlands and fall to the Gambella plains (TAMS-ULG, 1996). Within Ethiopia the Abbay River has an average slope of 1.4m/km. It was swift flowing and quite turbid (Merid, 2005). Trampling of water courses when semi-pastoralists move close to the river for grazing their cattle in the dry season is a further source of sediments when rainy season commence and water levels rise again, resuspending the fine dust particles in the trampled areas.

### *Mining and quarrying*

Runoff and leachates from mining activities can have a significant impact on surface and groundwater quality. However, Merid (2005) concluded that there were no large-scale underground and open-cast mining activities within the basin. There was evidence of quarrying which mostly involved extraction of rocks from outcrops. This extraction was done mostly by hand and the crushed stone was used for building and road construction. These activities have resulted in localised impacts on erosion and sedimentation.

### *Invasive aquatic plants*

Water hyacinth infestations can have serious impacts on water quality (ENTRO, 2007). In about 1957 water hyacinth (Eichhornia crassipes) appeared in the White Nile in the area of the Sudd, and has since spread north and southwards into the Baro in Ethiopia in about 1976 and also into the Sobat system. The weed has a number of serious negative impacts. The presence of the weed in the river system leads to an increased loss of water via increased evapotranspiration. It also reduces the areas of open water available for fishing, which is an important livelihood strategy for the people of the Sub-basin. It also impedes river navigation along the White Nile. River navigation is an important economic activity on the Nile and sections of the Baro and Sobat rivers. Other impacts relate to low oxygen concentrations below the hyacinth mats and an increase in organic content of the water due to dead and decomposing plants. Reports indicated that the water hyacinth problem was not as serious as it was in the nineteen seventies and eighties and consequently, the water loss would be less than previous estimates. The One System Inventory (ENTRO, 2007) felt that there would still be water lost due to the presence of water hyacinth in the White Nile reaches, and hence an updated investigation was required into the ecological and climatological impacts that could be trigger by a second, even more severe, episode of infestation.

### *Season flooding and waterborne diseases*

Most of the lowland areas are susceptible to riverine and rainfall flooding. This has led to an increase in waterborne diseases as bush toilets and animal dung become flooded and mobilising pathogens into water supply systems (Muso, 2011).

## Preliminary Conclusions and Recommendations

Although most of the previous studies concluded that water quality is not yet a problem in the Baro-Akobo-Sobat system, there are worrying signs of impacts that could, cumulatively, start to have a negative impact on water users in the basin. These include:

- Localised impacts of solid waste and wastewater impacts from urban and rural settlements,
- Oil exploration and extraction in the *Machar marches* and its potential impacts on water pollution and flow diversion,
- Deforestation in the Ethiopian highlands and the impacts on sediment loads in the rivers draining the highlands,
- The general poor state of flow and water quality monitoring in the basin; a prerequisite for management decision making,
- Future construction of hydropower projects and flow regulation in the Baro system,
- Artisanal gold mining in the highlands and the impacts on sediment loads and trace metal pollution, and
- Invasive aquatic weeds impeding navigation and impacting on the dissolved oxygen concentrations in the water.
- Fisheries is an important economic activity and an important source of proteins to communities living close to the rivers and wetlands (Sebuliba, 2012). Strategies to protect aquatic ecosystems would therefore contribute strongly to protecting this important resource.

All available water quality data will be assembled and analysed by the environmental team and put onto the project's database. This is an intensive effort and the examination of many old reports and databases since it is understood that there will be significant gaps in many part of the basin, particularly in the South Sudanese part of the basin. .

### Land Use Classification

The classification of land use is useful for many applications within the baseline since the various issues, challenges, threats and opportunities will often be related to the land use in an area. Land use classification can therefore play a role in planning basinwide

Remote sensing applications using satellite imagery will pay a prominent role **(see box here after on application of remote sensing for this study)**

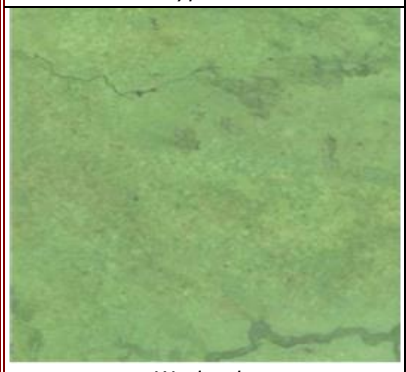
**Application of Remote Sensing**

**Possible approach to satellite imagery-based landuse classification (see example**

*Intensive slash and burn area*

*River-type features*

*River –type features*



*Wetlands*

*Bedrock*

*Bare ground*

| Code | Type | Sub type | Class |
|---|---|---|---|
| 1 | Artificialized areas | | |
| 1.1 | | Main urban areas | |
| 1.2 | | Activities and communications | |
| 1.2.1 | | | Main industrial area |
| 1.2.2 | | | Roads and main trails, railways |
| 1.2.3 | | | Airfields |
| 2 | Agricultural areas | | |
| 2.1 | | Areas growing traditional crops | |
| 2.2 | | Areas growing industrial crops, plantations | |
| 3 | Natural habitats | | |
| 3.1 | | Forests | |
| 3.2 | | Shrub and herbaceous vegetation, savannah, tree savannah | |
| 3.3 | | Gallery forest, ripisylve | |
| 3.4 | | Open spaces | |
| 3.4.a | | | Rocky outcrops |
| 3.4.b | | | Bare ground |
| 3.5 | | Wetlands, floating vegetation | |
| 4 | Water-covered areas | | |
| 4.1 | | Inland waters | |
| 4.1.1 | | | Watercourses and waterways |
| 4.1.2 | | | Waterbodies |
| 4.1.3 | | | Limits of flood waters (when visible on imagery) |
| 5 | Intensive slash-and-burn areas | | |

During the course of the Inception Phase work on a land-use classification has already started in order to inform both the preliminary scoping exercise and the baseline report.

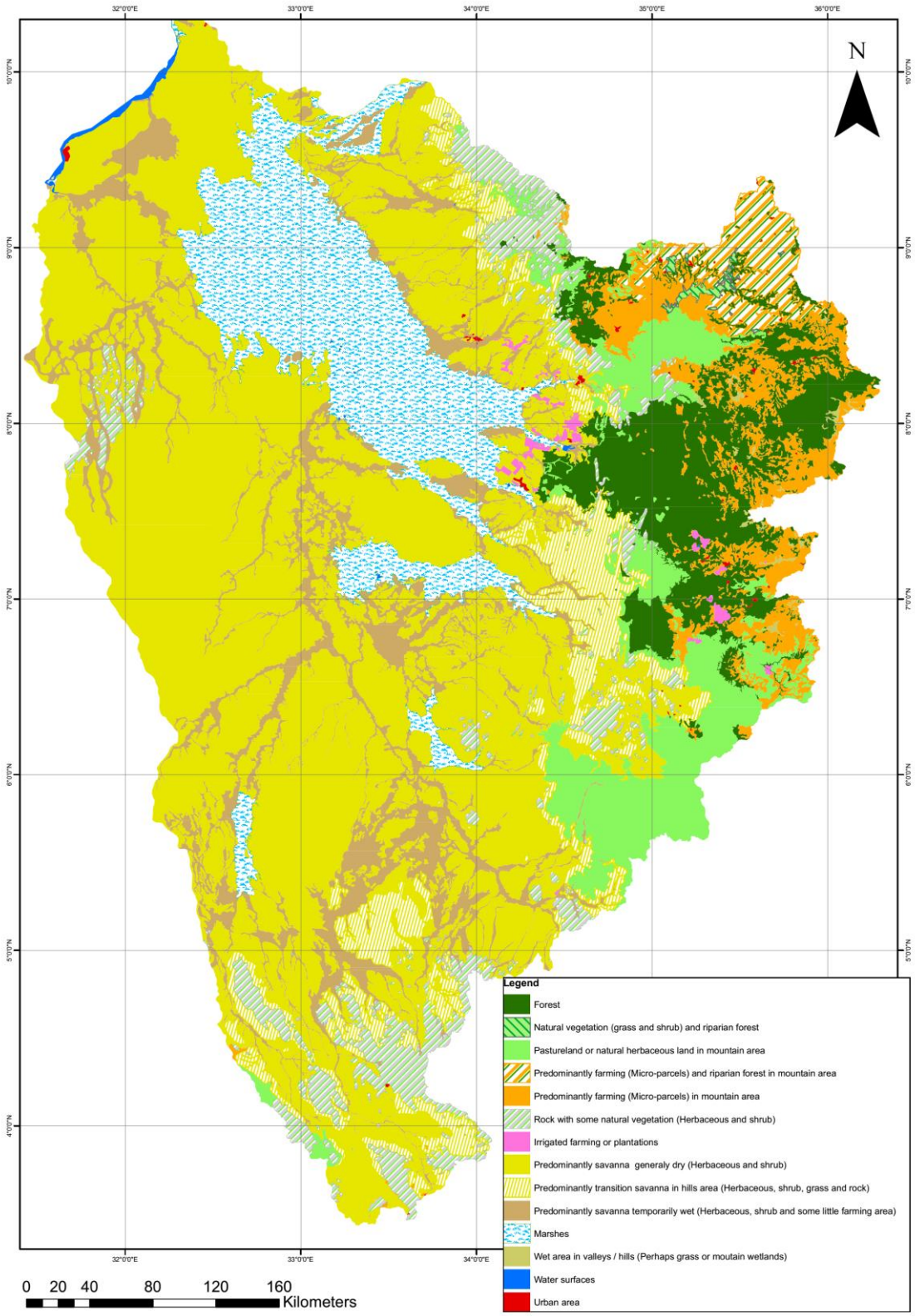



*Figure 5-15: Draft land-use map*

### WATERSHED AND EROSION PROCESSES

## Overview

In view of the fact that the large majority of the population depend on the good condition of the watershed, it is a given that watershed management interventions will form a key component of any the IWRDMPlan. It is understood that ENTRO is already engaged in the Regional Watershed Management Project which aims to establish sustainable management of watersheds on the Tekeze, Atbara, Mareb, Abbay/Blue Nile and the **Baro/Akobo/Sobat r**ivers. The initial project sites identified include Lake Nasser/Nubia in Egypt and Sudan; Jamma Reb, and Gumara in the Lake Tana sub-basin of Ethiopia, and Atbara, Ingessena and Dindir National Park in Sudan. It is understood therefore that there are currently no sites in the BAS Basin.

The application of remote sensing will greatly assist in getting a good picture of the condition of the watershed basin-wide **(see box on application of remote sensing for this study overleaf)** and can therefore guide the identification of priority areas for action.

There is obviously a strong link between the condition of the watershed and resultant erosion and anthropogenic factors. In most parts of the basin this means agricultural activities, generally subsistence in nature.

## Watershed Management

During the Inception Phase a reconnaissance visit was made to the highland areas of the sub-basin in both Ethiopia and (to a more limited extent) South Sudan. This reconnaissance had two main purposes, i) to better inform this methodology and ii) to provide the first necessary elements for the scoping and baseline reports. In the following paragraphs only the findings as they relate to justification of the methodology and the proposed ay forward for informing the baseline report are included.

### *Main Documentation and Data*

Two main documents relating specifically to BAS have been obtained and studied:

- Executive Summary of the Baro-Akobo Basin by TAMS/ULG in 1997 and
- CRA (Cooperative Regional Assessment) for Watershed Management, Trans-boundary Analysis, Country Report, Ethiopia by ENTRO/Tecsult et al in 2006.

The latter is the more informative document since it is more recent and concentrates on watershed management. It, together with information obtained during the reconnaissance visit, will form the basis for the scoping phase.

In addition to documentation specifically concerning the BAS basin, information relating to recent developments in watershed management approaches in Ethiopia has been obtained during the Inception Phase. It is known that WFP's MERET programme is winding down and has been superseded by MoARD's Sustainable Land Management Programme (SLMP) that is now starting phase two (SLMP 1 ran from 2009-2013 and SLMP 2 will run from 2014-2018). A meeting was held in the MoARD with SLMP officials and the Project Implementation Manual (PIM) obtained. Copies of the MoARD's Community Based Participatory Watershed Management Guidelines (the basis for all soil and water conservation and watershed management in Ethiopia) were also obtained.

Additional general information regarding MERET and SLMP 1 outcomes and the Mass Mobilisation programme, as well as BAS specific wetlands and historic resettlement documents and information are in the process of being obtained by the local consultant.

The Consultant now has good idea as to what data are available and from where they can be collected in the future. The CRA describes and maps relief, vegetation, land cover/land use, soils, erosion hazard and human settlement and describes the distribution of erosion and the state of the environment. However this information is now at least 10 years old and it is proposed that a new assessment be undertaken with more recent data and information where available. Remote sensing will assist in the updating process. This relates particularly to the use of the more detailed DEM (Digital Elevation Model) for erosion hazard assessment and for more recent population data at Kebele level. The availability of key information is discussed below.

### *Key Stakeholders*

As indicated above the inception phase input concentrated on a field visit rather than meeting stakeholders at federal or regional levels. The team met with stakeholders at zonal and woreda levels in Bench Maji, Shaka and West Wellega Zonal offices at Mizan Teferi, Masha and Gimbi respectively and also with woreda officials at Menit Goldiya woreda in Bachuma and Menit Shasha woreda in Jammu.

At the national and federal levels, meetings were held with ENTRO staff who were debriefed on the reconnaissance visit, with MoARD SLMP and LIFE project staff and a representative of MoWR accompanied the field trip.

### *Reconnaissance Field Trip*

The reconnaissance field trip took place between 16-21 June travelling between Addis Ababa, Jimma, Mizan Teferi, Jammu, Tepi, Masha, Metu and Gimbi before returning to Addis Ababa. The main objective of the trip was to gain an overview of conditions in the upper basins of BAS and to meet with zone officials regarding land and watershed management issues in their area.

The main findings are briefly presented here because they have an influence on the methodology going forward.

- Land Cover/Land Use in the upland areas of Ethiopian BAS basin is largely Forest (with or without coffee) and cultivation. The degree, extent and type of cultivation varies but in general, the more cultivation the greater the land degradation
- The main land issues reported by zone and woreda staff centre on deforestation for cultivation although the rate is generally reckoned to be quite low and that in general there is an appreciation by land users of the value of maintaining forest cover not least as shade for coffee cultivation
- The high rainfall and hilly topography, coupled with increasing population pressure is leading to an increase in land degradation in the absence of soil and water conservation interventions. There is a trend to convert grazing land to cultivation. Wetlands are an important feature in many areas.
- Mass Mobilisation initiatives have been seen to be effective in other parts of Ethiopia and are in the process of being adopted in the BAS uplands. To date, though, soil and water conservation interventions are small and piecemeal.
- Watershed management interventions are welcomed but not all steps of watershed management guideline are always followed meaning that priority concerns are sometimes not addressed. Need to address priority concerns as ‘entry points’.
- Markets are an issue since farmers need to be able to market excess produce to attain livelihood gains. Co-operatives do exist but they are often weak and constrained by poor access. World prices are as important as local ones, currently forests are protected by the high price of coffee but this could change if the price falls.
- There were no MERET (WFP led watershed management interventions) woredas in the area since these are concentrated on highly degraded and food insecure woredas. There were 4 SLMP Phase 1 woredas in BAS: Gambella, Abobo and Godere in Gambella Region and Geba (Metu) in Oromiya Region. There are 3 SLMP Phase 2 woredas proposed for the BAS basin: Shey Bench and Menit Goldiya in Bench Maji Zone and Masha woreda in Sheka Zone of SNNPR.

- Land Certification penetration is variable with some woredas and zones reporting complete 1st level coverage and others very little or none. There are no areas where 2nd level certification, which requires the mapping of individual plots, has taken place. Zone and woreda staff see certification as a useful tool in land management.
- Two main **'hotspot'** areas for watershed management interventions have been identified:
  - **Menit Goldiya and Menit Shasha** woredas in Bench Maji Zone of SNNPR in the upper Akobo sub-basin where shifting cultivation of maize coupled with a bimodal rainfall pattern and no soil and water conservation interventions make the area high risk and
  - Yubdo, Ayra, Guliso, Haru and Genji woredas in West Wellega Zone, Oromiya in the Bir Bir catchment where increased population pressure on convex hilltops with minimal soil and water conservation interventions is leading to land degradation.
- The identification of other hotspots will be completed as part of the Scoping Exercise.
- The classification of hotspots will have to take into account the need for action, not only in terms of physical factors such as erosion-risk, but also the need for improved farming practices from the livelihood enhancement perspective.

### *Methodology going forward*

The information required for the description and mapping of watersheds in the BAS is largely that used in the CRA with the exception of the assessment of erosion hazard and population density. As indicated above a new assessment of erosion hazard to assist in the identification of vulnerable and degraded areas will be undertaken.

This could use the Revised Universal Soil Loss Equation (RUSLE) which is derived from the Universal Soil Loss Equation (See Text Box) adapted to Ethiopian conditions by Hurni (1985) from research and data collected in SCRP stations with factors subsequently updated and/or reassessed by the Abbay Master Plan (BCEOM-MoWR 1998), the Woody Biomass Project (Tecsult 2004) and Nyssen et al 2004.

**Universal Soil Loss Equation**
A=R*K*L*S*C*P
where
A=total soil loss (t/ha/yr)
R=Rainfall Erosivity factor
K=Soil Erodibility factor
L=Slope length factor
S=Slope gradient factor
C=Land cover factor
P=Management factor

Since the aim of the erosion hazard assessment is to assess *relative* erosion hazard for use in catchment selection for watershed management intervention the actual rate of soil loss is not as important as indicating relative rates of soil loss. For this it is considered that the RUSLE will be suitable.

Information for use in the RUSLE will come from the following sources:

- **Rainfall** - Mean annual rainfall data available from NMA
- **Soil** - Ethiopia Soil Information System (SIS), Ethiopia National Soil Map (2000)
- Slope length and gradient – 30m DEM
- **Land Cover** – WBISPP or more recent data if available
- **Management** – Hurni (1985) updated by Tekeze Basin Study

Information from other sources will be used to define other criteria that may be used in a screening process in addition to the Erosion Hazard Assessment to identify areas of particular concern. These could include the criteria summarized in Table 5-4.

*Table 5-4: Possible criteria for screening process*

| No | Criterion | Measure | Information Source |
|---|---|---|---|
| 1 | Erosion Hazard | Soil loss in tons/ha/year from Erosion Hazard Assessment | Derived from project erosion hazard assessment incorporating rainfall, slope, soil, land cover and management data |
| 2 | Accessibility | Distance to road | Computed in GIS from ERA data |
| 3 | Urban Market Access | Distance to market | Computed in GIS |
| 4 | Downstream Impacts | Presence/absence of MoWR investments | Information from MoWR |
| 5 | Groundwater Recharge Potential | Permeability of Geological Strata | Derived from Recharge Potential Map |
| 6 | Fragile Ecosystems (Forests/Wetlands) | Presence of forests and wetlands | Derived from WBISPP land cover data, corroborated by EWDA |
| 7 | Intervention Suitability | AEZ variability, number of suitable soil and water conservation interventions per area | Derived by project incorporating AEZ, soil, slope and land cover data and MoARD soil and water conservation guidelines |
| 8 | Land Fragmentation/ Labour Availability | Population density | Derived from kebele population density data |
| 9 | Current Land Use | % cultivated area | Derived from WBISPP land cover data |
| 10 | Livelihood Impact | Presence/absence of food security project/programme by woreda | Data from MoA |

***Steps for Identification of priority areas for watershed management interventions.***

This will be based on an Erosion Hazard Assessment and other criteria which can be discussed with ENTRO in the next phase. Possible steps are:

i. GIS to identify sub-catchments using 30m DEM
ii. Undertake erosion hazard assessment as outlined above
iii. Overlay sub-catchments onto erosion hazard assessment
iv. Convert to a single Erosion Index for each sub-catchment
v. Assess current activity using kebele population data to map population density
vi. Overlay administrative boundaries to identify target woredas
vii. Overlay existing SLMP 1 & 2 woredas
viii. Undertake selection analysis

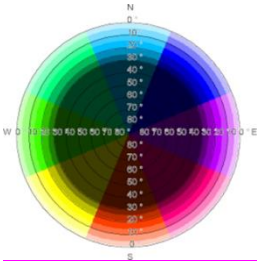
**Application of Remote Sensing**

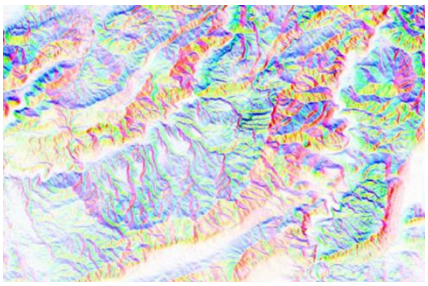
## Analysis of erosion and risk in relief - Output on slopes, direction and shading

Using the 30m DEM, after cleaning, the Consultant will produce the output that will allow improved analysis of erosion risks, the hydrographic context and the fault and fracture system.

### Slopes

The DEM output can be directly used for topographic and geomorphological analysis and to examine the links between altitude, soils and geomorphology.





The slopes and directions are shown on a single map which uses colour to indicate the direction of the slopes and colour intensity to indicate their steepness. Thus, very slightly sloped areas are white and steep slopes are black; this makes the information easier to read

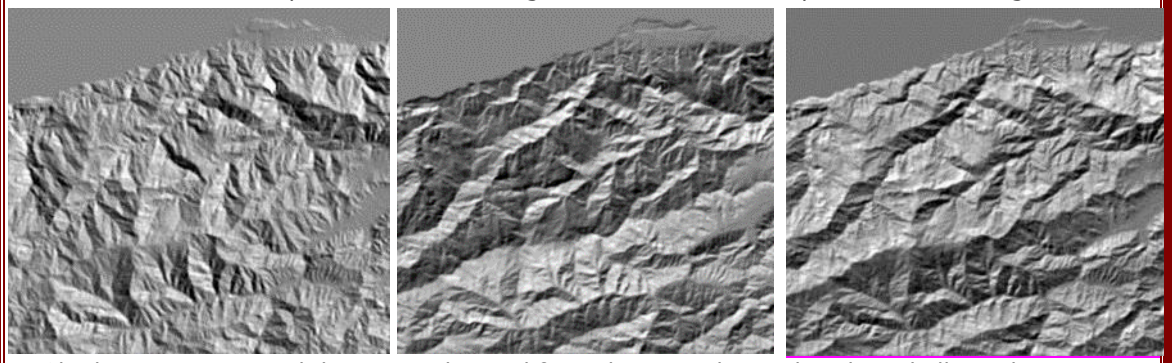
### Steepness of slope

It depends on topography and facilitates runoff.

- water tends to stagnate or seep into flat or slightly sloped ground under the influence of gravity.
- on sloped ground, under the same influence of gravity, the droplets of water flow towards the lower lying points. The steeper the slope, the faster the flow velocities. As the difference between flow velocity and seepage velocity increases, so does runoff.

### Shading

Based on the DEM, it is possible to generate shading depending on the direction. Shading, among others, enables the interpretation of fracturing and formations in the presence of lithological units



*Shading variations and directions obtained from the DEM The angle selected allows the user to highlight certain directions better*

This type of shading can also be used to produce altitude maps using false colours that are easier to read than those using textureless solid tints, as can be seen in the examples above and below. These maps are often used as a base for features such as fracturing so that it is easier to relate morphology with fracturing.

*False colour altitude maps superposed on top of the DEM (far left). Topography - colour transparency system superposed on top of the DEM with shading (near left)*

## HYDRAULIC CHARACTERISTICS OF MAJOR RIVERS AND RIVER MORPH DYNAMICS (RIVER GEOMORPHOLOGY)

Reports and readily available data, satellite images **(see box on application of remote sensing for this study further)** and surveys are being used to characterize the river hydraulics and fluvial morphology. Work is already well underway on this task.

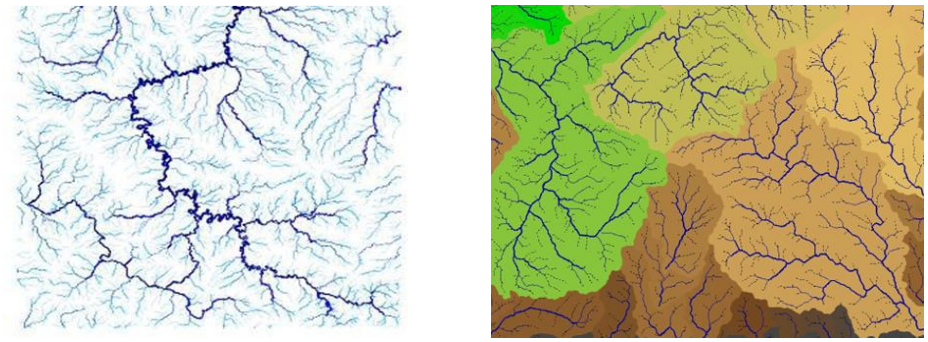
### Application of Remote Sensing

#### Output on the hydrographic system and watersheds

Once again using the 30m DEM, after cleaning, the Consultant will produce the output that will allow improved analysis of the hydrographic context, the fault and fracture system and aspects related to river geomorphology. The layers providing information on the hydrographic system, watersheds and divides can be automatically generated from a DEM. The data is cleaned up and rectified by comparing with the images.

**Slopes**

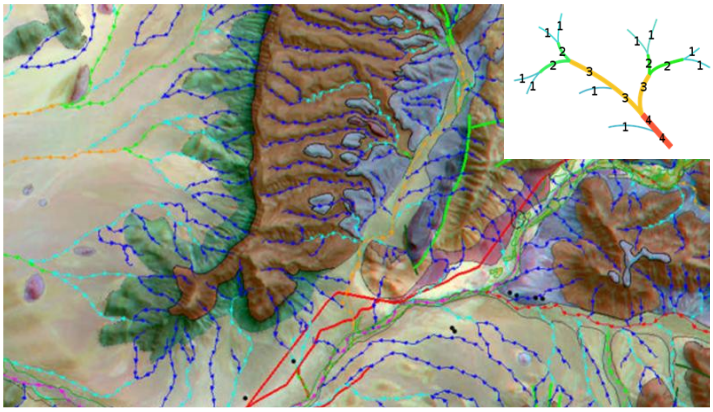
The DEM output can be directly used for topographic and geomorphological analysis and to examine the links between altitude, soils and geomorphology.



*A rectified hydrographic system (far left) and its associated watersheds (near left)*

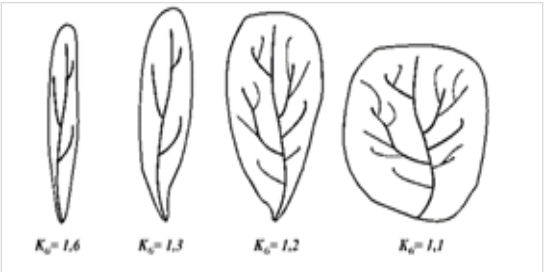
It should be noted that the rectification work will only concern watercourses numbered 1 according to the Strahler stream order. It is a fact that, considering the resolution of the DEM (30m) that is available, it is usually impossible to reproduce a coherent system automatically from a single DEM.

**Stream order and direction**



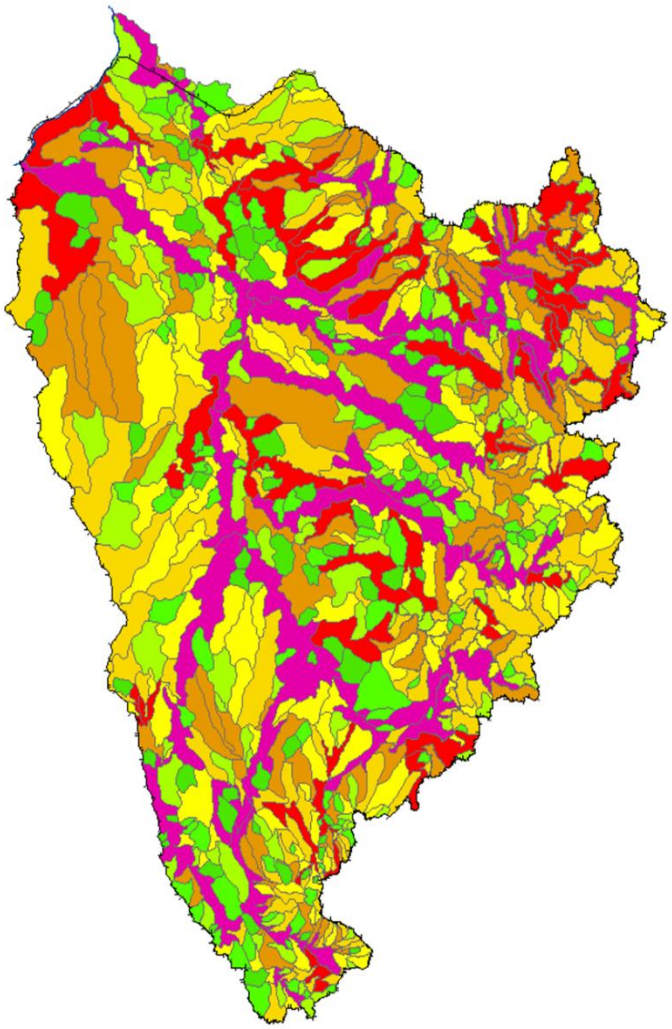
Stream hierarchy will mainly be established using the Strahler stream order classification. All main streams (referred to as segments) without tributaries are numbered 1; segments comprising a confluence of two other segments numbered N are given the number N+1, and segments comprising the confluence of two segments from different number-categories keep the highest number-rating of the two.

**Watershed quantification**




Automatic GIS quantification of these elements based on the 30m DEM provides multi-parameter information about the watersheds present: length, height range, average slope, surface area, compactness (Gravelius index), etc.

The shape of the watershed is typical of the stream velocity. When used in this manner, the Gravelius index makes it possible to interpret part of the possible hydrological functioning of a watershed.



In light of the limited existing information on sediment data and sediment yields, the SHETRAN model will be used for modelling of sediment yields of the sub-catchments of major rivers based on regional data, and by considering current land use. A general characterization of the river hydrodynamics and floodplain links and spills will be carried out by considering the river slope and shape, main channel and floodplains, hydraulic roughness (riparian vegetation) and hydrographic connectivity. In the fluvial morphological characterization, sediment transport, deposition and erosion will be evaluated for different flow (and flood) conditions, considering the bed material, river type, channel patterns etc. based on a simple MIKE 21 C hydrodynamic and morphodynamic model. The improved 30m SRTM DEM in conjunction with remote sensing data (e.g. satellite imagery) will be used to configure and calibrate the model in the floodplain and wetland areas. Specific aspect to be addressed include links between river channels and wetlands, seasonal variations in the areal extent of wetlands and potential morphological changes due to development interventions. It is important to note that the resolution and accuracy of the model will be dictated by the DEM quality and will not be at the same level as a model based on LiDAR and/or manual survey information. The fluvial morphological assessment will be focused on reaches where potential investments are identified. .

*Figure 5-16: mapping of Gravelius's index KG,*

## WETLANDS, WILDLIFE AND BIODIVERSITY

Wetlands in the basin will be inventorised and classified in terms of their condition and degree of exploitation. Where degradation has or is taking place the causes will be investigated. At the end of the exercise a complete classified inventory of wetlands will be available. Satellite imagery will be used to ensure that all of the basin is covered. Of special interest are the *Machar marshes* in South Sudan and use will be made of the study carried out by Water Watch for ENSAP in 2004. This project made extensive use of remote sensing to map the wetlands as five main bodies using NDVI. This work will updated using the satellite imagery acquired as part of the proposed remote sensing work.

Adequate consideration of the *Machar marshes* will be central to any version of the IWRDMPlan. At present the way the hydrology of the marshes and the related river systems is not adequately understood. Getting this understanding is fundamental to the sustainability of any development plan. In the scoping phase options for getting a better understanding of this hydrology will be outlined.

Using the remote sensing applications a draft map of all wetland areas has already been drawn up (see Figure 5-17).

The BAS sub-basin hosts outstanding biological and ecological phenomena and supports livelihoods for the BAS population who almost entirely relies on BAS natural resources. Key environmental features of the BAS can be summarized as follows on wildlife and biodiversity:

- A large part of the BAS belongs to a specific ecoregion of Africa, known as the *Sudd Flooded Grasslands*, which falls into the category called "globally outstanding" (maximum biological distinctiveness index).
- The major part of the BAS is made of large floodplains with permanent and seasonal wetlands.
- The BAS hosts one of the most important mammal migrations in the world.
- The BAS hosts the Nile lechwe endangered species which is present only in the Sudd swamps, in the *Machar marshes* and in the Gambella region.
- The BAS is situated on the major birds migratory routes between Africa and Europe and hosts an important population and diversity of birds.
- The BAS vegetation and floodplains offers grazing pasture to feed cattle and replace crop resources for human population when food stocks are low at the end of the dry season.
- The BAS forests "exhibit a wide variety with 8 types of forest" but "these forests are recognized as being less rich in avifaunal diversity than the woodland-shrubland habitats". However they host a wide diversity of wildlife.
- Effective biodiversity conservation and protection is very low in the BAS.

Fieldwork on wildlife and biodiversity is not appropriate for the SSEA, considering the scope of the study and the scale of the BAS sub-basin. An exhaustive bibliography review and the consultation of the main stakeholders and NGOs strongly involved in monitoring and conservation programs, already engaged, will be extended. Furthermore, the scoping report will aim at indicating where field work may be required and in connection with what potential developments (short term projects for example).

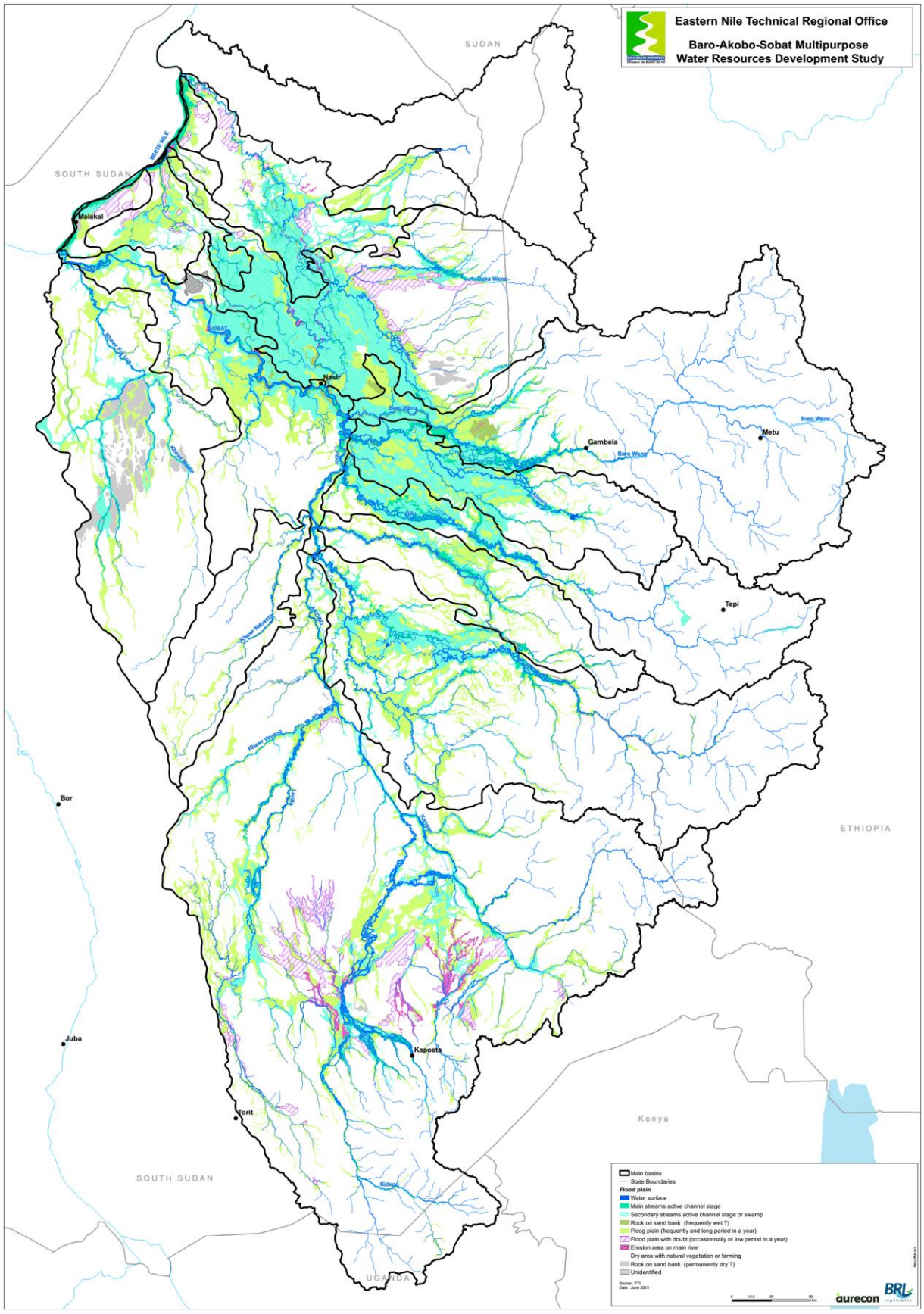



*Figure 5-17: Mapping of wetlands in the BAS*

### 5.2.4.3 Development of water resources – C1.3b

#### INTRODUCTION

This part of the baseline is aimed at getting a clear picture of the current status of development of water resources. The analysis is being carried out largely along sectoral lines and is once again making use of the **application of remote sensing**.

#### WATER INFRASTRUCTURE

Data and information on water infrastructure are required for configuration of water balance and/or hydrodynamic models in the pilot areas. The NBI has compiled an inventory of major impoundments in a Microsoft Access Database. The database contain information on reservoir storage-elevation-volume curves for pre- and post sedimentation scenarios of existing and planned reservoirs. This database will be supplemented with information available from the ENTRO database.

The **satellite imagery mapping exercise** will be used to generate an inventory of water infrastructure basin wide. A linked database, compatible with the above-mentioned NBI database will include a classification of water infrastructure in terms of physical characteristics, purpose and the water abstraction/diversion characteristics associated with it.

Typically the sort of information that will be collected will be:

- For Dams:
  - Name
  - River
  - Quaternary catchment (sub-catchment)
  - Full supply capacity (plus area/volume/stage relationships and operational rules where available)
  - Dead storage level
  - Maximum spillway capacity
- For pump stations and diversion structures:
  - Name
  - Location and water source
  - Capacity
  - Annual water demand
- Pipelines/canals:
  - Name
  - Length
  - Location and water source
  - Capacity
  - Annual water demand

**All this information will be georeferenced and included in the project GIS database**. One of the main uses for this information will be in the building of the water resources balance or allocation model. If Mike BASIN is used for this purpose the spatial database can be easily linked since Mike BASIN runs on the ARCGis platform.

## AGRICULTURE

The main agricultural land use systems in the BAS sub-basin in Sudan and Ethiopia are relatively distinct except along the international border. The economy, largely based on traditional methods of plough cultivation and supplemented by the hoe in the lowlands, is subsistence oriented.

Three mains broad systems can be identified in the BAS sub-basin: (i) rainfed cropping, (ii) high forest and (iii) extensive livestock production (with minor cropping). Differences in the scale of operations, tenure type and to a lesser extent cropping patterns give rise to a number of recognizable sub-categories.

Farm employment (combining crop and livestock production) constitutes the primary source of occupation for the population. The communities in the basin (both in Ethiopia and Sudan) have very limited experience in accessing cash income because of the remoteness and inaccessibility of the BAS sub-basin region from regional market centres and hence employment is concentrated in the production of primary commodities. There is very little use of the basin and its tributaries for irrigated agriculture (except some traditional methods of water diversion).

In view of the challenges in access to the field, especially in the South Sudanese part of the basin, the first task will be to ensure that all available existing information is collected and consolidated on a common platform. Key source of information will be:

- Past experience in agricultural and rural development in the region;
- Existing baseline from ENTRO;
- Synthesis of the international and local (NGO) agricultural support programs (FAO, UNHCR, USAID, Oxfam, ACORD, ACTED, etc.;
- International and regional experiences on rainfed cropping, forest management and extensive livestock production.

The classification of land uses was already introduced earlier. One of the key purposes of this classification will be to inform understanding of the agriculture sector. The use of satellite imagery will allow a clear classification of agricultural land into current use patterns.

Many of the existing irrigation schemes will be visited where possible, and mapped on the project database. For the situation in South Sudan, current knowledge is minimal. However, it is anticipated that the Consolidated Agriculture Master Plan and associated Irrigation Master Plan studies will go a long way to improving this knowledge.

## LIVESTOCK

In semi-arid to arid conditions, pastoral livestock becomes predominant. Livestock as a source of livelihood is especially important for the South Sudanese side of the basin population where there exists a high concentration of cattle, sheep, and goats. Generally, it seems that combining crop and livestock production followed by ‘crop only’ farming and ‘livestock only’ production are main livelihood strategies undertaken by the basin population in that order.

To evaluate the livestock situation in the BAS sub-basin, the same methodology as the one presented for the land use and agriculture will be developed.

It is often a challenge to get accurate information on livestock numbers and different approaches may have to be used to cross-check data. One which the consultant has used successfully in other countries, is to make use of data held by organisations such as veterinary services.

Access to the Consolidated Agriculture Master Plan for South Sudan will facilitate this task

### WATER SUPPLY AND SANITATION

As already mentioned earlier in this action, the existence of water supply and sanitation systems will be inventorised under the analysis of water infrastructure around the basin. This information will be verified as far as possible during visits to the field and through the use of satellite imagery.

The other part of this task will be to assess levels of improved water supply and sanitation in the basin. It is estimated that between 50% and 60% of the population of Southern Sudan has access to an improved water source, such as a hand pump, a protected well or – for a small minority - piped water supply. However, the levels of coverage are likely to be considerably lower in the basin. Getting good information on this may be a challenge and full use will be made of the South Sudanese focal point within the team and interaction with the authorities in Juba.

Ethiopia is among the countries that have subscribed the Millennium Development Goals (MDGs). Target 10 of MDGs is to halve by 2015 the proportion of people without sustainable access to safe water and basic sanitation. In a study (Getnet Alemu and Edilegnaw Wale (Editor) & Ethiopian Economic Association/Ethiopian Economic Policy Research Institute, 2013) describing the water supply and sanitation coverage in Ethiopia it was shown that the water supply and sanitation coverage in Ethiopia was one of the lowest in the world 39.4% and 11.5% respectively in 2004. 63.9% of water came from unprotected sources compared to 35.9% from protected well/spring, public and private tap. The situation in many parts of the basin is likely to be below the national average.

The Government of Ethiopia accepted the Millennium Development Goals to provide water supply and sanitation for 37,917,142 and 43,800.000 people by 2015, corresponding to 70 and 56% and has made good progress towards realizing these goals.

In this study, the Consultant will attempt to get a more accurate assessment of current levels of improved water supply and sanitation within the basin in order to identify the gap that still remains. Good progress with this task has already been made during the Inception Phase.

### ENERGY

The following information will be summarised for the different part of the basin:

- Current levels of dependency on different energy sources will be estimated using the available information,
- Levels of electrification in rural, peri-urban and urban areas,
- Ongoing electrification initiatives,
- Energy production by source and location.

### NAVIGATION

Navigation is particularly important to communities in the lower part of the Baro River. During the rainy season, when the water level of Baro River increases, river navigation is the main mode of transportation among the two countries along Gambella region although the Government of Ethiopia is currently upgrading the existing Gambella-Lare-Jikao road to a tarmac road. The maintenance of navigation routes is important for the food security with several major markets dependent on produce transported by river.

**Application of Remote Sensing**

**Navigation**

- Depth and shape of riverbed as related to river morphology
- Alluvium storage zones (deposits, banks)
- Floating vegetation
- Depending on the images available, the regularity of the watercourses
- Presence of traditional boats
- Existence of ferries
- Rapids

The main source of food commodities supplied to the Sudan border along Gambella is Ethiopia, where almost 90 % of the supply comes from Mechara, Bonga, Masha, Nekemte, Mettu, Weliso, Tulubolo and Addis Ababa. For destination markets on the border the most important route is from Gambella to Burbe via Matar because of its accessibility by **river** and road.

### 5.2.4.4 Project GIS and database – C1.3c

All the data collected is being centralised and logically stored on the project GIS and associated database. The GIS layers will be compatible with ENTRO GIS system. Outputs can be accessed via the project extranet.

The metadata will be clearly presented and an index page for the GIS database formulated to facilitate access.

All the information and imagery collected and processed by the teams remote sensing specialist sub-consultant will be pulled in the project GIS.

### 5.2.4.5 Modelling water resources (allocation) – C1.3d

#### OVERVIEW

The approach to the hydrological modelling of the BAS sub-basin will be informed by a detailed evaluation of available models and hydromet data, supplemented with remote sensing data. Modelling will entail rainfall-runoff and water balance modelling, which will provide analytical tools for the evaluation of development and management scenarios. A customised water balance model of the BAS sub basin will be constructed for this project. The final model resolution and configuration will be dictated by the hydrographic network, links between rivers and floodplains, spatial availability of hydromet data, locations of gauging stations and proposed schemes and vertical accuracy of the DEM. Daily time step, lumped conceptual rainfall-runoff modelling will also be undertaken. Final model parameter sets will be derived by a conventional iterative calibration procedure based on assessing the goodness-of-fit of simulated flows with observed flows via a range of objective functions. The model will simulate rainfall-runoff processes, irrigation water use, evaporation and seepage losses, spills and links between the river channels, floodplains and marshes limited groundwater-surface water interaction etc. During the modelling, cognisance will be taken of localized variation in precipitation and any notable higher precipitation areas will be incrementally modelled to account for any significant variation in mean annual precipitation.

**Review of draft methodology**

Although there are no significant changes to the methodology from that presented in the draft Inception report, the methodology has now been clarified, in particular with respect to the use of hydrodynamic modelling

The main purpose of the water resources modelling task is to assess the water balance along the major rivers in the Baro-Akobo-Sobat Basin and the impact on the White Nile and Main Nile Rivers downstream of the confluence, under both current (baseline) and future development scenarios / management options. Furthermore, the modelling will inform the evaluation of hydrological and related economic, social and environmental impacts resulting from water resource developments in the Baro-Akobo-Sobat Basin. This will be achieved through the application of water resource based models and will entail the following key activities:

#### MODEL SELECTION

One of the most important elements in any modelling process is the selection of the most relevant and appropriate model(s). This decision should be guided by a clear understanding of the purpose of the modelling, the type, accuracy and precision of required model output, spatial and temporal requirements for model configuration, the availability of relevant and accurate input data which are required to 'build' the model and the availability and quality of observed data to be employed in model calibration and validation.

Over the last number of years, various water resources models of the Nile Basin and/or the Baro-Akobo-Sobat basin specifically have been developed and applied in order to assess the water balance in the system, to evaluate the availability of water for future development, and to analyse alternative development scenarios and management interventions. These models were developed as part of the Flood Preparedness and Early warning Project, the Joint Multipurpose Program, the Eastern Nile Planning Model (ENPM) Project, the Regional Power Trade Investment Program, the Eastern Nile Irrigation and Draining Study, the Eastern Nile Watershed Management Project and various other research and *ad hoc* studies.

As part of the ENPM Project for example, various knowledge bases, toolkits and modelling tools were developed with the specific aim of informing integrated water resources planning within the ENTRO region by providing analytical insights into the resource management and investment options in the Eastern Nile in a multi-sectoral regional context.

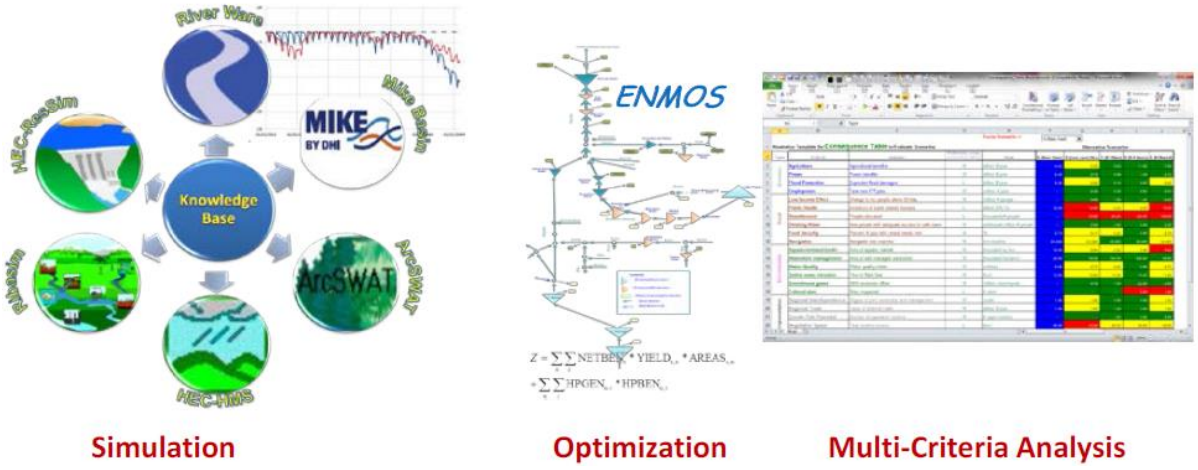



*Figure 5-18: Models developed under the ENPM project (World Bank, 2013)*

The models which were developed under the ENPM project included simulation, optimization, and multi-criteria tools and are summarised as follows:

- **Soil and Water Analysis Tool (SWAT):** A monthly time step SWAT model was developed and calibrated using public domain datasets for the entire Nile Basin, with a focus on Eastern Nile scenarios. Data collected as inputs to the model include a digital elevation model, land use, land cover and soil maps and weather data. Simulations were performed for forty years (1960 to 2000).
- **RIBASIM**: A monthly time step calibrated RIBASIM model was developed for the Eastern Nile and used to analyse future scenarios of changing water demands, water infrastructure, agriculture, climate change, land use change and management scenarios. Flows were synthesised from 1900 to 2002.
- **RiverWare:** A monthly time step model was configured for the Eastern Nile Region and used to analyze a number of scenarios, particularly related to Blue Nile mainstem projects and their impacts downstream under different filling and operating rules. Simulations were performed from 1956-1991.
- **HEC Suite**: Various HEC models were configured for the Eastern Nile region including the development of a monthly time step HEC-ResSiM model to explore the impacts of water infrastructure on system hydrology using the historical time series data for BAS sub basin from 1954 to 1980. In addition, daily time step HEC-HMS and HEC-RAS models were developed as part of the Eastern Nile Flood Season Monitoring program for the Baro-Akobo-Sobat Basin in Ethiopia and South Sudan.
- **MIKE Basin**: The monthly time step Mike Basin modelling system that was initially linked to the Nile DSS was used by ENTRO as part of the JMP1-ID project activities to optimise power production within the basin. The original model was calibrated based on observed flows at Gambella, Nassir and Hillet Doleib, while simulations were performed for forty years (1960 to 2000). As part of the original model configuration, long-term inflow sequences were generated upstream of proposed dam or hydropower sites and irrigation abstractions, while special attention was also given to the link between the Baro River system and the *Machar marshes* as well as to the interaction (spills) between the main river system and the large floodplains along the lower part of the basin.
- **Eastern Nile Multi-Purpose Optimization System (ENMOS):** This model entailed an optimization system that allows for selecting the optimal values for key decision variables (e.g. reservoir releases, cropping patterns, etc.) in order to maximize or minimize selected objectives (e.g. maximizing net benefits in the basin) subject to constraints (e.g. related to water, irrigated areas, budgets, physical infrastructure limitations, etc.). This model uses GAMS optimization software linked to an Excel Interface for inputs and outputs.

The specific purpose of the Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project demands that an accurate and detailed water resources model of the major rivers and proposed schemes in the Baro-Akobo-Sobat basin be developed, representing both current (baseline) and future development conditions. This model will be used to assess the water balance, to understand the spatial and temporal distribution of flow across the basin, to investigate links between the major rivers and floodplains, to assess climate change sensitivities and to inform the evaluation of hydrological and related economic, social and environmental impacts resulting from water resource developments in the Baro-Akobo-Sobat Basin under a range of scenarios. In addition, the model will be used in conjunction with the Nile Basin DSS to assess potential impacts of Baro-Akobo-Sobat developments on the White Nile and Main Nile Rivers down to Aswan Dam.

Although, in some way, all of the above models would be useful to inform this study, some of the models have obvious shortcomings. These mainly relate to the fact that many of the ENPM models were developed at a scale which is appropriate for application to the whole of the Eastern Nile Region as opposed to a local basin. As a result, many of the model networks are considered too coarse for the detailed evaluations to be conducted at sub-catchment level in the Baro-Akobo-Sobat Basin. This is echoed in the MSIOA Analytical Framework Report (ENTRO, 2014c), which states that *"[…] it is worth mentioning that the EN Basin Planning Model should not be used for modelling local complex water system, but only for the purpose of analysis at the scale of the entire EN region*". Other shortcomings of some of the above models include lack of detail with regard to spills and losses along the lower floodplains of the Baro-Akobo-Sobat system, incomplete analysis of future schemes for scenario modelling, inadequate simulation of stream flows in ungauged tributaries and the lack of rainfall-runoff modules, incompatibility with the NB-DSS.

The existing models have been reviewed and relevant aspects from applicable models, specifically the SWAT and RIBASIM models, have been earmarked for incorporation into a customised water balance model of the BAS sub-basin at an appropriate spatial and temporal scale Relevant input data from the existing models will be used to refine and improve the model to be developed For the purpose of this study, it is envisaged that the construction of the water balance model will entail the following sub-tasks:

- Refine subcatchment boundaries based on latest 30m DEM,
- Review and patch flow and rainfall records using observed and satellite based datasets,
- Improve rainfall-runoff calibration based on updated and patched rainfall and flow records,
- Refine approach towards simulation of synthetic flow sequences in upper sub-catchments and Pibor River tributaries,
- Improve conceptualisation of ponding, flooding, losses, spills and links in marshes and flood plains,
- Extend simulation period by means of rainfall-runoff modelling.

The recently developed MSIOA and NBDSS MIKE Hydro Basin models in conjunction with the NAM rainfall-runoff model will be used as base models for further refinement as describe above. he refined and improved baseline and scenario model will be imported into the latest version of the NB-DSS to inform the screening of development and investment options as part of the scenario evaluation phase of this project.

**It is important to note** that the screening of alternative development and management options and the assessment of these options (Tasks C1-5 and C1-6) will be based on the output of the water resources modelling task. **In order to promote synergy with the Nile Basin Initiative Secretariat (Nile-Sec) and to ensure the sustainability of the Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project, it is proposed that scenario evaluation and optimization related to water balance, water availability and allocation, irrigation, environmental and wetland management, reservoir filling and operations, hydropower and navigation be conducted with the NB-DSS framework**. In order to facilitate this process, it is proposed that the monthly time step MIKE Basin baseline and scenario models which were developed for the Baro-Akobo-Sobat and downstream basins as part of the project entitled "Data Compilation and Pilot Application of the NB-DSS" (NBI, 2012), and which have already been integrated with the NB-DSS, be used after having been refined as necessary. Where there is a need to investigate more localised water management issues related to water quality, flooding, catchment management, erosion and sediment control, it is proposed that a combination of other existing models might have to be employed on an ad-hoc basis, with the model outputs then still feeding into the NB-DSS. However, this approach will be discussed with ENTRO during the Inception Phase.

### DATA COMPILATION AND PREPARATION

Data compilation and preparation constitute a critical component in water resource development scenario analysis and relates to the collection, review, preparation and compilation of quality assured and relevant data sets which will improve confidence in water resource modelling outputs. Once the selection of models has been finalized, the next step under the water resource modelling task will therefore focus on the collection and pre-processing of data to be used as input to the models. Although most of the models listed above have already been configured and calibrated and used for simulations, it is possible that additional data might have to be sourced. Especially where development scenarios to be evaluated demand more detailed and spatially localized modelling.

The proposed approach towards the collection of relevant data as well as the most likely sources of data, to inform the water resources modelling task has already been described. Key types of data to be used as input to the water resource modelling include temporal hydro-meteorological data sets across the study basin (rainfall, flow, evaporation and temperature), spatial data sets on land use, land cover, topography and the drainage network and data related to the size, location and operation of existing and future bulk water infrastructure and abstractions. As part of the data task, historical rainfall and flow records will be screened and tested for stationarity, patched as necessary and processed to ensure compatibility with the selected water resource model(s). Data Quality Assurance and Quality Control procedures will be applied during the data compilation and preparation task. This would entail proper documentation of the source, lineage (processing steps) and quality of the data and models that are used. Typical data processing procedures include procedures for rainfall and stream flow gap filling and extension, model calibration and validation, processing and handling of spatial data sets, evaluation of model performance and metadata templates to document these.

### BASELINE MODEL CONFIGURATION

As far as possible, existing model configurations (as described above) of the Baro-Akobo-Sobat and White Nile / Main Nile systems will be used. However, refinements to the existing models will be required, especially where development scenarios and their impacts demand more detailed and spatially localized modelling. Using the existing models as starting point, a baseline model representing the current system will be configured. Specific attention will be paid to the accurate representation of subcatchments which have been earmarked for future development, the interaction between the main rivers system and wetlands e.g. the *Machar marshes* and attenuation along the extensive floodplains along the lower Baro River. It is envisaged that contributions from the Tekeze River, the Blue Nile River and Sudd outflows will be modelled as point inflows to this model.

Flow sequences will be generated for ungauged tributaries/subcatchments, while the feasibility of extending the hydrology will also be investigated. This will ensure sufficiently long flow sequences at key nodes within the system to be used during model simulations. A combination of monthly rainfall-runoff modelling (using observed rainfall and a calibrated model e.g. the NAM model) and the proportioning of observed flow records will be used for this purpose. Once the refined baseline model has been configured, the model will be calibrated and validated against observed flow records in terms of predefined model acceptance criteria. During this stage, care will be taken to ensure that the locations of potential future schemes are included in the baseline model as nodes.

## SCENARIO MODELLING

Having developed a baseline model configuration of the Baro-Akobo-Sobat and White Nile / Main Nile system, scenario models representative of the development interventions and/or management options to be evaluated will be developed. These models will typically involve modifications to the baseline model and allow the impacts of the various structural interventions and management options to be simulated. These would essentially entail the construction of multipurpose dams (hydropower, flood control, irrigation, water supply), the establishment of irrigation schemes and the implementation and optimization of operating rules to maximize trade-offs between environmental, economic and social impacts and benefits. The aim of the model simulations would be to investigate the impacts and benefits of water resource development interventions and management options in terms of hydropower production, water availability for irrigation, domestic and other uses, water efficiency, environmental flows, floodplain and wetland functioning, flood risk and inundation as well as sedimentation and river morphology . This will be assessed both in the Baro-Akobo-Sobat system as well as downstream along the White Nile and Main Nile Rivers.

An important consideration during the evaluation of water resources interventions relates to the quantification of environmental flows. For this study, a combination of hydrological index methods and holistic rapid assessment approaches will be used to obtain a first order estimate of the quantity and timing of environmental flows required to sustain ecosystems and livelihoods that depend on these ecosystems. The NBI-Sec will also be consulted to ensure alignment with the current basin-wide study on environmental flows.

### 5.2.4.6 Policies, legal and institutional arrangements – C1.3e

The existing national and regional institutional arrangement will be described and understood. This will include a review of:

- policies and legal and institutional arrangements for trans-boundary water resources development and management at national, regional and sub-basin levels within the framework of the Nile Basin Initiative.
- adequacy of institutional and human resource capacities of the related institutions including ENTRO
- Present a gap analysis which will be essential for guiding the design of key institutional aspects of the IWRDMP.

It is important to stress that the purpose of looking at the policy, legal and institutional frameworks is to understand how these aspects can influence the sustainability of the proposed IWRDMPlan. Institutional aspects are particularly relevant as even the smallest oversight can lead to challenges in implementation.

### 5.2.4.7 Task Summary

The activities and outputs for Task C1-3 are summarised in Table 5-5.

*Table 5-5: Summary of activities and Outputs for Task C1-3.*

| **TASK C1-3: Completion of Baseline** | | | |
|---|---|---|---|
| **Expected outcome(s):** | Completed baseline covering both resource and development aspects required for setting up the SSEA framework and its application and to inform the IWRDMPlan design. | | |
| **Task Leader**: Team Leader | **Team members**: Environmental and Social experts, water resources modeller, supported by most of the team | | |
| **Start date**: Month 3.0 | **End date**: Month 12.0.0 | **Task duration**: 9.0 months | |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** |
| C1.3a: Climate and natural resources -status | 5.5 | Input to the completion of baseline report | |
| C1.3b: development of water resources - status | 5.5 | Input to completion of baseline report | |
| C1.3c: Project GIS and databases | 7.0 | Consolidated GIS and associated database | Presented at 3rd stakeholder workshop |
| C1.3d: Modelling water resources (water balance/allocation) | 2.75 | Water resources model set up with resources inputs (hydrology etc) and demands | |
| C1.3e: Baseline report | 2.25 | **Baseline component** of Baseline, Key issues and objective report | Presented at 3rd stakeholder workshop |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.5 Identification of key issues and definition of water resources development and management objectives

### *5.2.5.1 Task Overview*

Towards the end of the baseline, work will start on consolidating understanding of the issues and challenges as well as the opportunities. It should be noted that identification of opportunities will largely come from Task C1.5 much of which will be carried out in parallel with the baseline.

The following sub-tasks have been identified

- Consolidation of key Issues – C1.4a
- Challenges, causes and impacts– C1.4b
- Key water-related challenges – C1.4c
- Vision and strategic objectives – C1.4d
- Report compilation – c1.4e

Work on these tasks will be concentrated into months 6 and 7 since their completion requires inputs from the baseline.

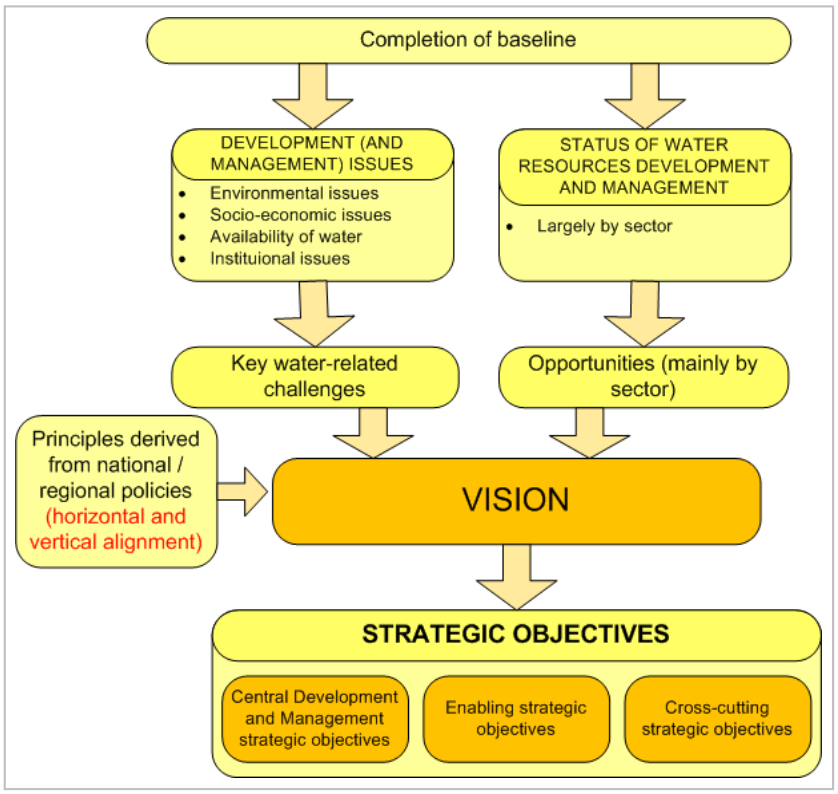



*Figure 5-19: Moving from the baseline to the identification of strategic objectives for the IWRDMPlan,*

### 5.2.5.2 Consolidation of key Issues – C1.4a

The key issues coming out of the baseline will be consolidated within the SSEA framework, probably under the following categories, bearing in mind that there is a considerable amount of overlap between these categories:

- Environmental issues
- Socio-economic issues
- Water availability issues
- Institutional issues

The current status of water resources management and development will also be consolidated and summarised. The aim of the consolidation exercise is to get a clear picture of both the issues which ultimately need to be addressed in the IWRDMP. For each of the issues areas, the issues will first be discussed making reference back to the appropriate parts of the baseline report ("situational analysis"). The issues will then be summarised in a tabular form as part of the SSEA matrix. An example from a recent study carried out by BRLi for NELSAP on a basin draining into Lake Victoria is provided as Table 5-6. The table is drawn up in such a way as to facilitate the understanding of the challenges that will have to be drawn up for the following step. It is anticipated that the sort of key socio-economic issues that will emerge in different parts of the BAS would include:

- High poverty levels,
- High population density (in some parts only),
- Subsistence agriculture with low productivity,
- Low access to basic services,
- High prevalence of disease and mortality rate,
- Extreme floods and drought.

*Table 5-6: Example of a table summarising environmental issues in a NELSAP sub-basin*

| Issues | Explanatory details |
|---|---|
| **Land degradation** | Poor agricultural practices.<br>Soil stabilisation and conservation practices such as contouring and terracing are largely absent on steeper slopes resulting in serious soil erosion. Especially evident in upper Gucha and middle Gucha and Migori.<br>In high rainfall area, cultivation up to river edge is the norm resulting in sediments being washed downstream. This practice is also found in the lower drier and is often exacerbated by steep slopes and shallow soil cover.<br>In the lower Gucha-Migori, over-stocking of livestock results in poor status of pasture. Livestock's tracks develop into erosion rills and gulleys. |
| **River bank destruction** | Poor agricultural practices.<br>One of the consequences of cultivation up to river edge, together with trampling by large herds of livestock, is the loss of natural bank stabilisation vegetation and resultant exposure of soil at river banks. The consequence is the destruction and erosion of river banks resulting in continued soil loss, increased sediment loads in rivers, river bank failures and interference with natural river morphology as well as loss of life and property, displacement of persons, destruction of infrastructure, crops, farmland and an increase in waterborne diseases. |
| **Depletion of forests** | Poor agricultural practices and urbanization.<br>Only small portions of forest remain in the basin despite conservation measures. Environmental issues associated with forest depletion include declining river water quality (especially increased silt load), reduced stream base flow and increased flood risk, loss of biodiversity. |

| Issues | Explanatory details |
|---|---|
| **Uncontrolled encroachment of wetlands** | Poor agricultural practices and urbanization.<br>Encroachment for agriculture and brick-making has decimated riverine and mountain wetlands in the upper Gucha basin. These wetlands are important for biodiversity, as for water supply for humans, agriculture, livestock and wildlife, groundwater recharge, fisheries, medicines, or grazing areas. They also support flood control, water purification, shoreline stabilization and $CO_2$ sequestration.<br>The Gucha-Migori downstream wetlands are also threatened by agricultural development. |
| **Low water quality** | Poor sanitation practices.<br>Poor sanitation practices not only have social (health) impacts but also have environmental impacts, mainly pollution of streams, surface water storage and wetlands as well as localised groundwater contamination. |
| **Extreme floods and droughts** | Climate, poor agricultural practices and urbanization.<br>The annual rainfall varies from year to year between -30% and +50% on average. That partially explains the occurrence of extreme floods and droughts. Serious flooding is a frequent phenomenon in the area of the delta at the river mouth. Serious drought is a frequent phenomenon in the small and medium reaches of the Gucha-Migori basin. Flood and droughts have been exacerbated in recent years by catchment destruction through deforestation, irrational agricultural practices especially cultivation on hill slopes, some very steep, cultivation up-to the river's water edge, and wetland destruction, which in turn are exacerbated by increase in population. |
| **Climate change** | Effects of climate change are still uncertain but are likely to lead to an increased occurrence of extreme events such as flood and drought |

Institutional issues could include :

- Inadequate water resources data/monitoring,
- Lack of technical capacity at different levels,
- Inadequate financial capacity,
- Lack of inter-sector coordination and cooperation,
- Lack of clear transboundary cooperative framework,
- Little experience of multipurpose project implementation.

Finally, a similar analysis and table will be drawn up describing the current status of water resources management and development considering water supply and sanitation, energy (especially hydropower), irrigation, rainfed agriculture, livestock farming, fisheries and fish farming, navigation, tourism.

### *5.2.5.3 Challenges, causes and impacts– C1.4b*

The issues summarised in the four parts of the matrix produced in the previous step will be used to investigate the challenges and related causes and impacts. It is useful to reduce the challenges down to a limited number of key challenges (which could include explicitly or by implication related or sub-challenges). In the case of the Multipurpose water resources development and management study carried out by this consultant for the Gucha-Migori basin in Kenya, for example, only four key water related challenges were identified as follows:

- Environmental degradation,
- Low level of water resources development,
- Frequent drought and flood and,
- Low level of human and social capital.

Table 5-7 provides an example of how the causes and impacts related to the challenge of environmental degradation were summarised. The matrix included such a summary for each of the four challenges.

Getting to these conclusions **cannot be done without a high level of stakeholder consultation**. This process is planned as part of this study.

*Table 5-7: Example from another study of causes and impacts related to one of four water-related challenges.*

| Challenges | Causes | Impacts |
|---|---|---|
| **Environmental degradation** | ▪ Expansion of rainfed arable agriculture into marginal areas (steep slopes, areas of poor soil cover, unsuitable soils...);<br>▪ Poor tillage and soil conservation practices;<br>▪ Cultivation up to river's edge and trampling of river banks by livestock;<br>▪ Conversion of forest and woodland into farmland;<br>▪ Conversion of upland wetlands into agriculture and use as source of material for brick-making;<br>▪ Unsustainable use of fuel wood due to non availability or high cost of other sources of energy;<br>▪ General lack of capacities of the water users;<br>▪ General lack of agricultural extension services;<br>▪ Lack of incentives for implementing soil conservation measures (e.g. to cope with risks of low harvest);<br>▪ Lack of sanitation and water treatment;<br>▪ Low environmental awareness and low environmental monitoring;<br>▪ Urbanization;<br>▪ High/growing population density;<br>▪ Insufficient funding for the environment.<br>▪ Poverty. | ▪ High levels of soil erosion and damage to river banks;<br>▪ High sediment load in rivers;<br>▪ Risk of sedimentation of reservoirs;<br>▪ Higher infrastructure costs;<br>▪ Higher water treatment costs;<br>▪ Higher risks of breakdown of equipment;<br>▪ Reduction of productivity (from loss of top soil), reduced income, poorer livelihoods<br>▪ Ecological damage and loss of biodiversity;<br>▪ Reduced flood attenuation;<br>▪ Reduced groundwater recharge;<br>▪ Reduced stream baseflows,<br>▪ Higher risk of drought and extreme floods;<br>▪ Higher risks of water related diseases. |

### *5.2.5.4 Key water-related opportunities – C1.4c*

The BAS basin is clearly well endowed with significant natural resources which, if managed and developed sustainably, can become the key drivers for social and economic development of the basin. **The precise magnitude of this potential will come out of TASK C1.5.** However it is also evident that the basin is faced with a wide range of issues that undermine the realization of its full development potential. Realisation of this potential will depend on the development of a coherent and comprehensive water resources management and development strategy fully responsive to the fundamental principles of IWRM. Within such an overall strategy, a multipurpose water resources management and development strategy for the basin can play a major, arguably dominant, role in ensuring the sustainable development of the basin's water resources. The inherent inter-sectoral cooperative nature of the multipurpose approach represents a concrete realisation of key IWRM principles.

The key water management and development opportunities that will form the basis and justification for the strategy are of course related to the key issues and challenges already identified in the previous step.

### *5.2.5.5 Vision and strategic objectives – C1.4d*

#### VISION

As shown in Figure 5-19, development of the Vision will follow on from a clear understanding of the water-related challenges. This is a picture of a future state of what the basin will look like after implementation of the IWRDMPlan. It should be stressed that the Vision statement does not aim to state how or what has to be done for the envisioned future state to be achieved. The identification of those mechanisms will be achieved through consideration of what actions are required to realise the goals that define the vision. These actions are, of course, the actions that will be detailed in the IWRDMPlan.

A visioning exercise will be carried out by stakeholders at the third stakeholder workshop.

In addition to defining a vision statement for the future state of the basin, this task will include the following:

- Justification and explanation of the vision,
- A comparison between the current and targeted situation,
- Monitoring indicators.

### STRATEGIC OBJECTIVES

The visioning process is usually done by first building goals related to the water-related challenges and opportunities. These goals can provide the main elements for the building of the strategic objectives.

The design of the strategic objectives should be such that the realisation of these strategic objectives will lead to achievement of the vision. It is likely (as shown in Figure 5-19) that there will be three type of strategic objectives. Firstly, there are the central (sometimes called key or core) development and/or management objectives. Secondly there are the "enablers" or enabling strategic objectives and finally there are the cross-cutting strategic objectives.

The strategic level SSEA thus leads to the identification of these objectives. It is very important that these strategic objectives are right for the basin and that they are endorsed by the stakeholders. **Once these strategic objective are in place, the development of the IWRDMP, although still a time-consuming process, is relatively straightforward**. In another recently completed study carried out by the Consultant, that of drawing up an IWRM Plan for the transboundary Orange-Senqu basin in southern Africa, a total of 11 strategic objectives were agreed (see box here after).

**Strategic Objectives**

Transformation of the proposed themes or goals into strategic objectives is straightforward:

**Central objectives**

1. Ensure the optimised sustainable management of the basins water resources
2. Support socio-economic upliftment and eradication of poverty in the basin
3. Ensure that the adverse effects of catchment degradation are reduced and the sustainability of resource use is improved
4. Maximise security from water-related disasters (especially flood and drought)

**Enabling strategic objectives**

In order to support the realisation of central strategic objectives:

1. Put an adequate knowledge base in place,
2. Build sufficient capacity and institutional strength,
3. Promote high level of stakeholder engagement
4. Ensure appropriate financing mechanisms are in place,
5. Promote adaptive management and effective monitoring and evaluation systems.

**Cross-cutting strategic objectives**

1. Promote the mainstreaming of adaptation to potential impacts of climate change into planned actions
2. Ensure the mainstreaming of gender considerations into planned actions



*Box 1: Strategic Objectives developed for the Orange-Senqu IWRM Plan*

### 5.2.5.6 Stakeholder Workshops – C1.4e

It is anticipated that two stakeholder workshops will feed into this process. The first opportunity for presentation and discussion with stakeholders could be as part of Workshop 2 at Month 8 when the scoping report is presented. The next opportunity would be at Workshop 3 when the key issues and objectives report is presented. It may be necessary to hold this workshop over two days and that the second day is **devoted to a genuine workshop format for discussion of issues and challenges, and particularly the vision and strategic objectives.**

### 5.2.5.7 Task Summary

The activities and outputs for Task C1.4 are summarised in Table 5-8.

*Table 5-8: Summary of activities and Outputs for Task C1-4.*

| **TASK C1-4: Identification of key issues and definition of water resources development and management objectives** | | | |
|---|---|---|---|
| **Expected outcome(s):** | Water resources development and management objectives in place and agreed by stakeholders | | |
| **Task Leader**: Team Leader | **Team members**: All senior team members (team leadership group) | | |
| **Start date**: Month 3.0 | **End date**: Month 7.0 | **Task duration**: 1.5 months | |
| **Main activities** | **Duration (months)** [1] | **Outputs** | **Meetings, workshops** |
| C1.4a: Consolidation of key issues | 2.5 | Statement of Issues tables | Focussed stakeholder meetings |
| C1.4b: Challenges, causes and impacts analysis | 5.0 | Statement of challenges, their causes and impacts matrix | Focussed stakeholder meetings |
| C1.4c: Key water-related opportunities | 5.0 | Statement of key water-related opportunities matrix | Focussed stakeholder meetings |
| C1.4d: Vision and strategic objectives | 1.5 | IWRM&D Vision for the basin and related strategic objectives | Stakeholder Workshop 3 |
| C1.4e: Drafting of report | 1.5 | **D4: Key Issues and objectives report** | Presented at Stakeholder Workshop 3 |
| C1.4f: Stakeholder workshops | - | Workshop Session: Stakeholder insight on issues, challenges and discussion of causal chains<br>Workshop Session: Definition of strategic objectives | Stakeholder Workshop 3 |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.6 Assessment of Potential Development

### *5.2.6.1 Introduction*

In line with the order of tasks presented in the ToR this task comes after Task C1.4 in this methodology. However, it is **stressed that much of the work on assessment of potential development** will be done at the same time as completion of the baseline (Task C1.3) and that the findings will feed into Task C1.4 as already indicated in the previous section.

The challenges in completing this task are largely the same as in completion of the baseline and the consultant will make extensive use of remote sensing to investigate potential especially in the less accessible parts of the basin.

The use of satellite imagery and remotely sensed products will be particularly useful for the assessment of:

- Hydropower potential,
- Navigation development opportunities,
- Irrigated agriculture,
- Areas where rainfed agriculture production can be improved,
- Fisheries,
- Conservation and eco-tourism.

### *5.2.6.2 Hydropower development potential – C1.5a*

#### OVERVIEW

The Highlands within the Ethiopian part of the basin have been studied over the years with a focus on identifying sites for large-scale hydropower. The Consultant will collect and review these studies. For the rest of the basin it will brought to a workable extent in term of the requisite data, information and knowledge: identification of dam sites, main technical characteristics of the dams, main environmental and social impacts, broad cost estimates (including the power transmission line), and multi-criteria analysis.

In order to identify potential hydropower sites in the parts of the basin that have not already been assessed in detail, the Consultant will in a first stage estimate the theoretical hydropower potential of each watercourse for which there would appear to be hydropower potential. Although, as indicated above, the Ethiopian part of the basin has been studied in the past, this approach (presented in detail below) will be applied to all parts of the basin where potential exists. To this effect, the Consultant has developed a methodology based on a Digital Elevation Model (DEM) of the study basin. For each reach of interest, the hydropower potential is estimated using the following step-wise approach:

a) Development of a profile of the reach,

b) Development of a profile of average discharge along the reach,

c) Development of the hydropower potential along the reach, and,

d) Development of the cumulative hydropower potential from the source to the confluence.

## River Reach Profile

A profile of the reach of interest is developed using the GIS on the study DEM. This profile consists in the elevation of each cell of the DEM along the reach. The development of the river profile includes an interpolation scheme that corrects the profile to offset the effect of DEM pre-processing to eliminate sinks in the DEM in order to resolve the drainage network. This in turn introduces some artificial plateaux in the profile which have to be eliminated. The following figure presents an example of this interpolation process. The example shown in is taken from a study of small hydropower reconnaissance.

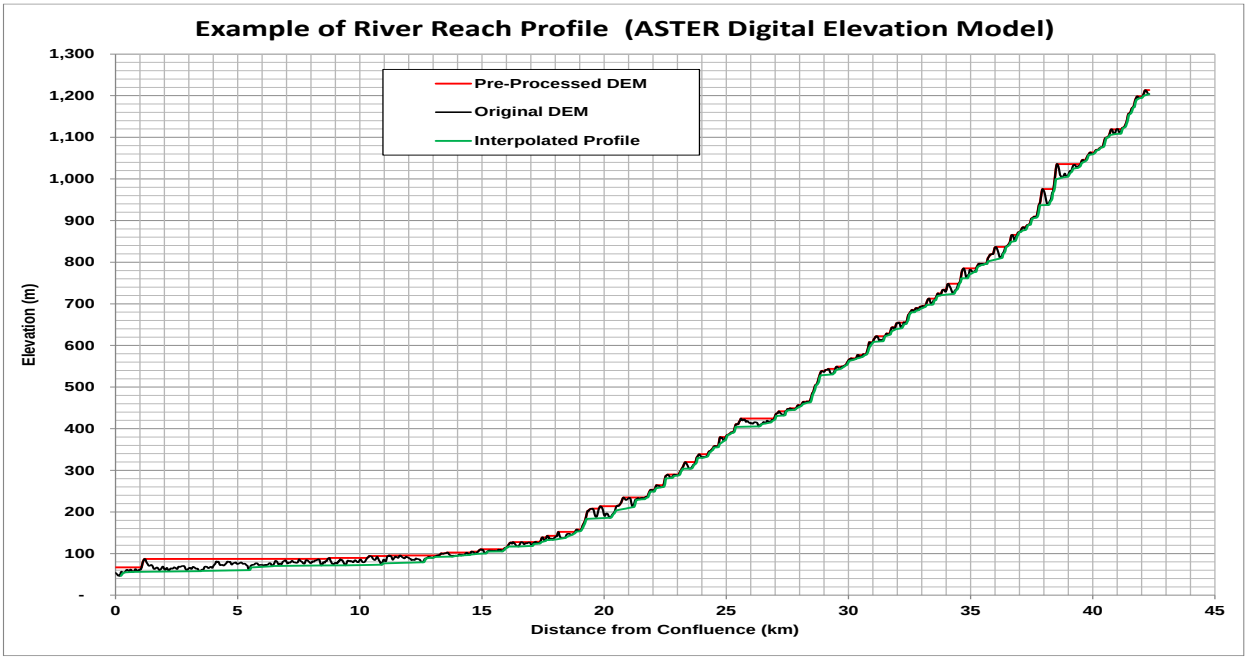



*Figure 5-20: Example of River reach profile (ASTER digital elevation model)*

## DISCHARGE PROFILE

The second step is to draw a discharge profile along the river course. The method to estimate the runoff will come from the hydrological studies. A typical example is presented in the following figure; both river profile and discharge profile are presented in Figure 5-21.

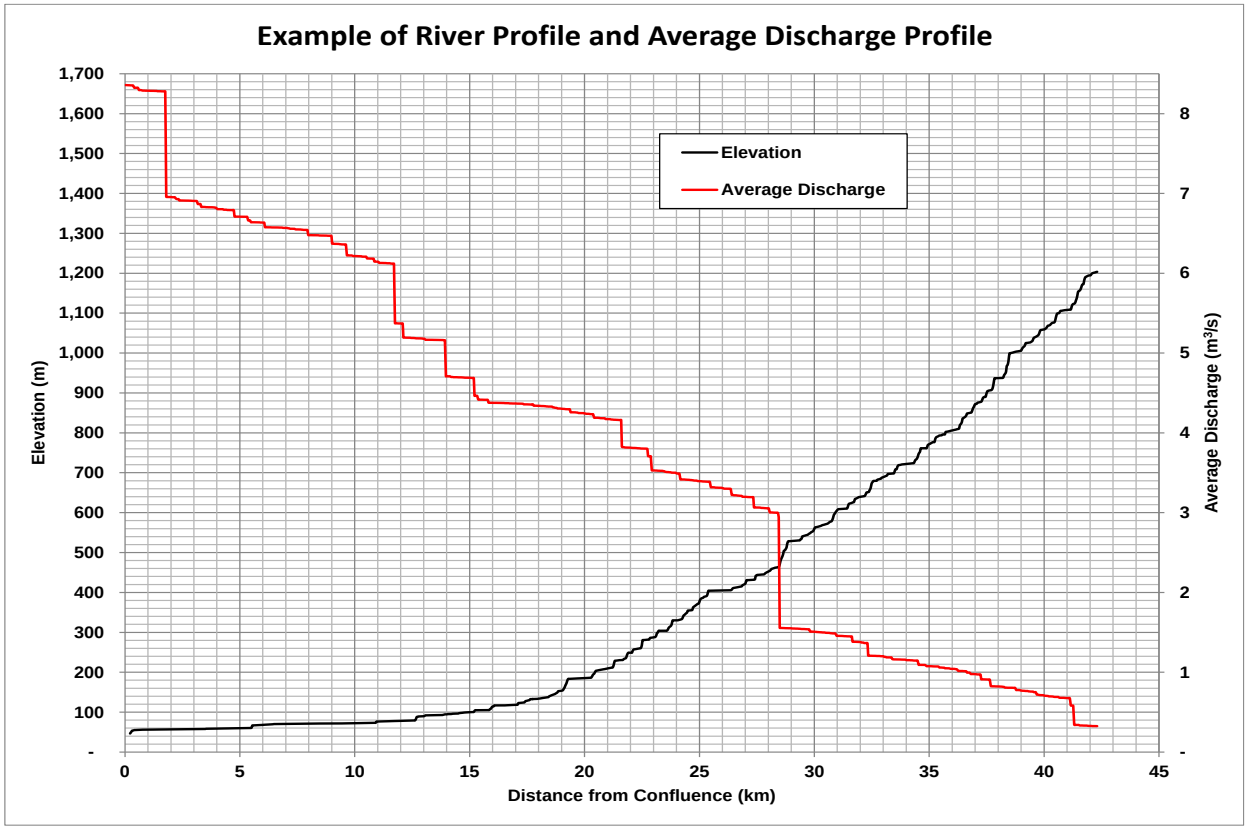



*Figure 5-21: Example of river profile and average discharge profile*

## HYDROPOWER POTENTIAL PROFILE

SRTM cells are approximately 90 m in the East-West or North-South direction and 130 m in the NW-SE or NE-SW direction while the ASTER cell dimensions are one third of those. These are too short to estimate the hydropower potential so a larger distance is selected to determine the hydropower potential across this distance. In the example shown herein, the selected distance is 500 m and the hydropower potential is determined by the difference between the upstream and downstream elevations and the following equation:

$$P = g.\eta.Q_1.(H_1 - H_2).(1-p_c)/1000$$

Where:

- $P$ = Generated Power (MW)
- $g$ = Acceleration of gravity, taken as 9.81 (varies with the location on Earth)
- $\eta$ = Overall HPP efficiency
- $Q_1$ = Turbine discharge ($m^3/s$)
- $H_1$ = Elevation at upstream end of reach (m)
- $H_2$ = Elevation at downstream end of reach (m)
- $p_c$ = Head losses (% gross head)

In general, overall HPP efficiency for modern turbo-machinery and auxiliary powerplant services is of the order of 90%. Head losses resulting from the friction of water running through the various hydraulic components varies according to the HPP configuration, generally between 2 and 4% of gross head.

The hydroelectric potential also varies according to the turbine discharge which is generally selected as 1,5 – 2 times the average discharge at that point on the profile. The resulting profile and cumulative potential profile is shown in Figure 5-22.

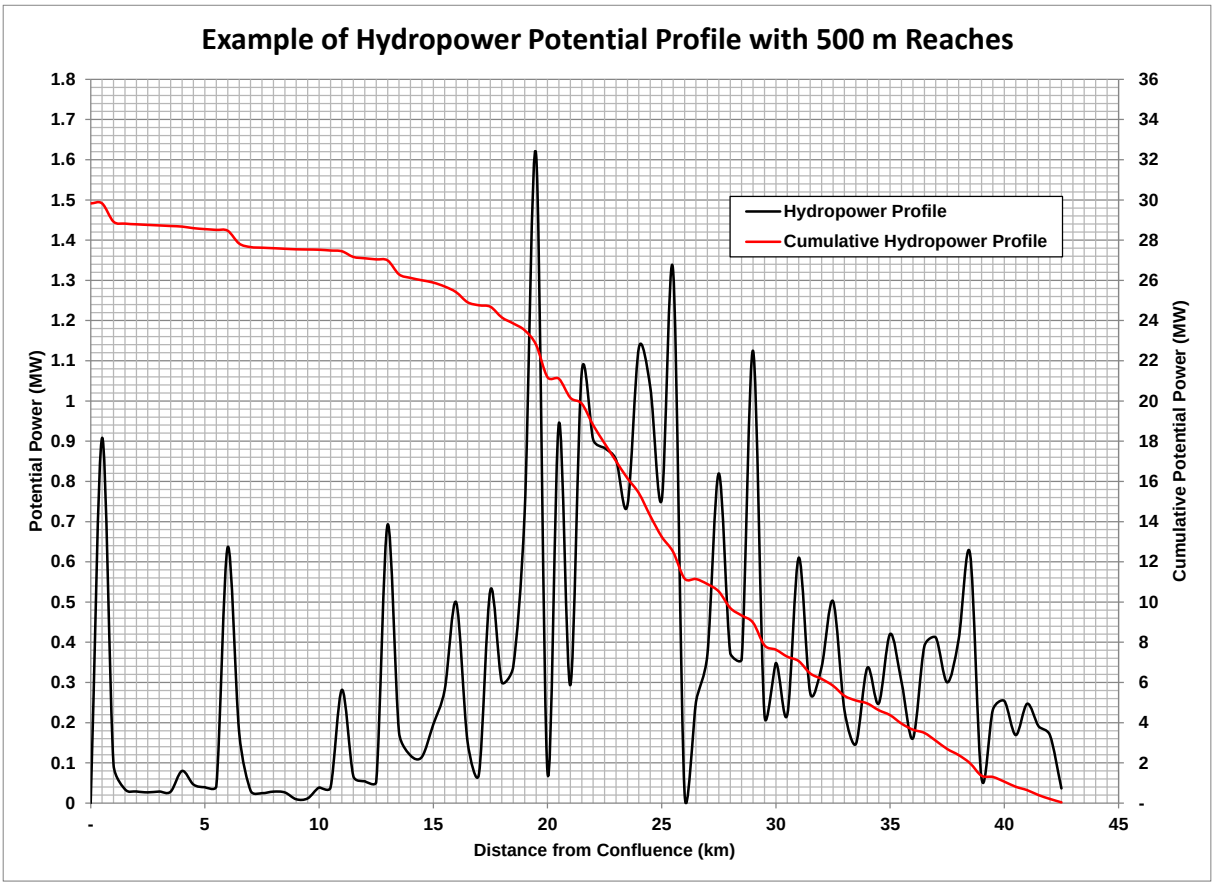



*Figure 5-22: Example of hydropower potential profile with 500m reaches*

From Figure 5-22 and the DEM, sites of interest, either for run-of-river HPPs or HPPs associated with reservoir can be identified and then analysed by conventional methods to determine firm and average energy generation, which in turn require an inflow series available from the hydrological studies. If a HPP of interest can be associated with a reservoir, then the reservoir elevation – area – storage relationship can be determined directly from the DEM.

### 5.2.6.3 Irrigated agriculture development potential – C1.5b

Irrigation potential is already well-mapped on the Ethiopian side of the border. The demarcated areas are unlikely to be exceeded. The potential schemes are shown on the map below (EN MSOIA; 2015).

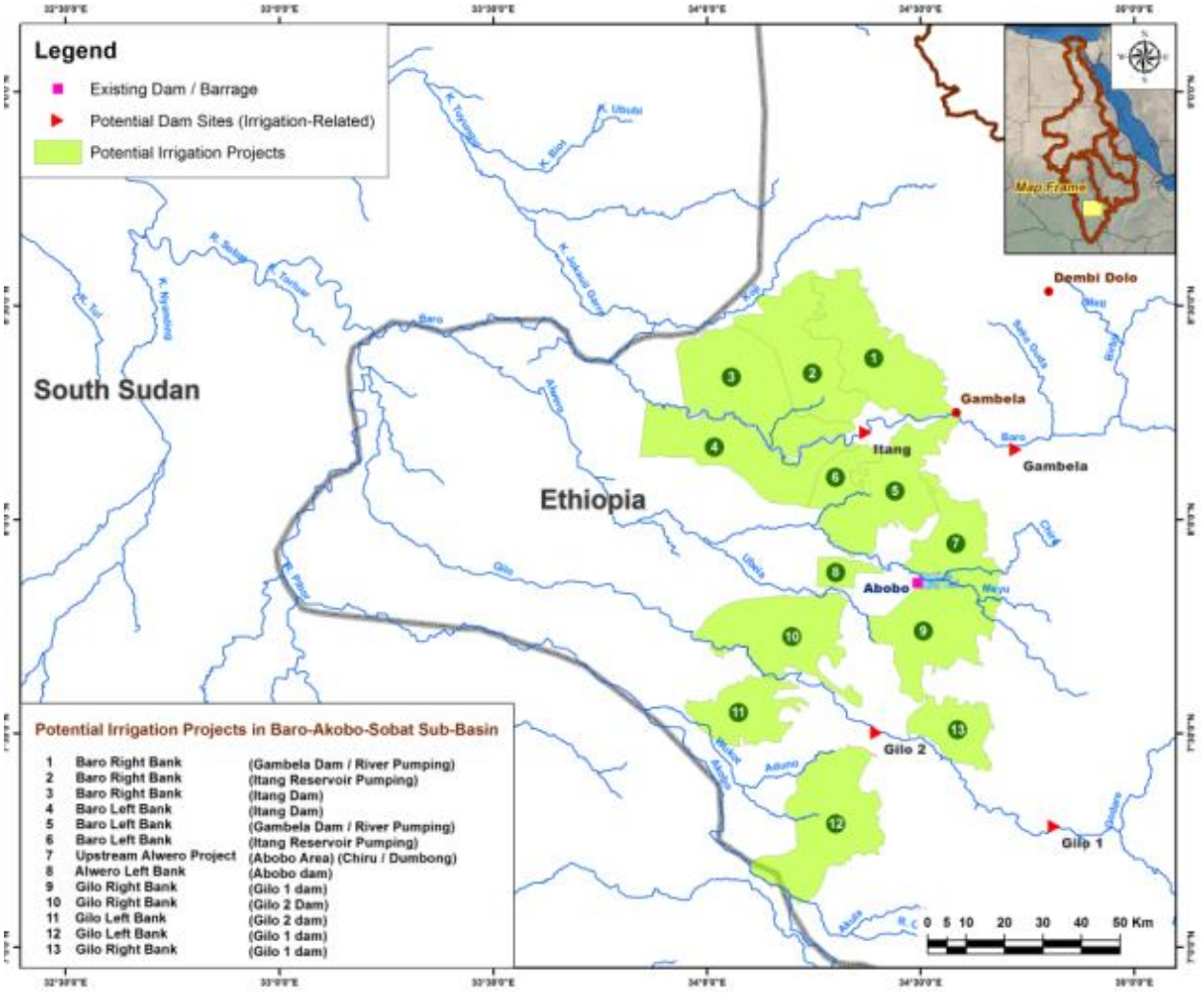



*Figure 5-23: Potential Irrigation Projects in the Baro-Akobo-Sobat Sub-Basin*

Information is currently lacking with respect to irrigation potential on the South Sudanese side of the border. The analysis will make use of the CAMP (Comprehensive Agriculture Development Master Plan) and the associated Irrigation Master Plan as soon as information from this report is made available.

### IDENTIFICATION OF POTENTIAL FOR AGRICULTURE DEVELOPMENT

In an indicative way the following parameters are presented as a contribution to an increase of the potential for agricultural development:

- Deep and soft soils,
- Gentle slopes,
- Presence of field plots (indicators of past cultivation),
- Marshy land (mostly potential for rice development),
- Midlands and low lands (for example: rice, sugar cane, vegetable during dry season, or other commercial crops),
- Uplands and midlands (for example: vegetables, maize, soya, horticulture, several commercial crops),
- Permanent water,
- Potential sites of dams (would enable irrigation around and downstream),
- Roads (for supply of input and export of produce),
- Villages (potential for availability of labour and aggregate small holder farmers).

### IDENTIFICATION OF CONSTRAINTS FOR AGRICULTURE DEVELOPMENT

The following parameters may be identified as constraints for agricultural development:

- Environmental sensitive area,
- Seasonal flooding,
- Presence of wood and primary vegetation,
- Absence of access and distance to roads,
- Lateritic soils,
- High slopes,
- Absence of or distance to a permanent water source,
- Land tenure, where overlords and local chiefs are less interested in facilitating or securing access to land.

### REMOTE-SENSING SUPPORT FOR SOIL INVESTIGATIONS

From LANDSAT 8 imageries the Consultant will further identify:

- Humid soils, where ground water table as in mid lands at the end of the rainy season (Infrared light shown as red areas),
- Seasonal flooding,

Contour lines of some homogeneous areas that are likely to belong to the same soil type.

#### ENVIRONMENTAL ISSUES

Some lands should remain in their present condition without improvement for environmental or social reasons.

- Environment impacts: During the screening, the Consultant shall identify area with greatest ecological interest areas due to their geographical situation (for instance some wetland areas located on migratory corridors for birds) or because the ecological inventory shows particular rich biodiversity for fauna and flora. To that purpose, bibliographic studies will be undertaken.
- Forest conservation especially along rivers and tributaries can be considered as a priority either for biodiversity savings or for mitigating pollutions coming from cropping activities.
- Consideration of protected areas.
- Negative impacts of land development on soils will be assessed.
- Taking in consideration social customs, religious sites and traditions.
- Sites for hydraulic infrastructure: Irrigation during the dry season may require increasing the water storage by hydraulic infrastructure.

#### SOCIAL ISSUES

The social issues will be mainly assessed through literature review, however, when possible, meetings with the main representative (Communities; Local Public Authority; NGO; etc.) of the potential zone selected will be organized to assess local interest for the project.

### *5.2.6.4 Rainfed agriculture- c1.5c*

Rainfed agriculture is widely practised in much of the basin, while farming systems are more commonly based on recession agriculture. Both cropping systems are of low intensity. The Consultant shall assess the potential of intensification of these cropping systems, in order to evaluate whether they could be an alternative to the development of irrigated agriculture. During a field visit to the flood plains and low lying areas downstream of Gambella, the commercialisation and intensification of rainfed agriculture is already starting to make inroads. The current cropping systems will be characterized, and the constraints for intensification analyzed (land tenure, manpower, agricultural credit, input supply, technology, marketing, productivity, etc.). The extent of potential area for development for each cropping system will be broadly estimated.

Rainfed agriculture is practised in almost all hydroclimatic zones. In view of the fact that the vast majority of the basin's inhabitants are subsistence farmers practising rainfed farming and livestock farming, this is a very important development area and one that will certainly feature strongly in all development scenarios.

Two global datasets are used to estimate the potential for rainfed agriculture :

- Climate data: information about water crop needs including annual precipitation rates as well as potential evapotranspiration
- Soil data: information about Soil-Water Storage Capacity (SWSC):

The soil moisture storage capacity varies from 0 to 800 mm, with the majority of soils having values between 100 and 300 mm. Higher values of SWSC are found for organic soils. A clear distinction can be seen in the distribution of SWSC between sub-Saharan Africa and Southeast Asia, the latter having a dual-normal distribution and the former a log-normal distribution. This dual-normal distribution originates not only from the mountainous areas of the Himalayas, but also from large areas in central India. For sub-Saharan Africa, most soils have an SWSC of at least 150 mm, and over 20 percent of them have an SWSC higher than 300 mm.

Vertisols concern more than 56 % of the BAS sub-basin mostly in the South Sudan part of the basin. This characteristic is very important. Rainfed farming is very difficult with vertisols but, when irrigation is available, crops such as cotton, wheat, sorghum and rice can be grown. Vertisols are especially suitable for rice because they are almost impermeable when saturated.

The study will aim at answering the following questions:

- What is the real rainfed agriculture potential in the Ethiopian part of the BAS sub-basin?
- What is the potential in the South Sudanese part of the basin and what kind of agricultural solutions (alternatives) could be implemented (irrigation (large or small scale); soil management (drainage, levelling, backfilling, grading, etc.)); adaptation of the farming system; etc.?

Our expertise will be based on information mobilised in the first part of the study. Local experts and international experience (aerials photographs, remote sensing imagery, other rainfed agriculture studies) will be mobilised to provide technical solutions adapted to the context.

### *5.2.6.5 Livestock development potential – C1.5d*

Livestock production is a key economic feature of most pastoral communities throughout the basin. The production and productivity of livestock is seriously affected by the seasonality of pastures, as influenced by availability of water supplies, widespread prevalence of endemic diseases and parasites coupled with poorly developed marketing infrastructure, veterinary services, and socio-cultural values. The consultant will examine the development potentials for livestock production, focusing in particular on the needs in terms of water supply infrastructure.

The importance of livestock watering in certain areas of the basin, especially in South Sudan is critical and will require adequate consideration.

### *5.2.6.6 Fisheries development potential – C1.5e*

The fisheries sector is an important one and efforts will be made to establish a good understanding of the resources.

The following tasks will be undertaken:

- Assessment of the extent, distribution and physico-chemical status of the water bodies in the region. This will be done through review of available secondary data and existing studies. These data will help to estimate the fish yield of these water bodies (Khalil, M.T. 1997).
- Assessment of diversity. This will be achieved through review of literature (Golubtsov et al, 1995; Golubtsove and Darkov, 2008; Golubtsove and Mina, 2003; Getahun, A. 1998, 2002, etc.).
- Assessment of fish abundance. This will be done using existing « Catch per Unit effort » data, if available.
- Assessment of fish markets: direct observation of the fish markets in the region and review of available data on catch at the Bureau of agriculture of the region
- Assessment of aquaculture potential of the water bodies. Determination of suitability of the region for aquaculture practices of Nile tilapia and other fish species (Potential source: a “Generic GIS based site suitability analysis for pond production of Nile Tilapia (Oreochromis niloticus) in Ethiopia”

A number of fishery associated activities can be part of multipurpose water development and management projects and could support the development of fish farming in the basin. Fish farming systems should be included in most multipurpose projects and could be accompanied by the following possible activities:

- Development of an efficient extension support adapted to the small fish farmers knowledge;
- Maintenance or development of a good network of transport and fish processing. This is mandatory to maintain a good (export) quality of the fresh fish, both for the fisheries and the fish farms;
- Potential for cage culture in reservoirs.

### 5.2.6.7 Navigation development potential – C1.5f

Within the wider context of the transport sector and access to markets and assessment of potential river transport demand (public and freight transport) will be carried out. This will take into account:

- the planned development of alternative transportation means in the sub-basin and the region;
- economic development scenarios which may have an impact on transportation needs;
- Alternative transportation routes (development/improvement of roads etc.).

One of the main constraints on development of the sector is a perceived lack of major demand. For major investment in the sector there is clearly a need for the demand to be present or potentially present.

Although no specific interventions have been included, it may be useful to look at the potential role of navigation in supporting a more regional approach to food security. This concept has already been underlined as a strategy for the Eastern Nile countries in the recent Multisector Investment Opportunity Analysis (MSIOA, 2014). According to the MSIOA, a regional approach to security would imply "*a regional approach to markets and the entire logistic chain getting produce to principal regional market centres. Maximising food production should be achieved from a regional perspective rather than a national one, with a focus on the most efficient use of the available water resources within the system as a whole*". There is perhaps therefore a (potential) place for navigation in the transport sector once that sector has been reviewed to understand what role it may play in moving produce around the basin. A study may be required to support proposals on a regional, transboundary approach to food security.

In view of the nature of transport, the analysis will have to go beyond the limits of the BAS basin. It will cover the Khartoum-Gambela section of the White Nile.

- Physical and non-physical constraints to navigation will be investigated. These include water hyacinth infestation, navigation aids, security issues, etc.
- River reaches which require specific works will be identified, as well as the main infrastructure (and related broad investment costs) needed to develop the traffic (e.g. river harbours).

Extensive use of satellite imagery will be used to facilitate this task.

### 5.2.6.8 Eco-tourism – C1.5g

There are two large national parks within the river basin, Gambella and Boma. The basin traverses annual wildlife migration routes, as well as large wetland areas, reserved areas and a wide diversity of eco-systems, extending from the escarpments to the lowlands.

As shown in Figure 5-24 there are also game reserves, controlled hunting areas, forest reserves and extensive wetland areas. There are clearly opportunities for eco-tourism development although there are also numerous constraints. For each option, the linked management measures and infrastructure requirements shall be broadly described.

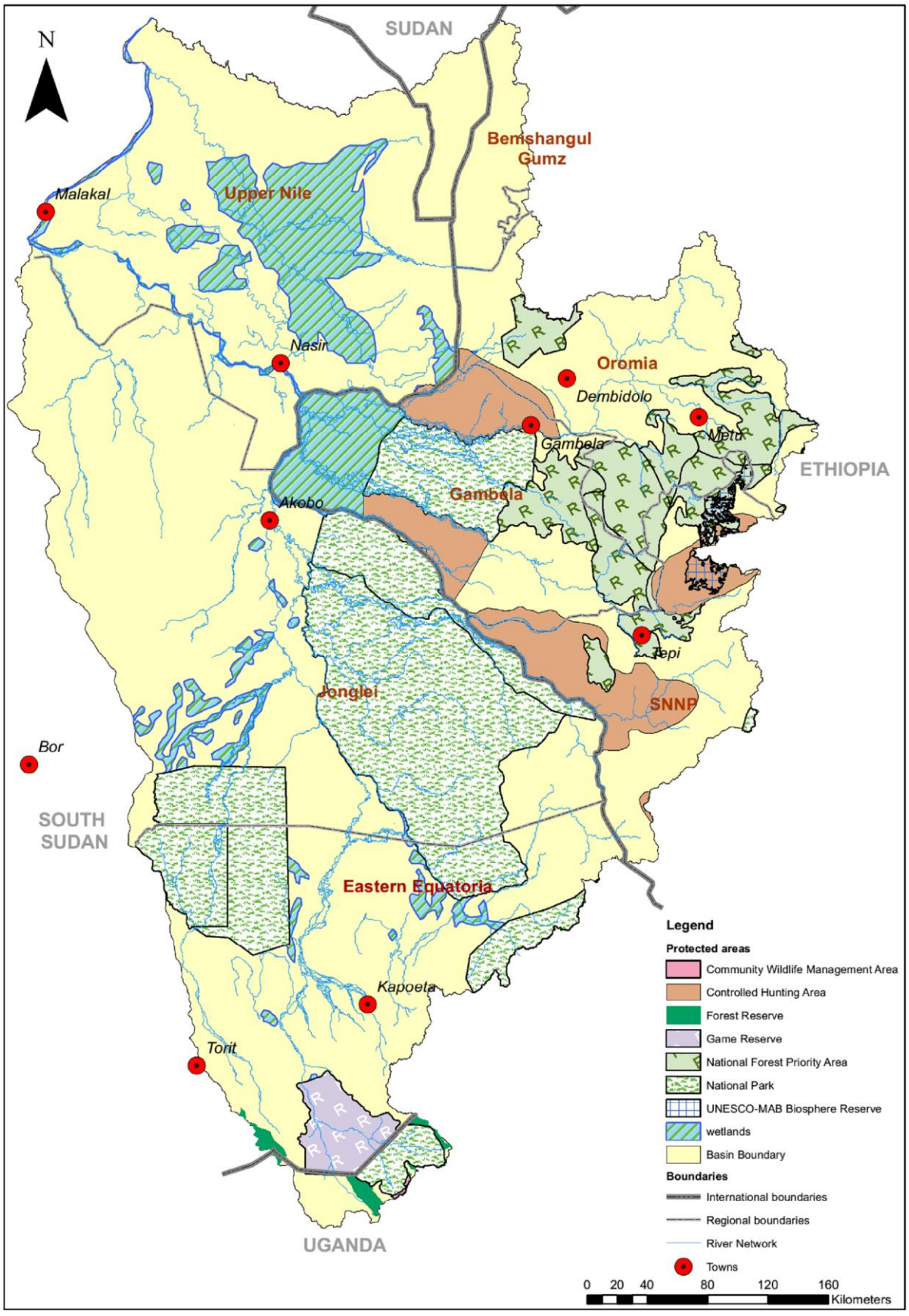



*Figure 5-24: Protected areas in the Basin*

### 5.2.6.9 Task summary

The activities and outputs for Task C1.5 are summarised in Table 5-9.

*Table 5-9: Summary of activities and Outputs for Task C1-5*

| TASK C1-5: Assessment of Potential Development | | | |
|---|---|---|---|
| **Expected outcome(s):** | Development potential of each sector identified, quantified and mapped | | |
| **Task Leader**: Team Leader | | **Team members**: Sectoral experts | |
| **Start date**: Month 6 | **End date**: Month 11 | | **Task duration**: 5.0 months |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** |
| C1.5a: Assessment of hydropower potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5b: Assessment of irrigated agriculture development potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5c: Assessment of rainfed agriculture potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5d: Assessment of Livestock development potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5e: Assessment of fisheries development potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5f: Navigation development potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5g: Assessment of eco-tourism potential | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.5h: drafting of report | 1.5 | **Potential water resources development report** | Focussed stakeholder meetings |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.7 Strategic Social and Environmental Assessment

### 5.2.7.1 Review of Methodologies applied – C1.6a

The Strategic Social and Environmental Impact Assessment (SSEA) refers to a range of analytical and participatory approaches that aim to integrate environmental and social considerations into policies, plans, and programmes and evaluate their interlinkages with economic and social considerations.

Strategic Environmental Assessments (SEAs) have been developed as instruments to bring environmental concerns into the strategic levels of decision making – policies, legislation, strategies, plans, and programs (PLSPP). This report should therefore be seen as providing some strategic guidance from the social and environmental perspective for the accompanying situational analysis, which includes a preliminary identification of regionally significant projects and programmes. In addition to providing economic development, these projects and programmes should address both social and environmental concerns and needs.

SEAs have been used for a variety of purposes, including developing a shared understanding of environmental issues, building a consensus on the way to tackle these issues, identifying issues to be tackled in depth in project-level EIAs, developing investment plans, in national, regional and transboundary settings. Essentially SSEAs allow decision makers to take advantage of environmental and social opportunities while managing environmental and social risks in a strategic setting. In this context, one of the objectives of the Inception phase has been to achieve a preliminary understanding of the social and environmental issues and challenges around the basin and then based on this analysis to identify the social and environmental hotspots around the basin with a view to supporting the strategic identification and planning of regional investment opportunities

SSEA will help outline the environmental and socio-economic status and goals of various alternative development strategies building both on the knowledge base/analysis as well as stakeholder inputs SSEA can be defined as a family of approaches which use a variety of tools, rather than a single, fixed and perspective approach. The approach thus allows us to work simultaneously on technical evaluations and at the same time take into account stakeholder inputs.

The SSEA targets two key decision making levels:

- Strategic decisions regarding the overall approach to the development of water resources in the basin; and,
- Selection of a preferred development scenario or set of linked development and management options. The process allows stakeholders to be consulted to provide inputs to and to review the assessments.

### *5.2.7.2 Review of social and environmental safeguard policies C1.6b*

The SSEA will be undertaken in accordance with the generally recognized principles of international best practices. Although it is not the same as an Environmental and Social Impact Assessment, the SSEA methodology will be compatible with:

- The World Bank Operational Policy OP 4.12 on Involuntary Resettlement, (April 2004)
- International Finance Corporation Performance Standards on Social and Environmental Sustainability (April 2006);
- The Equator Principles (July 2006) and;
- International conventions to which Ethiopia and South Sudan are signatory will also be taken into consideration such as the convention on Biological Diversity, Ramsar, or Endangered Species.

Finally, the methodology will take into account wherever applicable and relevant, the specificities of the local environmental legislations and regulations, particularly the following:

- The Guidelines issued by the Ethiopian Environmental Protection Authority, namely the Environmental Impact Assessment Guideline and the Environmental Impact Assessment procedure Guideline,
- Any relevant guidelines issued by the Government of South Sudan or under preparation.

### *5.2.7.3 Development of SSEA Framework for application – C1.6c*

The development of the SSEA framework for first level evaluation will be based on the work carried out under task C1.4. In the methodology already presented earlier, Task C1.4 looks at the environmental, social and institutional issues and with the aim of achieving a logical understanding of the challenges, their causes and the impacts. An exhaustive matrix will be built up so that the causes and impacts underlying each challenge can be clearly understood. It is understanding these causes and impacts that will allow the effectiveness and usefulness of development and management options to be evaluated.

### 5.2.7.4 Compilation of first draft SSEA Report – C1.6d

Development of the SSEA framework will be based on, the work carried out under task C1.4 and will be aimed at allowing the carrying out of the first or strategic level SSEA. This report will be informed by the second consultation workshop around month 11 or 12 in which the Consultant will have presented a first take on the issues, challenges and strategic objectives. The draft SSEA report will be compiled by Month 15 and then presented to stakeholders at the fourth Stakeholder workshop around Month 16.

### 5.2.7.5 Compilation of second draft SSEA Report – C1.6d

Following the stakeholder workshop work on the assessment of options will proceed and the second level of SSEA will be used to evaluate the different options. The second draft SSEA Report will then be drawn up and made available by Month 17 in time for presentation and discussion at the fifth stakeholder workshop at Month 18.

### 5.2.7.6 Task summary

The activities and outputs for Task C1.5 are summarised in Table 5-10.

*Table 5-10: Summary of activities and Outputs for Task C1-6*

| **TASK C1-6: Development of SSEA frameworks** | | | |
|---|---|---|---|
| **Expected outcome(s):** | Development of first level and second level SSEA framework and methodologies and their application | | |
| **Task Leader**: Environmental experts | | **Team members**: Social development expert and team leader | |
| **Start date**: Month 1.5 | **End date**: Month 18 | **Task duration**: 16.5 months | |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** |
| C1.6a: Review of methodologies applied | 1.0 | Working paper | Focussed stakeholder meetings |
| C1.6b: Review of social and environmental safeguard policies | 1.0 | Working paper | Focussed stakeholder meetings |
| C1.6c: Preparation of SSEA framework for application | 3.5 | Working paper | Focussed stakeholder meetings |
| C1.6d: Compilation of first draft SSEA report | 10.0 | Working paper | Focussed stakeholder meetings |
| C1.6e: Compilation of second draft SSEA report | 2.0 | Working paper | Focussed stakeholder meetings |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.8 Task C1-7: Screening of Development and Investment Options

### *5.2.8.1 Introduction/Overview*

The aim of this task is to bring together combinations of investments (combinations of multipurpose projects) and measures as identified in C1-4 and to use the SSEA framework to screen them against a number of environmental, social and developmental criteria to be sure that they meet the strategic objectives.

A key challenge will be finding a way to allow the stakeholders to fully understand the difference between the five different development options so that they can properly participate in discussion on them and that the steering committee can then choose

Water resources decision making is increasingly becoming a multi-stakeholder negotiation process. In such a process, the decision for selecting among a set of possible development and management options is not straightforward and the objectives and preferences of a range of stakeholders and decision makers (in a multi-jurisdiction context) have to be taken into account.

### *5.2.8.2 Selection of development options*

The selection of development options will be built on the analysis of a wide range of multipurpose development projects combined into a number of possible development options. Multipurpose projects can be quite different in nature and in a basin the size of the BAS it will be necessary to combine several different multipurpose projects under each option. From a similar experience on the Kyoga Basin, the Consultant developed different **types** of multipurpose projects such as:

- **Type A: integrated multipurpose reservoir**

  This type of multipurpose project would typically include:

  - Construction of reservoir/dam
  - Catchment management: this sub-component aims to improve water quality and reduce erosion upstream of the reservoir and therefore reduce low water quality sedimentation rate in the reservoir. The most degraded areas of the reservoir's sub-basin have to be identified and measures have to be implemented to reduce catchment degradation.
  - Water supply and sanitation: a portion of the water from the reservoir will be used for domestic water supply and improved sanitation.
  - Livestock: a portion of the water from the reservoir will be used for livestock watering.
  - Irrigation: a portion of the water from the reservoir will be used for irrigation.
  - Hydropower: it is proposed that the dam be used to generate hydropower, before the reservoir water is used to supply the irrigation scheme and after potable water supply.
  - Fisheries and fish farming: construction of a reservoir will create opportunities for both a reservoir fishery and cage culture fisheries.
  - Agro-processing : agro-processing will significantly increase the value of products, such as irrigated crops, livestock or fish production.
  - Tourism and recreation: recreation activities could be developed around the reservoir.

- **Type B: wetland conservation and development**

  This type of multipurpose project would typically include:

  - Catchment management: this sub-component aims to improve water quality and reduce erosion upstream of the wetland and therefore reduce low water quality and sedimentation rate in the wetland. The most degraded areas of the wetland's sub-basin have to be identified and measures have to be implemented to reduce catchment degradation.
  - Wetland conservation: part of the wetland must be conserved, in opposition to the part of the wetland which will be utilized for generation revenue activities.

- Water supply and sanitation: water from the wetland will be used for domestic water supply and improved sanitation.
- Livestock: watering and grazing of livestock in the wetlands can be organized.
- Irrigation: some area of wetlands will be utilized sustainably for irrigation.
- Fisheries and fish farming: part of the wetland will be utilized for fisheries and fish farming activities.
- Agro-processing: agro-processing will significantly increase the value of products, such as irrigated crops, livestock or fish production.
- Tourism and recreation: bird-watching and eco-tourism activities could be developed around the wetlands. The wetland could also be part of touristic tours.

▶ **Type C: Integrated catchment management**

This type of multipurpose project would typically include:

- Soil and water conservation: type C gathers a comprehensive group of activities that aim at improving the people livelihood in an ecologically-friendly manner. The project therefore gives more importance to activities such as enforcement of regulation, promotion and implementation of soil and water conservation measures, construction of valley tanks, reforestation, etc. Soil and water conservation is one of these activities.
- Tree planting: reforestation over a medium and long-term period with annual targets.
- Valley tanks for multipurpose uses: valley tanks will be constructed and used for livestock watering, fish production and supplementary irrigation.
- Water supply and sanitation: water from springs and groundwater will be used for domestic water supply and improved sanitation.
- Agro-processing: agro-processing will significantly increase the value of products, such as irrigated crops, woods, other agricultural products, livestock or fish production.
- Tourism and recreation: Bird-watching and eco-tourism activities could be developed around the forests and upstream part of the sub-catchment. The forests, slopes and landscape views could also be part of touristic tours in the region.

### *5.2.8.3 Finalisation of screening criteria*

Criteria based on **indicators established for the realisation of the IWRDMP objectives** will be developed. Each of the strategic objectives will have been developed with a set of indicators to measure progress towards their achievement. These will be further refined in view of the multipurpose components proposed (see examples of types in previous sub-section).

### *5.2.8.4 Screening of development options*

The five “preferred“ development options will be analysed based on the criteria developed. It should be noted that “preferred” does not mean that these are considered as being the best five development options. It is advisable that the five development options would cover a reasonably wide range of development trajectories. These could be based on different viewpoints of development scenarios.

One of the tools that will be useful for the screening process is the Nile Basin Decision Support System (NB-DSS). Over the past few years, the NBI has been in the process of establishing the NB-DSS to support water resources planning and investment decisions in the Nile Basin, especially those with cross-border or basin level ramifications in a multi-stakeholder context. The NB DSS is a shared analytic and knowledge system and is envisioned to serve both at policy/strategy as well as planning and management levels. At policy levels, it provides the necessary shared knowledge base to help with joint identification of development strategies. At planning and management level, it provides the necessary data, models and tools for evaluation of impacts and benefits from alternative water resources development and management plans. It is designed to meet the requirements of complex water resources planning and provides diverse toolsets for data processing, modelling, scenario management, optimization and multi-criteria decision making.

In order to evaluate the usefulness of the possible development options against the objectives defined in the SSEA, it is envisaged that the NB-DSS will play a central role. A key feature of the NB-DSS relates to the evaluation, screening and prioritization of water resource development and management opportunities, typically based on environmental, social and economic indicators which are identified in conjunction with and with inputs from stakeholders during stakeholder workshops. The DSS scenario comparison tool helps users compare different scenarios in terms of parameters selected by the user. The built-in cost-benefit-analysis functions allow the quantification of benefits, impacts and trade-offs of scenarios. Furthermore, the NB DSS offers a built-in multi-criteria analysis tool that supports informed decision making through evaluation of consequences of various decision options in a transparent and objective manner.

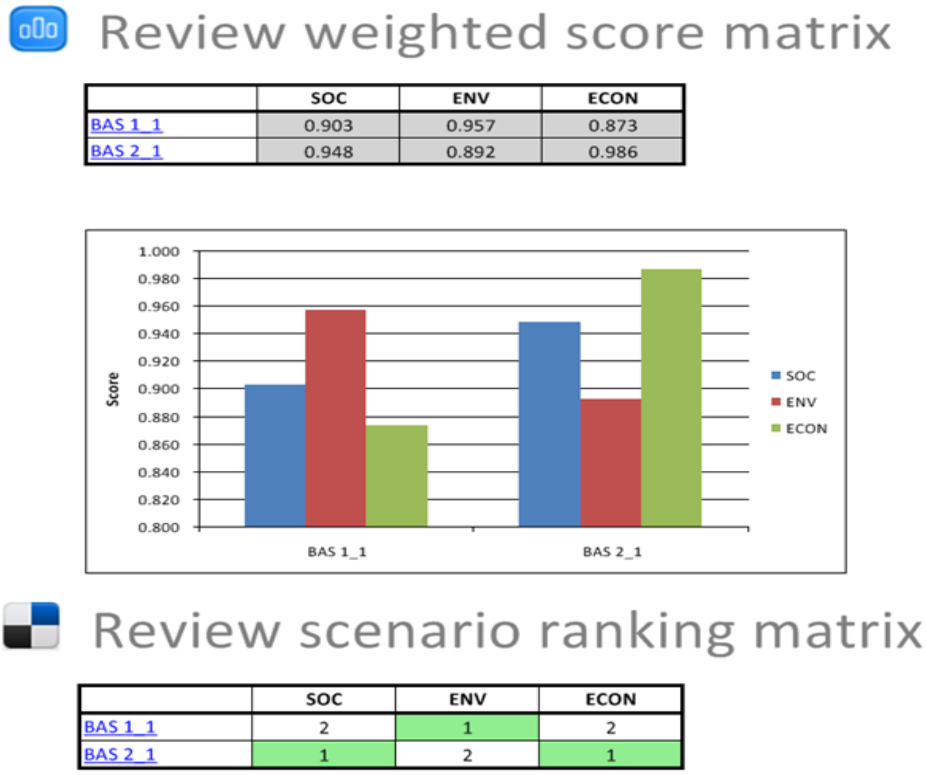



*Figure 5-25: Examples of scenario scoring and ranking in the NB-DSS*

### *5.2.8.5 Drafting of report – 1.7d and Stakeholder Workshop – 1.7e*

The assessment of options report will be drafted in time for presentation of a draft version, to the fourth stakeholder workshop at the end of Month 16. This is an important deadline since it is essential that stakeholders have a major input at this stage. The report submitted for consultation will contain the assessment of development opportunities as well as the proposed development options screened. As such, this is one of the most important reports that will be presented, especially in terms of stakeholder inputs.

At the end of the workshop it will be possible for the Consultant to finalise the draft report with a qualitative screening of the five development options in such a way that the Steering Committee is able to select **only three most** relevant options for further detailed assessment.

### 5.2.8.6 Stakeholder Workshop – 1.7e

The report submitted for consultation will contain the assessment of development opportunities as well as the proposed development options screened.

### 5.2.8.7 Task Summary

The activities and outputs for Task C1.7 are summarised in Table 5-11.

*Table 5-11: Summary of activities and Outputs for Task C1-7.*

| TASK C1-7: Screening of Development and Investment Options | | | |
|---|---|---|---|
| **Expected outcome(s):** | A qualitative screening of the five development options allowing the Steering Committee to select only three most relevant options for further detailed assessment | | |
| **Task Leader**: Team Leader | | **Team members**: | Options Analyst, environmental and social expert and water resources modeller |
| **Start date**: Month 7.0 | **End date**: Month 16.0 | | **Task duration**: 11.0 months |

| Main activities | Duration (months)[1] | Outputs | Meetings, workshops |
|---|---|---|---|
| C1.7a: Selection of development options | 3.0 | Wide range of development options | |
| C1.7b: Finalisation of development criteria | 1.5 | Criteria based on stakeholder-agreed objectives | Meetings with Client and Workshop 3 |
| C1.7c: Screening of development options | 3.0 | Minimum of five options for taking forward to stakeholders | Meetings with Client |
| C1.7d: Drafting of report | 2.5 | **D7. Assessment of Development Options report** | First draft presented at workshop 4 |
| C1.7e: Stakeholder Workshop | - | Stakeholder endorsement of five "best" development options. | Workshop 4 |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.2.9 Task C1-8: Assessment of screened Investment Options

### *5.2.9.1 Introduction/Overview*

This tasks concerns the application of the SSEA methodology already developed (see Task C1.6) at the second level for the three selected development options. The social and environmental impacts of each development option will be identified including secondary, cumulative and synergetic impacts and these will be quantified to the extent possible.

Impacts shall be characterized on short, medium and long term basis and the economic trade-offs associated with each development option will be identified and costs and benefits estimated. The most appropriate internationally accepted methods will be used after discussion and agreement with the Client.

Key impact areas that will be investigated will include:

- Changes in the river system in terms of river hydrodynamics, sedimentation, floods, flow regime, etc Their secondary impact on the ecosystems and water uses downstream;
- Socio-economic impacts related to recession agriculture, livestock, fisheries, food security, livelihood diversification, transport, access to electricity etc. with a particular focus on gender issues;
- Ecological impacts related to loss of or damage to ecosystems, biological corridor break, loss of biodiversity, landscape impacts, etc.
- Economic impacts such as food and power production, employment, reduction of transportation costs, environmental benefits and losses, etc.
- Health impacts, in particular those related to water-borne diseases;
- Climate change. Impact will be quantified over the long term through a broad carbon balance and sensitivity to climate change. The three options will be compared in terms of adaptability to climate change (suitability for climate proofing).
- Impact on wetlands and related activities: Seasonal and permanent wetlands cover over seven percent of the Sub-basin and are vital areas for fish spawning and fry rising for the local population. They also support the unique habitat for a variety of wildlife species. The study will focus on the impacts on the wetlands and will apply innovative best practices to minimize adverse impacts of the proposed investment projects.

### *5.2.9.2 Strategic Social and Environmental Assessment(s)- C1.8a*

In order to assess the environmental and socio-economic consequences of the shortlisted water investment options, it is envisaged to use the NB-DSS analysis built-in tools. For each of the investment option scenarios, indicators will be identified to quantify environmental, social and economic impacts related to water resource interventions. An indicator's defining characteristic is that it facilitates understanding of impacts related to water resource interventions by assessing how the interventions affect the direction of change in environmental, social and economic performance, and by measuring the magnitude of that change. Within the DSS, indicators will be evaluated based on the outputs of the simulation models. For example, the simulation of water balance under a new scenario would quantify changes to the hydrologic regime as a result of the scenario under question. These changes in hydrologic regime are then used as inputs for computing indicators of system performance based on "response functions", thereby translating simulation outputs into system performance in terms of environmental and socio-economic terms. Powerful built-in features of the NB-DSS which will facilitate the strategic social and environmental assessment of the identified development options include the Script Manager, which enables customized functionality, the NB-DSS Spreadsheet Manager and the NB-DSS GIS Manager.

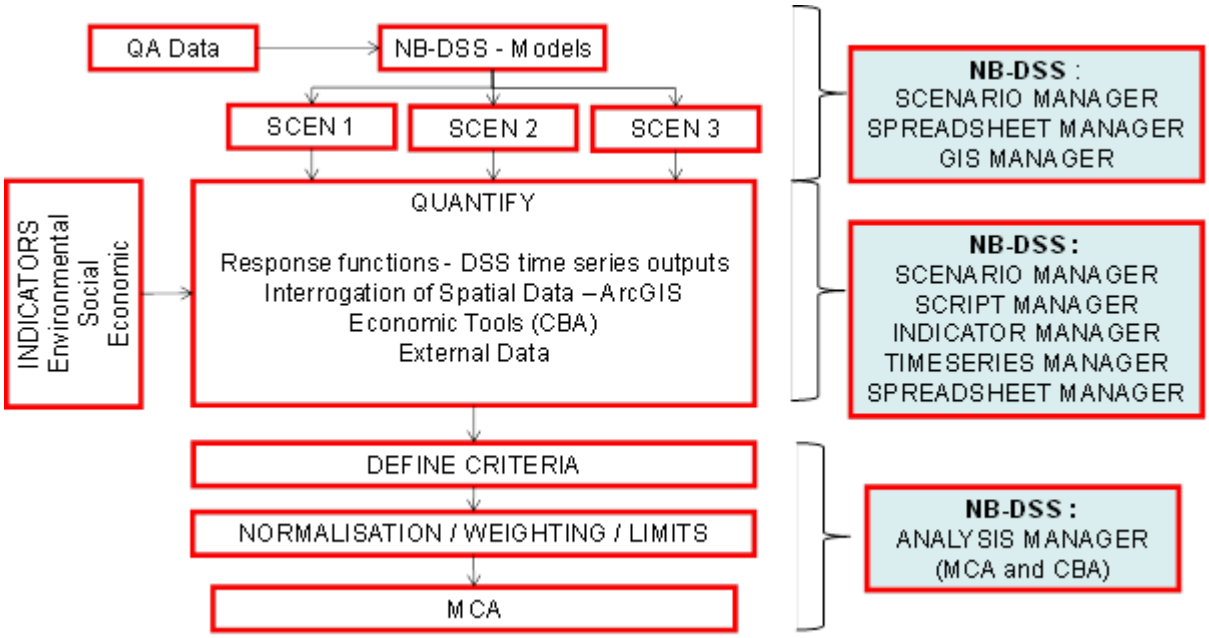
*Table 5-12: Typical NB-DSS Indicators used for Impact Assessment*

| SOCIAL | ENVIRONMENTAL | ECONOMIC |
|---|---|---|
| Water availability | Environmentally sensitive areas | Impact on navigation |
| Malaria risk | Carbon emissions | Energy production |
| Pest diseases | Fisheries production | Evaporation loss : dams/wetlands |
| Water pollution | Floodplain inundation | Food production |
| Flood risk | Extent of wetlands | Flood damage costs |
| Drowning risk | Ecological stress | Benefit/cost ratio (BCR) |
| Extent of commercial irrigation | Biological production | Internal Rate of Return (IRR) |
| Impact on recession agriculture | Abundance of pest blackflies | Gross Domestic Product (GDP) |
| Fish production | Bank stability | Employment opportunities |
| Loss in productive land | Recovery distance | |
| Loss of access to natural resources | Seasonal shift | |
| Physical displacement | Phytoplankton growth potential | |
| Economic displacement | Aquatic macrophytes growth potential | |

### 5.2.9.3 Economic Trade-offs, Costs and Benefits and multi-criteria anaysis- C1.8b

Based on the outcome of the NB-DSS Analysis Tools e.g. the CBA and MCA tools, informed investment decisions can be made. Solutions generally involve multiple criteria, trade-offs, compromise, conflict resolution and judgment, especially in shared river basins. When making decisions related to water management interventions, it is also important that cognizance is taken of the potential impacts associated with external factors which could have a significant impact on the outcome and viability of the interventions under consideration. These include climate change impacts, economic trends, policy changes, changes in funding mechanisms etc., all of which can be accommodated within the NB-DSS framework.

*Figure 5-26: DSS Scenario Analysis Flow Chart*



### 5.2.9.4 Institutional and Policy Framework Requirements – C1.8c

An assessment of the required institutional and policy framework for the management of the planned investments will be carried out. This will include consideration of the environmental and social impacts and will highlight the capacity, strengths and weaknesses of national structures as well as of ENTRO.

The institutional framework and measures to ensure sufficient capacity within national institutions and ENTRO to manage the environmental and social impacts that might arise from future investments will be identified and detailed.

Consideration will be given to development for managing investments projects, ensuring the achievement of the water resource management objectives, and/or mitigating impacts

### 5.2.9.5 Drafting of report and stakeholder workshop – C1.8d and C1.8e

The Consultant will draft ”Assessment of options” report. The TORs for specific studies including the rationale for the studies, will be included in this report.

The first draft of this report, sufficient for discussion with stakeholders will be ready for the fifth Stakeholder workshop at the end of month 18 and the results of the assessment will then be presented to the BAS project steering committee.

It is understood that the Steering Committee, in light of the report and the results of stakeholder consultation, may validate the report and select an option to be detailed in the Integrated Water Resource Development and Management Plan, or ask to modify/refine options4. The revised assessment will then be submitted in the final report

### 5.2.9.6 Task summary

The activities and outputs for Task C1.8 are summarised in Table 5-13.

*Table 5-13: Summary of activities and Outputs for Task C1-8.*

| **TASK C1-8: Screening of Development and Investment Options** | | | |
|---|---|---|---|
| **Expected outcome(s):** | A qualitative screening of the five development options allowing the Steering Committee to select only three most relevant options for further detailed assessment | | |
| **Task Leader**: Team Leader | | **Team members**: | Options Analyst, environmental and social expert and water resources modeller |
| **Start date**: Month 14.0 | **End date**: Month 18.0 | | **Task duration**: 4.0 months |

| Main activities | Duration (months)[1] | Outputs | Meetings, workshops |
|---|---|---|---|
| C1.8a: Strategic social and environmental assessment | 2.0 | Working paper to feed into the report | Meetings with Client |
| C1.8b: Economic Trade-offs, Costs and Benefits and multi-criteria analysis | 1.5 | Database on excel | Meetings with Client |
| C1.8c: Institutional and Policy Framework Requirements | 1.5 | Working paper to feed into report | Meetings with Client |
| C1.8d: Drafting of report | 4.0 | **D7. Assessment of Options report** | First draft presented at workshop 5 (Month 18) |
| C1.8e: Stakeholder Workshop | - | Stakeholder endorsement of five “best” development options. | Meeting with steering committee following workshop |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

[4]Including by mixing elements from distinct options

## 5.2.10 Development and Detailing of the Integrated Water Resources Management and Development Plan (IWRDMP)

### *5.2.10.1 Introduction/Overview*

Development of the integrated water resources development and management plan will build on the work done in previous tasks under Component 1, in particular the definition of strategic objectives coming out of Task C1.4 and the screening of options coming out of TaskC1.7 and C1.8.

### *5.2.10.2 Basin-wide Water Resources Management Plan – C1.9a*

#### OVERVIEW

Under Task 1.4 a number of strategic objectives will have been developed. These strategic objectives must be turned into a number of strategic actions which will effectively define the IWRDMPlan. Although it is difficult to separate the ideas of development and management, the aim in this task will be to develop all the strategic actions that will define the framework of the plan. Some of these actions will relate to the development options but without looking at specific actions.

In order to move from strategic objectives to strategic actions the Consultant proposes to make use of a suite of SWOT analyses and/or similar appropriate techniques and will **use a stakeholder workshop for detailing and verification** of the results. The consultant has considerable experience in the these type of analyses having applied them for this purpose for three basin water resource multipurpose development strategies and in the recently completed work of development of an IWRM Plan for the Orange-Senqu Basin.

#### METHODOLOGY

The methodology that will be used is as follows:

Based on the strategic objectives coming out of Task C1.4, the next step is to move towards the strategic actions. Based on the use of a SWOT analysis, the following steps are proposed **for each strategic objective:**

i. Listing of critical factors having an influence on achievement of the strategic objective
ii. SWOT analysis using critical factors
iii. Based on SWOT analysis, list strategic “measures”
iv. Development of strategic actions

#### FACTORS AND DRIVING FORCES AFFECTING THE ATTAINMENT OF THE STRATEGIC OBJECTIVES

In order to understand what can cause change it is necessary to examine factors and driving forces that **can** cause change. These can be external and /or internal forces, which drive changes in social, technological, environmental, economic and political factors. Alternatively - the driving forces could be analyzed according to the changes that they (can) drive under three broader categories of factors. For example:

- **Natural resource characteristics** including water quality and quantity issues, but also land and watershed characteristics and which could include:
  - Condition of arable and grazing farmland
  - Condition of riparian zones
  - Level of vegetative cover, especially forest
  - Condition of wetlands
  - Water quality
  - Frequency of flood and drought
  - Climate variability and climate change
  - etc

- **Characteristics of the human environment** including human and social capital, poverty, urbanization, demographics, water management awareness, technological and economic factors and which could include:
  - Poverty levels
  - Population density
  - Level of reservoir or natural water storage in the basin
  - Farming practices
  - Level of access to basic services
  - Level of access to socio-economic development paths
  - Level of disease prevalence and mortality rate
  - Land tenure
  - etc
- **Institutional characteristics** including political factors, institutional framework, the organisational capacities of government organisations at different levels, financing issues and planning and which include:
  - Level of water/natural resources monitoring
  - Capacity of interational/national/local government organisations
  - Financial capacity
  - Capacity/participation of stakeholders (CMAs, WUAs)
  - Level of inter-sector coordination / cooperation
  - Clarity of transboundary cooperative framework
  - Experience/expertise in MPP implementation, Operation & maintenance
  - etc

These categories clearly comprise factors that could lead to the attainment or non-attainment of the identified strategic objectives.

Internal and external driving forces affect these factors positively and negatively. For example:

*Table 5-14: Example of Factors and associated external and internal driving forces*

| | Factor | External Driving Forces | | ▪ Internal Driving Forces | |
|---|---|---|---|---|---|
| **A1** | Condition of arable and grazing farmland | ▪ Population pressures including in/out migration<br>▪ Variability in precipitation<br>▪ Steepness of slopes and depth of soil cover<br>▪ Access to markets | H<br>H<br>H<br>M | ▪ Soil and water conservation practices<br>▪ Degree of overstocking of livestock<br>▪ Quality of inputs (seeds and fertilizers)<br>▪ Availability of financial resources | M<br>M<br>M<br>H |
| **C1** | Level of water/natural resources monitoring | ▪ Level of financing available<br>▪ Level of acceptance by high-level decision makers as to necessity | M<br>M | ▪ Appreciation and support of local communities (participation and absence of vandalism)<br>▪ Technical capacity within WRMA/LVSCA at various levels | M<br>M |
| **C5** | Level of inter-sector coordination / cooperation | ▪ **Degree of high level single sector planning at national and regional levels**<br>▪ **Availability of a cross-sectoral water resources development strategies** | **L**<br>**L** | ▪ **Sharing of sectoral development plans at early stage in the project cycle**<br>▪ Degree to which project are developed bottom upwards in response to beneficiary needs | **L**<br>M |

H, M and L refer to the "predictability" or **level of intransigence** of the driving force. This is useful because it provides guidance on which driving forces can most easily be influenced by action.

As a first step, a list of factors will be built up and this can be quite quickly and will be as exhaustive as possible.

## SWOT Analysis

The factors which are most relevant for each strategic objective will be taken forward to the SWOT Analysis **The SWOT analysis must then be carried out for each of the strategic objectives.** This can be a time-consuming process so it is proposed that the Consultant will carry out a preliminary SWOT analysis on all strategic objectives and will then develop these further **during a day devoted to this as part of the fourth stakeholder workshop**.

The process of how the SWOT analysis could be carried out is illustrated through the use of an example taking a typical strategic objective:

- Strategic Objective : "to optimise the management (and utilisation) of the basin's water resources". The priority factors for this objective could include:
  - Level of knowledge of surface water resources
  - Level of knowledge of groundwater
  - Usefulness / applicability of water resources management models
  - Etc

These factors are put into the left hand column of the SWOT analysis as shown in Figure 5-27

*Figure 5-27: Setting up the SWOT Analysis*

| (Prioritised) critical factors | Internal | |
|---|---|---|
| | **Helpful** ***STRENGTHS*** *– Status of the internal driving forces enhancing achievement of the objective* | **Harmful** ***WEAKNESSES*** *– Status of the internal driving forces impeding achievement of the objective* |
| **Level of knowledge of surface water resources** | ▪ Long reliable hydrological records exist for some key station on the Akobo Rivers<br>▪ XX | ▪ Inadequate density of river gauges in parts x, y and z of the basin<br>▪ Frequency of discharge measurements is too low to allow accurate rating curves<br>▪ Inadequate budget for hydrometric monitoring<br>▪ Inadequate technical capacity….. |
| **Level of knowledge of groundwater** | ▪ | ▪ |
| **Usefulness / applicability of water resources management models** | ▪ | ▪ |
| **Etc…..** | ▪ | ▪ |
| **Prioritised critical factors** | **External** | |
| | **Helpful** ***OPPORTUNITIES*** *– Status of external driving forces enhancing achievement of the objective* | **Harmful** ***THREATS –*** *Status of external driving forces impeding achievement of the objective* |
| **Level of variability of precipitation and other climate variables** | ▪ | ▪ |
| **Climate change** | ▪ | ▪ |
| **Level of population pressure** | ▪ | ▪ |
| | ▪ | ▪ |
| **Etc….** | ▪ | ▪ |

A worked example for another study carried out by this Consultant is shown as Figure 5-28 for purposes of illustration. Involvement of stakeholders in carrying out the SWOT is important because it ensures that specific local perspectives are taken into account. This will ultimately help in identifying actions and activities that are relevant**.**

| **Prioritised critical factors** | **Internal** | |
|---|---|---|
| | **Helpful** ***STRENGTHS*** *– Status of the internal driving forces enhancing achievement of the objective* | **Harmful** ***WEAKNESSES*** *– Status of the internal driving forces impeding achievement of the objective* |
| **Capacity/participation of CAAC and WRUAs** | ▪ Good relationship between RBO and WUAs<br>▪ Provision made for WUA driven sub-catchment management plans | ▪ Current level of technical and managerial capacity at WUA level is limited<br>▪ Many WUAs are still to be formed and there are challenges in getting participation within WUAs<br>▪ Limited capacity and experience within CMAs<br>▪ Participation of CMAs is relatively infrequent |
| **Level of inter-sector coordination / cooperation** | ▪ For large projects, inter-ministerial committees, while not effective enough are in place<br>▪ As WUAs and new political organisation become operational, stakeholder participation in planning should grow | ▪ Sharing of plans between sectors early in the project cycle is lacking<br>▪ Development of major projects still lacks a bottom up approach<br>▪ Lack of an organisation taking charge of inter-sectoral water resources development projects |
| **Level of access to socio-economic development paths** | ▪ Sectors have/are putting in place development strategies and plans with projects identified<br>▪ National and regional programmes are supportive of the multi-sector investment approach | ▪ Lack of capacity in irrigation farming, aquaculture, agro-processing, tourism …<br>▪ Intransigence in adopting of new livelihood paths and opportunities |
| **Financial capacity** | ▪ RBO can play a role in coordinating water resources development to avoid duplication of effort and costs<br>▪ Availability of financing system for WUAs | ▪ Lack of adequate budget at grass-roots level, WUAS, district government …<br>▪ Lack of resource sharing by sectors during all steps of project cycle |
| **Experience/expertise in MPP implementation, operation & maintenance** | ▪ NELSAP/NBI and other are keen to support development of capacity in WRMA | ▪ Currently low level of exposure of stakeholders/beneficiaries to cross-sectoral development and MPPs<br>▪ Problems of access to planners by potential beneficiaries |
| **Prioritised critical factors** | **External** | |
| | **Helpful** ***OPPORTUNITIES*** *– Status of external driving forces enhancing achievement of the objective* | **Harmful** ***THREATS –*** *Status of external driving forces impeding achievement of the objective* |
| **Capacity/participation of CAAC and WRUAs** | ▪ Since restructuring of the water sector the introduction of WUAs and CMAs provides the enabling environment for stakeholder participation; | ▪ RBO unable to provide adequate technical support to WUAs and CMA<br>▪ Risk of upstream/downstream conflict of interests; |
| **Level of inter-sector coordination / cooperation** | ▪ The availability of cross-sectoral water resources development strategies such as the present MWRDMP | ▪ Continued tendency to plan at a high level on a single sector basis<br>▪ Budget planning and allocation is done sectorally making inter-sector cost sharing complicated |
| **Level of access to socio-economic development paths** | ▪ Availability of land and especially water resources<br>▪ Development of (identified) socio-economic developments in irrigation, hydropower, capture fisheries, aquaculture, tourism, industry<br>▪ Multipurpose projects have been identified | ▪ Lack of clarity with respect to available water in transboundary context |
| **Financial capacity** | ▪ Closer inter-sectoral cooperation would result in cost and benefit sharing<br>▪ MPP concept provides concrete opportunity for cross-sectoral cost sharing and maximisation of benefits per unit investment | ▪ Level of budget available for development, training, monitoring and evaluation at regional level<br>▪ Lack of strong rural financial institutions/market structures |
| **Experience/expertise in MPP implementation, operation & maintenance** | ▪ Keen interest at national and regional levels to provide support to MPP projects | ▪ Lack of capacity-building programmes in MPP planning and implementation, operation and maintenance |

*Figure 5-28: SWOT analysis of the strategic objectives*

NB: The SWOT analysis is "to ensure capacity building and coordination amongst various water users in order to optimize development and management efforts".

#### MEASURES REQUIRED AND STRATEGIC ACTIONS

Generation of the SWOT analyses for each strategic objectives will already provide a clear indication of the strategic measures and actions that will be required since these will be strongly related to the driving forces. For example taking the harmful driving forces that were highlighted (under weaknesses for level of knowledge of surface water resources) in the above table it is quite straightforward to identify the measures that may be required:

- Inadequate density of river gauges in parts x, y and z of the basin: Measures are required to increase the density of the hydrometric network in these areas (new stations, budget, staff)
- Frequency of discharge measurements is too low to allow accurate rating curves to be drawn up: Measures are required to ensure that the frequency of discharge measurements is increased (budget, staff, capacity etc)
- Inadequate budget for hydrometric monitoring: Measures required to highlight the importance of these data and to motivate increased budget…
- Inadequate technical capacity: Measures to improve capacity at different levels (in-house training, better recruitment, improved remuneration etc etc)

Many of these measures could be combined into more strategic (less specific) strategic actions.

Taking the example presented earlier, the SWOT analysis led to the identification of two strategic actions as shown in Table 5-15.

*Table 5-15: Example of proposed strategic actions*

| **Strategic objective 4: to ensure capacity building and coordination amongst various water users in order to optimize development and management efforts** | |
|---|---|
| **Prioritized critical factors** | **Proposed strategic actions** |
| Capacity/participation of Catchment Area Commitees and Water Resources User Associations<br>Level of inter-sector coordination / cooperation<br>Experience/expertise in MPP implementation, operation & maintenance | 1. Capacity building and support to catchment management units to ensure that they can play a more prominent role in catchment planning, needs-responsive single sector and multipurpose project identification<br>2. Capacity building and support to ENSAP and other sectoral planners to ensure improved inter-sector water-related project and programme planning through maximisation of inter and cross-sectoral communication and coordination |

#### DETAILING OF SPECIFIC ACTIONS AND ACTIVITIES

Once measures and strategic actions have been worked out, these have to be detailed out into more specific actions and activities in order that costs and timelines can be assigned.

### *5.2.10.3 Detailing of selected option – C1.9b*

The selected option will be refined according to the comments of the Steering Committee. The option type specifies a combination different interventions (components/sub-projects) but the relative sizes of the different components have to be optimized. All the related investments and measures will be described and it will be stated whether the projects should be implemented in the long, medium or short terms. A priority sequence of the multipurpose water resources development projects, based on an analysis of economic development trends in the region, as well as environmental and social considerations will be developed.

Component 3 will follow directly on from this. The development of medium and long-term project represents one set of activities that will be the focus of that Component of the study

### 5.2.10.4 Technical Characteristics of Option Components – C1.9c

This subject has already been introduced earlier in Section 3.4.10. For all chosen the multipurpose project type the characteristics of the various components will be described

- Water supply and sanitation: type of infrastructure, number and location for rural water supply and sanitation, and main characteristics for urban systems.
- Irrigation schemes: areas, type of diversion, main geometrical characteristics of the works, type of crops, type of farming systems, etc.;
- Hydropower schemes: dam sites, reservoir volume and extension, power, main geometrical characteristics of the dam, type of spillway, etc.
- Navigation: water depth and standard river section required, river sections to be dragged and related volume of sediments, measure against water hyacinth, docks and other specific works characteristics, etc.
- Rainfed agriculture and watershed management: structural and non-structural measures. Related non-water measures etc
- Eco-tourism development: description of the main components.

The climate change priority measures needed to ensure sustainability of the proposed investments will be detailed. .

### 5.2.10.5 Review of Social and Environmental impacts – C1.9d

Based on information already collected as well as on the assessment of the development options impact carried out during the SSEA, the Consultant will analyse potential specific investment related social and environmental impacts will be analysed and possible mitigation measures proposed.

### 5.2.10.6 Investment Costs, Cost/Benefit and Financial Analyses – C1.9e

**The investment costs of the proposed option will be estimated and cost/benefit and financial analyses will be carried out. A** benefit sharing framework will be developed to show clearly how costs and benefits may be shared in by beneficiaries in the sub-basin.

### 5.2.10.7 Institutional Framework – C1.9f

The Consultant will coordinate closely with ENTRO to recommend an appropriate institutional framework for the implementation of the water management and development plan, taking into account (at each level) competences (capacity building, operating and maintaining the investments, managing the water resources) and type of investment (hydropower, irrigation, navigation, eco-tourism, etc.).

An Action Plan and detailed Terms of Reference will be prepared for additional consultancies required for implementing the proposed institutional framework (policy and legal arrangements, consultation process, etc.

### 5.2.10.8 Mobilisation of Resources C1.9g

The objective of this task is to identify financing sources and modalities for the identified IWRDMP, including: national, EN regional, bilateral, multi-lateral, private, public, PPP, etc.

Various types of PPP contractual arrangements may be implemented between Public Authority and Private Sector when it comes to energy, irrigation, drinking water, ports, etc.

The diversity of PPP arrangements can be designed according to three main criteria, which will help identify the most suitable models to address issues at hand:

- **The different functions that the private partner** will take responsibility for through the PPP contract (e.g., design, construction);
- **The source of revenues** for the private operator (to be paid by the final users or by the contracting authority);
- **The contribution** (possibly none) of the private partner to the capital expenditure (CAPEX) of the project.

In terms of revenues, the private partner could rely on user fees, on payments from the public contracting authority, or on funds made available by the Government as payment or as subsidy to the operator for providing the service.

The level of risk borne by the private operator can vary widely from one case to another and from one model to another. The higher the risk, the higher should be the return to be offered to the private partner as incentive by the contracting authority; and the higher the return, the higher will be the cost to the final users. The contracting authority, with the help of transaction advisors, has to find the correct trade-off by allocating risks to the party most able to bear these to reduce the burden on final users.

The most important lesson to be learned from the experience of other countries is to avoid complex contracts (i.e., contracts with multiple objectives). It is better to break a large contract into several smaller, separate contracts. Complex contracts entail complex operational procedures and relationships, which increase the likelihood of delays in project implementation and conflict between the contracting parties.

In view of the investments needs in the BAS sub-basin, the PPP expert will expose all the possible arrangements which could be implemented for PPP. His contribution will be based on international experiences adapted to the local context (the high level of risk). It will include:

- A global presentation of PPP arrangement: roles of stakeholders, risk appreciation, link with the loan and local context, etc.
- Presentation of international experiences in several area;
- Explanation to develop and conduct PPP studies.

### 5.2.10.9 Task summary

The activities and outputs for Task C1.9 are summarised in Table 5-16.

*Table 5-16: Summary of activities and Outputs for Task C1-9.*

| TASK C1-9: Integrated Water Resources Development and Management Plan | | | | |
|---|---|---|---|---|
| **Expected outcome(s):** | Draft IWRM Plan and draft IWRDM Plan as part of draft Final report | | | |
| **Task Leader**: | Team Leader | **Team members**: | Environmental and social experts, Economist, PPP expert, power economist, options analyst and others | |
| **Start date**: Month 7.5 | **End date**: Month 17 | | **Task duration**: 9.5 months | |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** | |
| C1.9a: Basin-wide Water Resources Management Plan | 6.0 | **D8. Draft IWRM Plan** | Presented at 3rd stakeholder workshop | |
| C1.9b: Detailing of the selected Development Option | 3.75 | Working paper as input to final report | Elements discussed at 4th stakeholder workshop | |
| C1.9c: Technical Characteristics of Option Components | 2.25 | Working paper as input to final report | Elements discussed at 4th stakeholder workshop | |
| C1.9d: Social and Environmental impacts | 1.5 | Working paper as input to final report | Elements discussed at 4th stakeholder workshop | |
| C1.9e: Investment Costs, Cost/Benefit and Financial Analyses | 1.75 | Working paper as input to final report | Elements discussed at 4th stakeholder workshop | |
| C1.9f: Institutional Framework | 1.0 | Working paper as input to final report | Elements discussed at 4th stakeholder workshop | |
| C1.9g Mobilisation of Resources | 0.75 | | | |
| C1.9h: Drafting of IWRDMP Report | 3.5 | **D8. Final IWRDM Plan as part of draft Final report of the study** | Presented at 5th stakeholder workshop (Month 18) | |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously

## 5.3 COMPONENT 2 : IDENTIFICATION AND PREPARATION OF SHORT-TERM PROJECTS

### 5.3.1 Introduction

Component 2 of the study will start early on in the process. It is **not a follow on** from Component 1. This is clear from Figure 5-6 which showed the flowchart for the activities comprising Components 1 and 2.

The objective of Component 2 is to identify and advance the planning and preparation for implementation of a number of suitable projects. Although the projects will be chosen before the IWRDMP is drafted, they will be of such a nature that **they will have a clear place** in the plan.

The preparation of short-term projects is important for a number of reasons. The simplest is that it is important that implementation of the IWRDMP starts in the near future. The idea of fast-tracking can play a role in avoiding that study becomes a set of reports that are consigned to the bookshelf.

It has been noted that there should be a stress on water supply and sanitation, especially in the South Sudanese part of the basin where coverage levels are exceptionally low.

The Consultant will look for opportunities for the development of multi-purpose projects combining several sectors focussed either around a piece of infrastructure or a management and development concept.

### 5.3.2 Task C2-1: Development of a long list" – C2.1

The point of departure will be the list of projects that has been drawn up by ENSAP. These will be studied in terms of their characteristics and in terms of the motivation behind their selection. Thus it will be useful to look at any documentation relating to the stakeholder consultation process.

During the baseline work, one of the tasks when looking at the issues and challenges around the basin as well as when looking at the sectoral development potential will be to highlight opportunities for short-term projects, especially those which could be combined across sectors. The target will be to have a long list in place by the middle of month 6 at the latest. This will allow time for screening and selection and presentation of the seven potential multipurpose projects at the second Stakeholder Workshop.

A standard project description "fiche" will be developed for each multipurpose project with brief annexes on each project component. This will be done in such a way as to highlight the aspects for evaluation using the screening and selection criteria. These will be annexed to the Concept Note.

### 5.3.3 Project Selection – C2.2

Once again the point of departure will be the motivation behind the choice of short-term projects developed by ENTRO. It is likely that this motivation was based on certain criteria and it would be useful to examine these criteria.

A set of selection specific to the context of short-term projects will also be developed. These will include things like:

- Ability to yield early benefits or show early positive impacts
- Level of advanceness of preparation (typically projects already included in national and regional sectoral development plans)
- Potential for scaling up and replicability
- Not reliant on large quantities of data (surveys etc.)
- Level of support or potential support from the stakeholder communities
- Impact on poverty reduction and enhancement of livelihoods (water supply and sanitation especially in South Sudan, improved food security etc.)
- Budget between 5 and 10 million euros

### 5.3.4 Concept Note – 2.3

A concept note will be compiled for the seven best multipurpose projects. The Concept Note will include:

- Description of the components of the projects and the implementation arrangements,
- estimated costs and benefits and
- the social and environmental impacts.
- a mapping of the project sites, characteristics and impacts

The Concept Note will be prepared in advance of the Second Stakeholder Workshop so that the seven projects can be presented and evaluated at the workshop. Use will be made of higher resolution imagery to update the mapping of the seven short-term projects (see boxes).

**Application of Remote Sensing**

***Updating the coverage of the 7 short term project sites to a scale of 1:25000***

At a scale of 1:100000, a lot of features are too small or too narrow to be properly analysed; it is therefore necessary to improve the maps by enlarging them to a bigger scale.

Thus details will be added to the 7 short term projects sites 1:100000 theme maps thanks to the Rapideye 5 m resolution images.

The themes will be enriched by adding the following:

- analysis of the texture of bare ground: rugged, smooth, or intermediate,
- geological analysis: outcropping rocks and bedrock, fault systems in outcropping geological formations,
- floating vegetation
- identification of rapids on water courses, if any,
- limits of potentially flooded areas,
- limits of the watersheds determined through analysis based on the hydrographic system.

*Floating vegetation can only be seen when enlarged to 1:25000 or more*

*On the left, at a scale of 1:100000, it is impossible to differentiate the flood plain from the normal channel; on the right, at a scale of 1:25000, they are distinct*

## 5.3.5 Screening of projects – C2.4

Screening criteria will be organised in a similar way to the SSEA criteria that will be developed for the overall study. Thus environmental social and economic criteria will be set up at an early stage. These will include environmental and socio-economic criteria which are especially related to the idea of short-term project implementation and will be related to the selection criteria already introduced.

The Consultant will make careful preparations for the workshop. The Concept Note will be an important document but it will also be important to develop workshop materials so that the participants are able to look critically at the potential projects and apply the screening criteria. The Consultant can provide guidance on the process at the workshop but it is important that the stakeholders play an active role in prioritising the three projects to go forward.

After the workshop the Consultant will work closely with the project steering Committee in finalising the choice of three projects.

## 5.3.6 Project Preparation – C2.5

### *5.3.6.1 Overview*

The precise nature of project preparation will depend on the type of project selected. Some of the multipurpose projects will we a combination of both small infrastructure and "soft" type components, others may be entirely "soft" in nature.

Project preparation will be at two levels for each of the three multipurpose projects. The first level will be the level of the multipurpose project which comprises a set of linked sub-projects or components. It is important that the sub-projects are not prepared in isolation. The overall multipurpose project will be prepared as a whole, bearing in mind that one of the motivations for the multipurpose approach is that the overall project t benefit is greater than the sum of its individual components.

For the individual sub-projects the preparation will be carried out as follows:

- **small infrastructure sub-projects**: feasibility studies will be carried out and will include social, economic and financial analyses (including price setting if relevant), and environmental impact assessments to prepare the projects for implementation.
- **"soft type" development** sub-projects: Details of the projects components will be planned and designed and the costs estimated. Benefits and impacts will be assessed and quantified where possible.

### *5.3.6.2 Stakeholder Consultation*

A participatory approach will be central to the project preparation. In view of the nature of these projects it will be necessary to involve both the sectoral stakeholders (planners etc.) at the national and district levels and representatives of the targeted stakeholders.

Once the three projects have been agreed, the project team will start to work more closely with the sectoral planners and stakeholder representatives. The following steps are proposed both these will be refined during the Inception Phase:

- Identification of the key stakeholders at the management level, contact details, etc.
- Organise (through the national and district institutions) a stakeholder meeting at a site where stakeholder representatives can attend.
- Introduce the proposed project and present details (open discussion).
- Prepare details of the project.
- Second local stakeholder meeting to present final draft version of the prepared project.

### 5.3.6.3 climate proofing

The short-term projects will be climate proofed by taking into account the risks associated with climate change. Project design will include all mitigation measures.

**Application of Remote Sensing**

***Updating the coverage of the 3 priority project sites to a scale of 1:5000***

For the same reasons as before, it may be necessary to enrich the map work on the priority project sites to allow analysis in even greater detail. The degree of detail will be determined by the main project theme and the size of the project area.

For the sites where this is possible and necessary, the 1:25000 map theme features will be further refined using very high resolution images (1 metre resolution).

It will thus be possible to enrich each theme map thanks to a more detailed analysis of the following:

- type of settlement (traditional or dense urban settlement)
- presence of port facilities,
- presence of boats,
- presence and proportions of economic infrastructure,
- type of access to the river and type of banks

*Traditional settlement can only be differentiated from modern constructions when enlarged to 1:5000 or more*

*1: 100 000* *1: 25 000* *1: 5 000*

*Ripisylve shown at different scales. It is only possible to see the boundaries of gallery forest with a good enlargement*

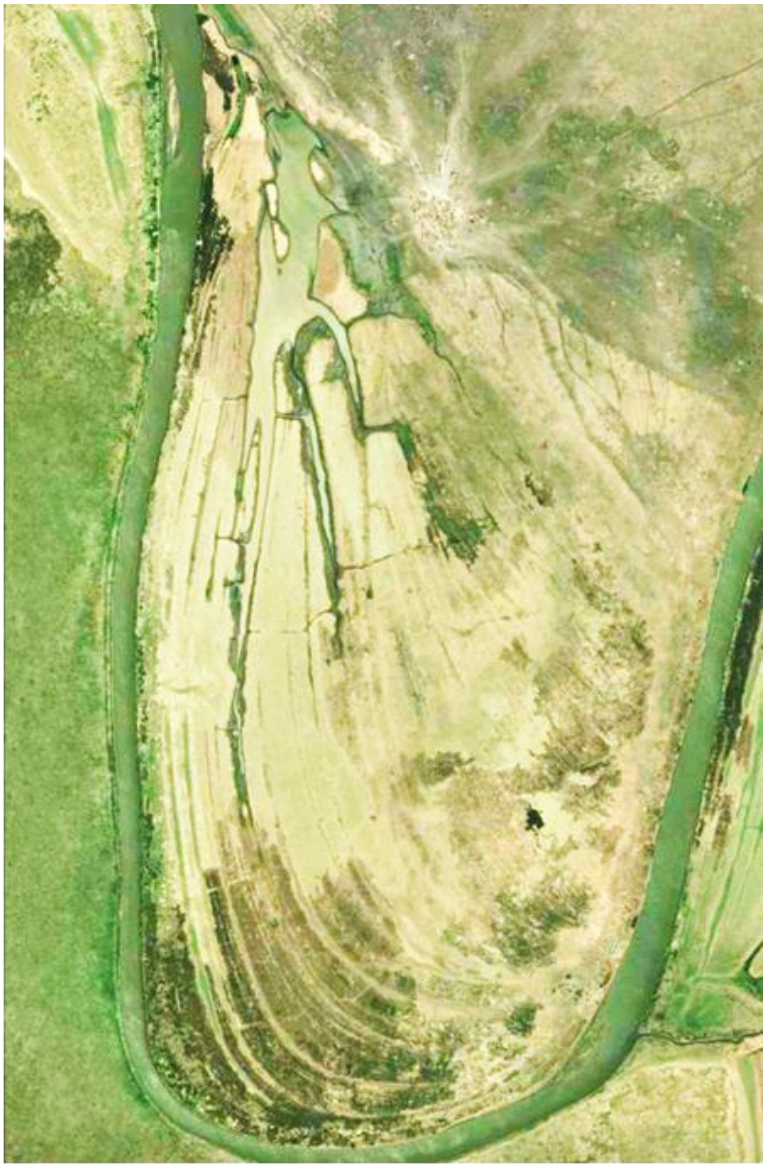
### 5.3.7 Formalisation of Outputs – C2.6

Multipurpose project reports will be prepared for each of the three multipurpose projects and will include

- Overall multipurpose project design explaining linkages between sub-projects,
- comprehensive feasibility studies of the selected infrastructure sub-projects,
- project design for the “soft type” development sub-projects,
- Financing proposals.

**Application of Remote Sensing**

***Use of high resolution imagery***



In order to analyse the 7 short term project sites and the 3 priority project sites, we intend to purchase Rapideye type high resolution (5 metres) and very high resolution (<1 m) Quickbird, Geoeye, World View, Ikonos or Pleiade satellite imagery.

The images will be selected depending on the surface area covered and the themes addressed on each particular site. We will use the most appropriate imagery available considering dates and cloud cover. The images will be orthorectified and integrated into the cartographic projection of the project

*Left: A Rapid-eye image - 5 metres resolution*

**Application of Remote Sensing**

**Use of high resolution imagery**

*Left: A VHR image of a meander – 1 metre resolution*

*On the very high resolution image, we can see where there is access to the river*

### 5.3.8 Task Summary

*Table 5-17: Summary of Activities and Outputs for Component C2.*

| COMPONENT C2: Identification and Preparation of Short-term Projects | | | |
|---|---|---|---|
| **Expected outcome(s):** | Investment Report for three short-term multipurpose projects | | |
| **Task Leader**: Team Leader | | **Team members**: | Environmental and social development experts, economist plus inputs from sectoral specialist |
| **Start date**: Month 2.5 | **End date**: Month 18.0 | | **Task duration**: 14.5 months |

| Main activities | Duration (months)[1] | Outputs | Meetings, workshops |
|---|---|---|---|
| C2.1: Development of long list | 3.5 | List of all potential multipurpose projects | |
| C2.2: Selection of seven projects | 4.0 | Seven multipurpose projects | Presented at third stakeholder workshop |
| C2.3: Concept Note | 3.0 | **D6. Short terms options report** | Presented at fourth stakeholder workshop |
| C2.4:Screening of projects | 1.5 | | Meeting with project steering committee |
| C2.5:Project preparation | 2.75 | Draft ToRs and designs | Local stakeholder consultation workshop |
| C2.6:Formalisation of outputs | 5.0 | ToRs, designs, financing options etc | Presented at 5th stakeholder Workshop |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.4 COMPONENT 3: IDENTIFICATION AND PROFILING OF MEDIUM AND LONG-TERM PROJECTS

### 5.4.1 Overview/Introduction

The identification of medium and long-term projects will follow directly on from the development of strategic actions and will be in line with the strategic objectives. Medium to long-term projects are seen as mainly large infrastructure projects that will require a significant amount of preparation and associated cost. The projects should be:

- Regional in nature,
- Transboundary in scope,
- Offer win-win benefits to the Eastern Nile countries,
- Contribute to improvement of access to drinking water and improved sanitation,
- Enhance food and energy security,
- Reduce poverty,
- Promote peace and stability,
- Promote health and security.

### 5.4.2 Comprehensive Analysis of candidate projects –C3.1

The comprehensive analysis of the candidate projects will be prepared. This will include:

- technical, social, environmental, and economic analyses.

### 5.4.3 Terms of Reference

The following terms of reference will be compiled :

- ToR for feasibility studies,
- ToR for Environmental Impact Assessments (EIA) of three medium to long term projects.

### 5.4.4 Roadmap for project preparation

The so-called “roadmap” for project preparation will include

- list of tasks to be carried out to ensure the project preparation and its funding;
- institutional arrangements;
- organizational setup of the project management;
- communication and consultation plan;
- resource mobilization plan and;
- the schedule.
- Terms of reference and EIA for three projects – C3.2

### 5.4.5 Training needs assessment – C3.5

A training needs assessment covering ENTRO and the organisations that will be responsible for implementation will be carried out.

### 5.4.6 Development of Training Plan – C3.6

A comprehensive training plan covering all aspects of project implementation will be prepared.

*Table 5-18: Summary of Activities and Outputs for Component C3.*

| **COMPONENT C3: Identification and profiling of medium and long-term projects** | | | |
|---|---|---|---|
| **Expected outcome(s):** | Terms of reference for feasibility studies and EIA and implementation roadmaps for medium and long-term projects | | |
| **Task Leader**: Team Leader | | **Team members**: Inputs from wide range of experts | |
| **Start date**: Month 13.0X | **End date**: Month 20 | | **Task duration**: 7.0 months |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** |
| C3.1: Comprehensive Analysis of candidate projects | 3.0 | Draft report | Present at Workshop 5 |
| C3.2: Terms of Reference | 3.0 | Self standing ToR | Draft for Workshop 6 |
| C3.3: Roadmap for project preparation | 3.0 | Report with schedule | Draft for Workshop 6 |
| C3.4: Formalisation of outputs | 3.0 | Self-standing project documents for annex to the final study report | |
| C3.5: Training Needs Assessment | 3.0 | Training needs assessment working paper | |
| C3.6: Development of training Plan | 2.0 | Training Plan | Present at Workshop 6 if required |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously.

## 5.5 COMPONENT 4: PROJECT IMPLEMENTATION SUPPORT

### 5.5.1 Overview/Introduction

The inclusion of a participative approach is a central part of IWRM. As has been indicated on many occasions in this proposal, stakeholder consultation will play a key role throughout. All efforts will be made to ensure that the identification and design of projects is needs and eland-driven rather than imposed on stakeholders. The stakeholders will be informed and provide inputs at key decision-making stages throughout the planning and development process.

### 5.5.2 Task C4-1: Stakeholder Consultation Plan

The stakeholder consultation plan, already introduced under Task C1 of Component 1 will be finalised.

Developing an IWRDM plan really requires the active cooperation and engagement of stakeholders. Not only does this have the positive impact of ensuring that the plans include the richness and diversity of inputs required to make these plans both appropriate and sustainable, but also importantly, this provides the **support and cooperation that will later enable the effective implementation of the plans**. This final part of the consultation planning work is aimed at ensuring this.

With this in mind, a stakeholder consultation and engagement process can be seen to achieve three key objectives:

- **Drawing upon a range of views** and perspectives on the nature and causes of challenges, and the various possibilities and opportunities that may exist to address these challenges. Many stakeholders have important information and insights that then provides innovation and diversity that makes the planning process, and the plans themselves, more robust.
- **Fostering alignment** with the various objectives, plans and activities of the various institutions and bodies so that plans are appropriate, integrated and implementable.
- **Generating understanding and ownership** amongst a wide range of stakeholders of the overall objectives of the plan and how the plan deals with challenges and solutions, so that in effect the implementation of the plan will be supported and enhanced.

IWRM is about balancing the need of socio-economic development with that of environmental sustainability, and therefore interaction with stakeholders is essential to ensure that integration is possible. Within the transboundary basin scale context, this takes on different dimensions and complexities with the requirement to balance needs and planning aspirations across the involved and implicated countries. Stakeholder participation can be considered in terms of three variables, namely:

- The **scale** at which stakeholder engagement should be undertaken (basin level/ national level/local level)
- The **scope** or level of management inputs of stakeholder engagement (project/programme/policy)
- The **form or the depth and extent** of stakeholder interaction and input (inform, consult, involve, collaborate)

These variables do help to think through how best to structure participation. International best practice also reflects that basin wide stakeholder engagement does indeed provide the best opportunities for the levels of support and transparency that are needed to develop owned and implementable plans.

Effective stakeholder participation needs to be based upon adequate mechanisms and structures at the regional to local level, and to a certain extent requires some harmonisation in policy with regards to participation. In debating the appropriate *scale* at which participation needs to take place, careful consideration of the various implications is key, and includes logistical issues, financial aspects, power relations and capacity differentials.

In considering the *scope* of inputs that stakeholders will engage one has to carefully consider the appropriateness of that engagement and the benefit the process will accrue through that engagement. Certainly, the levels of participation could vary from project to project, and from stakeholder to stakeholder.

When it comes to institutional cooperation we can start to see differing types of engagement depending on the project and institution and its own planning imperatives.

- **Incorporation**: The inter-relationships between planning processes are relatively independent, but do require some form of consideration and review.
- **Alignment**: Roles and responsibilities are distinct and independent, and therefore do not require harmonisation, but there is a need to be aware of impacts and there needs to be alignment constructed around consultation processes.
- **Harmonisation**: There are close linkages and interfaces so that planning requires coherence and consistency. This then requires a more structured process of coordination.
- **Integration:** The institutional linkages are such that effective and efficient implementation requires common action and response. This means that there needs to be a more cooperative process of exchange almost to the extent of joint decision making to ensure integration of plans and approaches.

## 5.5.3 Task C4-2: Stakeholder Communication Plan

From the above it is evident that communication could relate to the stakeholders in the following key ways:

- **Informing stakeholders**: with very limited discussion or dialogue information is provided to assist the stakeholder understand the various issues and challenges as well as the necessary actions and responses.
- **Consulting stakeholders**: stakeholders get the chance to air their concerns and provide views and perspectives with regards to issues, priorities, objectives and solutions with no real discussion.
- **Involving stakeholders**: stakeholders are provided with the chance to deliberate issues so that their concerns and interests are considered and incorporated.
- **Collaborating with stakeholders**: stakeholders take on responsibilities and working together with officials work towards joint-decision making.

## 5.5.4 Monitoring and Evaluation Framework

### *5.5.4.1 Overview*

Monitoring and evaluation is required to ensure that the various components of implementation of the IWRDM Plan are on track and that they will lead to the desired outcomes, essentially progress towards meeting the strategic objectives and realising the Vision. A monitoring and evaluation system is only effective if the understanding of the desired outcomes is clear and measurable in some way, hence the development of indicators is critical. The selection of indicators is facilitated by the work done under the SWOT analyses and a clear understanding of targets over time.

The overall aim of this task can be seen in two distinct parts:

- To develop a monitoring and evaluation framework with suitable indicators to track the progress towards the achievement of the strategic objectives of the IWRDM Plan and
- to provide feedback on the implementation process in terms of whether actions are being carried out according to the planned timeline and on budget.

The first of these concerns the monitoring and evaluation of “success” indicators. If application of the monitoring and evaluation framework shows these success indicators are not being met, this would imply:

- either that there may be problems with the basic design of some of elements of the IWRDM Plan or the implementation strategy OR
- that the plan is not being executed timely or according to specification.

The second level of monitoring and evaluation is designed to check the second of these two bullet points. The process is summarised in Figure 5-29.

In the application of the monitoring and evaluation framework we will distinguish between “success” indicators, which relate to progress towards the achievement of the strategic objectives and “process” indicators, which relate to progress with the correct and timeous implementation of planned actions and activities.

It should be stressed that the monitoring and evaluation programme is an integral part of the IWRDM Plan and not something outside of it.

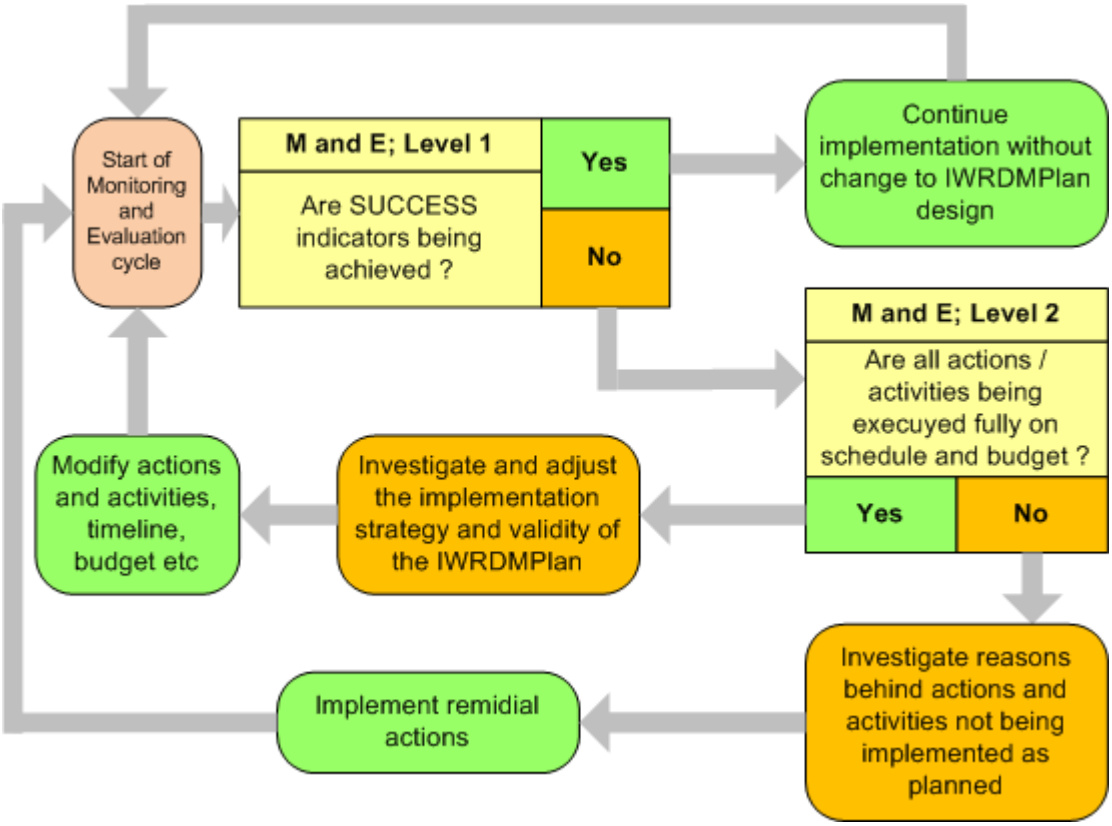



*Figure 5-29: Flow chart showing how progress with implementation of the IWRDMPlan will be monitored and evaluated*

### 5.5.4.2 Success Indicators

The first of these relates directly back to the strategic objectives that have been discussed earlier in the methodology. The detailing of indicators of progress towards the achievement of strategic objectives will take place during the course of the study.

### 5.5.4.3 Progress indicators

The other side of monitoring and evaluation refers to evaluation of progress of implementation of planned actions and activities, irrespective of whether they are achieving the desired progress towards realisation of the strategic objective. These are much more straightforward to design at least in terms of whether activities are being performed according to the programme or not. More complicated is the design of mechanism to react to the delays that monitoring and evaluation system may highlight. It is the ability of programme management to react to an identified problem that will ensure the sustainability of the programme.

## 5.5.5 Task Summary

*Table 5-19: Summary of Activities and Outputs for Component C4.*

| COMPONENT C4: Stakeholder Consultation and Communication Plan | | | |
|---|---|---|---|
| **Expected outcome(s):** | Comprehensive stakeholder consultation and communication plans in place to ensure that implementation goes forward smoothly. | | |
| **Task Leader**: Team Leader | | **Team members**: Senior team membersZ | |
| **Start date**: Month 16 | **End date**: Month 19.5 | | **Task duration**: 2.0 months |
| **Main activities** | **Duration (months)[1]** | **Outputs** | **Meetings, workshops** |
| C4.1: Finalisation of Consultation Plan | 3 | | |
| C4.2: Stakeholder Communication plan | 3 | **D2: Consultation and Communication plan** | |

Note 1: The sum of the durations of activities may be greater than the Task duration because some activities are carried out simultaneously

# 6. CONSULTATION AND COMMUNICATION PLAN

## 6.1 INTRODUCTION

Considerable importance is given to consultation and communication in this study as several components require significant participation of stakeholders:

- The identification of medium and long term projects will be achieved with participation and engagement of relevant stakeholders in the sub-basin.
- The Strategic Social and Environmental Assessment (SSEA) aims at identifying investment options that take into account social, environmental, economic and institutional considerations; this will be based on stakeholder consultation.
- The identification and preparation of feasibility studies for short-term/long term investment projects will be achieved in a participatory and consultative manner with relevant basin stakeholders.

An **effective framework** for stakeholder consultation is required to work on these components. Thereafter, the implementation of the IWRDMPlan will also require a clear plan for stakeholder communication.

This Consultation and Communication Plan will be organised as follow:

- **Rapid stakeholder analysis.** This aims at categorising the different stakeholders involved or concerned by the project. Their interests and concerns are listed in order to prepare the plan for consultation during the study.
- **Plan for consultation during the study.** This aims at identifying the stakeholders to be consulted during the study when and how to involve them.
- **Identification of development communication needs.** This aims at identifying the communication needs throughout the study in order to facilitate the implementation of the IWRDMP after completion of the study.
- **Consultation and communication plan.** This summarizes the main results of the previous sections and is the main output with respect to consultation and communication in the study.

The major steps for the elaboration of the Consultation and Communication Plan are briefly summarised hereafter.

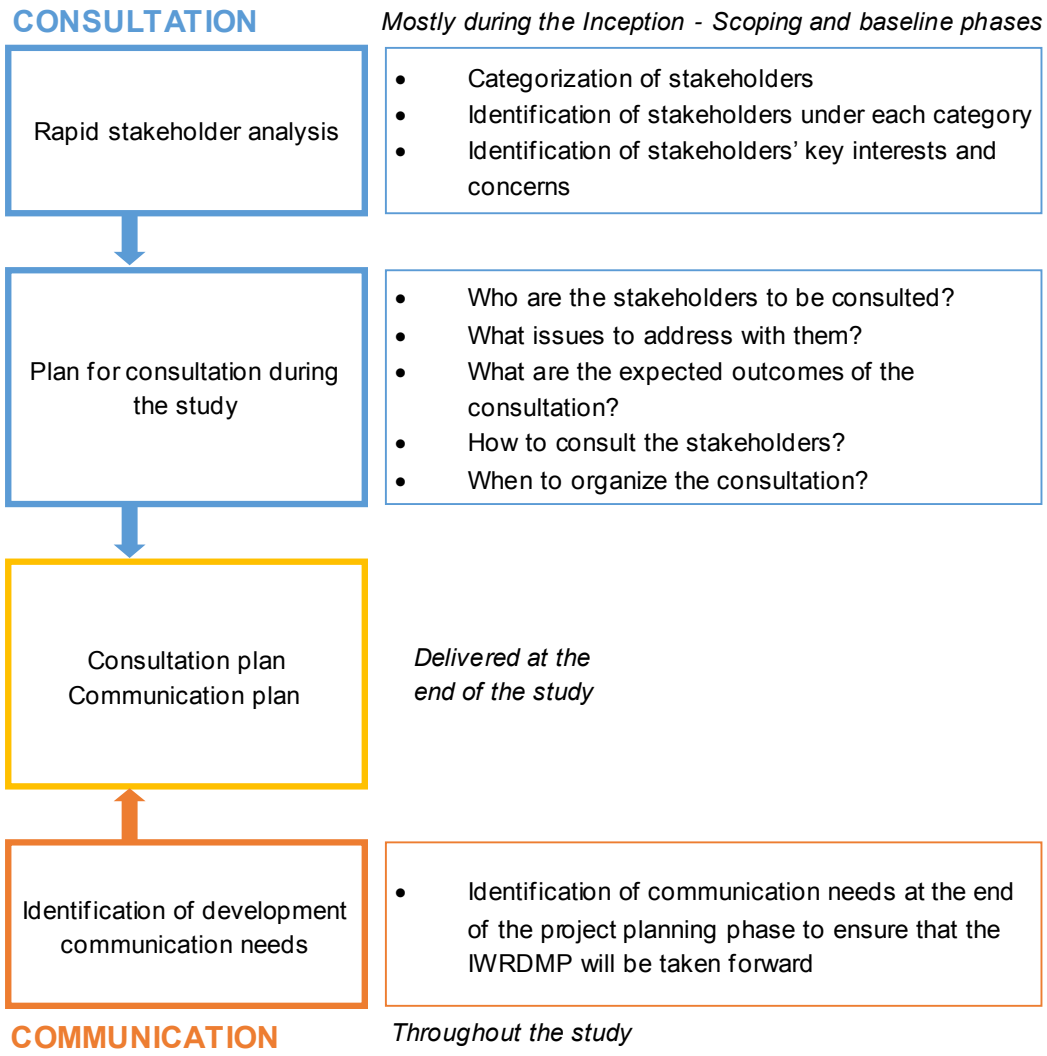



*Figure 6-1: Main steps for the Consultation and Communication plan elaboration*

This chapter of the Inception report mainly summarizes the approach adopted to build the consultation and communication plan. Preliminary results are presented in Annex 5 as work is still ongoing on the consultation plan as part of the scoping exercise.

## 6.2 RAPID STAKEHOLDER ANALYSIS

The output of the stakeholder analysis is a clear categorisation of the different stakeholders in order to build the stakeholder consultation plan.

### 6.2.1 Broad categorisation of stakeholders

The broad categorisation will help to determine all stakeholders involved or concerned by water management. In order to facilitate the construction of the consultation plan, the categorisation of stakeholders has been made at a geographic level (area of influence) and is presented in Annex 5. This categorisation has been drawn up on the basis of desk review and following the first meetings held on during the Inception phase. This will also help to determine the limits of the study in terms of consultation during the scoping phase.

### 6.2.2 Identification of stakeholders under each category

The proposed identification should not be considered as definitive as some new stakeholders could be identified during the baseline study. For each stakeholder identified, the sectors concerned by his activity are identified. This is in line with the sectoral approach chosen in this study and the following sectors have been identified:

- Rainfed and irrigated Agriculture;
- Livestock;
- Fisheries and Aquaculture;
- Forestry;
- Mining;
- Tourism;
- Hydropower and interconnection;
- Navigation;
- Potable water supply and Sanitation;
- Transport;
- Electricity supply;
- Health;
- Environmental issues;
- Social issues.

Other cross sectoral areas of interest have been identified, such as:

- Climate;
- Land registration;
- Water availability;
- Etc.

Results for this identification are presented in Annex 5.

### 6.2.3 Identification of stakeholder's key interests and concerns

Having identified the key stakeholders and the sectors concerned by their activity; it is essential to detail their concerns and interests and to select their degree of involvement in the project. This will help to build the consultation plan by answering the following questions:

- Who should be consulted during the study?
- What to discuss with each stakeholder?
- To what extent this stakeholder should be involved in the study?

Detailing the **concerns and interests** of the different stakeholders was made on basis of desk review and following the first meetings of the Inception Phase. This will be discussed and improved in the next phases of the project.

To select the **degree of involvement** of one stakeholder in the study, a cross-analysis was done between the **degree of influence of this stakeholder over the project** and the **impact of the project on his activity**.

#### DEGREE OF INVOLVEMENT

The different degrees of involvement - commonly used by the NBI - are summarised in the table here after.

*Table 6-1: Nile Basin Initiative's Stakeholder Involvement Model*

| INFORM | CONSULT | ENGAGE | COLLABORATE | EMPOWER |
|---|---|---|---|---|
| *Stakeholder Involvement Goal:* | *Stakeholder Involvement Goal:* | *Stakeholder Involvement Goal:* | *Stakeholder Involvement Goal:* | *Stakeholder Involvement Goal:* |
| To provide stakeholders with balanced and objective information to assist them in understanding the issue, | To obtain feedback on analysis, alternatives, decisions. | To work directly with stakeholders to ensure that their concerns and aspirations are consistently understood | To partner with stakeholders in each aspect of the decision, including development of alternatives and identification | To place final decision-making in the hands of stakeholders. |

*Adapted for NBI from the IAP2 Public Participation Spectrum*

Implications, in terms of involvement for each stakeholder, are the following:

- **Inform:** the stakeholder is not consulted during the study but he must be informed and have access to the results. The stakeholder will be engaged in the communication plan.
- **Consult:** the stakeholder is consulted in order to get his knowledge on specific points and to obtain his feedback on decisions made during the study. The stakeholder might be consulted during interviews or meetings.
- **Engage:** work with the stakeholder must be more significant than with simple consultation to ensure a good understanding of his concerns. Field work might be necessary as well as several interviews or meetings.
- **Collaborate:** the stakeholder is involved in the decision making process. Participation to workshops will ensure his involvement.
- **Empower:** the stakeholder makes final decisions and is involved throughout the study.

### DEGREE OF INFLUENCE OF STAKEHOLDERS OVER THE PROJECT AND IMPACT OF THE PROJECT OVER STAKEHOLDERS

The degree of influence of the stakeholder over the project is of importance to assess how significant the involvement of the stakeholder in the study must be. This **degree of influence** can be identified as follow:

- Little/No Influence
- Some influence
- Moderate Influence
- Significant Influence
- Very Influential

The degree of influence is not sufficient to determine the involvement of the stakeholders in the project. It is also essential to determine the **impact of the project over the stakeholder**. This impact can be identified as follow:

- No impact
- Some impact
- Moderate impact
- Significant impact
- High impact

These two criteria are arguable as they are based on a qualitative assessment. This should be discussed with the Client prior elaboration of the consultation plan.

### CROSS ANALYSIS

The cross-analysis between the degree of influence and the impact of the project over one stakeholder allows to determine the degree of involvement of the stakeholder. The table below proposes a decision-making matrix which can be discussed prior elaboration of the consultation plan.

*Table 6-2: Determination of the degree of involvement*

| | | Impact of the project | | | | |
|---|---|---|---|---|---|---|
| | | No impact | Some impact | Moderate impact | Significant impact | High impact |
| Degree of influence | Little/No Influence | inform | consult | consult | engage | engage |
| | Some influence | consult | consult | engage | engage | engage |
| | Moderate Influence | consult | engage | engage | engage | engage |
| | Significant Influence | engage | collaborate | collaborate | collaborate | collaborate |
| | Very Influential | empower | empower | empower | empower | empower |

Results for this identification are presented in Annex 5.

## 6.3 PLAN FOR CONSULTATION DURING THE STUDY

The rapid stakeholder analysis answered the following questions:

- What are the different categories of stakeholders involved in the study?
- In these categories, who are the stakeholders involved or concerned by the BAS study?
- What are their concerns or interests in the BAS study?
- What is their degree of influence on the study?
- How are they impacted by the study?
- How to involve them in the study?

Then, for the stakeholders for whom the consultation seems essential, the following questions have been answered:

- **What?** This question relates to the issues to be addressed with the stakeholder and is arguably the most important one to answer. Different types of stakeholders are concerned with different subject matters.
- **Why?** This question refers to the purpose that the consultation should serve. The expected outcomes must be clearly identified.
- **How?** This question relates to how the process of stakeholder consultation and participation should take place. This relates to the type of communication system or forum. Different approaches will be more suitable for different stakeholder groups and different issues. For example, a technical discussion on different irrigation options for engineers and technicians may be done at a technical workshop or in a meeting, while a discussion with community members on water supply may most effectively be done at the normal village meeting place or at the potential water supply site.
- **When?** This question refers to the appropriate time to trigger the consultation (according to the time frame of the study) and the frequency of consultation when this envisaged as being repeated.

This work is ongoing, as part of the scoping exercise.

# 7. WORK PROGRAMME, STAFFING AND STAFF DEPLOYMENT

## 7.1 WORK PROGRAMME

The updated work detailed programme as it relates to the activities outlined in the revised methodology is provided overleaf.

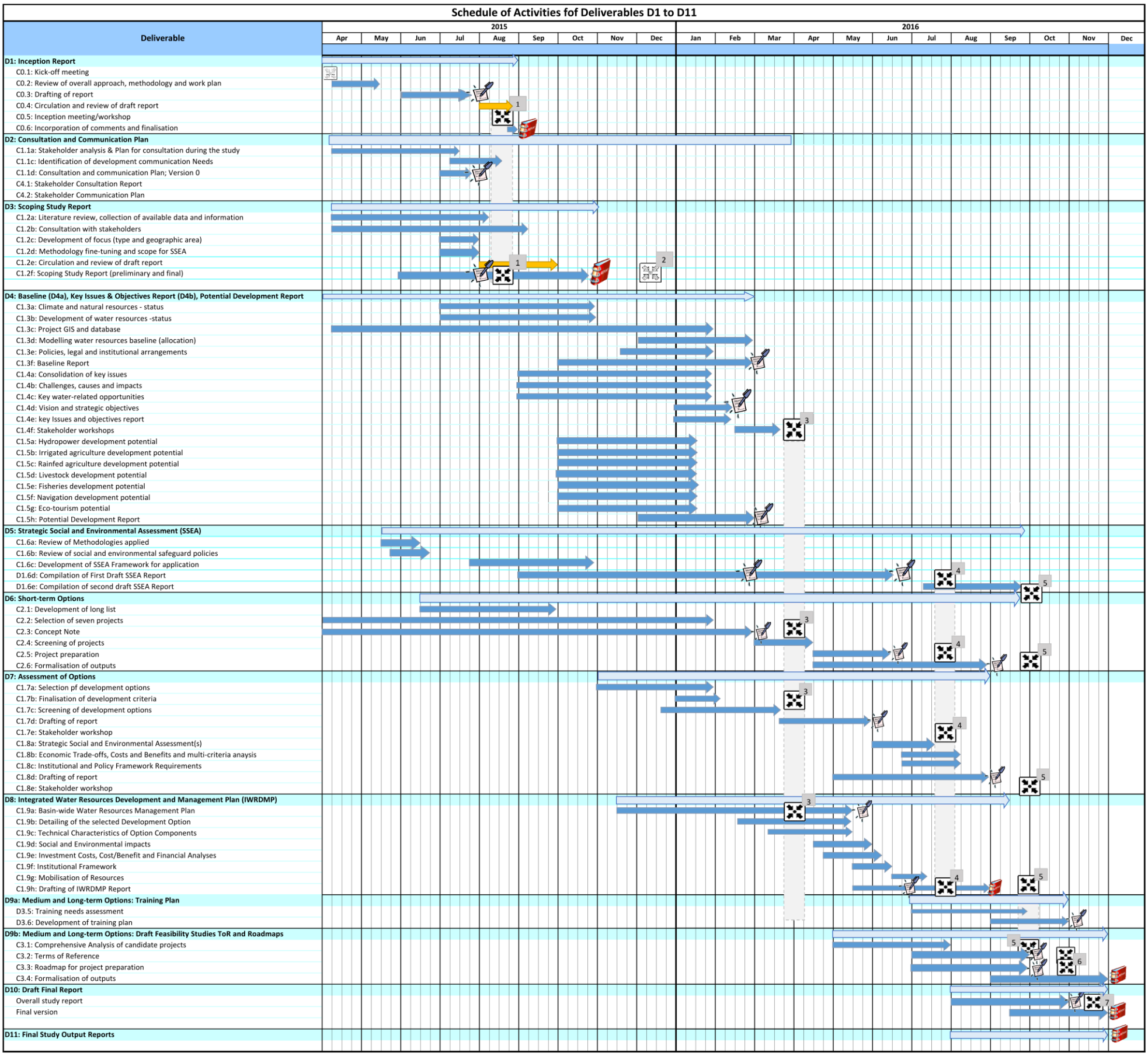



*Figure 7-1: Anticipated Work programme*

## 7.2 STAFFING AND INDICATIVE STAFF DEPLOYMENT

Figure 7-2 provides an indicative estimate of the field (mission) and office inputs of all of the Consultant's team for each deliverable. This is an updated version of the "TECH-5" that was included in the Consultant's proposal as required by the terms of reference.

| N° | Name | Expert's input (in person.month) per each Deliverable (listed in TECH-5) | | D1 Inception Report | D2: Consultation and Communication Plan | D3: Scoping Study Report | D4: Baseline (D4a), Key Issues & Objectives Report (D4b), Potential Development Report (D4c) | D5: Strategic Social and Environmental Assessment (SSEA) | D6: Short-term Options | D7: Assessment of Options | D8: Integrated Water Resources Development and Management Plan (IWRDMP) | D9a: Medium and Long-term Options: Long-term Options | D9a: Medium and Long-term Options: Draft Feasibility Studies ToR and Roadmaps | D10: Draft Final Report | D11: Final Study Output Reports | REVISED (sums inputs to D1-D11: see left) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Position | | D-1 | D-2 | D-3 | D-4 | D-5 | D-6 | D-7 | D-8 | D-9a | D-9b | D-10 | D-11 | Home | Field | Total |
| **KEY EXPERTS** | | | | | | | | | | | | | | | | | | |
| K1-Int | Jean-Michel CITEAU | Team leader/Water resources Engineer | Home | 0.20 | 0.10 | 0.25 | 0.75 | 0.25 | 0.30 | 0.20 | 0.50 | 0.20 | 0.25 | 0.50 | 0.50 | **4.00** | | **7.00** |
| | | | Field | 0.40 | 0.10 | 0.25 | 0.50 | | 0.30 | 0.25 | 0.70 | | | 0.25 | 0.25 | | **3.00** | |
| | Steve Crerar | River basin planner | Home | 0.20 | 0.25 | 0.15 | 0.50 | 0.25 | 0.25 | 0.25 | 0.70 | 0.35 | 0.50 | 0.75 | 0.50 | **4.65** | | **10.50** |
| | | | Field | 0.30 | 0.25 | 0.40 | 1.25 | | 0.75 | 0.50 | 1.00 | 0.40 | 0.50 | 0.25 | 0.25 | | **5.85** | |
| K1-N/R | Kine Tibebu | Local Coordinator | Home | 0.25 | 0.13 | 0.13 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.13 | 0.25 | 0.25 | 0.13 | **2.50** | | **3.00** |
| | | | Field | | | | 0.25 | | 0.25 | | | | | | | | **0.50** | |
| | Juliette Fradet | Junior IWRM Engineer; ENTRO Intern | Home | Full time on field for a period of 12 months (20 July 2015 to 31 July 2016) | | | | | | | | | | | | **12 months in field[1]** | | |
| | | | Field | | | | | | | | | | | | | | | |
| K2-Int | Gilles PAHIN | Environmental Expert | Home | 0.50 | | 0.35 | 0.50 | 0.25 | 0.25 | 0.90 | 0.75 | 0.25 | 0.50 | 0.50 | 0.25 | **5.00** | | **10.00** |
| | | | Field | | | 0.50 | 1.50 | 0.50 | 0.50 | 1.00 | 0.50 | 0.25 | | 0.25 | | | **5.00** | |
| K2-N/R | Zeleke Chafano | Environmental Expert | Home | 0.10 | 0.10 | 0.40 | 1.25 | 0.25 | 0.25 | 0.75 | 0.50 | 0.20 | 0.20 | 0.75 | | **4.75** | | **6.00** |
| | | | Field | | | | 0.75 | | 0.50 | | | | | | | | **1.25** | |
| K3-Int | Charles PENDLEY | Social Development Expert | Home | 0.10 | | | 0.25 | | 0.250 | 0.250 | 0.25 | | | 0.25 | | **1.35** | | **3.50** |
| | | | Field | | | 0.15 | 0.75 | 0.25 | 0.250 | 0.250 | 0.25 | 0.25 | | | | | **2.15** | |
| K3-N/R | Ali Hassen | Social Development Expert | Home | 0.10 | 0.10 | 0.15 | 1.10 | 0.50 | 0.750 | 0.900 | 0.50 | 0.25 | | 0.25 | | **4.60** | | **6.00** |
| | | | Field | | | | 0.80 | | 0.600 | | | | | | | | **1.40** | |
| K4-Int | Fady Hamade | Economist | Home | | | | 0.25 | | 0.50 | 1.00 | | 0.25 | | | | **2.00** | | **2.50** |
| | | | Field | | | | | | | 0.25 | | | 0.25 | | | | **0.50** | |
| K5-Int | Etienne DRESSAYRE | Public-Private-Partnership Specialist | Home | | | | 0.25 | | | | 0.25 | | | | | **0.50** | | **1.00** |
| | | | Field | | | | | | | 0.25 | 0.25 | | | | | | **0.50** | |
| K6-Int | Jean-Michel CITEAU | Institutional Expert | Home | | | | 0.50 | | | | 0.25 | | | | | **0.75** | | **1.50** |
| | | | Field | | | | 0.25 | | | | 0.25 | | 0.25 | | | | **0.75** | |
| K7-Int | Charly CADOU | Power Economist | Home | | | | 0.50 | | 0.250 | 0.250 | | | | | | **1.00** | | **1.50** |
| | | | Field | | | | 0.50 | | | | | | | | | | **0.50** | |
| K8-Int | Andre Gorgens | Water Resources Modeller | Home | | | 0.25 | 0.50 | | | 0.50 | 0.25 | | | 0.25 | | **1.75** | | **3.25** |
| | | | Field | | | | 0.50 | | | 0.75 | 0.25 | | | | | | **1.50** | |
| K10-Int | Verno Jonker | Options Analysis Expert | Home | | | 0.05 | 0.05 | | | 0.30 | 0.10 | | | | | **0.50** | | **0.75** |
| | | | Field | | | | | | | 0.25 | | | | | | | **0.25** | |
| K10-Int | Verno Jonker | Hydrologist | Home | | | | 1.00 | | | | 0.25 | | | 0.25 | | **1.50** | | **3.25** |
| | | | Field | | | 0.25 | 1.00 | | | 0.25 | 0.25 | | | | | | **1.75** | |
| K10-N/R | Yilma Seleshi SHIFERAW | Hydrologist | Home | | | 0.25 | 1.25 | | | | | | | | | **1.50** | | **2.00** |
| | | | Field | | | | 0.25 | | | 0.25 | | | | | | | **0.50** | |
| K11-Int | Ricky Murray | Groundwater Specialist | Home | | | 0.10 | 0.25 | | 0.15 | | | | | | | **0.50** | | **1.00** |
| | | | Field | | | | 0.50 | | | | | | | | | | **0.50** | |
| K11-N/R | Abebe Ketema | Groundwater Specialist | Home | | | 0.15 | 1.25 | | 0.25 | 0.10 | 0.00 | | | | | **1.75** | | **2.00** |
| | | | Field | | | | 0.25 | | | | | | | | | | **0.25** | |
| K12-Int | Gerrit R Basson | River Engineer / Hydrodynamics Expert | Home | | | | 0.75 | | | 0.250 | 0.25 | | | | | **1.25** | | **2.00** |
| | | | Field | | | | 0.50 | | 0.250 | | | | | | | | **0.75** | |
| K13-Int | Mike Shand | WSS Expert | Home | | | | 0.25 | | | | | | 0.25 | | | **0.50** | | **1.50** |
| | | | Field | | | | 0.50 | | 0.50 | | | | | | | | **1.00** | |
| K13-N/R | Yemarshet Yemane | WSS Expert | Home | | | 0.25 | 1.50 | | | | 0.25 | | 0.25 | | | **2.25** | | **3.00** |
| | | | Field | | | | 0.50 | | 0.25 | | | | | | | | **0.75** | |
| K14-Int | Dawid van Wyk | Dams Engineer | Home | | | | 0.75 | | | | | | 0.25 | | | **1.00** | | **1.75** |
| | | | Field | | | | 0.50 | | | 0.10 | | 0.15 | | | | | **0.75** | |
| K15-Int | Déocard MUGANGU | River Navigation Expert | Home | | | 0.25 | 0.75 | | | 0.10 | | 0.15 | | | | **1.25** | | **1.75** |
| | | | Field | | | | 0.25 | | 0.25 | | | | | | | | **0.50** | |
| K16-Int | Eric VERLINDEN | Irrigation Engineer | Home | | | | 0.50 | | | 0.250 | | | 0.25 | | | **1.00** | | **2.00** |
| | | | Field | | | | 0.50 | | 0.250 | | | 0.25 | | | | | **1.00** | |
| K16-N/R | Ermias BIRRU | Irrigation Engineer | Home | | | 0.25 | 1.50 | | | | | 0.25 | 0.25 | | | **2.25** | | **3.00** |
| | | | Field | | | | 0.75 | | | | | | | | | | **0.75** | |
| K17-Int | Benjamin VENNAT | Agro-economist | Home | | | | | | | 0.25 | | 0.25 | 0.25 | | | **0.75** | | **1.50** |
| | | | Field | | | | 0.50 | | 0.25 | | | | | | | | **0.75** | |
| K17-Reg | Bejiga Abdo | Agro-economist | Home | | | | 0.50 | | 0.25 | 0.25 | | 0.25 | 0.25 | | | **1.50** | | **2.00** |
| | | | Field | | | | 0.50 | | | | | | | | | | **0.50** | |
| K18-N/R | ~~Girma G/Medhin~~ | Soil specialist | Home | | | | 0.25 | | 0.250 | | 0.25 | 0.25 | 0.25 | | | **1.25** | | **1.70** |
| | | | Field | | | | | | 0.450 | | | | | | | | **0.45** | |
| N/R | Erneo Peter | South Sudanese Focal Point | Home | | | 1.00 | 1.50 | | 1.00 | | | | | | | **3.50** | | **4.00** |
| | | | Field | | | | 0.50 | | | | | | | | | | **0.50** | |
| K19-N/R | Abebe Getahun | Fisheries Expert | Home | | | | 0.75 | | | | 0.25 | 0.25 | 0.25 | | | **1.50** | | **2.25** |
| | | | Field | | | | 0.50 | | 0.25 | | | | | | | | **0.75** | |
| K20-Int | Mark HOPKINS | Watershed Management Expert | Home | | | 0.25 | 0.25 | | | | | | 0.25 | | | **0.75** | | **2.00** |
| | | | Field | | | | 0.75 | | 0.25 | | | 0.25 | | | | | **1.25** | |
| K20-N/R | Tariku ALEMU | Watershed Management Expert | Home | | | | 1.00 | | 0.25 | | | 0.25 | | | | **1.50** | | **2.00** |
| | | | Field | | | | 0.50 | | | | | | | | | | **0.50** | |
| | | | | | | | | | | | | | | | **SUB TOTAL** | **58.85** | **36.35** | **95.20** |
| **NON KEY EXPERTS** | | | | | | | | | | | | | | | | | | |
| NK1-Int | Frank BELLET | GIS/Remote sensing Expert | Home | | | | 0.25 | | | | | | | 0.50 | | **0.75** | | **0.75** |
| | | | Field | | | | | | | | | | | | | | **0.00** | |
| NK1-N/R | Wondimagegn Sine Hailegiorgis | GIS/Remote sensing Expert | Home | 0.50 | | 0.75 | 3.00 | 0.50 | 0.75 | 1.00 | 0.50 | O.25 | 0.25 | 1.00 | | **8.25** | | **8.55** |
| | | | Field | 0.15 | | | 0.15 | | | | | | | | | | **0.30** | |
| | | | | | | | | | | | | | | | **SUB TOTAL** | **9.00** | **0.30** | **9.30** |
| | Notes | 1. The months of time allocated to the Junior IWRM Engineer are not included in the global totals, since this is an additional input | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | **TOTAL** | **67.85** | **36.65** | **104.50** |

*Figure 7-2: Indicative Inputs by all Consultant Team Members by deliverable*

# ANNEXES

# Annex 1: Kick-off Meeting ; Elements for Consultant's Mobilization

# BAS MWRD STUDY –ELEMENTS FOR CONSULTANT'S MOBILIZATION

Date: 19th March 2015

Origin: JM Citeau (TL)

Subject: Baro-Akobo-Sobat Multipurpose Water Resources Development (BAS MDWR) Study – Report on Consultant's mobilization at kick off stage

Dissemination: ENTRO, Consultant team members

1. Activities during the kick off mission (16th to 19th March).

   Various work sessions with ENTRO and especially the Project Coordinator (PC).

   Liaison with the Ethiopian Experts and team building.

   Joint identification of milestones for this phase and scheduling of the next coming four months (inception and scoping phase).

2. Staffing – mobilization of experts

   The consultant informs ENTRO that in addition to the experts team as requested by the TOR, a permanent junior Engineer (water resources and rural development) will be allocated to the study and be resident in Addis. This will be effective in a few weeks.

   The Ethiopian team has been mobilized during the stay of the TL in Addis

   The remaining team members will be mobilized as soon as the last week of March.

3. Documents, sources of information and conservation

   The consultant will establish an EXTRANET platform in order to share information between ENTRO, the Stakeholders and the Consultant's experts. Rules of security and rights to upload/download will be discussed and put into force closely with ENTRO.

   ENTRO gave the Consultant a series of documents under electronic version. A provisional bibliography is provided as appendix to this note (to be completed with all references collected during this phase).

   Additional documents will be collected, especially GIS layers and files.

4. Milestones

The satellite imagery works according to the methodology proposed by the Consultant, have already been launched. The results are expected to be available on mid-June, to be disseminated in ENTRO and among all experts.

The next coming rainy season imposes that paying a first visit to key stakeholders must happen within April and May. ENTRO and the Consultant have coordinated closely to organize such a visit during the inception/scoping phase (see below). This first visit will gather ENTRO PC and key Consultant's experts: the TL, the River Basin Planner, the Ethiopian focal point, the South Sudan focal point (possibly others: social expert and environment expert).

The whole staff will be mobilized as per the schedule attached. A Consultant's team workshop will be held in Addis before or after the field visits.
The Inception workshop will take place in late July.

5. Organization of field visits

It is envisaged to visit: i) the central key Ministries in Addis Ababa and in Juba ii) the regional bureaus in the concerned Regional/States i.e. Gambela, Oromia, SNNPRS for Ethiopia and Eastern Equatoria for South Sudan. Two other States of South Sudan, Upper Nile and Jongolei still have difficulties to access. Our visit to these States will consist in meetings with the related bureaus and other stakeholders in Juba.

Transportation to Juba will be organized by plane from Addis, and then with vehicles to Torit and back to Juba.

Visits to Jimma, Nakam, Gimpi, Metu (Oromia), Gambela and SNNPRS will be organized in a round trip by car from Addis (two cars). A specific visit will be paid to Awassa-Meizantefere (SNNPRS) by car.

The schedule for these visits is planned in April and May (see the attached sketch).

6. Key stakeholders

They are the i) Ministries (central level) and ii) Bureaus (Regional or State level) in charge of: water resources, energy, agriculture, livestock and fisheries, forests, the environment, housing and physical infrastructures (roads and transport), health, tourism, plus possibly foreign affairs and finance.

ENTRO will establish ASAP with Countries a list of persons to contact in each Ministry/Bureau.

The Consultant will establish a simple questionnaire to facilitate the meetings and including:

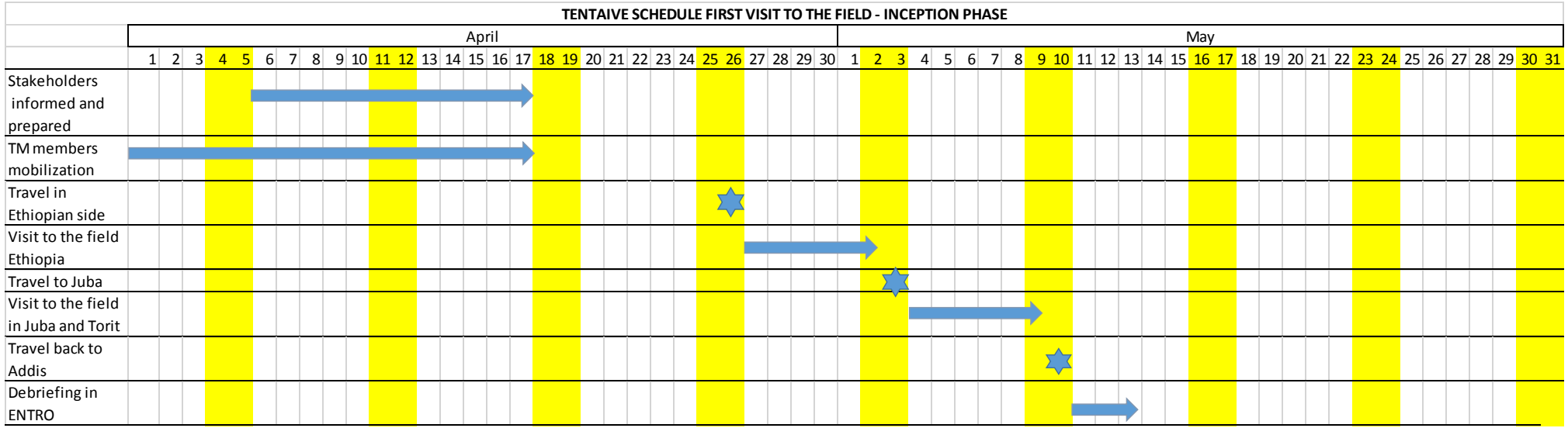
- The question on which stakeholders should be considered as additional key informants: civil society (youth, women, faith based organizations), professional associations/cooperatives/NGOs…private sector…

- First identification of potentialities, main challenges, urgencies, constraints and risks (as a quick diagnosis),

- Mention of already identified projects, documents and sources to be scrutinized by the Consultant.

- Identification and as far as possible collection of data/reports

These meetings will serve and help preparing the study work and the next coming workshop (Inception/scoping).




Note: The schedule to Inception period (4 month) will developed within 2 weeks and sent to ENTRO

# Annex 2: Minutes of Meetings during Field visits

**28 April – 2 May 2015 ETHIOPIA**

*Meeting in Nekemte*

| | |
|---|---|
| **Date** | 28/04/2015 |
| **Location** | Nekemte - OROMIA |
| **Organization of the meeting (followed for all meetings)** | 1. Presentation of the Project by Ato Asmamaw (Ministry of Water)<br>2. Presentation of the Study by Jackson (ENTRO)<br>3. Presentation of the Consultant Team (BRL and Yerer)<br>4. Presentation of the Participants<br>5. Presentation of the key points of the study by the Team leader Jean-Michel Citeau and Steve Crerar<br>Key points to be kept in mind<br>- Study of two years and currently is the Inception Phase. The tour is organized to have a first contact with people concerned by the study (key stakeholders). This is the first chance to exchange views with people who know the situation and to involve them in the process. The tour is also the opportunity to collect data and information on projects implemented in the area.<br>- An important point is to update reports previously produced on the Baro-Akobo Sobat basin thanks to the participation of stakeholders in the basin.<br>- The aim of the study is to build a master plan and then to go into details for few specific projects. The final target of the study is to think about regional development. The knowledge of stakeholders is important to select the priority projects and to then implement them as the involvement of stakeholders ease the process.<br>6. Exchange with the participants |
| **Remarks** | Nekemte is not included in the basin but remains a key city because of market exchange with Gimbi. |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | 1. Food safety<br>Crucial point: Nekemte is not in the national food security intervention program.<br>2. Environmental problem<br>2.1 Natural resources degradation due to agricultural practices<br>- Water quality issues<br>- Deforestation and land degradation<br>2.2 Climate change<br>Impacts of climate change have been experienced for ten years, temperatures have increased and the rainy season is shorter. |
| **Potential identified** | 1. Food safety and response to climate change<br>1.1 Irrigation<br>Water resources use in not really developed, there is no large scale irrigation. The government initiated many programs to move from rainfed to irrigation but it is still not successful in Nekemte. The national level strategy is to increase by 30% irrigation every year but they do not reach this goal (small scale irrigation between Addis and Nekemte). The irrigation office is working on convincing people to shift from rainfed to irrigation to minimize the dependence to rain. This office is also working on credits to improve seeds at zonal level.<br>1.2 Organization of farmers<br>The organization of farmers could lead to water users association in the future<br>2. Environmental potential<br>Protecting the exiting and afforestation are two projects to fight deforestation. The rate of afforestation is good and farmers are aware of this issue. Afforestation is led by the agriculture office and everybody collaborates; environmental section work covers vast areas of land. |
| **Constraints and risks experienced** | 1. Irrigation<br>- Technology and money are missing to shift to irrigation but the interest of farmers is really high.<br>- Nekemte is far from central market and private investors ask whether there will be profit and hesitate to invest.<br>2. Afforestation<br>The rate of deforestation is probably higher than the rate of afforestation. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and** | 1. NGOs: Catholic relief service (CRS) are working on projects on drinkable water<br>2. Sustainable Land Management (governmental project) Now is the preparation of lands |

| | |
|---|---|
| **investments projects** | for planting and training sessions are organized by the agricultural office at Woreda level. There is a total involvement of farmers. |
| **Relevant data and their availability** | Poverty alleviation? Drought strategy? Zonal strategy? Social strategy? Annual reports maybe available.<br>- Agricultural office, Land and environment management office and Planning department for data regarding deforestation and land degradation (annual reports might be available)<br>- Irrigation office (not represented during the meeting) might have annual reports regarding irrigation development in Nekemte<br>- Most offices have data regarding water |
| **Main stakeholders identified** | - Agriculture office<br>- Land and environment management office<br>- Planning department<br>- Irrigation office |

*Meeting in Metu*

| | |
|---|---|
| **Date** | 29/04/2015 |
| **Location** | Metu - OROMIA |
| **Key points/Remarks** | Altitude in the zone from 500 to 2 575m and area of 16 500 sq. km<br>Population: 1.6 M people and 33% in low lands, 10% in high lands and 57% in middle lands<br>GTP under process. Aim to double area under irrigation within the next five years.<br>250 000 households in the zone, 60% of them plant coffee. 18 of the 22 districts grow coffee and the grain is collected administratively. |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **1. Poverty**<br>People livelihood largely depends on rainfed agriculture (maize, tef), forest exploitation (coffee) and more rarely on livestock.<br>**2. Crops and animal diseases**<br>Animal diseases are coming from wild animals and flies: endanger livestock development in the area.<br>**3. Climate change**<br>Delay of the rainy season and sometimes interruption of rain (1150 mm per year to 2200 mm). Also, the distribution and the importance is affected by climate change.<br>**4. Prevalence of water diseases**<br>People are getting aware on how to treat water locally and the challenge is to give this awareness in all the zone. There is not much underground water because of the topography of the area.<br>**5. Access to water**<br>River are located in gorges and it is difficult for people to bring water to their home (82% of the population has access to water springs and most people in rural area use shallow water)<br>**6. Food security issues**<br>The area is not categorized by the government as food unsecured zone even if there were production issues for maize in the previous years. Marketing is a challenge but the road construction will surely help to develop the market.<br>**7. Environmental issues**<br>Water used for coffee is treated: the consumption of water is very minimal, and a recycling process is in place. |

| | |
|---|---|
| **Potential identified** | **1. Agricultural extension**<br>Agricultural extension policy is provided by the government (1 700 agencies for agriculture development in the zone). There are good resources of water which can be used for irrigation but a necessity for more funds. Irrigation is needed to mitigate climate change, it is "vital and crucial".<br>**2. Infrastructures development**<br>**2.1 Hydropower potential**<br>There is a need for electric power which is currently highly limited and the Government and private organizations are highly supporting hydropower development.<br>**2.2 Road connection in the zone**<br>**3. Environmental potential**<br>There is an important potential for the enhancement of forests in the area. The government has started to aware people about the importance of forest protection.<br>Delineation of forests into three zones:<br>- Active areas: coffee plantation which preserves the forest from deforestation<br>- Buffer zones<br>- Core areas/zones<br>**4. Health coverage**<br>Community health is a point of attention (before the current government, they were only 3 health centres and now 67 health centres and one hospital are finished).<br>Nevertheless, people sometimes have to travel 10 km to access medicine so there is still a need to develop more health centres.<br>**5. Deep water wells**<br>Deep water wells represent an important potential to provide a safe potable water.<br>**6. Entrepreneurship**<br>People use there earning when working in coffee plantation to develop their own coffee business. |
| **Constraints and risks experienced** | **1. Irrigation**<br>- Need of skills, maintenance and electricity to develop irrigation<br>- Potential to build dams for reservoirs but the gap is the funding |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | **1. Research centres**<br>Development of agricultural technologies (improved seeds for tef and maize)<br>**2. GTP "growth and transformation plan"**<br>The first GTP has been elaborated now they are doing the 2nd. The GTP consists of several pillars:<br>- Increase agriculture<br>- Increase irrigation on an efficient way (share of water between users).<br>- Commercialization of products and agroprocessing industries<br>- telephone access<br>- Hydropower<br>- Access to water<br>- Hospitals<br>- Manufacturing<br>- Etc.<br>**3. World Bank "a nail of the soil"**<br>Promotion of conservation practices for agriculture to grow crops on a sustainable way (problems of erosion).<br>**4. Biosphere project**<br>Promotion of participatory management of the area.<br>**5. Pest program for endangered livestock development in the area** |
| **Relevant data and their availability** | Key document: The Growth Transformation Plan (GTP)<br>Data are collected administratively, then compiled at district and zonal level (22 districts)<br>Need to ask the different Offices (Agriculture office, Land and environment management office, Planning department, Irrigation office, etc.) |

*Meeting in Gambella*

| | |
|---|---|
| **Date** | 30/04/2015 |
| **Location** | Gambella - GAMBELLA |

| | | |
|---|---|---|
| **Key points/Remarks** | | The population of Gambella region is 409 000 and the growth rate is 4.1 % (including internal and external migration). Rural migration is mainly due to the search of services and jobs (school, health…).<br>80% of the population are farmers. |
| **Situation in the sub-basin area** | | |
| | **Challenges and urgencies identified** | **1. Health situation**<br>100% health coverage on paper but there are concerns about the actual service coverage and its quality. There is 1 functional hospital, 31 centers and 170 aids posts in the Gambella region. Malaria is still number 1 problem in the region.<br>**3. Water safety**<br>Water demand and supply are not matched: there are drought problem and a need to find a new system for the tanks.<br>**2. Food security**<br>Big challenge<br>**3. Soil erosion**<br>Mainly due to deforestation and agriculture practices which cause saltation of waters. The land is flat in the area and deforestation and floods cause erosion of the soil.<br>**4. Livestock activity**<br>There are not enough incentives for livestock activity and there is a gap between the grass available and needed to feed the livestock. |
| | **Potential identified** | **1. Health situation**<br>Safety net program<br>**2. Water safety**<br>2.1 Development of groundwater use<br>2.2 Use of Baro Akobo waters<br>2.3 Floods are a problem. Nevertheless, it could be a resource to be used during the dry season.<br>**3. Food safety**<br>3.1 Irrigation viewed as an opportunity (three irrigation sites under construction)<br>3.2 Potential for livestock<br>3.3 Potential for fisheries. Currently, the way people practice fishing does not permit the development of the activity (traditional activity, not enough skills developed). There are 14 flights (a day? a week? a month?) from Gambella to Addis and also a good road so there is a need for investments and awareness amongst fishermen to develop the fishery activity.<br>3.4 Potential for honey production<br>3.5 Market potential for agricultural products: people are practicing agriculture in a traditional way and they are just getting aware of market potential.<br>**4. Trade between Gambella and South Sudan**<br>**5. GTP**<br>5.1 For the environment part, the focus of the next plan will be on mitigation<br>5.2 For water coverage: if the study shows there is a 100% coverage then the GTP will focus on the use and management of shallow waters and on the pumping system. Water coverage means there is a water point within 1.5 km of the habitation (rural areas) and 0.5 km (urban areas). |
| | **Constraints and risks experienced** | **1. Agriculture and irrigation**<br>- Knowledge of how to use water<br>- Soil conservation is a problem even if there is awareness growing in the region.<br>- Wetlands: investments activities are in conflict with the national parc, especially when there is no special planning for the development and for the delineation of wetlands and the national parc |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | 1. Allocation of 5 million from the government for potable water program<br>2. Safety net program<br>3. Horn of Africa regional environmental centre: HoA-REC, involved in the assessment of the transfrontier Gambella-Boma region<br>4. GTP "growth and transformation plan"<br>The first GTP has been elaborated now they are doing the 2nd. The GTP consists of several pillars:<br>- Increase agriculture<br>- Increase irrigation on an efficient way (share of water between users).<br>- Commercialization of products and agroprocessing industries<br>- telephone access<br>- Hydropower<br>- Access to water<br>- Hospitals<br>- Manufacturing<br>- Etc. |

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| | **Relevant data and their availability** | Key document: The Growth Transformation Plan (GTP). On process to complete the evaluation report for the last 5 years program and the 2nd program is already starting.<br>Reports on health can be asked to Andrew<br>See also Water office Bureau and Regional agriculture bureau |

*Meeting in Abobo*

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| **Date** | 30/04/2015 |
| **Location** | Abobo - New Horizon Plantation Group - GAMBELA |
| **Participants** | Contact: Yibeltal Shemedes 0935409538 |
| **Key points/Remarks** | Private corporation SAUDI STAR<br>Last year, cultivation of 2 000 ha of rainfed rice.<br>There is a processing mill for paddy in the compound.<br>Part of the production is for local people and and the other part is for exporting (to finance the irrigation project).<br>The company will also contract with small farmers as outgrowers. |
| **Project** | Construction of a 21 km canal from the Abobo reservoir to the irrigation site. 11 km to be completed (should be finished next year).<br>The project consists in the cultivation of 10 000 ha of irrigated and rainfed rice. There will be six varieties of rice in double culture. For the long term, all the cultivated area will be equiped for irrigation.<br>Today 600 permanent staff, more seasonnal workers<br>Expected yields are: 4.4 t/ha for rainfed, 8 to 9 t/ha for irrigated plots |
| **Documentation** | The map of planned areas is available in the Ministry as the project was agreed by the Ministry. |

**6 May – 11 May 2015 SOUTH SUDAN - Juba**

*Meeting with the MEDIWR-WR*

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| **Date** | | 06/05/2015 |
| **Location** | | Juba - Ministry of water dams and irrigation |
| **Key points of the meeting** | | 1. South Sudan part of the basin is less documented than the part in Ethiopia. The major beneficiary of the study will be South Sudan. Most of the information in South Sudan is not documented but is present in the head of people from the Ministry.<br>2. Proposition to form a national working group within the ministry of water and irrigation on the BAS: Think tank able to give the guidelines for the identification of projects.<br>3. First visit of the Consultant who will go into details in the following months<br>3. Jonglei and Upper Nile of the basin are well documented. Eastern Equatoria is less documented and must be studied into details. Physical points should be discussed for the Pibor and its tributary the Krun river part of the basin.<br>4. Omer: Extension of the project to the white nile is very likely.<br>5. A key point is the participation of stakeholders to validate the results of the study and ENTRO will organize 7 workshops.<br>6. Flow of Pibor is bigger than Akobo. Runoff from Boma Plateau can be high → potential for Hydropower<br>7. Fast track projects: see the previous workshops dated 2010 |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | Projects about wildlife |
| | **Relevant data and their availability** | 1. Maps available for the water system in South Sudan + Eastern mountain rivers (contact: Robert from the MWI) - refer to old maps if necessary (1946-1954)<br>2. NBI working group might have lot of information: possible to collect information<br>3. Investment and Implementation plan "Sanitation and Water Supply"<br>4. Irrigation development master plan is elaborated at the moment<br>5. Plans for navigation are available - see SWECO study<br>6. Humanitarian affairs of disaster management "Resilient Program to Climate Change". Reports |

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| | | are available<br>7. Water act , Policy and strategy for WASH of RSS |

*Meeting with the MEDIWR-ED*

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| **Date** | | 06/05/2015 |
| **Location** | | Juba - Ministry of Energy and Dams |
| **Remarks** | | Aim of the meeting: Understanding of hydropower projects and existing documentation and interconnection planning.<br>Necessity to evaluate the economic opportunity of the projects. |
| **Situation in the sub-basin area** | | |
| | **Challenges and urgencies identified** | No general overview on hydropower potential at national scale.<br>Demand projection: today 80 MW in Juba, 140 MW in the South, expected to grow at 300 MW |
| | **Potential identified** | Aswa: potential for hydropower but not studied yet<br>Katire: other potential hydropower site?<br>Mico and medium hydropower on Krun and Pibor rivers |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | Existing projects along the Nile : 5 (Sites already studied in 2010)<br>No general investigation in the BAS basin<br>Connections lines: yes, some projects with Ethiopia. Possible interconection with GERD |

*Meeting with the MAFCRD*

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| **Date** | | 06/05/2015 |
| **Location** | | Juba - Ministry of Agriculture, Forestry, Cooperatives and Rural Development |
| **Key points of the meeting** | | -Understanding agriculture projects which are going on or planned in the basin<br>-Understanding the importance of irrigation in South Sudanese agriculture programs. (large scale? small agriculture farming?) |
| **Situation in the sub-basin area** | | |
| | **Challenges and urgencies identified** | **1. Droughts**<br>1.1 Six agroecological zones within a green belt: production of vegetables but 3 to 4 months without rain. Same thing for sugar cane production.<br>1.2 Eastern part of Eastern Equatoria has very law rainfall: 20 to 30 mm a year hence the need to build reservoirs. Wetlands are south west and north of this area. |
| | **Potential identified** | **1. Irrigation - Agriculture**<br>- Flat plains and high plateaux: Irrigation is needed<br>- High mountains: rainfed agriculture is efficient<br>- Development of irrigation around Kapoeta<br>- Development of storage<br>- Development of new varieties of crops<br>**2. Livestock**<br>Construction of small reservoirs for the dry season.<br>There is no problem of marketing except for milk sector where there is no processing. There is a need of incentives to break the current cycle<br>**3. Forest enhancement** |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | **CAMP (Comprehensive Agriculture Development Master Plan)**<br>25 years plan for agriculture sector development and 113 projects for four sectors (crops, fisheries, livestock, forests).<br>Data in the document have been compiled for the last three years. The document will be finalized by the end of July it will be a "reference book". *The demarcation of planned irrigated areas should be available to do the scoping work.*<br>The CAMP identifies projects but does not really address priorities. It will be of importance with the SSEA to see what the major priorities in the basin are. |

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| | **1. Agriculture development**<br>Mostly based on rainfed farming but few irrigation projects are in the program. Irrigation development was restricted in South Sudan when Sudan was one country. It explains why irrigation is not developed at the moment.<br>**2. Livestock**<br>Livestock is as important as agriculture in South Sudan in terms of employment (importation of cattle from Uganda). The main concern for the development of this activity is water shortage. |
| **Relevant data and their availability** | 1. Master plan for Irrigation Development and Water Harvesting for South Sudan.<br>1 000 ha irrigated in three different areas should be proposed in the plan.<br>2. CAMP (Comprehensive Agriculture Development Master Plan) |

*Meeting with the MOEN*

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| **Date** | 06/05/2015 |
| **Location** | Juba - Ministry of Environment |
| **Key points of BAS environmental baseline** | BAS areas are of importance and, conservation plans must be elaborated.<br>**1. Wildlife**: there is a huge migratory channel from Boma to North east of South Sudan and Ethiopia (Baro river).<br>**2. Wetlands** in the BAS: Mashar marshes,.etc. An inventory is ongoing over RSS |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **1. Socio economic aspects**<br>Ethnic groups (Nuer, Annuak, Shiluk..) live on fishing, livestock, gum Arabic, but not enough economically valued. Social unrest due to competition for limited natural resources is exacerbated. Migration of people between the two countries<br>**2. Settlements in Sensitive areas**<br>2.1 No identification of sensitive areas<br>2.2 Unplanned settlements and urbanization in wetlands: destruction of habitat<br>2.3 No management plans for national parks but areas of national parks are delineated<br>3**. Climate Change and siltation**<br>Perennial rivers thinner<br>4**. Competition on limited resources**<br>4.1 Poaching and mass killing of wildlife. In the past the spears were traditional and the resource could recover but now with firearms, mass killing is possible.<br>4.2 Decreasing of fishing stock: originally fishers had to have the authorization to fish but now there is privatization and there is no more control.<br>4.3 Tension between people due to the competition on limited resources which leads to insecurity.<br>5**. Pollution issues**<br>Oil company<br>6**. Flooding issues**<br>Flooding during the wet season because of heavy rainfall and river flow coming from Uganda. Need for humanitarian assistance during these events. |
| **Potential identified** | **1. Sensitization**<br>Sensitization of communities to protect the environment; need for capacity development. WCS has started action for this.<br>**2. Establishment of a transnational park between Gambella and Boma**<br>This could be ease by the presence of the World Conservation Society in Boma.<br>**3. Flooding**<br>Establishment of a flooding information System (early warning system) and river bank protection against flooding<br>**3. Tourism**<br>Big potential for tourism |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | 1. Wise use of wetlands.<br>2. Plans to develop the inventory of wetlands in South Sudan (Unity, Upper Nile, Junglei) under the RAMSAR convention. RAMSAR has provided grants to develop the expertise but the situation in the area did not permit the study. The project waits things improvement of the situation in the area to begin.<br>3. Horn of Africa regional environmental centre: HoA-REC, involved in the assessment of the transboundary Gambella-Boma region.<br>4. Policy and environment bill are not yet official: Min. of Justice |

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| **Relevant data and their availability** | Must be asked to the following:<br>1. World Conservation Society<br>2. African Wildlife Fundation<br>3. Horn of Africa<br>4. RAMSAR |

*Meeting with the MLFI*

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| **Date** | 07/05/2015 |
| **Location** | Juba - Ministry of fisheries and livestock |
| **Participants** | Under secretary - Makuei Kaang<br>Judge of extension<br>Fisheries and catchment development<br>Research and development<br>Investment marketing |
| **Remarks** | Akobo and Baro and Sobat: intensive study in that area ; data: Jonglei Executive Office<br>Mainly inhabited by livestock + significant migration of wildlife<br>Difficult to travel during the rainy season and very dry during summer<br>Pibor and Gilo river have resources and people depend on these resources<br>Tia contains lot of wildlife<br>Dry season: conflict between people about resources, especially for water (Jonglei up to Nyanding) |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **CATTLE**<br>**1. Water Scarcity**<br>Big challenge during the dry season which forces the migration of cattle to the wetlands and creates social conflicts. There is a cycle from highlands to wetlands depending on the availabilty of water. For Jonglei people, it is very difficult because during the dry season, people have to move their cattle to find water but they are also practicing agriculture and there is conflict between the two activities. Idea to build valley dams, small or bigger (#40,000 m3) but only 4 today (?)<br>**2. Cattle reselling and poaching**<br>**3. Diseases**<br>Livestock diseases are essentialy due to the presence of tse tse fly and the prevalence is increasing in some areas (Baro, Akobo, Pachala) specially when livestock go together during the dry season. Vaccination program with the African Union and IGAD<br>4**. Change of lifestyle**<br>Young people go to school and live in urban areas, they do not learn from their parents and prefer making money rather than taking care of the cattle. On another hand, people were not aware of the monetary value of their cattle, they had no marketing information and skills. This is changing. As people have to pay for school and medicine, they start to understand the value of money.<br>**FISHERIES**<br>**1. Practices are still traditional -** see the program supported by USAID for training<br>**2. Access to the market is a big challenge**<br>**3. No accurate data of the catches -** catches are limited to self-consumption; sun dried fish, but no conservation in the rainy season<br>**GENERAL**<br>**1. Climate change**<br>The frequency of droughts and floods is increasing. People in the past knew what to do and when to do it but with the variability of climate, people do not always know how to react to extreme events.<br>**2. Impacts of flood**<br>People cannot adapt to floods which are very frequent, people do not build strong houses and live in precarious conditions. |
| **Potential identified** | **CATTLE**<br>**1. Water scarcity**<br>Supplying water to the cattle during the dry season would increase the livelihood of people and would reduce the conflict between people. Storage (water harvesting) in small reservoirs with around 40 000 m3 reservoirs is a big potential.<br>**2. Market development**<br>**3. Milk collection Centre**<br>During the rainy season, people have more milk than needed and cannot preserve it. On the other hand, during the dry season, people experience a lack of milk. |

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| | | **FISHERIES**<br>**1. Development of aquaculture**<br>**2. Development of conservation techniques and hygiene improvement for fish drying**<br>**3. Need for an economic analysis**<br>In order to see the benefits for developing techniques and market<br>**GENERAL**<br>**1. Response to floods**<br>Currently people build dikes. The regulation of rivers to minimize floods and provide water during the dry season could restore communities in their places of origin (necessity to see the economic value of livestock development with a multi criteria analysis)<br>**2. Spreading of information**<br>This will enable people to be aware of the potential they have, through cellphones for example<br>**3. Climate change**<br>A project should be elaborated to help people respond to the effects of Climate Change. It could be training of people on how to react to floods and droughts. |
| | **Constraints and risks experienced** | **1. Livestock diseases**<br>No program currently due to financial issues but the government is the one who should take care of it.<br>**2. Insecurity makes hard to develop any kind of strategies** |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | **1. Projects of the African Union**<br>A project on cattle diseases prevention **(**rift valley fever, tse tse, etc) should start in october. There is a technical comitee in the AU which support each country within this project (eight countries in total). A transboundary meeting with Uganda already took place.<br>**2. Rangeland development Project**<br>Did not started because of the lack of funds<br>**3. USAID Program**<br>Development of skills and conflict resolution for the fishery sector. *There is a document with data.*<br>**4.** Upper Nile Jonglei: study on corridors between the 2 countries (available at ENTRO)<br>**5**. CIDA: livelyhood |
| | **Relevant data and their availability** | 1. Strategic plan for fisheries, no study for aquaculture (there is an assessment for eastern equatoria but the results are not yet known)<br>2. Small Reservoirs Design Study: ask document to Thomas |

*Meeting with the MPs of UpperNile*

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| **Date** | 07/05/2015 2pm |
| **Location** | Juba - MPs Upper Nile State |
| **Participants** | Chair person of water resources and irrigation in the parliament<br>Honorable representatives of Upper Nile State (six counties) |
| **Remarks** | First project of this type since the Independence of the country<br>Upper Nile and Jonglei are two states where it is difficult to go at the moment. This emphasizes the necessity to meet representatives of people living in these areas. The MPs can tell what people expect, what issues they face and what solutions can be implemented. |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **1. Water availability and use** *"South Sudan is rich of water resources but is not benefiting of it"*<br>1.1 No potable water<br>1.2 Floods during the rainy season and inaccessibility of villages<br>1.3 Droughts during the dry season<br>1.4 Rainfed agriculture, irrigation is not developed at all<br>1.5 No hydropower production<br>**2. Environmental issues**<br>2.1 Erosion is a big issue because of floods and cropping practices<br>2.2 Poaching of wild animals (elephants, gazelles and other mammals) during their migration (dry season)<br>**3. Social issues**<br>3.1 Tension between people during the dry season because of water shortage<br>3.2 Mass migration during the dry season<br>3.3 Problem of cooperation with Ethiopia for the management of the resources. |
| **Potential identified** | **1. Junction of the Sobat and the Pibor**<br>Construction of a hydropower dam to produce electricity, control floods, establish fishing projects |

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| | in the reservoirs (employment for young people during the dry season) and provide grazing for the dry season. It will probably affect people downstream but will increase livelihood of people of the area and will reduce conflicts between people.<br>**2. Important potential for irrigation**<br>**3. Improvement of navigation**<br>**4. Development of boreholes** so people can get clear water (16 have already been drilled in Upper Nile), specially during the dry season.<br>**5. Development of fishery activity** in the Sobat river |
| **Constraints and risks experienced** | 1. An important displacement of populations took place in 2002. People who lived in the region were displaced so it is hard to evaluate their priorities<br>2. There are no feasibility studies in the region so there is no available information on how water can be used hence the importance of the present project.<br>3. Each management plan in the basin must be elaborated in consultation with Ethiopia. |

*Meeting with the MPs of Jonglei*

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| **Date** | 08/05/2015 10am |
| **Location** | Juba - MPs Jonglei State |
| **Participants** | Chair person of water resources and irrigation in the parliament<br>Honorable representatives of Jonglei State |
| **Remarks** | First project of this type since the Independence of the country<br>Upper Nile and Jonglei are two states where it is difficult to go at the moment. This emphasizes the necessity to meet representatives of people living in these areas. The MPs can tell what people expect, what issues they face and what solutions can be implemented. |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **1. Water availability and use**<br>1.1 Remoteness and issues of transport during the rainy season except for people who live next to navigable rivers. Floods are threatening the population and their agriculture practices.<br>1.2 No water available during the dry season for potable water and cattle. This is a big issue for communities who have to move during the dry season to find water.<br>1.3 Irrigation is not developed at all.<br>**2. Health condition**<br>Big issue: water related diseases are very common. For example, in the town of Ayod it was possible to drink water but it is not possible anymore because water is polluted by the cattle. Also, there are flies problems and many water related disease.<br>**3. Infrastructure challenges**<br>There is no road network. |
| **Potential identified** | **1. Agriculture extension and potential for irrigation**<br>There are important resources which can be mobilized during the dry season. Soils in Boma and Kapoeta are very rich and productive and there is a need to educate people on the kind of crops which are suitable for swamps areas (soils in Jonglei are very good for sugar cane cropping, in Malakal there is a huge potential for Sorgho production and from Malakal to Bore for rice production). Nevertheless, wildlife must not be jeopardize for agriculture development because wildlife is of importance for the country.<br>**2. Clearing of rivers**<br>There is a lot of sedimentation and water has become shallow. The river should be excavating.<br>**3. Development of fisheries in the southern part of Jonglei**<br>**4. Gold exploitation in Boma plateau**<br>**5. Forest exploitation**<br>The main concern is about how to use the forest without endangering the wildlife and specially the migration corridor.<br>**6. Development of boreholes**<br>This is important for people to get clear water during the dry season (considering that pumping is very exhausting for women: work must be done on the pumping system).<br>**7. Development of tourism**<br>Tourism in Boma national park could be developed in more favorable conditions. There is a need to stop poaching; change in mentalities is essential and actions from the government must be implemented.<br>**8. Development of water reservoirs**<br>This will make water available during the dry season. |

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| **Constraints and risks experienced** | 1. Management of the Akobo river is very challenging. Akobo is not one river during the rainy season, everything is flooded and it is impossible to build a dam (it would be necessary to inundate the all area).<br>2. No potential for hydropower in Jonglei State except maybe in the "Puchala" river (very small potential)<br>3. Not possible to implement projects while places are still unsecured. On another hand, the meeting cannot give all the information, there is a need to go on the field. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Relevant data and their availability** | 1. 1953 South Sudan development strategy<br>2. Need to go to meet people and discuss with them. The MPs do not have any data because they left the area a long time ago. |

*Meeting with the MPs of Eastern Equatoria*

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| **Date** | 08/05/2015 2pm |
| **Location** | Juba - MPs Eastern Equatoria |
| **Participants** | Chair person of water resources and irrigation in the parliament<br>Honorable representatives of Eastern Equatoria |
| **Remarks** | First project of this type since the Independance of the country<br>MPs expressed their wish to get results from the study |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **1. Water availability**<br>1.1 People must travel long distances to search water (potable water and water for the cattle)<br>1.2 There is no water storage during the dry season to develop irrigation<br>**2. Environmental issues**<br>Land degradation due to overgrazing in Kapoeta area |
| **Potential identified** | **1. Water harvesting**<br>Reservoirs will make people stay in their community during the dry season. It is a real chance for peace to come. This is also a chance for children to go to school, for health improvements, irrigated agriculture, etc.<br>**2. Education on how to use water**<br>2.1 Water treatments for potable water<br>2.1 Water use in agriculture<br>**3. Potential for hydropower**<br>**4. Development of fishing activity in some areas** |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Netherlands: working on the policies for the all Eastern Equatoria and based in Torit<br>Small project of water catchment (NGOs) but no big projects |

*Meeting with the MTR&B*

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| **Date** | 11/05/2015 9am |
| **Location** | Juba - Ministry of transport, roads and bridges |
| **Participants** | Directorate of river transport - Eng Abdu S. M. Lako |
| **Key points** | **Two key questions during the meeting**<br>1. What are the plans for navigation in the basin?<br>2. Is it possible to connect Gambella to malakal with a navigational road? The channel will enhance market between the two countries.<br>**Main idea**<br>On river, transport can be much higher compared to roads and it is cheapest. This is an attractive mode of transport and should be dominant in the future. The port of Malakal is the first port connecting South Sudan to Sudan and, from Malakal it is possible to go to Juba and to Ethiopia (Gambella). Nasser is at the connection between Baro and Sobat and is connected to Juba. So, if Nasser is connected to Gambella, it means that Juba is connected to Gambella, through Naser and Malakal. This channel can be connected to roads to create a "multimodal transport". |

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| **Situation in the sub-basin area** | |
| **Potential identified** | During the rainy season, there is sufficient depth in the Baro for navigation (2 to 3 meters of depth allow navigation). During the dry season, the end point for big vessels is Nasser, small boats can go further. The problem is sedimentation so dredging is one of the priorities to allow navigation during the dry season. |
| **Constraints and risks experienced** | There is currently no technical committee for operations in Ethiopia and South Sudan |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | **1. African Development Bank Project**<br>For transport development, the Baro river was mentioned during a meeting with the ADB. A workshop was organized last year in that purpose. There might be some documents or minutes of the workshop.<br>**2. Meeting between ministries of Ethiopia and South Sudan**<br>A meeting was held in 2012. The subject of this meeting was transport routes (roads and rivers) between the two countries. |
| **Relevant data and their availability** | There are no data concerning navigation in the Baro river.<br>The MTR&B is working on a masterplan integrating road transport and navigation (not yet started). The first masterplan did not include river transport. Nevertheless, the Ministry of water resources must have documents concerning river transport (prepared in 2013). |

*Meeting with the Meteorology Office*

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| **Date** | 11/05/2015 12am |
| **Location** | Juba airport - Meteorology |
| **Participants** | Director of meteorology<br>Forecast section<br>Observer |
| **Key points** | 1. The meteorology office is covering the all country (all data are centralised in Juba) and there are five meteorological stations in South Sudan.<br>2. Before the separation of Sudan, meteorology was centralised in Karthoum. In 2011, only a few amount of data were communicated to Juba. So available data are very limited. In the BAS basin, there is non meteorology centre (except in Malakal).<br>3. Seasonal data are difficult to obtain. It is maybe possible to find data such as rainfall, temperature (air and soil), humidity, number of rainy days for Malakal and Renk from the 1940s to the 1970s. |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | Lack of data<br>Data acquisition<br>Need to train observers<br>Issue of equipment and maintenance |
| **Knowledge of on-going projects in the sub-basin** | |
| **Relevant data and their availability** | Request for data must be done in Juba to the director of meteorology<br>Malakal: data available up to 2013 |

*Meeting with the MWC&T*

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| **Date** | 11/05/2015 3pm |
| **Location** | Juba - Wildlife conservation and tourism |
| **Key points** | **Key question:**<br>What can be done in terms of water management to help wildlife?<br>The BAS basin is one of the largest wildlife migration area and ecological niche of the eastern part of the White Nile |
| **Situation in the sub-basin area** | |

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| | **Challenges and urgencies identified** | Adverse effects of Jonglei canal on wildlife: animals are not able to cross the canal. The canal is located on the migration area: this is definitely a lesson for any future new project<br>The traditional way of living of tribes with the wildlife is peacefull. However, things are changing, marketing of animal products (meat, skin, horns...) |
| | **Potential identified** | Observation of white ear Kob migration<br>Provision of water during the dry season<br>Prevention of poaching<br>Preservation of wildlife wil increase the development of tourism. |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Relevant data and their availability** | The MWC&T works closely with the WCS and can introduce the Team to obtain data. They have a lot of data including maps of migratory routes.<br>Possibly WCS could bring international expertise to work on organizing conducive tourism and ecotourism |

**7 May – 10 May 2015 SOUTH SUDAN - Torit**

*Meeting with Kapoeta representatives*

| | |
|---|---|
| **Date** | 09/05/2015 |
| **Location** | Torit (Torit Hotel) |
| **Participants** | Kapoeta representatives |
| **Organization of the meeting** | Binyiri Sebit Paul - DIG housing-pu-ut |
| **Remarks** | Some stakeholders were not available |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | **Kapoeta East**: population of pastoralists in a dry area using underground water for water supply and livestock. The water shortage does not permit people to settle. Big challenge: water supply<br>**Kapoeta South**: people depend on groundwater and face seasonal issues. There are not enough water points, hand pumps are not ergonomic and there is deforestation for charcoal production. |
| **Potential identified** | **Kapoeta East**: watershed catchment storage<br>**Kapoeta South**: floods from seasonal large silted rivers --> catchment management to improve seepage and storage of rainfalls. Irrigated mango trees could be a potential with a correct road<br>**General**: wind power potential |
| **Constraints and risks experienced** | **Kapoeta East**: risks of strong conflicts between communities about water points (high sensibility)<br>**Kapoeta South**: limited skills to maintain boreholes (and also limited goods in this landlocked country) |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | **Kapoeta South**: solar pumps experienced |
| **Relevant data and their availability** | The study team is invited to come to Kapoeta to meet other stakeholders in order to get available data |

**22 June – 27 June 2015 Water supply and Sanitation - ETHIOPIA**

*Meeting with the Head Bureau for Water, Mines and Energy - SNNPR*

| | |
|---|---|
| **Date** | June 23,2015 |
| **Location** | Office of the Bureau head for Water, Mines and Energy |

| | |
|---|---|
| **Participants** | Samuel Tamiru Amade- Bureau head for Water, Mines and Energy, Tadele Kibru Wolde Semayat - Water Resource Study Management Core Process Owner, Bekele Kassaye - WASH coordinator, Meskelu Tumbisso - hydrologist, Kassahun Woldegiorgis - Water supply scheme and machinery maintenance & adminstration core process owner, Mulugeta Feleke- expert in WRSM core process, Gebru Askale - MOWIE - tourism expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • No standardization of pumps but dependant on allocated budget and least bidding price.<br>• High capacity gap for O&M<br>• High abstraction of water from groundwater sources causing lowering of water table and burning of pumps<br>• Less study conducted in this particular basin area. |
| **Constraints and risks experienced** | Iron content and excessive pumping lowering the ground water level |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | The source for water supply for Mizan Teferi and Masha towns (towns within the basin) is abstracted from Baro river. There is a plan for developing irrigation scheme and hydropower projects in GTP II. |
| **Relevant data and their availability** | Growth and Transormation Plan II & Multi-sector investiment opportunity analysis, Report on Inventory of Water Supply and Sanitation Facilities in SNNPR as part of "The National WaSH Inventory (2011) - hard copy collected, |
| **Main stakeholders identified** | Pastoralist Community development Project, One WaSH program - CWA, Sugarcane project boreholes for community water supply (13 boreholes in two woredas: Salamago- 9 and Decha 4) |

*Meeting with the Bureau of Health - SNNPR*

| | |
|---|---|
| **Date** | June 23,2015 |
| **Location** | Bureau of Health in disesase promotion an health promotion core processor bureau |
| **Participants** | Ephrem Yohannes - UNICEF WaSH specialist, Mallei Mati - hygiene and sanitation officer, Gebru Askale - MOWIE - tourism expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | Poor sanitation condition in towns. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | 5 years H&S plan |
| **Main stakeholders identified** | One WaSH program |

*Meeting with the Irrigation Development and Scheme Administration Agency Manager - SNNPR*

| | |
|---|---|
| **Date** | June 24,2015 |
| **Location** | Irrigation Development & Scheme Administration Agency D/Manager office |
| **Participants** | Demsew Demeke - D/Manager, Abiyod Ejegu -engineer, Gebru Askale - MOWIE - tourism expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |

| | | |
|---|---|---|
| **Situation in the sub-basin area** | | |
| | **Potential identified** | Small Scale Irrigation Schemes |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | Number of small scale irrigation projects have been identified, studied, tendered and constructed. (Schemes to be identified in 4 Woredas in Bench maji zones, 2 schemes under study, 4 tendering stage, 2 constructed) |

*Meeting in the Pastoralist Community Development Program Office - SNNPR*

| | |
|---|---|
| **Participants** | June 24,2015 |
| **Location** | Pastoralist Community Development Program -office |
| **Participants** | Haile Nuru - Project Coordinator, Milloon Teklay - MIS- IT, Yonas Tabor - Planning and M&E officer, Gebru Askale - MOWIE - tourism expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Community Development Programs in 10 Woredas in Bench Maji zone benefiting from PCDP program |
| **Relevant data and their availability** | PCDP constructed Water supply scheme data (collected) |
| **Main stakeholders identified** | World Bank , International Fund for Agricultural Development |

*Meeting in the Office of Pastoralist Affairs - SNNPR*

| | |
|---|---|
| **Date** | June 24,2015 |
| **Location** | Office of Pastoralist Affairs |
| **Participants** | Dr. Seyum Metaferia - D/head of Infrastructure/Building/Technology Developments Main process head, Lepiso Shambedo - Water and Irrigation officer, Tesfaye Gida - M&E for Infrastructure, Gebru Askale - MOWIE - tourism expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | Food insecurity, conflict mainly caused due to use of services |
| **Potential identified** | Semi-pastoralizing project (Villagization- demands availing particularly water supply services and promotion of sanitation facilities) |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Villagization program for Omo sugar cane project (2000 Hectares of land distributed to 2000 HH, a hectare per HH, to plant sugarcane in the ¾$^{th}$ of the land and food crops in the remaining one quarter of the land.<br>Introduction of better breed cattle to improve quality and reduce number |
| **Main stakeholders identified** | PCDP |

*Meeting in the Bureau of Water Resources Development - Gambella*

| | |
|---|---|
| **Date** | June 25,2015 |
| **Location** | Bureau of Water Resources Development |
| **Participants** | Chuol Biel Thoan - Water Study, design and construction of schemes and resource management core process owner, Ayele Deweru -Planning for the regional water bureau, Getachew Kebede - MOWIE -expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • Low water supply and sanitation coverage particularly in the boarding in Akobo and Jor woredas.<br>• Conflict particularly along these border woredas during the dry season.<br>• Shortage of technical staff and worse at zonal and woreda level<br>• Migration<br>• Great demand for water, intermittent supply (reportedly once a week), scheme in Gambela requiring rehabilitation and expansion: currently Baro river is source of water but there is a potential for groundwater source but 7 km from the centre. New developing areas requiring network expansion. |
| **Potential identified** | Expansion of Gambela water supply scheme, Water supply schemes development for Akobo and Jor woredas |
| **Constraints and risks experienced** | Financial constraints for Gambela town WSS expansion program |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Gambela town water supply rehabilitation and expansion project |
| **Relevant data and their availability** | Technical documents of Gambela water supply scheme expansion |
| **Main stakeholders identified** | UNICEF, AGRI service, IRC |

*Meeting in the Bureau of Health - Gambella*

| | |
|---|---|
| **Date** | June 26,2015 |
| **Location** | Bureau of Health |
| **Participants** | Tagesse Fekre - WaSH and Health extension program case - team leader, Getachew Kebede - MOWIE -expert, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • Low latrine facility coverage (39.4%)<br>• Akobo and Jor woredas being far and inaccessible, Mengeshi and Dima are also inaccessible during the rainy season<br>• No vacuum truck to empty septic tanks and pit latrines for Gambella town comes, when requested it comes Jimma ( 400 km far)<br>• No treatment for septage/latrine sludge but dumping site 7 kms away from the town |
| **Constraints and risks experienced** | Flood |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | GTP II - planning to improve basic latrine coverage from 39.4% to 56% and ODF from 9.2 to 22.8% and Improved latrine from 2% to 9%. |

| | |
|---|---|
| **Main stakeholders identified** | UNICEF, WHO and little support from IRC |

*Meeting in the Bureau of Agriculture – Gambella*

| | |
|---|---|
| **Date** | June 26,2015 |
| **Location** | Bureau of Agriculture |
| **Participants** | Abay Enyew - Vet expert |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • Livestock watering during the dry season<br>• Prestigious to have high number of livestock and also as the girls' families give up to 20 cattle as dowry during marriage making it difficult to reduce the number of cattle holding per household<br>• The inaccessible Jor Woreda and the low water supply coverage zone Nuere have the highest livestock population in the region |
| **Constraints and risks experienced** | Livestock watering during the dry season, movement creating conflict |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | • Villagization program with Hand Dug Wells planned for human consumption and ponds for livestock watering<br>• Project focusing on productivity of livestock than number |
| **Relevant data and their availability** | Livestock population (emailed) |

**28 June – 4 July 2015 Water supply and Sanitation – SOUTH SUDAN - Juba**

*Meeting in the MEDIWR - Juba*

| | |
|---|---|
| **Date** | June 29,2015 |
| **Location** | At the office of Minstry of Electicity, Dams, Irrigation & Water Resources (MEDIWR) |
| **Participants** | Isaac Liabwel C.Yol MEDIWR, Water Sector -under secretary, Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | Stressed on the need for:<br>• Integrated water shed management,<br>• Water for productive use,<br>• Taking Water supply and Sanitation Initiatives |
| **Potential identified** | Availability of water at shallow depth |
| **Constraints and risks experienced** | Financial constraints, Ground water having saline test |
| **Knowledge of on-going projects in the sub-basin** | |
| **Relevant data and their availability** | Water Resource Assessment reports, Study and design reports for seven towns of which two are within the basin |
| **Main stakeholders identified** | UNICEF, JICA, The government of the Netherlands |

*Meeting in the Office of Water Supply and Sanitation - Juba*

| | | |
|---|---|---|
| **Date** | | June 29,2015 |
| **Location** | | At the office of Director General for Water Supply and Sanitation, Juba, South Sudan |
| **Participants** | | Peter Makan, Director General of WSS,Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | | |
| | **Challenges and urgencies identified** | • Low water supply (about 40%) and sanitation coverage (14%),<br>• Progress to meeting the MDG target delayed because of conflict,<br>• Communities' preference to use surface water instead of protected groundwater because of saline test.<br>• Guinea worm a problem in Eastern Equatoria,<br>• Groundwater potential not known,<br>• Technical guidelines require update |
| | **Potential identified** | Studies on Ground water potential, guidelines update, supplying urban communities along the rives course treated surface water, |
| | **Constraints and risks experienced** | Financial constraints, low technical capacity, sustainability of schemes |
| **Knowledge of on-going projects in the sub-basin** | | |
| | **Existing development and investments projects** | WB program from 2008-13, UNICEF and GTZ financing projects now. (documents collected need to be reviewed) |
| | **Relevant data and their availability** | Bottleneck analysis of 2012, |
| | **Main stakeholders identified** | UNICEF, German government (KFW) through GTZ, WB in the past, the Netherlands government, |

*Meeting in the WASH section of UNICEF - Juba*

| | | |
|---|---|---|
| **Date** | | July 3,2015 |
| **Location** | | UNICEF - WASH section |
| **Participants** | | Lillian Okwirr - Chief WASH, BiarKuai Biar: Water Sanitation and Hygiene Officer (M & E), Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | | |
| | **Challenges and urgencies identified** | • Uptake for change in sanitation practice has been difficult,<br>• Unreachable areas because of vandalism<br>• Sustaining water schemes is a major issue<br>• Difficult to carrying out water quality testing despite its establishment in every State capital because of high manpower turnover of trained staff, lack of reagents, lack of incentive, difficulty in sample collection,<br>• Low financial capacity<br>• Tribal conflict<br>• In accessibility to certain communities<br>• Lack of proper documentation |
| | **Constraints and risks experienced** | High emergency intervention because of conflict, guinea worm, increase in number refugees |
| **Knowledge of on-going projects in the sub-basin** | | |

| | |
|---|---|
| **Existing development and investments projects** | Emergency and development programs, Water tracking and septage removal and waste collection for IDPs (refugees camp) |
| **Relevant data and their availability** | Water Assessment report for Eastern Equatoria and Jonglei (emailed), Water schemes data shared to the data management unit with the Water Ministry (not willing to share theirs) |
| **Main stakeholders identified** | NGO's |

*Meeting in the Office of Water cooperation - Juba*

| | |
|---|---|
| **Date** | June 30,2015 |
| **Location** | At the office of Urban Water Cooperation, Juba, South Sudan |
| **Participants** | Magol Gabriel Alueth - Secretary general, Hon. Madol Cuot CEP Deputy managing Director, Eng. Lawrence Lopula B. Muludyang, D/G for Projects and Planning, Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • Existence of old schemes (built in the 30ies) in many of the six towns that the cooperation is operating requiring major rehabilitation and expansion: in terms of volume and distribution network,<br>• In the emerging towns, communities are using any source (treated or any surface water),<br>• Inefficient revenue collection where it is collected like Juba flat rate used regardless of volume used, since many households do not have water meter, but the rate for a $m^3$ of water is supposedly at 6SSP rate, rate that water trackers pay for the utility.<br>• Cooperation is not financially autonomous now and would not be without a change in policy |
| **Potential identified** | Multipurpose projects particularly for towns along the borders, Multi town projects (having abstraction and treatment at one place), |
| **Constraints and risks experienced** | Financial constraints, Flat rates set by the government, financially dependent on the government funding, Institutional improvement, bill collection, |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Investment plans, |
| **Relevant data and their availability** | Act. 2011, Technical studies for Tori and Malkal, Investment plans (collected), SWOT analysis, 3 Yrs cooperative Act (2015-18), |
| **Main stakeholders identified** | JICA, The Netherlands government, |

*Meeting in the Office of Animal resources and Fisheries - Juba*

| | |
|---|---|
| **Date** | June 30,2015 |
| **Location** | At the office of Minister of Animal Resources and Fisheries, Juba, South Sudan |
| **Participants** | Makuel M. Kaang under secretary (introduction only), Anna Felix Baigo - director General of Animal Production, Philip Justin - Livestock officer, Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |

| | |
|---|---|
| **Challenges and urgencies identified** | • Availing water for livestock in improving production & controlling overgrazing.<br>• Understanding and mapping the movement pattern in search of livestock water and tribal boundaries |
| **Potential identified** | Provision of water in one place for livestock + human consumption+ for irrigation, haffirdams for livestocks and irrigatiton, & borehole for human consumption, provision of livestock water along the market route, updating the movement routes mapped in 2007-8, Mapping the grazing lands and development of rangelands, arresting the conflict. |
| **Constraints and risks experienced** | Financial constraints, insecurites are always issues for the communities movement, particulrly Jongelie and Easter Equatoria states suffer from dry season problem. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | Strategic plans for 2012-17 |
| **Relevant data and their availability** | Peace and conflict assessment, Strategic plans for 2012-17, Movement maps of 2007-8, |

**1 July – 2 July 2015 Water supply and Sanitation – SOUTH SUDAN - Torit**

*Meeting in the Office of the Director General for Ministry of Physical Infrastructure - Torit*

| | |
|---|---|
| **Date** | July 1,2015 |
| **Location** | At the office of Director General for Ministry of Physical Infrasturcture,Torit, South Sudan |
| **Participants** | Binyiri Sebit Paul - Director General of Ministry of Physical Infrastructure, Theo Otto Lam Director of Urban Water Supply and Sanitation at MPI, Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • No fee paid for water from the service users as the state bylaw considers it as free good.<br>• Huge financial constraint as budget allocated from the government to the water sector (urban & rural water supply & sanitation) is just sufficient to cover salaries and basic running cost.<br>• Rural communities particularly in Buti, Kapoita and Lopa-lapon counties having limited water source for livestock watering, a cause, always for conflict.<br>• Open defecation is practiced highly particularly in Torit because of hard formation. |
| **Potential identified** | Torit town water supply system expansion and sanitation system improvement |
| **Constraints and risks experienced** | Health risk particularly Cholera outbreak last year in Torit town, and in other places in the past. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | • Detail design study, including bid document preparation for Torit town water supply carried out in 2013<br>• Government of the Netherlands financing Water for Eastern Equatoria (WEES) Project |
| **Relevant data and their availability** | Torit town water supply study report collected in soft copy, Organizational structure and tasks of water supply and sanitation units collected |
| **Main stakeholders identified** | The Government of the Netherlands (25 Million Euro), UNICEF (3 million USD), and |

*Meeting in Torit Hotel*

| | |
|---|---|
| **Date** | July 1,2015 |
| **Location** | Torit Hotel, Torit, South Sudan |
| **Participants** | Binyiri Sebit Paul - Director General of Ministry of Physical Infrastructure, Theo Otto Lam Director of Urban Water Supply and Sanitation at MPI, Andrew Yunda - WEES - ILWRM counter part, Charles Laku Losin -Project manager for African Wildlife Foundation,,Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • About 50% of UNICEF drilled wells are not functional due to lack of spare parts<br>• Conflict amongst the pastoralist communities while moving in search of water<br>• Concentration of animals in one place because of water<br>• Lack of budget for maintenance and repair work |
| **Potential identified** | Rain water harvesting for multiple use, provision of water along the migratory routes |
| **Constraints and risks experienced** | Conflict amongst the pastoralist communities and concentration of animals in one place. |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | WEES - carried out by NIRAS |
| **Main stakeholders identified** | WEES- NIRAS, African Wildlife Foundation, GIZ, UNICEF |

*Meeting in the Office of Nirat – Torit*

| | |
|---|---|
| **Date** | July 2,2015 |
| **Location** | At the office of NIRAS, Torit, South Sudan |
| **Participants** | Binyiri Sebit Paul - Director General of Ministry of Physical Infrastructure, Theo Otto Lam Director of Urban Water Supply and Sanitation at MPI, Fubian Musila - WEES ILWRM advisor,Theo Hendriksen WEES - team leader, Andrew Yunda - WEES - ILWRM counterpart, Charles Lopero -WEES- WASH counterpart, yika Charles Jacob - WEES- ILWRM -counterpart,,Chut Issac - National Project Coordinator, Jackson Muso- Project Manager, Mike Shand- Aurecon, Yemarshet Yemane- Yerer Engineering |
| **Situation in the sub-basin area** | |
| **Challenges and urgencies identified** | • Neither recent nor historical meteorological data is available<br>• Lack of ownership and financial & technical Sustainability of water schemes<br>• Lack of hygiene awareness<br>• Low access to protected water supply source |
| **Constraints and risks experienced** | Cholera outbreak |
| **Knowledge of on-going projects in the sub-basin** | |
| **Existing development and investments projects** | WEES- NIRAS implemented fund management for hygiene & sanitation promotion, for constructing about 300 new and maintaining 200 existing water supply schemes |
| **Relevant data and their availability** | WEES planning & Budgeting workshop report collected, |
| **Main stakeholders identified** | NGOs implementin WEES software aspect - Caritas (of Switzerland), Drop in Bucket, SNV, DOT (Diocese of Torit), AAH (Action Against Hunger)Japan, |

# Annex 3: Stakeholders met

**28 April – 2 May 2015 ETHIOPIA**

| Ministry of environment - 27 april 2015 | | | | |
|---|---|---|---|---|
| Name | Organization | Position | E-mail | Mobile |
| Teshome Atnafie | | | teshomeg87@yahoo.com | 0924403512 |
| Semunesh Golla | | | semunesh_golla@yahoo.com | 0911123708 |
| Kifle Alemayehu | | | kifleroman@gmail.com | |
| Molla Zewdu | | | tememew@hotmail.com | 0911318194 |
| Wondimagegn Sine | | | wondimagegn_s@yahoo.com | 0911835347 |
| Asmamaw Kume | | | asmamawkume@yahoo.com | 0912142271<br>0943182867 |
| Yiheyis Esheju | | | yiheyise@yahoo.com | 0911974164 |
| Solomon Cherie | | | solomoncherie12@gmail.com | 0911887678 |
| Omer Elawad | | | omerelawad@nilebasin.org | 0929235513 |
| Gilles Pahin | | | gilles.pahin@brl.fr | |
| Juliette Fradet | | | juliette.fradet@brl.fr | |
| Jean-Michel Citeau | | | jmciteau@brl.fr | |
| Jackson Elisoma | | | jelisoma@nilebasin.org | |
| Nekemte - 28 april 2015 | | | | |
| Name | Organisation | Position | E-mail | Mobile |
| Debels Wolgari | WM&ED | Expert | | 0913157619 |
| Kidane Yonbo | land and environment office | vice head | | 0917812787 |
| Mitikel Duvesa | Zone administration office | Office head | | 0917818756 |
| Etana Erati | CSA | Statistics | | 0917836474 |
| Gamule Dhuzaaso | CSA | Statistics | gamuledhuzaaso@gmail.com | 0917855845 |
| Mescerem Abebe | women Ass Affairs | vice head | | 0917818756 |
| Teshome Kene | Zone health office | vice head | tashekene@gmail.com | |
| Adamu Chany Alem | East Wallega zone land and environement office | Environmentalist | gizashure@gmail.com | 0931664645 |
| Getu Kenea | East Wallega | Expert | | 0913851712 |
| Metu - 28 april 2015 | | | | |
| Name | Organization | Position | E-mail | Mobile |
| Bedassa Negasa | Irrigation office | Team leader | | 0917158961 |
| Belaynen Lencho | Finance and Economic | Officer and Date | belaynenlencho@gmail.com | |
| Suleman Fedesa | Development office and information | | | 0948099179 |
| Ketema Eshetu | Women and child affaire | Process owner | | 0917830562 |
| Etana Asfaw | Zonal health departement | Process owner | | 0937173148 |

| | | | | |
|---|---|---|---|---|
| Wondim Kinde | Water, Mineral and Energy | Process owner | | 0913802669 |
| Ketema Addibu | Zone Agricultural office | | | 0941533765 |
| Vega Dargie | Livestock departement and health office planner | | | 0913256010 |
| Tamene Balcha | Administration and agriculture | | tamenebalcha@gmail.com | 0917805949 |
| Gambella - 28 april 2015 | | | | |
| Name | Organization | Position | E-mail | Mobile |
| Andrew Tnt | WERDB | | andrewtntnet@gmail.com | 0913360049 |
| Biel Keat | EPA | Core process owner | songbiel2001@gmail.com | |
| Mesfin Teshome | WERDB | Core process owner | mesfin.chem@yahoo.com | 0911753481 |
| Steve Crerar | BRLi | Consultant | stevecrerar@live.com | |
| Domach | WCYA | Expert | | 0917560364 |
| Tenisis Amdesilassia | | Plan and program | | 0917778987 |
| Abtu Kebebe | Agriculture bureau | Irrigation engineer | abtukebebe120@gmail.com | 0912348843 |
| Alemayahu Mamo | BWCYA | Plan supp process | | 0917804837 |
| Abolla Octange | WERDB | Hydraulic engineer | | 0917318801 |
| Zevitu Kebede | WCYA | Process owner | | 0912079032 |
| Berenech | WCYA | Child officer | | 0913077952 |
| Gizachew Assrie | WERDB | Water resource management expert | | 0911762216 |
| Aibibe Naivesa | LUAEPA | Expert | | 0917834116 |
| Tana Ebrahim | | Water resources development | | 09351554802 |
| Girum | BOWCYA | Core process owner | | 0911090950 |
| Kalaturi Camp - 28 april 2015 | | | | |
| Name | Organization | Position | E-mail | Mobile |
| Kifle Alemayehu | | | kifleroman@gmail.com | 0911348772 |
| Jackson Elisoma | | | | 0939789880 |
| Tekulign Yissaw | | | | 0917843060 |
| Steve Crerar | | | stevecrerar@live.com | |
| Omer Elawad | | | | |
| Asmaman Kume | | | | |
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# Annex 4: Annotated Table of Contents for the Scoping Report

# BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY

## Preliminary Scoping report – Annotated table of contents

# 1. INTRODUCTION

## 1.1 OVERALL CONTEXT

- In order that the report can be understood without reference to the Inception report or ToR, this section will provide a rapid overview of the context
  - Overview of the basin (biophysical and social context)
  - NBI/ENTRO and context of this study (objectives etc)

## 1.2 STUDY OVERVIEW

- Rapid overview aimed at showing the main steps of the study and the position of the scoping task within these steps

## 1.3 THE SCOPING EXERCISE

### 1.3.1 Methdology

It is important to note the ToR state that the scoping exercise is aimed at determining the relevant information ***to be*** collected **to complete the baseline** in order to determine the "key issues and potentials related to water resource development and management in the river basin"[1]

The objectives of the scoping exercise are shown here after.

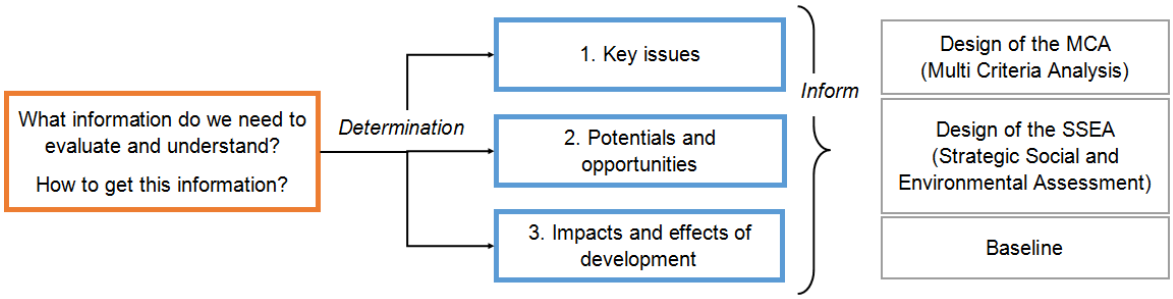



*Figure 1: Objectives of the Scoping Exercise*

It is important to note that this study has a clear focus on the **identification and development of projects**. At the same time, this development of projects (large and small) has to take place within a coherent strategic framework for the management and development of water resources basinwide. For this reason the baseline (and hence the scoping exercise) has to be carried out at two levels:

- **Basinwide (BAS)** (and to a certain extent the **whole Eastern Nile/Nile** in order to take downstream impacts of identified projects into account). This is especially necessary for:

1 The baseline report comprises i) baseline, ii) key issues, iii) development potentials and iv) management/development objectives

- water resources (what aspects in particular?),
- the environment (existing and potential issues are both basinwide and localized),
- Certain policy, strategic and institutional aspects (some are quite high level related to sectoral development, water resources and environmental management, socio-economic issues/aspects such as poverty alleviation etc),
- Electricity interconnection and transmission
- Etc.

- **"Project" level.** The level of detail that is required at this level is too detailed to be assessed/collected at the basin-wide level. The challenge here is that many projects/interventions are yet to be identified so - **how to know where to do the baseline work?** Our approach to the baseline and the related scoping at the intervention/project level will be as follows:

  1) Interventions can be:
     - A) the development of **already identified projects** (from masterplans, existing studies etc)
     - B) as a result of identifying a **need** and/or a **potential.** For example there may be a specific need for development (or a type(s) of development in a specific part of the basin) or there may be a specific potential for a certain type of development (irrigable land, hydropower potential etc)
  2) The baseline/issues/objectives/potential should therefore be focused on these two areas A) and B).
     - For A) the already identified projects it is clear. We need to make sure that we inventorize all of the projects. **This is a clear goal and output of the scoping exercise**
     - For B) we need to identify **both areas of need and potential (opportunity)** (NB this is at the project/intervention level). The focus (need or opportunity) will depend on the sector or thematic area. For example:
       - Hydropower – based on potential
       - Interconnection/transmission – need (and opportunity)
       - Water supply – based on need (for human and livestock)
       - Irrigation – large-scale is mainly on potential. Small-scale on need and/or potential
       - Fisheries – capture fisheries mainly on potential; aquaculture need and potential
       - Tourism – mainly potential
       - Etc.
  3) Conclude on what sort of information has to be collected in completing the baseline.
  4) Environmental and social impacts for the identified projects will be assessed with the SSEA. The strategy and the scope of the work for the SSEA will thus be at two levels: basin wide and project level.

The methodology for the scoping exercise at project level is shown in **Erreur ! Source du renvoi introuvable.**. It is important to remember that the scoping exercise will also be realised at basin level in order to define the limits of the study and that application of the SSEA at the project level has to fit within the basin-wide context and limits.

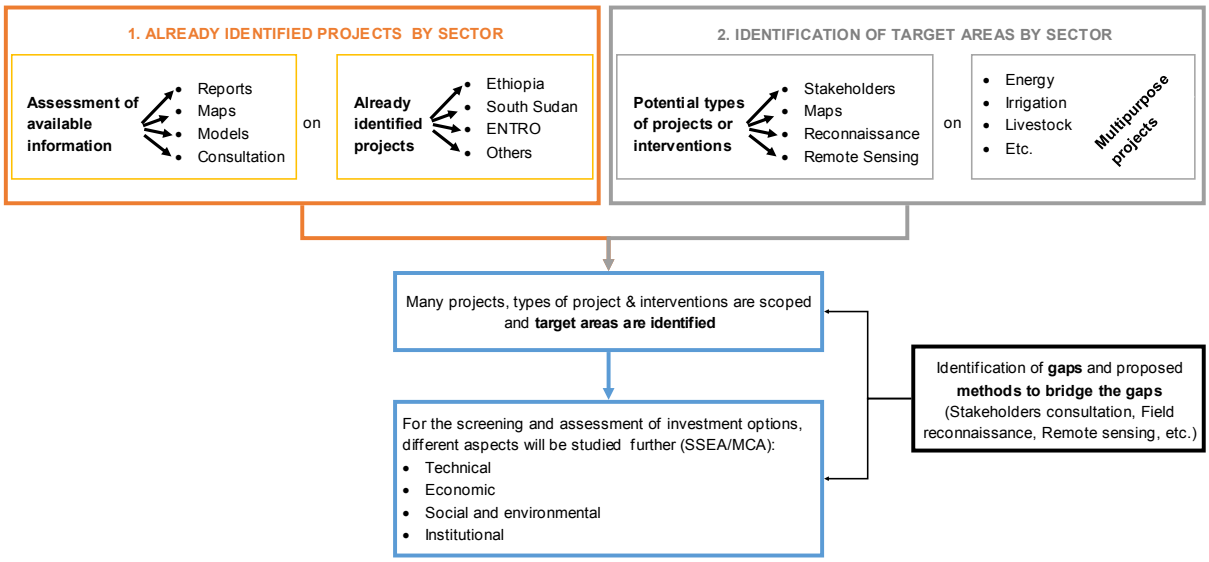



*Figure 2: Methodology for the Scoping exercise at project level*

In conclusion, it is important to stress that the scoping exercise is not about the actual collection of this information but getting clarity on what information should be collected and how it will be (is being) achieved. Thus, the two main objectives of the scoping report are the following:

- Clear definition of the work to be carried out in the baseline and for the SSEA
- Assessment of information available, identification of gaps and implications, suggestions for mitigating critical gaps.

### 1.3.2 Scoping and the SSEA

In the baseline, we need to collect certain information, including for the SSEA. To do so, it is important to evaluate how the baseline will inform the SSEA. The role of the scoping exercise is to answer the following questions:

- What information will be required during the baseline phase in order to feed into the SSEA framework?
- What are the limits of the SSEA?

This must be done at project level and at the basin wide level.

# 2. SOURCES OF INFORMATION

## 2.1 INTRODUCTION

This chapter provides an overview/details of the information sources that have been used to do the scoping and which are seen as **key documentation/sources of information** for the baseline.

We use the documentation in 2 ways:

- In order **to write the scoping report**: Identification/listing of projects and identification of potential developments (by geographic area and/or need)
- Know what is in the documentation to help us complete the baseline

## 2.2 DETERMINATION OF THE RELEVANT INFORMATION PER SECTOR

### 2.2.1 Surface water hydrology

#### *2.2.1.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. For example:

- Shahin, Hydrology of the Nile basin, 1985
- Sutcliffe & parks, Hydrology of the Nile, 1999
- Selkhozpromexport, Baro-Akobo basin master plan study of the gambella plain (annex 1: climatology and hydrology), 1990
- Ardco-Geoserv, survey and analysis of the upper Baro-Akobo-Sobat basin: final report, volume ii: water resources, 1995
- TAMS-ULG, Baro-Akobo river basin integrated development master plan study, annex 1: water resources , 1997
- Etc.

This must help to identify with ENTRO what sources of information are missing.

#### *2.2.1.2 Assessment of the information currently available in reports*

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following lines (examples below):

**SHAHIN, HYDROLOGY OF THE NILE BASIN, 1985**

This report is a comprehensive source of information on the hydrology of the Nile Basin. It describes and quantifies the key components of the hydrological cycle in the Nile Basin and analyses the water balance based on recorded data and by means of analytical methods. Information is provided on a sub-basin basis. Key aspects which are addressed include the physiography of the basin, the climate, precipitation,

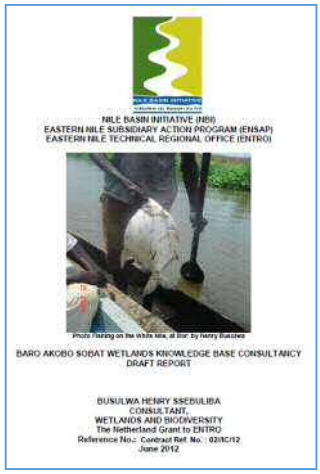
evaporation and evapotranspiration, geology, geohydrology, surface water runoff, water storage and conservation, control works and environmental impacts.

### SUTCLIFFE & PARKS, THE HYDOLOGY OF THE NILE, 1999

This report provides an overview of the Nile Basin surface water hydrology in terms of the drainage network, early studies, the hydrometric network, water balance calculations, land use and climate and the operation of existing dams. It includes a chapter on the Baro-Akobo-Sobat Basin and provides a detailed analysis of the water balance of the Machar Marshes, while the links and spills between different rivers and channels on the Gambela Plains are also described.

### ENSAP-ENTRO, BARO AKOBO SOBAT WETLANDS KNOWLEDGE BASE CONSULTANCY, 2012

- Hydrology & Water Quality: The swamp is flooded during the rains to depths in excess of 1 m. The 9 rivers feeding it are seasonal, but some retain pools of water in their beds during the dry season. A small lake forms in the swamp after the rains at a point 4°59'N/34°41'E in Sudan, but disappears during the dry season. Precipitation over the swamps is 250-500 mm/yr, but reaches 650 mm in the Ugandan catchments and 800 mm in those of Ethiopia.
- Altered hydrology, water flow and water quality are likely to affect the vast extent of wetlands found in the region. An important aspect of the potential lost from environmental degradation is the likely negative impact on the local fisheries. The combined yield from the Baro, Alwero and Gilo Rivers make up the largest fisheries in Ethiopia (Abrha and MoWR 2005).
- Wetlands control floods by storing water and they trap and remove sediments which come with the water. The natural ways water would enters into wetlands from the river banks will be altered and the regulated flow consisting of a changed water quality and probably less sediments will impact the habitats to which ecological adaptation has evolved.
- Some of the wetlands have been documented in previous inventory studies using GIS. But there is need to study their ecology since wetlands depend on the amount of on the quality and amount of water in them together with the nature of their topographical basins.


NILE BASIN INITIATIVE (NBI)
EASTERN NILE SUBSIDIARY ACTION PROGRAM (ENSAP)
EASTERN NILE TECHNICAL REGIONAL OFFICE (ENTRO)
BARO AKOBO SOBAT WETLANDS KNOWLEDGE BASE CONSULTANCY
DRAFT REPORT
BUSULWA HENRY SSEBULIBA
CONSULTANT,
WETLANDS AND BIODIVERSITY
The Netherland Grant to ENTRO
Reference No.: Contract Ref. No. : 02/IC/12
June 2012

- The entire ecosystem of BAS is dependent on its hydrology, hence, developments which might alteration water flow regimes and water quality are likely to affect the wetlands and the ecosystem found in the BAS.
- Emphasis should be to examine the influence of the physical environment and hydrology on the existence of the wetlands and other ecosystems and their role in modifying water quality from the catchments by removing pollutants presumably from sediments and suspended solids, agricultural pesticides and fertilisers.

Etc.

## 2.2.2 Water Quality

### *2.2.2.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.2.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.3 Groundwater

#### 2.2.3.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.3.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.4 Watershed Management

#### 2.2.4.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.5 Agriculture (rainfed and irrigated)

#### 2.2.5.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.5.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

## 2.2.6 Livestock

### *2.2.6.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

### *2.2.6.2 Assessment of the information currently available in reports*

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

## 2.2.7 Fisheries and aquaculture

### *2.2.7.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

### *2.2.7.2 Assessment of the information currently available in reports*

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

## 2.2.8 Hydropower and Interconnection

### *2.2.8.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

### *2.2.8.2 Assessment of the information currently available in reports*

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

## 2.2.9 Water supply and sanitation

### *2.2.9.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.9.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.10 Tourism

#### 2.2.10.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.10.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.11 Navigation

#### 2.2.11.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.11.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.12 Biodiversity conservation

#### 2.2.12.1 Bibliography relevant for the study

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### 2.2.12.2 Assessment of the information currently available in reports

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

### 2.2.13 Social situation and security

#### *2.2.13.1 Bibliography relevant for the study*

The list of all potentially relevant documents will be provided. See example for Surface Water Hydrology

#### *2.2.13.2 Assessment of the information currently available in reports*

A brief review of each document, emphasizing its importance for the study will be presented in this section along the following line (see surface water hydrology)

## 2.3 EXISTING DATA

### 2.3.1 Introduction

The aim of this brief section is state very concisely

- What data exists (according to documents and feedback from stakeholders)
- What data we have
- What data we don't have (of the data that apparently exists)

We **can't do a comprehensive gap analysis yet** because we don't have a picture of exactly what **data we will need**. This will only become clear in Chapters 3 and 4. However, it is possible to identify at this early stage what crucial data are required and not yet obtained (because they are not available or because they don't exist).

"Data" is taken to include both numerical data and spatial (GIS) data sets (raster files such as DEM and vector files such as shape files)

### 2.3.2 Water infrastructure

Scoping on the availability and sources of these data will be divided up according to the main BAS sub-catchments. Water infrastructure includes dams and weirs, diversion structures, pipelines and canals.

It will be necessary to establish a minimum threshold for these items.

#### 2.3.2.1 Purpose of water infrastructure data

#### 2.3.2.2 Data availability

#### 2.3.2.3 Data gaps

### 2.3.3 Land use and land cover

#### 2.3.3.1 Purpose of land use and land cover data

#### 2.3.3.2 Data availability

#### 2.3.3.3 Data gaps

Most of the available information is in the form of raster files, GIS layers and associated databases. This includes data on irrigation areas.

### 2.3.4 Topography

#### 2.3.4.1 Purpose of topograpic data

#### 2.3.4.2 Data availability

#### 2.3.4.3 Data gaps

This will include digital elevation models at the basin scale and at a more detailed scale for some parts of the basin where more detailed studies have been carried out.

### 2.3.5 Meteorological data

This will include

- historical climate observations within and close to the basin as held by the national authorities
- extracts from global datasets
- data from previous studies including patched datasets
- satellite based rainfall data
- climate change projection

#### 2.3.5.1 Purpose of meteorological data

#### 2.3.5.2 Data availability

#### 2.3.5.3 Data gaps

### 2.3.6 Hydrological data

#### 2.3.6.1 Purpose of hydrological data

#### 2.3.6.2 Data availability

#### 2.3.6.3 Data gaps

This will include:

- water level and discharge data from gauging stations operating or once operated by the national authorities (for rivers, lakes and wetlands)
- second generation datasets derived during the course of previous studies

### 2.3.7 Water quality data

This include sediment data.

#### 2.3.7.1 Purpose of water quality data

#### 2.3.7.2 Data availability

#### 2.3.7.3 Data gaps

### 2.3.8 Sediment and morphological data

#### 2.3.8.1 Purpose of sediment data

#### 2.3.8.2 Data availability

#### 2.3.8.3 Data gaps

### 2.3.9 Groundwater data

This will include:

- water level discharge data from gauging stations operating or once operated by the national authorities (for rivers, lakes and wetlands)

- Aquifer characteristics (capacities, yields recharge rates etc)

#### *2.3.9.1 Purpose of groundwater data*

#### *2.3.9.2 Data availability*

#### *2.3.9.3 Data gaps*

### 2.3.10 Soils data

Most of the available information is in the form of raster files, GIS layers and associated databases. Data will be available at a coarse level of detail at the basin-wide scale and at a higher level of detail for some sites where more detailed studies have been carried out.

#### *2.3.10.1 Purpose of soils data*

#### *2.3.10.2 Data availability*

#### *2.3.10.3 Data gaps*

### 2.3.11 Conservation areas

#### *2.3.11.1 Purpose of conservation areas data*

#### *2.3.11.2 Data availability*

#### *2.3.11.3 Data gaps*

Most of the available information is in the form of GIS layers and associated databases. Data will be available at a coarse level of detail at the basin-wide scale and at a higher level of detail for some of the conservation areas.

### 2.3.12 Demographics and social data

Includes data on:

- Population distribution/density (data and spatial GIS files)
- Access to improved water and sanitation
- Migration data into/out of and within the basin
- Income, poverty, employment etc – census data

#### *2.3.12.1 Purpose of demographic and social data*

#### *2.3.12.2 Data availability*

#### *2.3.12.3 Data gaps*

### 2.3.13 Vegetation

#### *2.3.13.1 Purpose of vegetation data*

#### *2.3.13.2 Data availability*

#### *2.3.13.3 Data gaps*

Most of the available information is in the form of raster files, GIS layers and associated databases. Data will be available at a coarse level of detail at the basin-wide scale and at a higher level of detail for some sites where more detailed studies have been carried out.

### 2.3.14 Wildlife

#### *2.3.14.1 Purpose of wildlife data*

#### *2.3.14.2 Data availability*

#### *2.3.14.3 Data gaps*

# 3. BASIN WIDE APPROACH: SCOPE OF WORK

## 3.1 ENVIRONMENT AND SOCIAL CONTEXT WITHIN THE BASIN

### 3.1.1 Environment and Biodiversity

#### *3.1.1.1 Introduction*

This should not be confused with the baseline study. The aim is to emphasize **what** is going to be studied at basin level in order to identify key issues, challenges and opportunities at basin level. It should highlight what may be the critical areas with respect to potential developments and what baseline (environmental/biodiversity) information will be important in these areas. This will provide the basic information for the environmental component of the SSEA.

This exercise is to get a clear picture of the environmental issues which will be addressed in the IWRDMPlan and to define the framework of the Plan. The Basin wide approach will inform strategic decisions regarding the overall approach to the development of water resources in the basin.

#### *3.1.1.2 Key issues, challenges and opportunities*

This section aims at defining what information is required to identify environment-related key issues, challenges and opportunities at basin wide level.

To assess information requirements, an indication of the main issues, challenges and opportunities that are going to be studied at basin level will be given in the scoping report (Key issues relate to different types of development - eg for irrigation, for expansion of rainfed farming, etc…). Some explanations of why this is important in the context of the study will be provided.

#### *3.1.1.3 Data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed.

#### *3.1.1.4 Level of detail*

- To what level of detail will we have to go at in the baseline?
- Bearing in mind that the environmental baseline should have sufficient information to understand what the impacts of development will be (basin-wide and further downstream and locally).
- What sort of information are we going to use in the SSEA?

- For example, if stakeholders consultation is required to complete the baseline study, say if the consultation will be at national level, local level, who is going to be approached, etc.

#### *3.1.1.5 Study limits*

Some comments on the fact that the limits of the study are generally defined as the hydrographic limits. Do we see any problem with this as it relates to the environment?

### 3.1.2 Social assessment, human dynamics and land use

#### *3.1.2.1 Introduction*

This should not be confused with the baseline study. The aim is to emphasize **what** is going to be studied at basin level in order to identify social development related key issues, challenges and opportunities at basin level. It should highlight what may be the critical areas with respect to potential developments and what baseline social information will be important in these areas.

This exercise is to get a clear picture of the social issues which will be addressed in the IWRDMPlan and to define the framework of the Plan. The Basin wide approach will inform strategic decisions regarding the overall approach to the development of water resources in the basin.

#### *3.1.2.2 Key issues, challenges and opportunities*

This section aims at defining what information is required to identify key issues, challenges and opportunities at basin wide level.

To assess information requirements, an indication of the main issues, challenges and opportunities that are going to be studied at basin level will be given in the scoping report (Key issues relate to different types of development ; eg for irrigation, for expansion of rainfed farming, etc…). Some explanations of why this is important in the context of the study will be provided.

**In the case of social aspects, there is a big difference compared to the environment in that it will usually be social issues and challenges that will drive the need for development.** When we look at the environment we are usually more concerned with the impact of developments on the environment. THUS social issues are often drivers of development. This is not usually the case for environmental issues which may constrain development.

(Consider use of tables if appropriate)

#### *3.1.2.3 Data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2 –reports and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed. .

#### 3.1.2.4 Level of detail

- To what level of detail will we have to go at in the baseline?
- Bearing in mind that the social baseline should have sufficient information to understand what the impacts of development will be (basin-wide and locally).
- What sort of information are we going to use in the SSEA?
- For example, if stakeholders consultation is required to complete the baseline study, say if the consultation will be at national level, local level, who is going to be approached, etc.

#### 3.1.2.5 Study limits

Some comment on the fact that the limits of the study are generally defined as the hydrographic limits. Do we see any problem with this as it relates to social aspects (movements of people into and out of the basin for example).

### 3.1.3 Water resources and catchment condition/status

#### 3.1.3.1 Introduction

This should not be confused with the baseline study. The aim is to emphasize **what** is going to be studied at basin level in order to identify key issues, challenges and opportunities at basin level. It should highlight what may be the critical areas with respect to potential developments and what baseline environmental/biodiversity information will be important in these areas.

This exercise is to get a clear picture of the Water resources issues which will be addressed in the IWRDMPlan and to define the framework of the Plan. The Basin wide approach will inform strategic decisions regarding the overall approach to the development of water resources in the basin.

Finding the right place in the scoping for **watershed management** is a challenge. From the basin-wide point of view, the focus is on the interaction with water resources and the environment. This means issues of erosion, deforestation etc. However, from the livelihood enhancement point of view (improved farming practices supporting both reduced erosion AND improved livelihoods there is a need to include it in Chapter 4 as well.

#### 3.1.3.2 Key issues, challenges and opportunities

This section aims at defining what information is required to identify water resources-related key issues, challenges and opportunities at basin wide level.

To assess information requirements, an indication of the main issues, challenges and opportunities that are going to be studied at basin level will be given in the scoping report. Some explanations of why this is important in the context of the study will be provided.

For water resources, **the issues, challenges and opportunities generally relate to the availability (in space and time) of adequate water resources and of its quality**. This is what will be studied in the baseline so we need data on this. In the scoping we have made an assessment of what data are available and these data take the form of:

- Climate data
- Surface water data (river gaugings stations, lakes, dams/reservoirs etc)
- Groundwater data
- Water quality data
- River morphology, erosion and sedimentation data

Include maps of gauging stations and key tables. (Consider putting some tables to the annex)

#### *3.1.3.3 Data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2 – reports and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed.

#### *3.1.3.4 Level of detail*

- To what level of detail will we have to go at in the baseline?
- Bearing in mind that the water resources baseline should have sufficient information to understand what the impacts of development will be (basin-wide and locally).
- What sort of information are we going to use in the SSEA?
- For example, if stakeholders consultation is required to complete the baseline study, say if the consultation will be at national level, local level, who is going to be approached, etc.

#### *3.1.3.5 Study limits*

**In this section we should look at the issue of scoping the basin limits.**

**As suggested by stakeholders (South Sudan in particular) in the Inception workshop we should proceed as follows:**

1) Present the existing ENTRO boundary as used in the most recent studies (eg MSIOA)
2) Overlay the possible variations that we have discovered, one by one and present the technical arguments for whether there should be a change or not.
3) Conclusions

## 3.2 ENABLING ENVIRONMENT IN THE BASIN

### 3.2.1 Introduction

The central aim of this study is the formulation of the Integrated Water Resources Development and Management Plan (IWRDMP). It is different from national and regional development plans in that the focus is **water resources**.

However, even if the focus is the development (and management) of water resources, it is clear that **useful/efficient development requires the appropriate enabling environment**.

It is not necessary to analyse this enabling environment in detail but it is important to understand how it can have an impact on water resources developments.

The Scoping exercise is particularly relevant for the enabling environment since it will be important to know what to look at in some detail and what to deal with in a more cursory manner.

There are different possible ways of categorising the enabling environment: We have chosen the following categories:

- Access to services
- Institutional framework
- Legal and Policy framework
- Availability of funds
- Peace and security

### 3.2.2 Access to basic services

This includes the following areas:

- Transport - Land transport infrastructure: important enabler for developments such as irrigation etc. Also the opportunities for navigation to link with land networks
- Communications, especially mobile phone and internet access coverage
- Electricity
- Healthcare

### 3.2.3 Institutional framework

What institutional frameworks are important to analyse with respect to this study ?

The institutional frameworks as they relate to the development of specific projects will generally be the national (and sometimes regional/international) sectoral frameworks and will be dealt with under the sectoral parts of the baseline (see Chapter 4).

- Water resources management (NBI, Entro…, national level)
- Environment (Regional and national organizations)

- Social ?
- Some related to the enabling environment (for trade etc)

### 3.2.4 Legal and Policy framework

- Water resources
- Environment
- Social (Poverty reduction strategies etc)
- Land tenure
- National Development strategies

### 3.2.5 Availability of funds

The scoping report will provide an overview of the different funding options for different types of project development that should be investigated in the baseline.

### 3.2.6 Peace and security

This is difficult to analyze but the scoping report should attempt to highlight the key points and their implications on development that have to be described in the baseline.

## 3.3 CONCLUSION AND LIMITS FOR THE BASELINE STUDY

### 3.3.1 Overall Conclusions

Based on the preceding sub-sections, the idea would be summarize the main conclusions for the basin-wide scoping and the limits for the baseline work.

### 3.3.2 Recommendations for scope of the work for the SSEA at basin level

It is important to be clear that the SSEA framework at the basin-level will be built on the work done during the baseline. In the scoping it will therefore be important to be clear on what information this framework will need to be useful and applicable. This information will be outlined here.

# 4. SECTORAL APPROACH: SCOPING FOR PLANNED AND POTENTIAL INTERVENTIONS

## 4.1 INTRODUCTION

A sectoral based approach is taken for the scoping of projects/interventions. However, it is important to remember that the development of multipurpose opportunities is a key aim of the study so this should always be kept in mind when scoping opportunities.

## 4.2 POTENTIAL INTERVENTIONS FOR THE DIFFERENT WATER RELATED SECTORS

### 4.2.1 Rainfed and irrigated Agriculture

#### *4.2.1.1 Introduction*

Projects/interventions under this heading can include the following:

- New small, medium and large-scale irrigation development projects
- Rehabilitation and/or modernization of small, medium and large-scale irrigation development projects
- Medium and large-scale rainfed development projects
- Small-scale rainfed development although this is included only when as component of livelihood-based watershed management. The generalized development of small-scale rainfed farming is considered outside the scope of work.
- Capacity-building

A number of projects falling under these categories have already been identified and are introduced in Section 4.2.1.2. These projects will be detailed in the Baseline Report. In Section 4.2.1.3 the areas which have been identified as having the potential for the identification of projects are presented together with an overview of the work that will be required as part of the baseline.

#### *4.2.1.2 Identified development projects*

As explained in the Introduction, section 1.3.1

#### *4.2.1.3 Identification of target areas*

As explained in the Introduction, Section 1.3.1.

#### *4.2.1.4 Enabling environment*

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.1.5 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.2 Hydropower and Interconnection

#### 4.2.2.1 Identified development projects

As explained in the Introduction, section 1.3.1

#### 4.2.2.2 Identification of target areas

As explained in the Introduction, Section 1.3.1.

#### 4.2.2.3 Enabling environment

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.2.4 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- **Indicate** our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.3 Potable water supply and Sanitation

#### 4.2.3.1 Identified development projects

As explained in the Introduction, section 1.3.1

#### 4.2.3.2 Identification of target areas

As explained in the Introduction, Section 1.3.1.

#### 4.2.3.3 Enabling environment

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.3.4 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.4 Livestock

#### 4.2.4.1 Identified development projects

As explained in the Introduction, section 1.3.1

#### 4.2.4.2 Identification of target areas

As explained in the Introduction, Section 1.3.1.

#### 4.2.4.3 Enabling environment

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.4.4 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.5 Fisheries and Aquaculture

#### 4.2.5.1 Identified development projects

As explained in the Introduction, section 1.3.1

#### 4.2.5.2 Identification of target areas

As explained in the Introduction, Section 1.3.1.

#### 4.2.5.3 Enabling environment

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.5.4 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.6 Livelihood-based watershed management

#### 4.2.6.1 Identified development projects

As explained in the Introduction, section 1.3.1

#### 4.2.6.2 Identification of target areas

As explained in the Introduction, Section 1.3.1.

#### 4.2.6.3 Enabling environment

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

#### 4.2.6.4 Information requirements and data gaps

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

## 4.2.7 Forestry (as an economic sector)

### *4.2.7.1 Identified development projects*

As explained in the Introduction, section 1.3.1

### *4.2.7.2 Identification of target areas*

As explained in the Introduction, Section 1.3.1.

### *4.2.7.3 Enabling environment*

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

### *4.2.7.4 Information requirements and data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

## 4.2.8 Mining (including oil exploration and extraction)

### *4.2.8.1 Identified development projects*

As explained in the Introduction, section 1.3.1

### *4.2.8.2 Identification of target areas*

As explained in the Introduction, Section 1.3.1.

### *4.2.8.3 Enabling environment*

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

### *4.2.8.4 Information requirements and data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)

- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

## 4.2.9 Tourism

### *4.2.9.1 Identified development projects*

As explained in the Introduction, section 1.3.1

### *4.2.9.2 Identification of target areas*

As explained in the Introduction, Section 1.3.1.

### *4.2.9.3 Enabling environment*

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

### *4.2.9.4 Information requirements and data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

## 4.2.10 Navigation

### *4.2.10.1 Identified development projects*

As explained in the Introduction, section 1.3.1

### *4.2.10.2 Identification of target areas*

As explained in the Introduction, Section 1.3.1.

### *4.2.10.3 Enabling environment*

- Institutional, legal and policy frameworks
- Availability of capacity and capacity building opportunities

### *4.2.10.4 Information requirements and data gaps*

Having identified what information we need to get, and looked at what should be available (Chapter 2, documents and data) we can highlight what we see as the data gaps.

For each of the data gaps we should:

- Briefly discuss the significance of the gap (how important is it in the context of the study)
- Indicate our ideas for how to mitigate these gaps so that the study is not de-railed

### 4.2.11 Biodiversity conservation

#### *4.2.11.1 Identified development projects*

#### *4.2.11.2 Identification of target areas*

#### *4.2.11.3 Enabling environment*

#### *4.2.11.4 Information requirements and data gaps*

## 4.3 VULNERABILITY AND DISASTER RISK MANAGEMENT

## 4.4 CLIMATE CHANGE – EFFECTS AND MITIGATION

### 4.4.1 Introduction

### 4.4.2 Degrees of Impacts

### 4.4.3 Identification of hotspots

### 4.4.4 Adaptation

## 4.5 DATA ACQUISITION SYSTEM

The idea is to design a data acquisition system to improve knowledge of the basin (meteorology, hydrology, water quality, etc.) pending the first years of implementation of the plan and allow further monitoring. Can be locally an instrument for employment…

## 4.6 SCOPE OF THE WORK FOR THE SSEA AT PROJECT LEVEL

The aim is to apply the SSEA at the level of development options, that is combinations of projects/interventions that may represent a movement towards the overall strategic development objectives

In this section, having scoped the different types and combinations of projects in Chapter 4, the information required for application of the SSEA framework will be detailed.

### 4.6.1 General information

### 4.6.2 Focus on the social issues

# 5. MAIN CONCLUSIONS OF THE SCOPING EXERCISE

## 5.1 INTRODUCTION

## 5.2 IDENTIFICATION OF GAPS AND TECHNIQUES PROPOSED TO BRIDGE THE GAPS

### 5.2.1 Data gaps identified

### 5.2.2 Limitation of the field missions in some sensitive areas within the basin

### 5.2.3 Studies ongoing and documentation to be collected

### 5.2.4 Use and limits of remote sensing

### 5.2.5 Consultation with stakeholders

## 5.3 TRANSBOUNDARY EFFECTS

## 5.4 RISKS MANAGEMENT

# Annex 5: Preliminary results for the Consultation plan

*Figure 1: Proposed categorisation for stakeholders to be consulted*

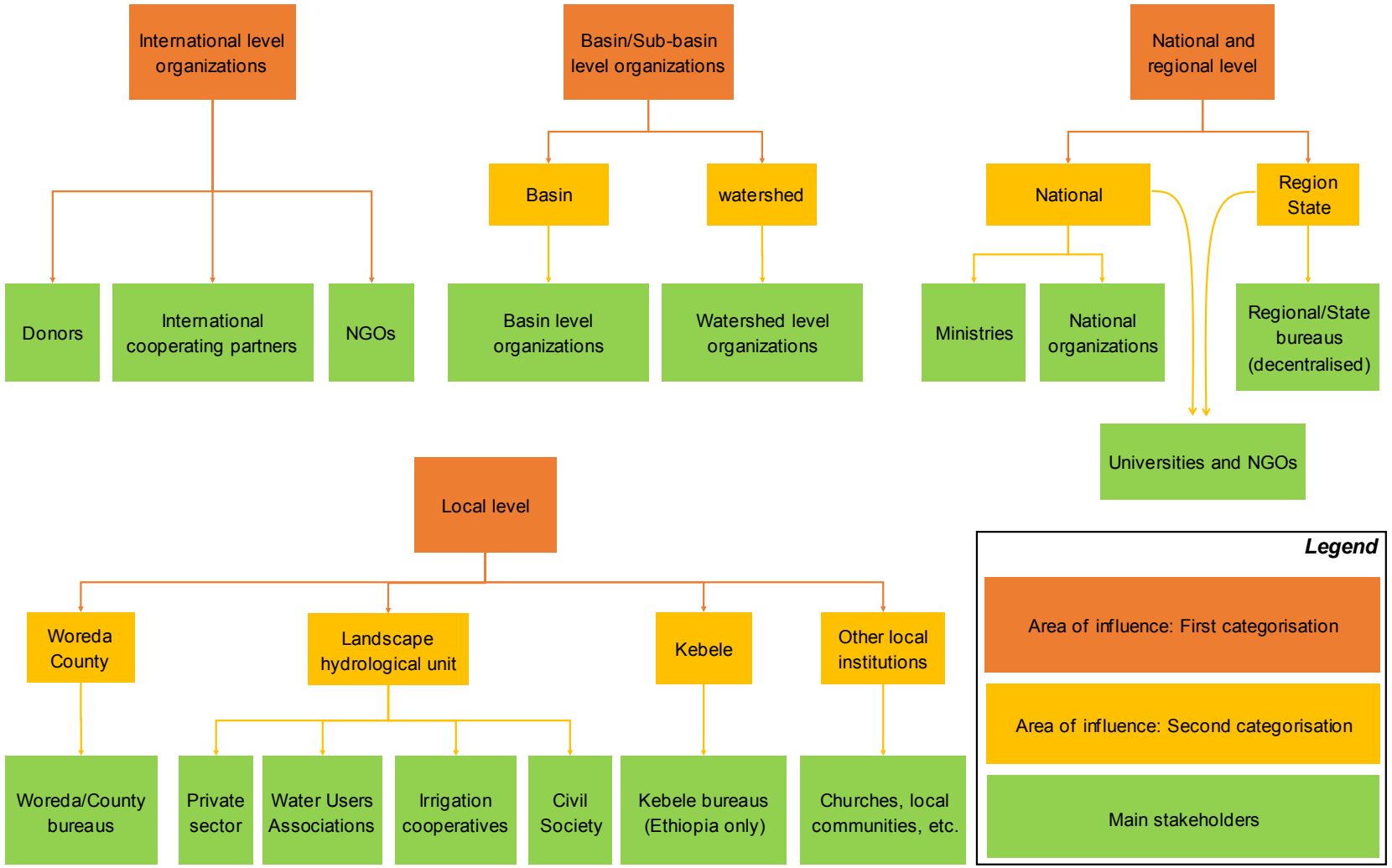


*Table 1: Preliminary identification of the key stakeholders involved or concerned by the BAS study*

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **A. INTERNATIONAL LEVEL ORGANIZATIONS** | | | | | |
| **A.1 International cooperating partners** | | | | | |
| **International Water Management Institute (IWMI)** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Health | | Board of trustees/directors | |
| **International Livestock Research Institute (ILRI)** | | Livestock, Social issues | | Board of trustees/directors | |
| **Consultative Group on International Agricultural Research (CGIAR)** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture | | Board of trustees/directors | |
| **Global Water Partnership (GWP)** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Health | | Board of trustees/directors | |
| **Chr. Michelsen Institute (CMI)** | | Forestry, Health, Social and environmental issues | | Board of trustees/directors | |
| **International Institute for Environment and Development (IIED)** | | Rainfed and irrigated Agriculture, environmental and social issues | | Board of trustees/directors | |
| **A.2 International NGOs** | | | | | |
| **Wildlife Conservation Society** | | Environmental issues | | Board of trustees | |
| **Horn of Africa Regional Environment Centre and Network** | | Environmental and social issues | | Board of trustees | |
| **A.3 Donors** | | | | | |
| **African Development Bank** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Board of directors | |
| **World Bank** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Board of directors | |
| **French Agency of Development** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Board of directors | |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Other donors.** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Board of directors | |
| **B. BASIN/SUB-BASIN LEVEL ORGANIZATIONS** | | | | | |
| **B.1 Basin level** | | | | | |
| **Nile Basin Initiative** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Nile Council of Ministers | |
| **Eastern Nile Technical Regional Office** | | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues | | Eastern Nile Council of Ministers | |
| **B.2 Watershed level** | | | | | |
| | | | | | |
| **C. NATIONAL AND REGIONAL(ETH)/SATE(SS) LEVEL** | | | | | |
| **C.1 National level** | | | | | |
| **C.1.a National Policy makers** | | | | | |
| **Ministry of Water, irrigation and energy** | Ministry of Electricity, Dams, Irrigation and Water Resources | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Potable water supply and Sanitation, Health, environmental issues | Irrigated Agriculture, Hydropower and interconnection, Potable water supply and Sanitation, Electricity supply, Health, Environmental and social issues | Minister and designated persons | Minister and designated persons |
| **Ministry of Mines** | | Mining | | Minister and designated persons | |
| **Ethiopian Electric Power Corporation** | | Hydropower and interconnection, Electricity supply | | Board of directors | |
| **Ministry of Agriculture** | Ministry of Agriculture, Forestry, Cooperatives and Rural Development | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Environments and social issues | Rainfed and irrigated Agriculture, Livestock, Forestry Transport, Electricity supply, Health, Environmental and social issues | Minister and designated persons | Minister and designated persons |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| | Ministry of livestock and fisheries | | Livestock, Fisheries and Aquaculture | | Minister and designated persons |
| **Ethiopian Environmental Protection Authority** | Ministry of Environment | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Health, Environments and social issues | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Health, Environmental and social issues | Board of Directors | Minister and designated persons |
| **Ethiopian wildlife conservation authority** | Ministry of Wildlife conservation and tourism | Rainfed and irrigated Agriculture Forestry, Mining, Environments and social issues | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Environmental and social issues | Board of Directors | Minister and designated persons |
| **Ministry of Health** | Ministry of Health | Potable water supply and Sanitation, Health, Social issues | Potable water supply and Sanitation, Health, Social issues | Minister and designated persons | Minister and designated persons |
| **Ministry of transport and communications** | Ministry of transport, roads and bridges | Navigation, Transport | Navigation, Transport | Minister and designated persons | Minister and designated persons |
| | Ministry of Housing and Physical Planning (MHPP) | | Sanitation | | Minister and designated persons |
| **National meteorology agency** | Meteorology Office | Weather, Climate | Weather, Climate | Director | Director |
| / | Urban WASH central Executing Agency | / | Potable water supply and Sanitation, Health, social issues | / | Ministry of water resources |
| / | South Sudan Land Commission | / | Land registration (agricultural lands, forestry, mining, etc.) | / | ? |
| **C.1.b National organizations** | | | | | |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Ethiopian Institute of Agricultural Research Organization** | / | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture | / | Director general and Board of trustees | / |
| **Disaster Risk Management and Food Security Sector** | / | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Health, Social issues | / | Director general and Board of trustees | / |
| / | The Sudd Institute | / | Livestock, Health, social issues | / | Independent Board of Directors |
| / | The Sudan Institute for Research and Policy (SIRP) | / | Mining/oil, Environments and social issues | / | Director general and Board of trustees |
| **C.1.c Universities** | | | | | |
| | | | | | |
| | | | | | |
| **C.2 Region (Ethiopia) / State (South Sudan)** | | | | | |
| **Regional bureaus of Water Resources development** | Water and sanitation directorates | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Potable water supply and Sanitation, Health, Environmental and social issues | Potable water supply and Sanitation | Director and designated persons | Director and designated persons |
| / | Urban WASH Project Implementation Units | / | Potable water supply and Sanitation | / | Director and designated persons |
| **Regional bureaus of Agriculture and Rural Development** | / | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry | / | Director and designated persons | / |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Environmental Protection and Land Administration and Land Use Authority (EPLAUA)** | / | Rainfed and irrigated Agriculture, Livestock, Fisheries and Aquaculture, Forestry, Mining, Hydropower and interconnection, Navigation, Potable water supply and Sanitation, Transport, Electricity supply, Health, Environmental and social issues, land registration | / | Director and designated persons | / |
| **D. LOCAL LEVEL** | | | | | |
| **D.1 Woreda (Ethiopia) / County (South Sudan)** | | | | | |
| **Urban Water supply utilities** | Water supply and sanitation department | Potable water supply | Potable water supply and Sanitation | Director and designated persons | Director and designated persons |
| **Water Desk** | / | Follow up water related projects and programmes – report to the desk for rural development | / | Director and designated persons | / |
| **Desk for rural development** | / | Management of the water desks – report to the Woreda Council | / | Director and designated persons | / |
| **Woreda Council** | / | Highest authority at Woreda scale | / | Director and designated persons | / |
| **D.2 Kebele** | | | | | |
| **Land administration committees** | / | Land registration process | / | EPLAUA | / |
| **Water and sanitation (WATSAN)** | / | Potable water supply and sanitation (operational and maintenance of water points) | / | Urban Water supply utilities (Woreda level) | / |
| **D.3 Landscape/hydrological unit** | | | | | |
| **D.3.a Private sector** | | | | | |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Rainfed Agriculture** | | Rainfed Agriculture, Electricity supply, water availability, land registration | | Independently and through representatives at Woreda/County level | |
| **Irrigated agriculture: small farms, medium scale, big estates** | | Irrigated Agriculture, Livestock, Electricity supply, water availability, land registration | | Through WUAs and Irrigation cooperatives if they exist | |
| **Hydropower companies** | | Water availability, Hydropower and interconnection, Transport, Electricity supply | | Independently and through umbrella organisations | |
| **Fisheries** | | Fisheries and Aquaculture, Navigation, Transport | | Independently and through representatives at Woreda/County level | |
| **Pastoralism** | | Water availability, Livestock | | Independently and through representatives at Woreda/County level | |
| **Drilling companies** | | Transport, Electricity supply, Environmental and social issues | | Independently and through umbrella organisations | |
| **Mine companies** | | Mining, Transport, Electricity supply, Environmental and social issues | | Independently and through umbrella organisations | |
| **Tourist operators** | | Transport, Electricity supply, Environmental and social issues | | Independently | |
| **D.3.b Civil Society** | | | | | |
| **Urban households** | | Potable water supply and Sanitation, Transport, Electricity supply, Health, Social issues | | Political leaders in their areas | |
| **Peri-urban households** | | Potable water supply and Sanitation, Transport, Electricity supply, Health, Social issues | | Political leaders in their areas | |
| **Rural households** | | Potable water supply and Sanitation (especially nearest water point), Transport, Electricity supply, Health, Social issues | | Political leaders in their areas | |
| **Educational institutions** | | Potable water supply and Sanitation, Transport, Electricity supply, Health, Social issues | | Through Ministry of Education ‘s representations at Woreda/County level | |
| **Hospitals, clinics** | | Potable water supply and Sanitation, Transport, Electricity supply, Health, Social issues | | Through Ministry of Health ‘s representations at Woreda/County level | |
| **D.3.c Water Users Associations** | | | | | |
| | | | | | |
| | | | | | |
| **D.3.d Irrigation cooperatives** | | | | | |
| | | | | | |

| Stakeholders | | Sector concerned | | Represented by | |
|---|---|---|---|---|---|
| Basin | | Basin | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| | | | | | |
| **D.4 Other local institutions** | | | | | |
| **Churches** | | Representatives can have influence on several matters | | Local representatives | |
| **Edir** | | Representatives can have influence on several matters | | Local representatives | |
| **Ekub** | | Representatives can have influence on several matters | | Local representatives | |
| **Labor Sharing** | | Representatives can have influence on several matters | | Local representatives | |

*Table 2: Detailing interests and concerns of stakeholders and determination of their degree of involvement in the study – preliminary work*

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **A. INTERNATIONAL LEVEL ORGANIZATIONS** | | | | | | | | | |
| **A.1 International cooperating partners** | | | | | | | | | |
| **International Water Management Institute (IWMI)** | | **Interests:** Research and work to provide solutions for sustainable management of water and land resources in order to achieve food security, enhance people's livelihoods and respect the environment<br>**Concerns:** clear strategy for water management development at nation and basin level | | Little/No Influence | | No impact | | Inform | |
| **International Livestock Research Institute (ILRI)** | | **Interests:** Research and work on the link between livestock and poverty to bear on poverty reduction and sustainable development<br>**Concerns:** clear strategy for water management development at nation and basin level | | Little/No Influence | | No impact | | Inform | |
| **Consultative Group on International Agricultural Research (CGIAR)** | | **Interests:** Reduction of rural poverty; Improved food security; Improved nutrition and health; Improved management of natural resources<br>**Concerns:** clear strategy for water management and agriculture development at nation and basin level | | Little/No Influence | | No impact | | Inform | |
| **Global Water Partnership (GWP)** | | **Interests:** Catalyse change in policies and practise, generate and communicate knowledge, Strengthen partnerships<br>**Concerns:** clear strategy for water management development at nation and basin level | | Little/No Influence | | No impact | | Inform | |
| **Chr. Michelsen Institute (CMI)** | | **Interests:** Work on political and social mechanisms linking natural resources and development<br>**Concerns:** clear strategy for water management development at nation and basin level | | Little/No Influence | | No impact | | Inform | |
| **International Institute for Environment and Development (IIED)** | | **Interests:** Adaptation to climate change issues, capacity and wise decision-making for fair and sustainable use of natural resources<br>**Concerns:** clear strategy for water management and agriculture development at nation and basin level – links between national strategies and their application on field | | Little/No Influence | | No impact | | Inform | |
| **A.2 International NGOs** | | | | | | | | | |
| **Wildlife Conservation Society** | | **Interests:** Wildlife conservation<br>**Concerns:** clear strategy for wildlife conservation at nation and basin level | | Moderate influence | | Some impact | | Engage | |
| **Horn of Africa Regional Environment Centre and Network** | | **Interests:** Sustainable development, Environmental conservation, Prevention of conflict around access to natural resources in the Horn of Africa<br>**Concerns:** clear strategy for development compatible with environment conservation | | Moderate influence | | Some impact | | Engage | |
| **A.3 Donors** | | | | | | | | | |
| **African Development Bank** | | **Interests:** Developing projects related to water management<br>**Concerns:** clear integrated strategy and action plan for water nationwide and by basin | | Very influential | | Moderate impact | | Empower | |
| **World Bank** | | **Interests:** Developing projects related to water management<br>**Concerns:** clear integrated strategy and action plan for water nationwide and by basin | | Little/No Influence | | No impact | | Inform | |
| **French Agency of Development** | | **Interests:** Developing projects related to water management<br>**Concerns:** clear integrated strategy and action plan for water nationwide and by basin | | Little/No Influence | | No impact | | Inform | |
| **Other donors** | | **Interests:** Developing projects related to water management<br>**Concerns:** clear integrated strategy and action plan for water nationwide and by basin | | Little/No Influence | | No impact | | Inform | |
| **B. BASIN/SUB-BASIN LEVEL ORGANIZATIONS** | | | | | | | | | |
| **B.1 Basin level** | | | | | | | | | |
| **Nile Basin Initiative** | | **Interests:** Development of the River Nile in a cooperative manner in order to share substantial socio-economic benefits and promote regional peace and security<br>**Concerns:** basin conservation and equitable sustainable development in member countries | | Very influential | | High impact | | Empower | |

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Eastern Nile Technical Regional Office** | | **Interests:** Development of the Eastern Nile in a cooperative manner in order to share substantial socio-economic benefits and promote regional peace and security<br>**Concerns:** basin conservation and equitable sustainable development in member countries | | Very influential | | High impact | | Empower | |
| **B.2 Watershed level** | | | | | | | | | |
| | | | | | | | | | |
| **C. NATIONAL AND REGIONAL(ETH)/SATE(SS) LEVEL** | | | | | | | | | |
| **C.1 National level** | | | | | | | | | |
| **C.1.a National Policy makers** | | | | | | | | | |
| **Ministry of Water irrigation and energy** | Ministry of Electricity, Dams, Irrigation and Water Resources | Sustainable development of the country's water resources and management of associated natural resources<br>Availability of water resources for sustainable development of energy production (hydropower in particular) | - Sustainable development of the country's water resources and management of associated natural resources<br>- Availability of water for sustainable development of irrigation<br>- Availability of water resources for sustainable development of energy production (hydropower in particular) and for mining | Significant influence | Significant influence | Significant impact | Significant impact | Collaborate | Collaborate |
| **Ministry of Mines** | | Availability of water resources for mining | | Significant influence | | Significant impact | | Collaborate | |
| **Ethiopian Electric Power Corporation** | | Availability of water resources for sustainable development of energy production (hydropower in particular) and for mining | | Some influence | | Some impact | | Consult | |
| **Ministry of Agriculture** | Ministry of Agriculture, Forestry, Cooperatives and Rural Development | - Availability of water for sustainable development of agriculture and irrigation.<br>- Improved understanding of climate change and adaptation measures | - Availability of water for sustainable development of agriculture.<br>- Improved understanding of climate change and adaptation measures | Significant influence | Significant influence | Significant impact | Significant impact | Collaborate | Collaborate |
| | Ministry of livestock and fisheries | | Availability of water for sustainable development of livestock and fisheries | | Significant influence | | Significant impact | | Collaborate |
| **Environmental Protection Authority** | Ministry of Environment | - Conflict between agricultural lands and natural reserves<br>- preservation of the environment, including the wetlands<br>- sustainable development of agriculture, soil erosion control | - Conflict between agricultural lands and natural reserves<br>- preservation of the environment, including the wetlands<br>- sustainable development of agriculture, soil erosion control | Moderate influence | Moderate influence | Significant impact | Significant impact | Engage | Engage |
| **Ethiopian wildlife conservation authority** | Ministry of Wildlife conservation and tourism | - Conflict for water and lands between livestock and wild animal<br>- Conflict between agricultural lands and natural reserves | - Conflict for water and lands between livestock and wild animal<br>- Conflict between agricultural lands and natural reserves<br>- availability of water and power for touristic infrastructures | Moderate influence | Moderate influence | Significant impact | Significant impact | Engage | Engage |
| **Ministry of Health** | Ministry of Health | - Availability of water for health facilities<br>- Availability of good quality water for water supply and proper sanitation to prevent water related diseases | - Availability of water for health facilities<br>- Availability of good quality water for water supply and proper sanitation to prevent water related diseases | Moderate influence | Moderate influence | Significant impact | Significant impact | Engage | Engage |
| **Ministry of transport and communications** | Ministry of transport, roads and bridges | - Water flows in key rivers to develop navigation all-year round<br>- National strategies regarding water related infrastructures | - Water flows in key rivers to develop navigation all-year round<br>- National strategies regarding water related infrastructures | Moderate influence | Moderate influence | Moderate impact | Moderate impact | Engage | Engage |
| | Ministry of Housing and Physical Planning (MHPP) | | Proper urban Sanitation to prevent water related diseases | | Moderate influence | | Moderate impact | | Engage |

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **National meteorology agency** | Meteorology Office | Availability of data and forecasts | Availability of data and forecasts | Some influence | Some influence | No impact | No impact | Consult | Consult |
| / | Urban WASH central Executing Agency | / | Availability of good quality water for water supply and proper sanitation to prevent water related diseases | / | Some influence | / | Some impact | / | Consult |
| / | South Sudan Land Commission | / | Availability of good quality water for water supply and proper sanitation to prevent water related diseases | / | Some influence | / | Some impact | / | Consult |
| **C.1.b National organizations** | | | | | | | | | |
| **Ethiopian Institute of Agricultural Research Organization** | / | - Detailed information regarding agricultural development in Ethiopia (strategies, action plan)<br>- Prospective and innovation | / | Some influence | / | No impact | / | Consult | / |
| **Disaster Risk Management and Food Security Sector** | / | Detailed information of drought and flood. Real-time data and forecasts | / | Some influence | / | No impact | / | Consult | / |
| / | The Sudd Institute | / | - Communication to decisions-makers at national and local level<br>- Integrated strategy and action plan for water nationwide and by basin | / | No influence | / | No impact | / | Inform |
| / | The Sudan Institute for Research and Policy (SIRP) | / | - Communication to decisions-makers at national and local level<br>- Integrated strategy and action plan for water nationwide and by basin | / | No influence | / | No impact | / | Inform |
| **C.1.c Universities** | | | | | | | | | |
| **Ethiopian Institute of Water Resources** | / | - Detailed information regarding water management in Ethiopia<br>- Prospective and innovation | / | No influence | / | No impact | / | Inform | / |
| | | | | | | | | | |
| **C.2 Region (Ethiopia) / State (South Sudan)** | | | | | | | | | |
| **Regional bureaus of Water Resources development** | Water and sanitation directorates | - Sustainable development of the region's water resources and management of associated natural resources<br>- Alignment with national directives of the MoWR | Availability of good quality water for water supply, proper sanitation and hygiene to prevent water related diseases | Moderate influence | Moderate influence | Significant impact | Significant impact | Engage | Engage |
| / | Urban WASH Project Implementation Units | / | Availability of good quality water for water supply, proper sanitation and hygiene to prevent water related diseases | / | Moderate influence | / | Significant impact | / | Engage |
| **Regional bureaus of Agriculture and Rural Development** | / | - Access to sufficient water for agriculture and livestock<br>- Information on flows and levels for planning of intakes etc | / | Moderate influence | / | Moderate impact | / | Engage | / |

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Environmental Protection and Land Administration and Land Use Authority (EPLAUA)** | / | - Respect of federal and region policies regarding land use for rural development<br>- Respect of environmental guidelines for projects developments (irrigation, hydropower, etc.) | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **D. LOCAL LEVEL** | | | | | | | | | |
| **D.1 Woreda (Ethiopia) / County (South Sudan)** | | | | | | | | | |
| **Urban Water supply utilities** | Water supply and sanitation department | - Availability of good quality water for water supply<br>- Communication with the higher authority (Regional bureaus of Water Resources development) | - Availability of good quality water for water supply.<br>- Proper sanitation for prevention of pollution | Moderate influence | Moderate influence | Moderate impact | Moderate impact | Engage | Engage |
| **Water Desk** | / | - availability of funds to implement monitor and follow up water related projects and programs<br>- Communication with the higher authority (desk for rural development) | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **Desk for rural development** | / | - Access to sufficient water for agriculture and livestock<br>- Information on flows and levels for planning of intakes etc | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **Woreda Council** | / | - Agricultural development and preservation of the natural resources<br>- Accountability to the region and to the electorate at Kebele's level | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **D.2 Kebele** | | | | | | | | | |
| **Land administration committees** | / | - human and material resources to proceed to land registration | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **Water and sanitation (WATSAN)** | / | - human and material resources for management and maintenance of water points | / | Moderate influence | / | Moderate impact | / | Engage | / |
| **D.3 Landscape/hydrological unit** | | | | | | | | | |
| **D.3.a Private sector** | | | | | | | | | |

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Rainfed Agriculture** | | - Unpredictable climatic conditions (climate change)<br>- Erosion problems<br>- poor yields<br>- lack of access to markets and credit | | Some influence | | Some impact | | Consult | |
| **Irrigated agriculture: small farms, medium scale, big estates** | | - Access to sufficient water<br>- Reliable source of appropriate quality<br>- Resource affordable | | Some/moderate influence | | Some/significant impact | | Consult/Engage | |
| **Hydropower companies** | | - Flow of the river | | Significant influence | | Moderate impact | | Collaborate | |
| **Fisheries** | | - Availability of water<br>- Water quality and fish abundance<br>- lack of access to markets and credit | | Some influence | | Some impact | | Consult | |
| **Pastoralism** | | - Availability of water for the livestock<br>- Access to veterinarian care<br>- lack of access to markets and credit | | Some influence | | Some impact | | Consult | |
| **Drilling companies** | | Information on groundwater | | Some influence | | Some impact | | Consult | |
| **Mine companies** | | Information on water availability | | Some influence | | Some impact | | Consult | |
| **Tourist operators** | | - Conservation of the environment<br>- Infrastructures to receives tourists | | No influence | | Some impact | | Consult | |
| **D.3.b Civil Society** | | | | | | | | | |
| **Urban households** | | - Lack of continuous supply<br>- Water of poor quality<br>- Poor water pressure | | No influence | | Some/significant impact | | Consult/Engage | |
| **Peri-urban households** | | - Lack of continuous supply<br>- Water of poor quality<br>- Poor water pressure | | No influence | | Some/significant impact | | Consult/Engage | |
| **Rural households** | | - Nearest water point may be far away<br>- Lack of continuous supply<br>- Quality issues | | No influence | | Some/significant impact | | Consult/Engage | |
| **Educational institutions** | | - Lack of continuous supply<br>- Water of poor quality<br>- Poor water pressure | | No influence | | Some/significant impact | | Consult/Engage | |
| **Hospitals, clinics** | | Lack of very reliable supply source in quantity and quality | | No influence | | Some/significant impact | | Consult/Engage | |
| **D.3.c Water Users Associations** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **D.3.d Irrigation cooperatives** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **D.4 Other local institutions** | | | | | | | | | |
| **Churches** | | Lack of clear channels of communication to decisions-makers | | No influence | | No impact | | Inform | |
| **Edir** | | Lack of clear channels of communication to decisions-makers | | No influence | | No impact | | Inform | |

| Stakeholders | | Detailing interests and concerns | | Degree of Influence of Stakeholder over Project | | Impact of the project over stakeholders | | Degree of involvement | |
|---|---|---|---|---|---|---|---|---|---|
| Basin | | Basin | | Basin | | | | Basin | |
| Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan | Ethiopia | South Sudan |
| **Ekub** | | Lack of clear channels of communication to decisions-makers | | No influence | | No impact | | Inform | |
| **Labor Sharing** | | Lack of clear channels of communication to decisions-makers | | No influence | | No impact | | Inform | |

*Table 3: Proposed degree of involvement for the different stakeholders*

| Stakeholders | Degree of involvement |
|---|---|
| Eastern Nile Technical Regional Office | Empower |
| Nile Basin Initiative | Empower |
| African Development Bank | Empower |
| Ministry of Water, irrigation and energy(Ethiopia) | Collaborate |
| Ministry of Electricity, Dams, Irrigation and Water Resources (South Sudan) | Collaborate |
| Ministry of Mines and Energy (South Sudan) | Collaborate |
| Ethiopian Electric Power Corporation | Collaborate |
| Ministry of Agriculture (Ethiopia) | Collaborate |
| Ministry of Agriculture, Forestry, Cooperatives and Rural Development (South Sudan) | Collaborate |
| Ministry of livestock and fisheries (South Sudan) | Collaborate |
| Hydropower companies | Collaborate |
| Wildlife Conservation Society | Engage |
| Horn of Africa Regional Environment Centre and Network | Engage |
| Environmental Protection Authority (Ethiopia) | Engage |
| Ministry of Environment (South Sudan) | Engage |
| Ethiopian wildlife conservation authority | Engage |
| Ministry of Wildlife conservation and tourism (South Sudan) | Engage |
| Ministry of health (Ethiopia and South Sudan) | Engage |
| Ministry of transport and communications (Ethiopia) | Engage |
| Ministry of mines (Ethiopia) | Engage |
| Ministry of transport, roads and bridges (South Sudan) | Engage |
| Ministry of Housing and Physical Planning (MHPP) (South Sudan) | Engage |
| Regional bureaus of Water Resources development (Ethiopia) | Engage |
| Water and sanitation directorates (South Sudan) | Engage |
| Urban WASH Project Implementation Units (South Sudan) | Engage |
| Regional bureaus of Agriculture and Rural Development (Ethiopia) | Engage |
| Environmental Protection and Land Administration and Land Use Authority (EPLAUA) (Ethiopia) | Engage |
| Water supply and sanitation department (South Sudan) | Engage |
| Urban Water supply utilities (Ethiopia) | Engage |
| Water Desk (Ethiopia) | Engage |
| Desk for rural development (Ethiopia) | Engage |
| Woreda Council (Ethiopia) | Engage |
| Land administration committees (Ethiopia) | Engage |
| Water and sanitation (WATSAN) (Ethiopia) | Engage |
| Irrigated agriculture: small farms, medium scale, big estates | Engage (for short term projects, through representatives) |

| | |
|---|---|
| Urban households | Engage (for short term projects, through representatives) |
| Peri-urban households | Engage (for short term projects, through representatives) |
| Rural households | Engage (for short term projects, through representatives) |
| Educational institutions | Engage (for short term projects, through representatives) |
| Hospitals, clinics | Engage (for short term projects, through representatives) |
| National meteorology agency (Ethiopia) | Consult |
| Meteorology Office (South Sudan) | Consult |
| Ethiopian Institute of Agricultural Research Organization | Consult |
| Disaster Risk Management and Food Security Sector (Ethiopia) | Consult |
| Rainfed Agriculture | Consult (through representatives) |
| Irrigated agriculture: small farms, medium scale, big estates | Consult (through representatives) |
| Fisheries | Consult (through representatives) |
| Pastoralism | Consult (through representatives) |
| Drilling companies | Consult |
| Mine companies | Consult |
| Tourist operators | Consult |
| Urban households | Consult (through representatives) |
| Peri-urban households | Consult (through representatives) |
| Rural households | Consult (through representatives) |
| Educational institutions | Consult (through representatives) |
| Hospitals, clinics | Consult (through representatives) |

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# Annex 7: List of participants to the Inception workshop

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# Annex 8: Finalising the boundary for the Baro-Akobo-Sobat river basin – Technical note

# FINALISING THE BOUNDARY FOR THE BARO-AKOBO-SOBAT RIVER BASIN

# TECHNICAL NOTE

## THE BARO AKOBO SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY

The Eastern Nile sub-basin of the Nile is shown in Figure 1 (left). It is usually described as having four main sub-basins as shown in Figure 1 (right).

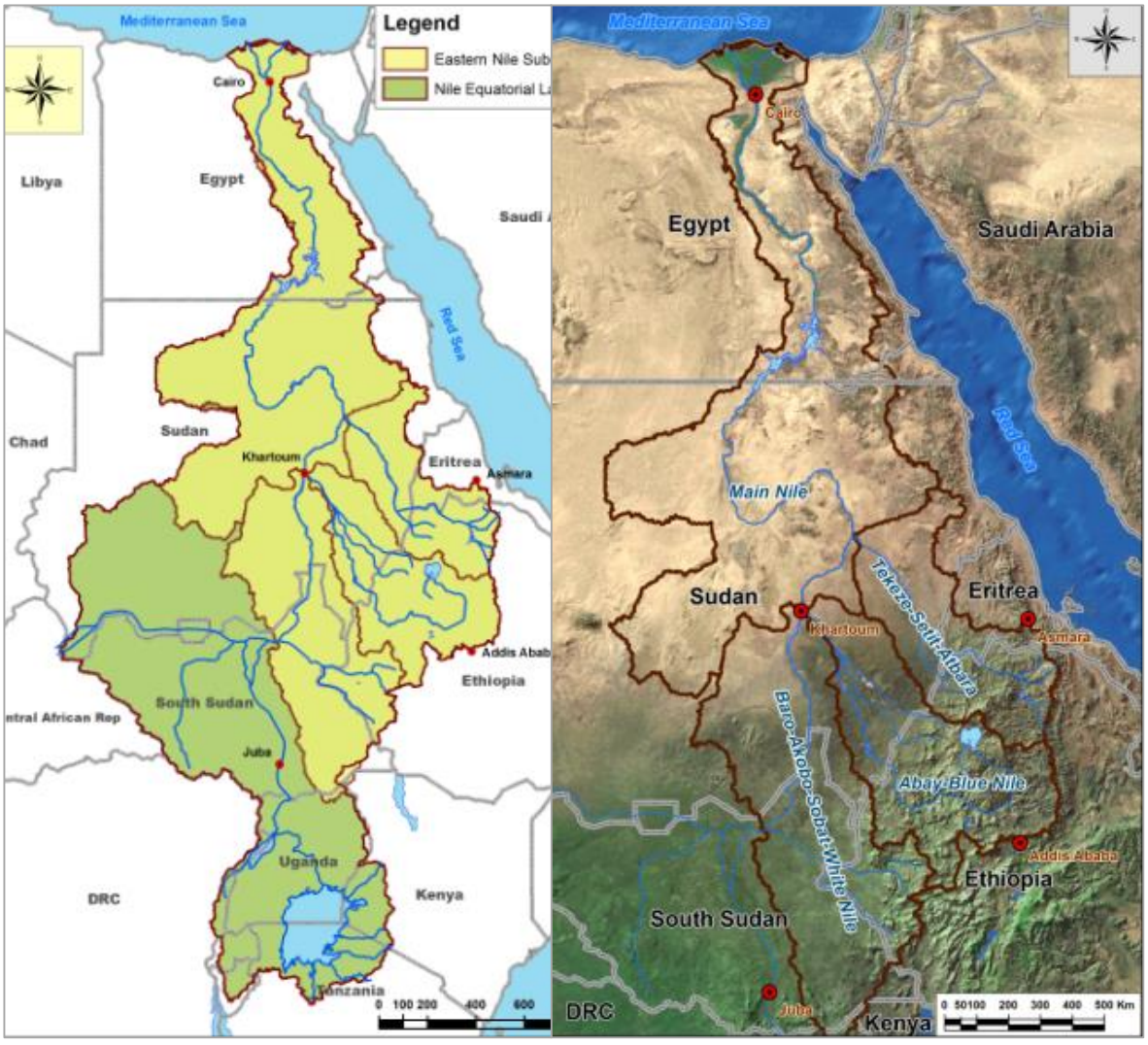


*Figure 1: Eastern Nile sub-basin as part of the overall Nile Basin (left) and the fours sub-basins of the Eastern Nile (right). Source: ENTRO 2015*

This study concerns the Baro-Akobo-Sobat (BAS) sub-basin of the Baro-Akobo-Sobat-White Nile sub-basin of the Eastern Nile. It therefore does not include the White Nile.

The objective of the study is to prepare 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. An important part of the study is the modelling of the water resources of the basin and this has required an in-depth analysis of all the available maps, satellite imagery and other remotely sensed information. One of the purposes of this analysis has been to accurately define the limits of the Baro-Akobo-Sobat River Basin and its own sub-basins.

## OBJECTIVE OF THIS CONCEPT NOTE

The objective of this concept note is to set out the proposed basin boundary for the Baro-Sobat-Akobo Basin limits so that this boundary can be accepted and used for the remainder of the study.

## EXISTING BASIN LIMITS

The existing basin limits are indicated in red in Figure 2. This boundary corresponds to the shapefile as provide by ENTRO to the Consultant. It is the same as used in one of the most recent ENTRO studies, the Multi-sectoral Investment Opportunity Analysis (MSIOA) for the Eastern Nile. It is important to note that the study considered the BAS as part of the greater BAS-White Nile sub-basin. As a result the basin boundary provide by ENTRO does not include a boundary separating the BAS and the White Nile.

## PROPOSED BASIN BOUNDARY

### The need for revision

As already indicated above, the existing basin boundary does not include any separation between the BAS and the White Nile. Defining this northern boundary of the BAS was one of the aims of this exercise. In addition, the detailed analysis of a range of satellite imagery (both free and purchased for the purpose of this study) and other remotely sensed products, showed that parts of the western boundary of the BAS were not correct and that a significant tributary draining into the Badingilo Wetlands is currently omitted from the basin. Understanding the interaction between stream flows and wetland storage is an important part of the hydrological modelling exercise so this type of omission has to be corrected.

### Challenges and assumptions

It is important to stress that during high flood conditions the limits of the basin (between the Bas and White Nile) become unclear in some places. This is evident in several of the very flat areas where there are exchanges between the BAS and the White Nile. These are discussed below. This should not be seen as a problem but should be kept in mind. During the high flood part of the season, for example when the Machar Marshes are at their fullest, there will be movement to and from the BAS across the delineated boundary.

While flow channels can be clearly seen in the various maps and on the various satellite images analysed, flow can move into 2 different directions depending on where areas flood first. This is why the catchment boundary will inevitably cross some of these streams/flow channels. In order to decide where this point is the dry season conditions are generally analysed since these represent the natural flow direction (slope) of the stream.

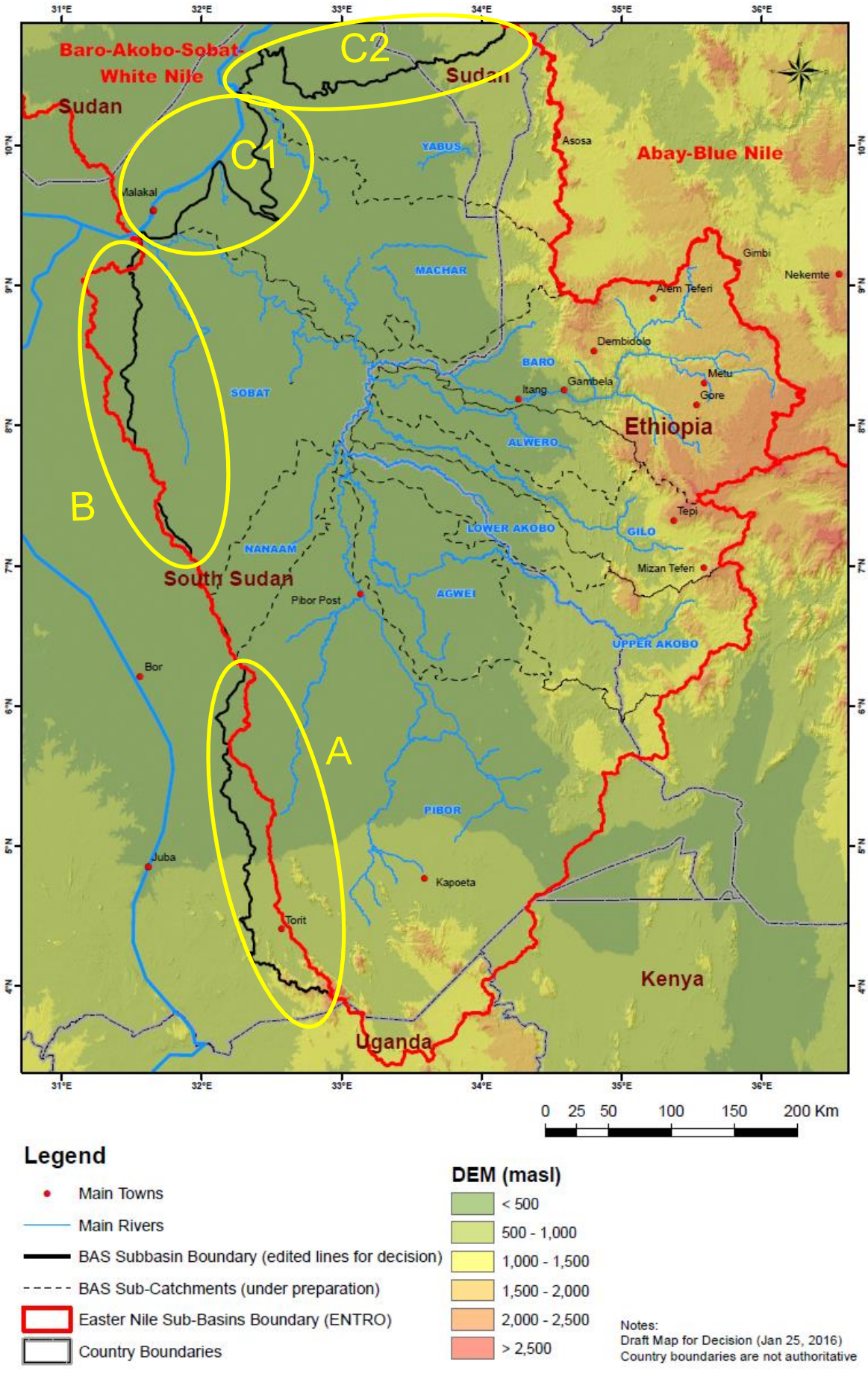


*Figure 2: Comparison of existing and proposed basin limits*

## DISCUSSION OF PROPOSED CHANGES

### Overview

The proposed revised basin boundary is shown in black in Figure 2. Where the black basin limit is coincident with the red limit, this means that no revision is proposed in this area.

No changes are proposed for the southern and eastern limits of the BAS sub-basin. These limits are generally well-defined by distinct topographical feature. The main changes and/or additions are shown on Figure 2 as A to C. these are briefly discussed in the following paragraphs.

### Inclusion of the Kineti River (A on Figure 2)

During meetings with stakeholders and experts in South Sudan it was understood that the Kineti River, which takes its source in the Imatong Mountains is considered as a tributary of the Pibor River and hence part of the BAS. The river was also visited during a field visit to the area in May 2015. Close analysis of the available mapping and imagery indeed indicates that the Kineti River is an important source of water for the Badingilo Wetlands. These wetlands are already correctly included in the existing BAS boundary. Outflow from the Badingilo Wetlands joins the Pibor River. As shown in Figure 1 (zone A), the Kineti River is now included.

### Western limits (B on Figure 2)

The western limits of the BAS basin are very flat. This complicates the delineation of the boundary between the BAS. The simple application of a digital elevations model (DEM) is not sufficient. Through the analysis of all available information the boundary has been modified. The analysis showed that some stream which had been shown to be part of the BAS, are in fact part of the White Nile.

### Northern limits; divide between BAS and White Nile (C1 and C2 on Figure 2)

On Figure 2 the northern limits of the BAS basin have been divided into two parts. C1 shows the divide between the BAS and the small streams that flow directly into the White Nile. It is also in this reach that a minor outflow from the Machar Marshes may occur, probably only during years when the level of the marshes is exceptionally high. The magnitude and frequency of this possible outflow is not known.

The main outflow from the Machar Marshes is the Khor Adar, shown joining the White Nile in Figure 3.

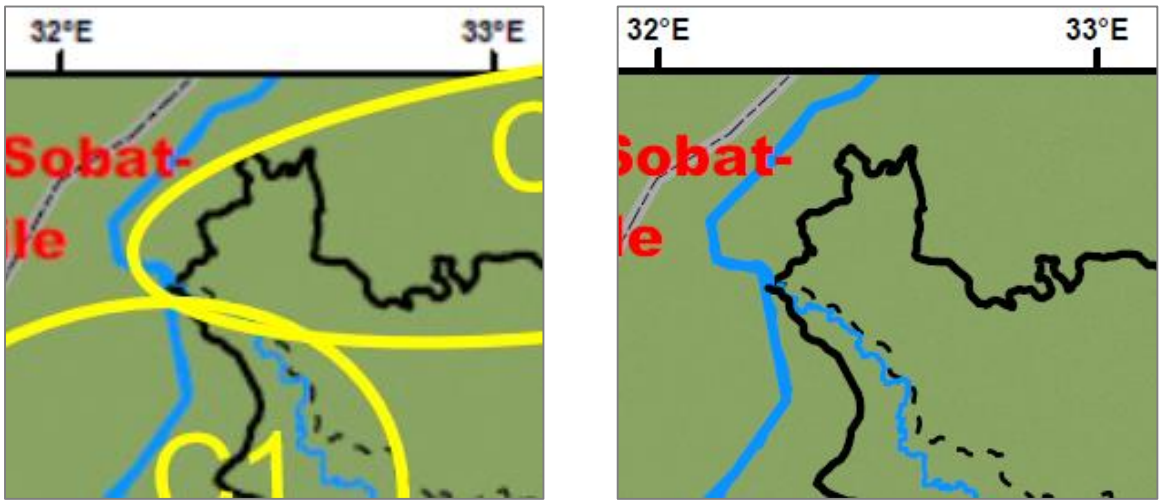


*Figure 3: Khor Adar, the main outflow from the Machar Marshes joins the White Nile*

The northern boundary of the BAS basin is delineated eastwards from the confluence of the Khor Adar and separates the streams that flow towards Machar marshes and those which flow generally north-westwards towards the White Nile. The areas is very flat and this delineation is difficult to define precisely. Indeed there is some limited exchange of water across this divide depending on the relative water levels during the wet season. The boundary is somewhat artificial and underlines the fact that the BAS and White Nile should be studied in conjunction with each other where possible.

## RECOMMENDATIONS

It is recommended that the boundary shown in black in Figure 2 of this short technical note is adopted as the official basin boundary for the Baro-Akobo-Sobat Basin and used henceforth in this study.

*Draft version 1; 25 January 2016*