



The Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION
PROJECT II

**ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT FOR THE
PROPOSED CONSTRUCTION OF WADELAI IRRIGATION SCHEME IN
WADELAI SUB-COUNTY, UPPER RAGEM AND PUMIT PARISHES,
NEBBI DISTRICT**



SUBMITTED BY:

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ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
ALARP	As Low As Reasonably Practicable
AsDB	Asian Development Bank
CCA	Culturable command area
CDO	Community Development Officer
CEC	Cation Exchange Capacity
DEA	Directorate of Environmental Affairs
DEG	German Investment and Development Corporation
DEM	Digital Elevation Modal
DO	Dissolved Oxygen
DWD	Directorate of Water Development
DWO	District Water Officers
DWRM	Directorate of Water Resources Management
EAC	East African Community
EBRD	European Bank for Reconstruction and Development
ECe	Electrical Conductivity
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMMP	Environmental Management and Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESM	Environmentally Sound Manner
ESMP	Environmental and Social Management Plan
ETC	Crop Evapotranspiration
ETo	Evapotranspiration
FIEFOC	Farm Income Enhancement and Forestry Conservation
FIR	Field Irrigation Requirement
FMO	Netherlands Development Finance Company
FRL	Full Reservoir Level
GIR	Gross irrigation requirement
HIV	Human Immunodeficiency Virus
IADB	Inter-American Development Bank
IESA	Integrated Environmental and Social Assessment Guidelines
ILO	International Labor Organization
ISS	Integrated Safeguards Systems
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
Kc	Crop Coefficient
LC	Least Concern
LMC	Left Main Canal
MAAIF	Ministry of Agriculture Animal Industry and Fisheries

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm
Income Enhancement & Forestry Conservation Project

MDDL	Minimum Draw Down Level
MFPED	Ministry of Finance, Planning and Economic Development
MoGLSD	Ministry of Gender, Labour and Social Development
MoH	Ministry of Health
MWE	Ministry of Water and Environment
MWL	Maximum Water Level

NAADS	National Agricultural Advisory Services
NAPA	National Adaptation Programme of Action
NASSEC	National Agriculture Sector Secretariat
NDF	Nordic Development Fund
NDP	National Development Plan
NEMA	National Environment Management Authority
NIA	Net Irrigation Area
NIR	Net irrigation requirement
NPA	National Planning Authority
NUSAF	Northern Uganda Social Action Fund
NWSC	National Water & Sewerage Corporation
ORP	Oxidative Reduction Potential
OS	Operational Safeguard
PCBs	Polychlorinated Biphenyl pH Potential of Hydrogen
PIC	Prior Informed Consent Procedure
PMA	Plan for Modernization of Agriculture Secretariat
POPs	Persistent Organic Pollutants
PRA	Participatory Rural Appraisal
RMC	Right Main Canal
SHM	Stakeholder Meetings
SIA	Strategic Impact Assessment Guidelines
TBL	Top Bund Level
TDS	Total Dissolved Solids
TN	Total Nitrogen
UN	United Nations
VES	Visual Encounter Surveys
VIP	Ventilated Improved Pit Latrine
VSLAs	Village Savings and Loans Associations

EXECUTIVE SUMMARY

The proposed Rhino Camp-Wadelai Irrigation Scheme is located at geographical coordinates: 200 57' 50" North, 310 24' 40" East and at an elevation 650m above sea level, Wadelai Sub-County, in Nebbi district. The proposed Wadelai Irrigation scheme is located along River Oraa which discharges into the Albert Nile. The project area covers two parishes and 7 villages in Wadelai Sub-County. The parishes and the respective villages are; Ragem Upper Parish (Prison Farm Village, Ayabu East Village; Ayabu central; and Ayabu West Village) and Punit Parish (Aroga LC1, Agu South LC1 and Lwalo LC1)

This project is consistent with the National Development Plan (NDP) II of the years 2015/16-2019/2020 and Vision 2040, whose main goal is to eradicate poverty through appropriate investments and policies for agricultural sector transformation. In 2005, the the Farm Income Enhancement and Forestry Conservation (FIEFOC) Project was established in Uganda with the aim of contributing to poverty reduction and livelihood improvement for the rural population.

The project is to be financed by the African Development Bank (AfDB), the Nordic Development Fund (NDF) and the Government of Uganda, and initially comprised of six sub-components that were reduced to four following the mid-term evaluation in 2009. The estimated project cost is UGX 25,782,723,000 (Uganda Shillings Twenty Five Billion Seven Hundred TEighty Two million Seven Hundred Twenty Three Thousand). The irrigation system comprises of canals to provide and distribute the irrigation water and natural drains to collect and remove excess irrigation water and surface runoff. The layouts of the canals, natural drains and access road systems have been designed based on the 30m SRTM Data. The total project command area is divided into 2 command areas having 250 Ha areas on both sides of the Oraa River. Each command area is irrigated by a network of secondary and tertiary canals and Quaternary canals. A 5.0 m width of all-weather inspection road is provided on the right or left side of the Main Canal and both sides of secondary canals for operation and maintenance. Nomenclature of canals forming a part of canal network has been adopted.

This ESIA followed the Guidelines for Environmental Impact Assessment in Uganda (NEMA, 1997) and Integrated Safeguard Systems of the AfDB's (2013). In undertaking the ESIA, the following methodology was adopted: Literature Review; Field surveys of the proposed project site, including baseline information of the environmental conditions and resources in the project area; in-depth stakeholder consultation; and Professional judgment. A review of the national policy, legal and institutional framework and the AfDB's operational safeguards and other multilateral development financial institutions was done.

A biophysical and socio-economic baseline is also presented. Alternative sites and technology was also evaluated. Several beneficial impacts envisaged will include: Employment of local communities during the pre-construction/mobilization and the construction phase; The project will contribute towards improvement of farm incomes, rural livelihood and food security; Local revenue to the communities, District; Improved flood water utilization in the area; Income generation; water will be availed throughout the year to ensure productivity even in dry season; Increased of Agricultural Production; Minimize Soil Deterioration; Crop diversification; Provision of Livestock Feed and; Restoration and Protection of Catchments.

Direct negative impacts will include: watershed degradation; encroachment of unique ecosystems and historical and cultural sites; biodiversity loss and change; proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion and sedimentation, Noise during construction; poor water quality, and its delivery to the irrigated land; increased pollution by other chemical contaminants; occupational safety hazards, and HIV/AIDS risk associated with construction labour. An environmental and social

management plan (ESMP) and monitoring plan has been put in place to address the above adverse impacts mentioned above.

The proposed Wadelai Irrigation Scheme is environmentally and socially feasible for implementation provided the recommended mitigation and monitoring measures are implemented, and the proposed implementation arrangements are upheld.

1. INTRODUCTION

1.1 BACKGROUND

Water is a key factor in the production of adequate food for Uganda. Water resources are a prime factor in irrigation, livestock watering, aquaculture, fisheries, food processing and other agro-industry, and fishing industries, which provides opportunities for employment to a large proportion of the rural and urban populations. The provision of water for water supply and agriculture to the poor segments of the society is a development imperative, both for reasons of social equity as well as food security and economic development (UN Water, 2005). As part of the government plans to modernizing Agriculture, increasing incomes and improving the quality of life of poor subsistence farmers and their households, government intends to establishment new irrigation schemes in different parts of the Country under Phase II of the Farm Income Enhancement and Forestry Conservation (FIEFOC) Project. Since majority of the population living in rural areas earn their living from agriculture, efforts to reduce poverty need to take in account increasing agricultural growth rates, diversifying agricultural production and expanding non-farm employment, without jeopardizing the dynamic stability of the agricultural ecosystems that ensures sustainability of the agricultural production. This project is consistent with the National Development Plan (NDP) II of the years 2015/16-2019/2020 and Vision 2040, whose main goal is to eradicate poverty through appropriate investments and policies for agricultural sector transformation.

It is against this background that in 2005, the FIEFOC Project was established in Uganda with the aim of contributing to poverty reduction and livelihood improvement for the rural population. Its overall objective is to improve farm incomes, rural livelihood and food security through sustainable natural resources management and agricultural enterprises development. It is being implemented by the Ministry of Water and Environment (MWE) and Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) with the Ministry of Water and Environment as the Executing Agency. The Project in Phase-1 was implemented directly using the existing line of administrative structures at central, districts and subcounty levels.

The project was financed by the African Development Bank (AfDB), the Nordic Development Fund (NDF) and the Government of Uganda, and initially comprised of six sub-components that were reduced to four following the mid-term evaluation in 2009. These project components are: Community Watershed Management, Tree Plantation, Apiculture Promotion, and irrigation sub-component that comprised of reconstruction of Mubuku Irrigation Settlement Scheme in Kasese district, Doho Rice Irrigation Scheme in Butaleja district, and Agoro Irrigation Scheme in Lamwo district.

On the basis of the registered performance towards the delivery of set targets for each sub-component, the project worked satisfactorily and to some extent exceeded what it was set to do. Under the irrigation sub-component, it increased functionality of formal irrigated agriculture systems in the country by 3,000 ha that has been restored after the reconstruction of three medium irrigation schemes as mentioned above, which are now benefiting 5,790 farming families.

The project fits within the criteria for Category 1 projects of the AfDB which require a full Environmental and Social Impact Assessment (ESIA), including the preparation of an Environmental and Social Management Plan (ESMP). According to the Environmental and social assessment procedures developed for the AfDB's public sector operations, these projects are likely to induce important adverse environmental and/or social impacts that are irreversible, or to significantly affect environmental or 6

social components considered sensitive by the Bank or the borrowing country. The ESIA therefore according to the AfDB should examine the project's potential beneficial and adverse impacts, compare them with those of feasible alternatives (including the "without project" scenario), and recommends any measures needed to prevent, minimise, mitigate or compensate for adverse impacts and to enhance environmental and social project benefits.

The impact of irrigation development on the environment is equally important, as it affects the quality of the water resources and downstream water users as well as the ecosystem at large. It is therefore upon this premise that the Developer has carried out an Environmental and Social Impact Assessment (ESIA) for the proposed development in line with the Ugandan Environmental Impact Assessment (EIA) regulations of 1998 and the process has been guided by the EIA guidelines of 1997 published by NEMA as well as the Environmental and social assessment procedures developed for the AfDB's public sector operations.

1.2 THE PROPOSED PROJECT LOCATION

The proposed Wadelai Irrigation Scheme area is located along River Oraa at geographical coordinates: 200 57' 50" North, 310 24' 40" East and at an elevation 650 m above MSL, in Wadelai Sub-County, in Nebbi district, western Nile region of Uganda. The project area covers 7 vilages in two parishes in Wadelai Sub-County. The table and figure below show the parishes and respective villages covered by the proposed Wadelai Irrigation Scheme project.

Table 1: Parishes and villages covered by the proposed Wadelai irrigation Scheme

SUB-COUNTY	PARISH	VILLAGE
WADELAI SUB-COUNTY	RAGEM UPPER PARISH	1) Prison Farm Village 2) Ayabu East Village 3) Ayabu central 4) Ayabu West
	PUMIT PARISH	1) Aroga LC1 2) Agu South Village 3) Lwalo LC1

The figures below show the location of Wadelai Irrigation Scheme and its immediate surroundings and the proposed project command area.

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

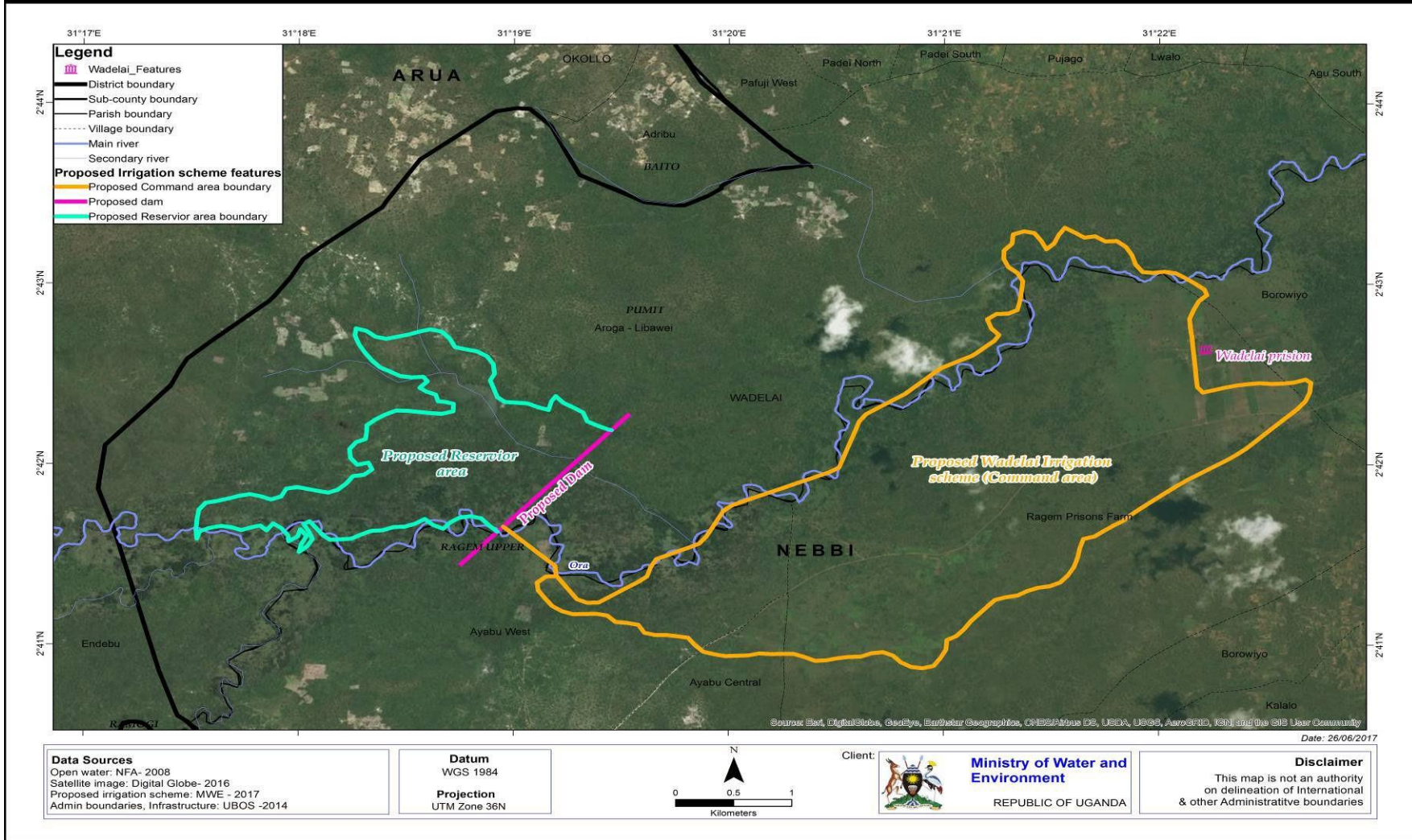
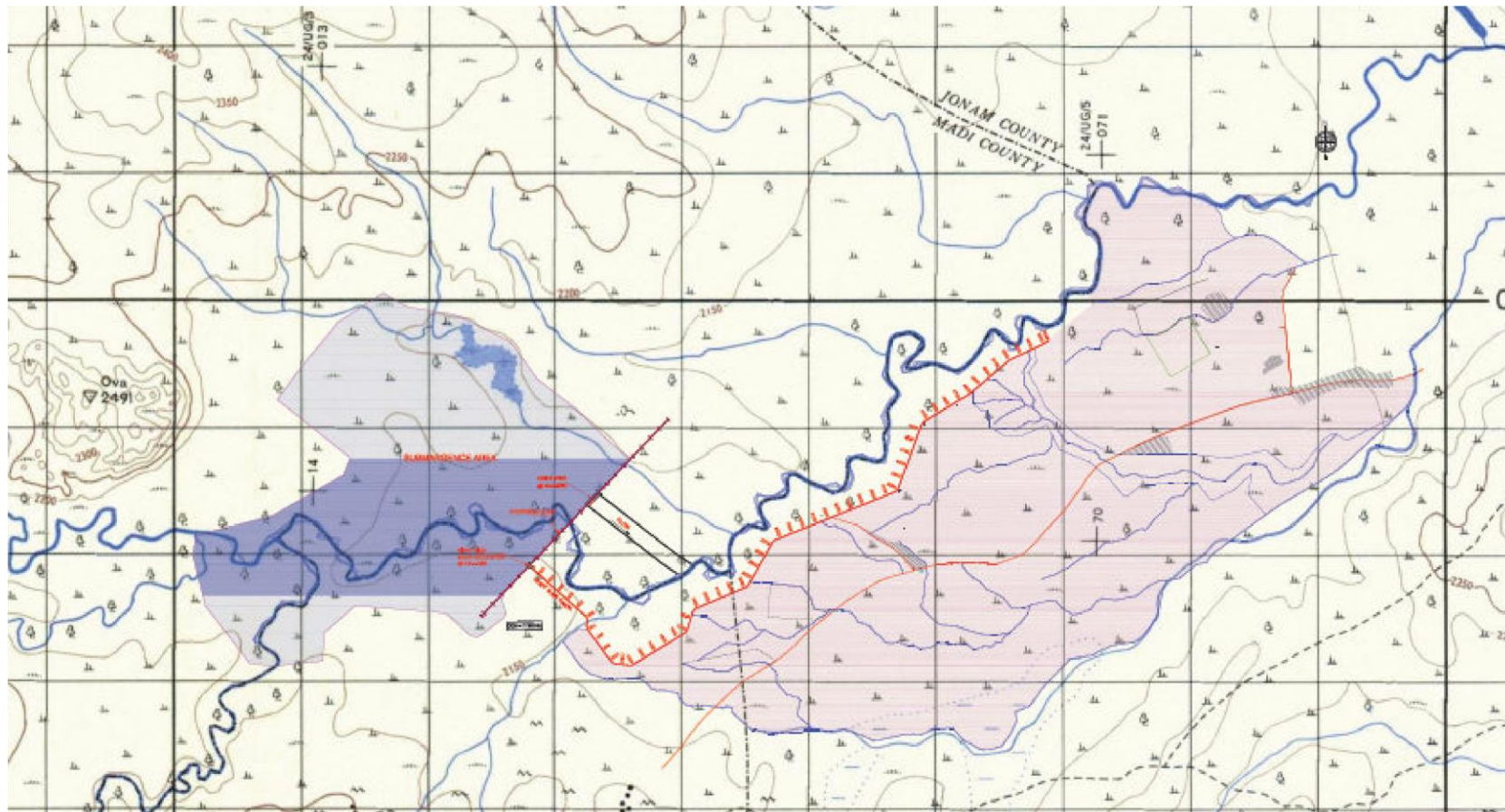


Figure 1: Project Area Boundary and immediate Surroundings (Source: Google Earth)

Figure 2: Lay out Map of Wadelai Irrigation Scheme



1.3 OBJECTIVES

1.3.1 Project Objective

The overall objective is to achieve improvement of farm incomes, rural livelihood and food security through implementation of the project. This will foster Government programme of modernizing agriculture that aims at increasing incomes and improving the quality of life of poor subsistence farmers and their households. It will further ensure food security and provision of gainful employment through improved agricultural enterprise development and promotion of sustainable land use and management of natural resources. The project design is hinged on community-based participation with the districts and sub-counties as focus of implementation, and the private sector as main technical service providers. The focus therefore is to develop the identified sites into modern irrigation schemes with farmer based sustainable institutional management arrangements.

ESIA objectives as listed in the EIA guidelines (NEMA, 1997) include;

- Detailed analysis of the key national and international legislation under which the proposed project will profess compliance;
- Identification of any significant impacts that the proposed project may pose to the environment;
- Analyze the significance of the adverse environmental impacts and propose suitable and adequate preventive or mitigation actions;
- Formulation of an environment management and monitoring plan for the implementation of the mitigation actions during the construction and operation phases.

1.4 ESIA PROCESS

Environmental Impact Assessment (EIA) procedure in Uganda is stipulated in the Environmental Impact Assessment Regulations (National Environmental Management Authority (NEMA), 1998), Guidelines for Environmental Impact Assessment in Uganda (NEMA, 1997) and Environmental and social assessment procedures developed for the AfDB's public sector operations of June 2001. The overall EIA procedures consist of Screening, Environmental Impact Study and Decision. Stakeholder meetings (SHM) are required throughout the study period, from the Scoping, through the EIS study, to the project implementation and entire lifecycle.

The ESIA process followed the procedure laid forth by the EIA guidelines of 1997, capturing key requirements set forth by the Environmental lead agency in Uganda. Environmental and social assessment procedures developed for the AfDB's public sector operations were also referred to in the construction of this report.

1.4.1 Scope of Work

The nature and scope of the ESIA details a description of the project area, elements of the construction and operation of the proposed Wadelai Irrigation Scheme. A review of the legislation, policies and standards that is relevant to the project and the sustainable use of water resources for various purposes, in particular, irrigation. The review also entails specific requirements for ESIA and a scope of field studies required. The report also provides baseline information on the natural resources within the project area, including but not limited to, topographic conditions, hydrology, biodiversity surveys (including flora and fauna studies), water quality, geological characterizations and socio-economic surveys.

The ESIA report identified the nature of environmental and social impacts that the irrigation scheme and ancillary developments/operations would generate; this includes elaborating the source of the impacts,

receptors, describing in detail social impacts and impacts on the ecosystems in the project area. The ESIA identified prevention measures and proposed mitigations based on recommendations from similar projects and professional opinion from the consultant. The process developed an Environmental Management and Monitoring Plan (EMMP) to showcase the mitigations of the negative environmental impacts and provides monitoring criteria upon which the developer can assess the success of the proposed actions.

1.5 STRUCTURE OF THE REPORT

The report is has been presented in order of the following chapters.

Chapter No.	Title
	Executive summary
1	Introduction, Background, Project and ESIA objectives
2	Project Description
3	Methodology
4	Policy, Legal and Institutional Framework
5	Biophysical and Social economic Baseline
6	Alternatives Analysis
7	Stakeholder Engagement
8	Impact assessment and mitigation measures
9	Environmental Management and Monitoring Plan
	Conclusion
	Annexes

2. PROJECT DESCRIPTION

2.1 PROPONENT CONTACT AND PROJECT COST ESTIMATE

The details of the Developer are listed below: Main

Contact Name: Mr. Mugabe Montram

Address: P.O Box 20026, Kampala, Uganda

Organization: Ministry of Water and Environment

Tel: +256 782 717 329

The estimated project cost is UGX 25,782,723,000 (Uganda Shillings Twenty Five Billion Seven Hundred Eighty Two million Seven Hundred Twenty Three Thousand). The break down of the project costs are shown below;

Bill No.	Description	Costs in UGX	
A	Head works	16,269,507,128	
B	Main Canals	3,045,455,163	
C	Secondary Canals	4,521,744,972	2.2 LOCATION
	Tertiary Canals	1,092,953,710	OF PROJECT
	Quaternary Canals	853,031,353	Wadelai
TOTAL		25,782,723,000	Irrigation Project

envisages irrigating an ayacut of 1000 Ha utilizing annual river flows of Oraa River. Presently only rain fed agriculture is being practiced in the proposed command area. Rainfall follows a uni-modal pattern; a period being of short duration. The intervening period experiences long dry spells. This does not permit high yields of the crops grown in the area.

The annual river flows will be impounded by constructing dam across Oraa River and then drawing the water from the reservoir as per irrigation requirement spread over the year. The 'Irrigation and Drainage system' meant to deliver water from the reservoir to the fields comprises structural system made of canals and natural drainage network including the canal and structures. Canal network is designed to convey irrigation water from head works to fields and to deliver it as equitably as possible, matching the supply closely to the water requirements of crops in the command, during all stages of crop growth.

2.3 PROJECT COMPONENTS

2.3.1 Irrigation system

The irrigation system will comprise of canals to provide and distribute the irrigation water and natural drains to collect and remove excess irrigation water and surface runoff. The layouts of the canals, natural drains and access road systems have been designed based on the 30 meter SRTM Data. The total project command area is divided into 2 command areas having 250 Ha area on both sides of the Oraa river and covering seven villages in two parishes with each parish on each side of the river (See table 1). Each command area is irrigated by a network of secondary and tertiary canals and Quaternary canals. A 5.0 m width of all-weather inspection road will be provided on the right or left side of the Main Canal and both sides of secondary canals for operation and maintenance purposes.

Table 2: Canal Definition

Canal	Definition
Main Canal	Two main conveyor canals one on the left side and other on right side serving all the project command areas starting at the dam outlet point. The Main Canal is designed for 24 hr continuous irrigation supply when irrigation is required.
Secondary Canal	Secondary canals off take from the Main Canal deliver water to the individual command areas. There are a total of 2 secondary canals in the Left Main Canal and 3 secondary canals in the Right Main Canal are proposed in this project and lined with cement concrete lining. The boundary of the blocks is in most cases natural drainage.
Tertiary Canals	A canal which off takes from the secondary canals and delivers irrigation water to tertiary blocks. The tertiary canals are designed for 24 hour irrigation supply. Tertiary canals are generally unlined canals in balanced cut and fill.
Quaternary Canals	The quaternary canals will be unlined fill canals which off take from tertiary canals. In most cases the area of served by a quaternary canal is limited within the range of 8 - 16 ha irrigation unit bounded by tertiary canal, quaternary canal, natural drain and SC block boundary
Field Canals	Unlined field channels will serve an area of 2.0 ha within the quaternary unit.

Table 3: Area Definitions

Area	Definition
Field	The field is the smallest unit considered in the design of the project; generally 2 ha
Unit	Units are groups of fields, ideally 8 but also in multiples of 4 or 2 with an area of between 8 and 16 ha NIA (Net Irrigation Area). All fields within a unit will be irrigated during one rotation cycle. Where there are less than 8 fields in a unit the irrigation cycle will be truncated and the irrigation stream diverted elsewhere in the block.
Block	The area irrigated by a tertiary canal off taking from a secondary canal. Blocks are variable in size being built up from groups of units.
Command Area	The area irrigated by a secondary canal off taking from the Main Canal. Individual command areas consist of a number of blocks.

2.3.2 Command Area

The total command area available for irrigation is 2800Ha, however a net command area of 1000Ha was selected for irrigation development in the first Phase. After a detailed layout of fields and network of canals, a net command of 1000Ha was found for the proposed wadelai Irrigation Project excluding the areas lost due to network of canals, drains and project roads which constitutes about 20% of area available for irrigation development.

2.3.3 Headwork Design

The head works of the proposed Wadelai Irrigation scheme consists of earthen dam; spillway and canal head works (Head regulators). To make water flowing in a stream available for irrigation use, it must be diverted by means of a diversion dam and head works. The purpose of the diversion dam includes heading up of river flow water level, provision of undisturbed condition at intake section, reduction of

sediment load to intake etc. It is not desirable from design considerations to extend the spillway section (diversion dam) across the entire river channel; the length which is not closed by a spillway section is closed by a non overflow section with concrete gravity dam or earthen dam or dike.

Hence, it is proposed to construct an earthen dam across the Oraa River to make water flowing in a stream available for irrigation use. The spillway is proposed on the left flank of the Ora River to heading up(raise) or control the water surface in the river so that the desired flow may be diverted into the canal and yet function properly as a spillway for flood flows. The canal head works (Head regulators) are used to divert water into a main canal from lakes, equalizing reservoirs or natural streams. The purpose of the head work structure is to control and regulate the flows into the diversion canals.

For the design of head works the data and information required are hydrology, topography, irrigation demand and Simulation studies or working tables. Simulation studies or working tables are important to fix hydraulic parameters, such as the Full Reservoir Level (FRL), of the proposed reservoir.

2.3.4 Earthen dam/Earth dikes

Homogeneous earthen dam is proposed across the Ora River to impounding of water in the reservoir. The total length of the dam including spillway and max height of the dam proposed are 1834 & 8.70m for irrigating an ayacut of 1000 ha and 2499m & 10.9m for irrigating an ayacut of 2800 ha. The top width should be sufficient for the travel of trucks or cars for inspection, maintenance, and access to the spillway section and head works, hence top width of 4.50 m is proposed. The upstream slopes will be protected against erosion, wave action, and the destructive work of rodents. The upstream slope of earthen dam is protected with 450 mm thick riprap laid over 200 mm thick graded metal and 200mm sand, it as acting as filter. The downstream slope is protected with grass (turfing) to prevent the erosion by rain water and chute drains are proposed at 45 m interval.

Inclined and horizontal sand filter of 1.0 m thick along with a rock toe provided on the downstream of earth dam will help to relieve seepage problems in the downstream areas of an embankment on impervious foundations. The rock toe should be overlain by coarse sand and gravel to prevent embankment materials being drawn into it, a situation that could ultimately reduce the permeability of the toe and cause subsidence of the dam.

A cutoff with 4.0 m bottom width and retainable slopes is proposed in the foundation of an earthen dam and it will reduce seepage and improve stability. The cutoff trench will be excavated to a depth that will minimize all possible seepage. The cutoff trench should be backfilled with clay i.e. acting as impervious layer to prevent foundation seepage.

2.3.5 Spillway

In selecting the type of spillway section, the following controlling factors were considered; character and strength of foundation, availability of construction material, necessity for a controlled crest and cost. The types of spillway sections are Concrete ogee solid gravity, Concrete dam with control gates on crest, Concrete ogee slab and buttress, Concrete slab on compacted earth fill and Rock fill. The concrete ogee solid gravity spillway is proposed at km 0.435 on the left bank of the earthen dam in order to reduce the height of the spillway instead of providing a spillway in the stream or gorge portion. The Concrete ogee solid gravity section has a vertical upstream face and a rounded crest with an ogee face downstream.

2.3.6 Canal head works (Head Regulators)

The canal head works are proposed to divert water into main canal from lakes, reservoirs or natural streams. The purpose of the head work structure is to control and regulate the flow into the diversion canal. The canal head works will usually be located along the main bank of the River where the source of water is to be obtained and at a point which in general is determined by the position of the diversion canal.

The Head regulators are proposed at 0.085km and 1.275km on both flanks of the Oraa River to irrigate an ayact of 500ha on each side.

At reservoirs where the intake structure is constructed through an earth embankment or a small earth dam, the closed type of intake structure is used. This type is essentially a buried conduit consisting of a single or multiple barrel reinforced concrete section which extends through the embankment.

2.3.7 Gates

The flow through the structure is controlled by top sealed radial gates or vertical lift gates which are located near either the centre of the embankment or the upstream end of the conduit. The total gate opening required for a given discharge is generally based on an allowable velocity of 1.2m/sec to 1.8m/sec.

From an operating point of view, a single gate is desirable; but when more than one gate is installed they should be operated in parallel to avoid unsymmetrical flow. To permit closure of the structure during an emergency and to permit maintenance work on the gates, it is customary to make provision for stoplogs by providing grooves in the piers.

Two gates are proposed for Head regulator one is service gate and other one is emergency gate. The size of the vertical gate proposed is 1.9 x 1.5m to irrigate an ayacut of 500ha on both sides of the Oraa River. The size of the vertical gate for head regulator on left side is proposed as 3.20m x 1.70m for 1200ha and on right side is proposed as 3.60m x 1.90m for 1600ha. Salient features of the Wadelai Irrigation Scheme are given in Table 4.

Table 4: Salient features of the Wadelai Irrigation Scheme

S.No.	Description	Unit	1000 Ha	2800 Ha
1	Maximum flood discharge	Cumecs	334	334
	Minimum Draw Down Level(MDDL)	m	660.00	660.00
2	Full Reservoir Level(FRL)	m	661.75	665.00
4	Maximum Water Level(MWL)	m	662.95	666.20
5	Top Bund Level(TBL)	m	664.45	667.70
6	Sill Level	m	660.00	660.00
7	Capacity of the resorvior at FRL	MCM	4.500	18.750
8	Capacity of the resorvior at MDDL	MCM	1.243	1.243
9	Total length of the dam	m	1834	2499
10	Maximum height of dam	m	8.70	10.96

The size of the vent for head regulator at km 0.117 is proposed as 3.00m x 1.70m for design discharge of 5.011 cumecs for 1100ha and at km 0.965 is proposed as 2.20m x 1.60m for design discharge of 3.188 cumecs for 700ha.

3. ESIA METHODOLOGY

3.1 INTRODUCTION

The consulting team executed the following tasks in pursuit of the ESIA Study;

- Literature Review and reference to the already existing published information including laws, regulations and policies to verify how the proposed development would conform to them; The process also encompasses the review of literature from similar projects, on the lessons learned and way forward;
- Field surveys of the proposed project site, including baseline information of the environmental conditions and resources in the project area;
- An indepth stakeholder consultation, including members of the local community and lead agencies with regard to the proposed project; and
- Professional judgment for all the issues related to the nature of the proposed development project.

3.2 BASELINE SURVEY

Field surveys were conducted for the baseline and these included a collection on information for the Physical, biological and social environment within the project area using methods discussed in this section.

3.2.1 Physical Environment

i. Water Quality

Water samples were taken from different locations on both the southern and northern banks of Oraa River. Two sets of samples were taken, one for bacteriological quality and the second one for physicochemical analysis. Microbiology samples were collected in sterilized bottles obtained from National Water & Sewerage Corporation (NWSC). All samples were transported in cool box to the laboratory on the same day of sampling and kept at 40C before analysis on the following day.

During sample collection, on-site measurements were carried out, and these included pH, temperature, dissolved oxygen (DO) (mg/L), DO Saturation (%), conductivity (mS/cm or microS/cm), total dissolved solids (TDS) (mg/L), oxidative reduction potential (ORP) (mV), resistivity (ohm.com or Mohm.cm or Kohm.com), salinity (PSU), and atmospheric pressure (mmHg). For each site the elevation above seas level (easl) and locations were recorded. Onsite measurements were carried using HANNA HI 9828 multi-parameter water quality meter.

ii. Soil surveys

Samples were collected from 30cm depth and were analyzed at Makerere University College of Agriculture and Environmental Sciences. Besides this, the soil maps published by Ugandan Government were also studied and maps were prepared for both command and catchment area of Wadelai area. The soil chemical characteristics of the soil was analyzed and discussed

iii. Agronomy

Literature review for Land holdings, landuse, cropping patterns, crop rotation was undertaken after which the area was surveyed to determine current agricultural practices in the Wadelai Sub-County. Interviews with farmers in the Wadelai and the local leadership informed consultants on issues dealing with agricultural practice and with that crop yields were estimated against the national average through the years. Crop production constraints and potential in the Wadelai area was investigated through and assessment of the current practice of farming technology, capital, post harvest technology facilities, farm input supply system, marketing and climate. This helped to inform the crop and scheme water requirements, most of which (climatic data) was obtained from Gulu meteorological station.

3.2.2 Biological Environment

a) Vegetation

Literature review

The desk-based study of the area was undertaken to gather exiting information on the study area vegetation characteristics. Existing sources of data were used to gather a range of information to identify potential biological information, and also to define the most appropriate scope of work for the field surveys. The available literature about the vegetation, flora, and their conservation status was reviewed. Previous vegetation classifications were reviewed to provide an overview of the likely vegetation and habitats present within the study area. This was intended to identify beforehand, the unique, threatened, rare and other cases of conservation concern species and habitats known to occur in the area of the proposed activities.

Field Surveys

Transect walks were conducted within the project areas at intervals of 250meters, at geo-referenced sites. A 10 x 10 meter and 5 x 5 meter quadrats were established at each sampling site, to capture woody and herbaceous-weedy species respectively. Vegetation/ habitats types were classified, and the flora species were systematically recorded per site. Vegetation classification was determined by the species composition and dominance compared with the vegetation structure. Dominant species were ranked based on scores from DAFOR scale, which is a rapid assessment technique of species distribution over a given study area.

b) Birds

Birds were surveyed along transects. Transects and points counts were made along the River course on either sides. Transects were established to ensure they cut across the different vegetation types. Using the 10-minute species time count method, species records were made based on sight of flying birds, patching birds or nests and sound at 100meter interval along the transects. Habitat information was recorded and described with in puts from the vegetation classification by the botanist. Opportunistic

Records (i.e. records made outside regular count times) were added to the overall lists of species for each respective habitat recorded. Field identification of the species followed Williams & Aalott (1996) birds of East Africa. Identification of Birds of Conservation Concern will be done. Species of conservation concern were assessed/ identified based on habitat use/ dependence and whether they are listed on the IUCN RedList Species.

c) Mammal

Transect walks were made to detect, and observe for signs of mammal presence in the project area based on animal sightings, prints or fecal material, animal parts and callings. The surveys aimed at obtaining data on habitat use and preferences by the different species. Photographic records of species and ecologically sensitive-mammal features were observed and recorded. The use of Visual Encounter Surveys (VES) and Opportunistic Encounters also complimented the field techniques.

Local Consultations

Local consultations with communities were also made being that they are constantly in touch with their environment. Communities encounter animals of different kinds during their daily activities. Communities mentioned species of which some were later confirmed through field observations during the surveys.

d) Herpeto fauna

Field data was obtained by conducting a survey of amphibians and reptile species within habitats around and or along the project area to determine the impacts of the project footprint on their biological life. The methods used are described below.

Visual Encounter Surveys

The use of Visual Encounter Surveys (VES) is a well known method for surveying heptero fauna. They can be used to document presence of reptiles and amphibians. This constitutes moving through a habitat watching out for and recording surface-active species. The data gathered using this procedure provides information on species richness of the habitat. During the study VES was done in the environs of river Tochi and the surroundings to sample all amphibians and reptiles that were visible.

Opportunistic Encounters

This method involves recording any amphibian or reptilian species encountered anywhere and at any time within the study area. Opportunistic records occur outside the sampling points but within the project surrounding. Such records are likely to be impacted upon by the project. The opportunistic encounters compliment the herpetofauna checklist within the project area, because of their high mobility levels. Therefore Opportunistic searches were used to maximize the number of species encountered in the study area.

Local Consultations

Local consultations with communities were also made being that they are constantly in touch with their environment. Communities encounter amphibians and reptiles of different kinds during their daily activities. Communities mentioned species of which some were later confirmed through field observations

during the surveys. Identification of herpetiles will follow Channing & Howell (2006), The AmphibiaWeb (2014), and The Reptile Database (Uetz, P. & Jirí Hošek (eds.) 2014), while the conservation status will be measured against the IUCN Red Listing.

e) Aquatic Ecology

The assessment covered the area directly under the project footprint. Five sites along Oraa River within the project area were selected for sampling and techniques for sample collection focused on the algae, zooplanktons, benthic macro invertebrate and fish.

Methods for sampling Fish

Minnow traps were used to obtain fish samples during the study. All the fish caught were counted, identified to a species level using the descriptions given in Greenwood (1966). The fish specimens that were not identified with certainty in the field were preserved in a 95% ethanol solution and stored in labeled jars for subsequent laboratory identification

f) Phytoplankton

Samples were taken with Van Dorn bottles, fixed with 0.2ml Lugol, to preserve and colour the cells, and then bottles rapped with aluminum foil prior to transportation to the laboratory. The relative abundance and diversity of the different algal groups were established using the standard literature and the taxonomical criteria of Talling (1987) and Komarek & Kling (1991).

g) Zooplankton

Samples were collected using a Schindler sampler concentrated through a 53µm sieve and preserved with 75% ethanol. In the laboratory, samples were washed with distilled water over a 53µm sieve to remove the fixative and species identification was done under a microscope to the lowest possible taxon using published keys (Pennak, 1953, Rutner-Kolisko, 1974).

h) Benthic macro-invertebrate

Benthic macro-invertebrates were collected with a frame benthos net fitted with a 500 µm mesh net. Sampling was done by positioning the benthos net disturbing one square meter to dislodge the upper layers of cobble, debris and scrape the underlying bed sediment. Samples were drained of water and placed into appropriate sealed plastic bags and fixed with 70% ethanol. Samples were then placed in a plastic container for transportation to the laboratory. In the laboratory, macro-invertebrates were sorted out from the sediments with the help of a hand lens and pair of forceps, analyzed and determined to the level of species, genus or family using taxonomic identification keys.



Figure 3: Illustrations of the biodiversity survey transects within the project boundary NB:

TL -Transect Line

3.2.2 Social Survey

- a) Review of Documentation: All necessary relevant documents relating to plan, policies, progress, account procedures of the existing schemes were reviewed to get an insight into these aspects. This information was used to design data collection tools like household survey questionnaire and focused group discussion interview guide.
- b) Stakeholder Consultations: Stakeholders were be consulted at two levels, the first being gained entry into the study area and capturing of key issues relating to the study. The second level of

stakeholder consultations related to understanding the different alternatives proposed in the project and the selection of the best option.

- c) Primary Data Collection: A household survey data collection tool was developed and a total of 60 questionnaires were administered in the two parishes of Punit and Upper Ragem Parish in Wadelai Sub-County. 10 questionnaires were administered in each village.
- d) Data Entry & Analysis: Both, quantitative and qualitative data entry and analysis was applied. SPSS software were used for data analysis.
- e) Needs Assessment & Capacity Building Plan: After the demographic and institutional analysis, a capacity needs assessment was undertaken in order to address the gaps identified.
- f) Training: A study tool and field training manual will be prepared by the Sociologist Expert, on which the technical staff, extension agents and farmers' associations will be trained. The study tool and field training manual will be discussed with the Client and prior approval will be taken before imparting training activities.

3.2.3 Impact Significance

Virtually all human activity imposes some disturbance to components of the environment because of physical impacts on natural systems or due to interactions with other human activities and human systems. Often such impacts are slight or transitory and have an effect that may be regarded as insignificant. There is no statutory definition of significance and the determination of significance is therefore necessarily subjective.

Table 5: Overall significance criteria for the ESIA

	Low magnitude	Medium Magnitude	High Magnitude
Low sensitivity	Minor	Moderate	Moderate
Medium Sensitivity	Moderate	Moderate	Major
High sensitivity	Moderate	Major	Major
Impact significance			
No Impact or insignificant	Impacts are indistinguishable from the background/natural level of environmental and social/socioeconomic change.		
Minor Significance	Impacts of low magnitude, within standards, and/or associated with low or medium value/sensitivity resources/receptors, or impacts of medium magnitude affecting low value/sensitivity resources/receptors.		
Moderate significance	Broad category within standards, but impact of a low magnitude affecting high value/sensitive resources/receptors, or medium magnitude affecting medium value/sensitivity resources/receptors, or of high magnitude affecting medium sensitivity resources/receptors.		
Major Significance	Exceeds acceptable limits and standards, is of high magnitude affecting high or medium value/sensitivity resources/receptors or of medium magnitude affecting high value/sensitivity resources/receptors.		

3.2.4 Mitigation Measures

A key objective of the ESIA is to identify means of reducing the impact of the Project on the receiving environment. To achieve this, mitigation measures have been developed and integrated into the Project design in response to impacts that are anticipated to be of significance. These mitigation measures have been established through legal, best practice industry standards or specialist environmental input from the ESIA team.

3.2.5 Unplanned Impacts

In addition to the predicted impacts, those impacts that could result in the event of an accident or unplanned event within the Project (e.g. accidents at worksite), or in the external environment affecting the Project, are taken into account. These impacts are termed unplanned impacts and are defined as being a combination of event or incident frequency (probability) and the environmental consequences of the event or incident. Unplanned impacts are considered in much the same way as predicted impacts save for the inclusion of the probability factor. Probability and consequence are elaborated upon in table 6.

Table 6: Overall unplanned impact Significance

Potential Consequence (Significance)	Frequency of Event/Incident Occurrence (Probability)		
	Low	Medium	High
Minor	Minor	Moderate	Moderate
Moderate	Moderate	Moderate	Major
Major	Moderate	Major	Major
Low	Continuous Improvement Zone		
Moderate	ALARP Zone - demonstrate that the likelihood of the environmental impacts has been reduced to As Low As Reasonable Practicable and that contingency measures are in place to minimize the consequences.		
High	Intolerable Zone: Unacceptable to the countries of origin, affected countries and Nord Stream.		

4. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This Chapter provides a review of the national policy, legal and institutional framework relevant to the proposed irrigation projects. A review of the operational safeguards among multilateral development financial institutions such as World Bank, AfDB has also been made and presented in this Chapter.

4.1 POLICY FRAMEWORK

Table 7: Policy Framework relevant to Wadelai Irrigation Scheme

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
The National Water Policy, 1999	To manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with the full participation of the stakeholders.	Water Resources Management (covering policy objectives, principles and strategies for monitoring, assessment, allocation and protection of the resource and management framework) Water Development and use (covering policy objectives, principles and strategies for the development and use of water for domestic water supply, water for agricultural production, and other water uses including industry, hydropower, recreation and ecosystem needs) Development and efficient use of water in agriculture. Promotion of measures for control of pollution of water resources.

The Uganda National Land Policy, 2013	To ensure an efficient, equitable and optimal utilization and management of Uganda's land resources for poverty reduction, wealth creation and overall socio-economic development	<p>Ensure large-scale investment decisions and activities do not compromise the sustainable management and conservation of natural resources</p> <p>Strengthen community level institutions for effective management of land development and land use regulation</p> <p>Restore and maintain the quality of land resources to enhance the proprietary value of land resources</p> <p>Ensure sound land use practices and appropriate conservation measures for land quality and land-based resources</p>
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Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
		<p>Develop guidelines to Control of soil degradation and industrial waste disposal</p> <p>Provide special protection for fragile ecosystem, including unique and sensitive biodiversity colonies, like hill tops, wetlands, water catchment areas, lake-shores and river banks</p> <p>Discontinue the alienation of designated wetlands, hilltops, water catchment areas, lake shores, river banks and other sensitive eco-systems by enforcing legislation, regulations, guidelines and standards</p> <p>Take measures to develop programmes for restoration of waste disposal sites and polluted water courses</p>
The National Fisheries Policy, 2004	To ensure increased and sustainable fish production and utilization by properly managing capture fisheries, promoting aquaculture and reducing postharvest losses	<p>Set binding minimum standards for the protection of the environment from fisheries and aquaculture activities</p> <p>Establish and/or maintain systems to monitor the quality of aquatic environments that support active fisheries</p>
The National Health Policy, 2010	To reduce mortality, morbidity and fertility, and the disparities therein.	Address the increasing burden of disease resulting from water borne diseases associated with safe and clean water, hygiene and environmental sanitation.

<p>The National Policy for the Conservation and Management of Wetlands Resources, 1995</p>	<p>To promote the conservation of Uganda's wetlands in order to sustain their ecological and socio-economic functions for the present and future well-being of the people.</p>	<p>Require that all proposed modifications and restorations on wetlands be subject to an environmental impact assessment (EIA), the result of which will determine whether such restoration modification should proceed and if so to what extent No drainage of wetlands unless more important environmental management requirements supersede. Thus artificial large-scale removal or exclusion of water from a wetland by whatever means such as pumping, by excavation of water channels and perhaps and other drainage means which include building of dams upstream of a wetland be avoided</p>
<p>The Uganda Gender</p>	<p>To establish a clear framework for identification,</p>	<p>Recognize the role of women and youth in access and use</p>

Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
<p>Policy, 2007</p>	<p>implementation and coordination of interventions designed to achieve gender equality</p>	<p>of water at household levels. It anchors the importance of gender responsiveness in terms of planning, implementation and management of water related initiatives</p>
<p>The National Forestry Policy, 2001</p>	<p>To establish an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all Ugandans</p>	<p>Establish watershed protection forests that can be rehabilitated and conserved. Promote the rehabilitation and conservation of forests that will protect the soil and water in the country's key watersheds and river systems.</p>

The National Environment Management Policy, 1994	to promote sustainable economic and social development that enhances environmental quality without compromising the ability of future generations to meet own needs	Develop local capacity for community management and maintenance of water resources and institute measures to prevent environment degradation around water points; Increase the level of community awareness on the importance of water particularly with regard to hygiene; Strengthen the capacity to measure and to continuously assess and monitor quality and quantity of water resources Establishment of environmental standards for permissible levels of pollution Establishment of a system for monitoring compliance with water, land and air pollution control standards and regulation Develop and promote the wider application of appropriate technologies for infrastructure development such as water supply and sanitation for example recycling solid waste and waste water for agriculture use and industrial use.
The National Agricultural Policy, 2013	To achieve food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition.	Develop capacity to harvest and utilize rain water for agricultural production Support development and sustainable use, management, and maintenance of water and land resources for agriculture to boost production, enhance value-addition, and reduce the effects of climatic shocks.
The Uganda Vision	Uganda aspires to transform the Agriculture sector	As a way of increasing agricultural productivity,
Policy	Overall Policy Objective (s)	Strategies relevant to Irrigation Projects/Activities
2040	from subsistence to commercial agriculture through mechanization and introduction of modern irrigation systems	Government will invest in the development of all major irrigation schemes in the country. Government will also reform the extension system in the country to increase information access, knowledge and technologies to the farmers; ensure that land fragmentation is reversed to secure land for mechanization.

The National Development Plan, 2010 - 2015	To enhance agricultural production and productivity.	Enhance productivity of land through sustainable land use and management of soil and water resources Increase supply of water for agricultural production (irrigation, water for livestock, aquaculture). Establish new irrigation schemes (informal, small scale, commercial).
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4.2 LEGAL FRAMEWORK

Table 8: National Laws relevant to Wadelai Irrigation Scheme

Law	Requirements	Relevance
The Constitution of Uganda, 1995	<p>The Constitution includes basic requirements including: The state to ensure that all Ugandans enjoy rights and opportunities and access to clean and safe water (Objective XIV); The state to take all practical measures to promote a good water management system at all levels (Objective XXI); The state to promote development sustainable development and the public awareness of the need to manage water resources in a balanced and sustainable manner for the present and future generations (XXVII). Every Ugandan has a right to a clean and healthy environment (Article 39).</p>	Development of this project will put into consideration catchment based IWRM aspects and water source protection planning for a clean and health environment.

Law	Requirements	Relevance
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<p>The National Environment Act Cap, 153</p>	<p>Section 19 subsection 3 stipulates that an environmental impact assessment shall be undertaken by the developer where the lead agency, in consultation with the executive director, is of the view that the project– a) may have an impact on the environment; b) is likely to have a significant impact on the environment; or c) will have a significant impact on the environment.</p> <p>No person is permitted to carry out activities in relation to a river or lake without a permit</p> <p>No person is permitted reclaim or drain any wetland; erect, construct, place, alter, extend, remove or demolish any structure that is fixed in, on, under or over any wetland or disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse effect on the wetland or deposit in, on or under any wetland any substance in a manner that has or is likely to have an adverse effect on the wetland or destroy, damage or disturb any wetland in a manner that has or is likely to have an adverse effect on any plant or animal or its habitat or introduce or plant any exotic or introduced plant or animal in a wetland without approval of NEMA.</p>	<p>An ESIA has been undertaken, the purpose for which this report has been written. The developer will ensure that the proposed environment and social management plan is adhered to and that the contractor develops site specific ESMPs.</p>
<p>The Water Act, 1997</p>	<p>It's a principal law for the management of water resources in Uganda. The Act provides for the use, protection and management of water resources and supply.</p> <p>A person who is responsible for the production, storage, discharge or deposit of any waste or is engaged in any trade; or owns or occupies any premises, shall not cause or permit any waste to be discharged directly or indirectly into any water unless he or she gets a waste discharge permit.</p> <p>Provides for water abstraction permit.</p>	<p>The developer will prepare a water source protection plan and obtain a water abstraction permit. A wastewater discharge permit will also be obtained and the requirements of the above permits will be implemented and monitored e.g. water flow levels, water quality and quantity being discharged.</p>
<p>The Land Act, Cap 227</p>	<p>The Land Act provides for the tenure, ownership and management of land. It requires a person who owns or occupies land to manage and utilize the land in accordance</p>	<p>The land on which the project is to be located is owned by the community and an understanding will be reached between the community local leaders, Oyam Local</p>

Law	Requirements	Relevance
	with the environmental laws and other laws including the Water Act. That the Government or a local government shall hold in trust for the people and protect natural lakes, rivers, ground water, natural ponds, natural streams, wetlands, forest reserves, national parks and any other land reserved for ecological and touristic purposes for the common good of the citizens of Uganda and thus the Government or a local government shall not lease out or otherwise alienate any natural resource.	Government and MWE on how the land will be utilized
The Occupational Safety and Health Act, 2006	Article 13 provides for duty of employers to protect employees while Article 47 provides for a healthy and safe working environment.	The provisions of this Act shall be adhered to during implementation phases, especially at the construction stage where many workers will be on site to ensure a safe working environment is kept.
The Employment Act, 2006	The employment act spells out the general principles regarding forced labour, discrimination in employment sexual harassment and provisions to settle grievances. The Act further stipulates in section 31 subsection (1) that a child under the age of twelve years shall not be employed in any business, undertaking or workplace. It further states in subsection (2) that a child under the age of fourteen years shall not be employed in any business, undertaking or workplace, except for light work carried out under the supervision of an adult aged over eighteen (18) years and which does not affect the child's education.	The Contractor will apply principles of this Act and will not engage any child workers at the project site at any one time during the project lifecycle.
The Workers' Compensation Act Cap. 225	This law provides for compensation to workers for injuries suffered in the course of their employment. Under the Act, an employee is entitled to compensation for any personal injury from an accident or disease arising out of, and in the course of his or her employment even if the injury or disease resulted from the negligence of the employee.	The Contractor will ensure that compensation is paid to workers that sustain injuries during the execution of project work and a register should be kept at site for all injuries on duty as per OSH, 2006 requirements for Uganda. The Contractor shall take a work mans compensation insurance to cover all the workers.

The Physical Planning Act Cap.	Establishes a district and urban physical planning committees to provide for the making and approval of physical development	According to the District Urban Planner, the area was designated for agricultural activities. Therefore the
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Law	Requirements	Relevance
30	plans and for the applications for development permission and for related matters.	development falls within the gazetted landuse of the area.
The Local Government Act Cap. 243	The Local Governments Act defines roles for different levels of government in provision and management of water related activities. It provides that the provision of water services and maintenance of facilities is a responsibility of local councils in districts and urban centres with the support and guidance of relevant central government agencies.	Local Government officials will be responsible for monitoring the implementation of the EMMP during the project cycle.
The Public Health Act Cap. 281	It place duties on the Urban and local authorities in matters pertaining to public health. It requires every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any supply of water which the public within its district has a right to use and does use for drinking or domestic purposes, whether the supply is derived from sources within or beyond its district and for purifying any such supply which has become so polluted. Such Local authority can take measures, including if necessary, proceedings at law, against any person so polluting any such supply or polluting any stream so as to be a nuisance or danger to health.	Local Government officials will be responsible for monitoring the implementation of the EMMP during the project cycle and ensure that public health concerns have been addressed.

The Mining Act, 2003	It restricts mining activities in water. Under the Act all rights in wetlands and in the waters of any spring, stream, river, watercourse, pond or lake on or under public land, are vested in Government; and no such wetlands or water shall be obstructed, dammed, diverted, polluted or otherwise interfered with, directly/indirectly, except in accordance with the provisions of Part II of Water Act.	The planned project activities do not require any mining activities however, in an event that mining is required an new ESIA will be carried out and a mining licence will be required.
The Rivers Act Cap. 357	Section 4 of the Act states under subsection (1) that it shall not be lawful to dredge in any river without a license from the Minister, which shall be in Form A of the Second Schedule to the Act.	Dredging in a river requires a license and if this activity is to be done, the developer will apply for the permit.
Law	Requirements	Relevance
	(2) Any person dredging in a river without a license, or contrary to the terms of the license, commits an offence and is liable on conviction to a fine not exceeding one thousand five hundred shillings for every day during which the offence continues.	
The Control of Agricultural Chemicals Act Cap 29	This Act regulates the manufacture, storage, distribution and trade in, use, importation and exportation of, agricultural chemicals and for other purposes connected therewith. It establishes the Agricultural Chemicals Board and one of the members should be a public officer appointed by the Minister responsible formatters relating to the environment. The Board is charged with ensuring that agricultural chemicals are properly managed through registration, labelling, issuance of licences regulating quality and importation.	Approved chemicals and recommended measurements will be followed during the operation stage. Storage, use and disposal of chemicals and waste will observe internationally acceptable waste management measures.

Regulations	Requirements	Relevancy
The National Environment (Wetlands, Riverbanks and Lakeshores Management) Regulations, 2000	The regulation provides that resources in riverbanks lakeshores and wetland should be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological functions and services. Environmental impact assessment as required under the statute is mandatory for all activities in the wetlands, riverbanks and lakeshores and special measures are essential for protection of riverbanks, lakeshores and wetlands of international, national, and local importance of ecological systems and habitat for fauna and flora species, and for cultural and aesthetic purposes, as well as for their hydrological functions and values for preventing soil erosion, siltation and water pollution.	Mitigation measures and an ESMP have been proposed to ensure that construction activities will not modify any aspect of the function of the wetlands and river banks functionality. Due to wetland alterations or encroachment that is envisaged as a result of implementing project activities, a wetland use permit will be applied for.

4.3 REGULATIONS

Table 9: National Regulations Related to the Proposed Wadelai Irrigation Scheme

Regulations	Requirements	Relevancy
Environmental Impact Assessment Regulations, 1998	Regulation 10 sub-regulation (1) outlines the provisions under which an EIA should be undertaken. It states that an environmental impact Study shall be conducted in accordance with terms of reference developed by the developer in consultation with the Authority and the lead agency. Regulation 13 (1) stipulates that where the Executive Director has, under sub-regulation (1) of regulation 9 determined that an environmental impact study be made under these regulations, the developer shall make an environmental impact statement on completing the study.	Scoping and ToR were done and approved and the approval by NEMA is appended to this ESIA report, purpose for which it has been written in keeping with regulation 13(1). EIS was submitted to NEMA for approval.

The Water (Waste Discharge) Regulations, 1998	Under these regulations, the National environment management authority sets the standards for discharge of treated effluent or waste into water or on land in consultation with the lead agency under section 26 of the National Environment Act, Cap 153. The regulations prohibit the discharge of effluent or waste under regulation 4 (1) by stating that no person shall discharge effluent or waste on land or into the aquatic environment contrary to the standards established under regulation 3 unless he or she has a permit in the format specified in the First Schedule issued by the Director. Regulation 4 (2) obliges a person granted a permit under sub-regulation (1) to (a) ensure that the effluent or waste discharged conforms to the maximum permissible limits established under regulation 3.	The developer will not discharge any waste or effluent into the environment unless prior permission from NEMA has been given, in consultation with the lead agency (DWRM) on the medium into which they intend to discharge. All discharges to the wetland will be consistent with the set National standards as stipulated under the Schedule (Regulation 3). The water to be released back into the environment will follow the required minimum water quality standards and the developer will apply for a wastewater discharge permit from DWRM before commencement of the operation stage.
The National Environment (Waste management) Regulations 1999	Regulation 4 outlines the requirement for sorting and disposal of domestic waste. Under sub-regulation (4), a person who generates domestic waste shall sort the waste by separating hazardous waste from non-hazardous waste in accordance with the methods prescribed under sub-regulation (3). Sub-regulation (5) stipulates that a generator of domestic waste may, without a license issued under these Regulations, dispose of nonhazardous waste in an environmentally sound manner in accordance with by-laws made by a competent local authority.	The contractor during construction and the developer during the operation, in keeping with this regulation will engage NEMA licensed waste transportation companies to collect waste from the worksite and dispose of it at gazette and prior agreed sites with the Authority.
The National Environment (Standards for Discharge of	The regulations outline the standards for effluent into the environment in regulation 3 (1). They further set out the	The water to be released back into the environment will follow the required minimum

Regulations	Requirements	Relevancy
Effluent into Water or on Land) Regulations, 1999	obligations to mitigate pollution in regulation 4 (1) which states that every industry or establishment shall install at its premises, anti-pollution equipment for the treatment of effluent chemical discharge emanating from the industry or establishment.	water quality standards and the developer will apply for a wastewater discharge permit from DWRM before commencement of the operation stage.

<p>The National Environment (Noise Standards and Control) Regulations, 2003</p>	<p>Regulation 3; The purpose of these Regulations is to ensure the maintenance of a healthy environment for all people in Uganda, the tranquility of their surroundings and their psychological wellbeing by regulating noise levels, and generally, to elevate the standard of living of the people. Regulation 8; (1) It is the duty of the owner of machinery or the owner or occupier of a facility or premises, to use the best practicable means to ensure that the emission of noise from that machinery, facility or premises does not exceed the permissible noise levels.</p>	<p>Both during construction and operation phases, noise generated should not exceed limits prescribed by these regulations i.e. construction sites 60dB and 50dB for day and night respectively. Regular monitoring to ensure compliance will be undertaken.</p>
<p>Draft National Air Quality Standards, 2006</p>	<p>Considering that construction equipment and machinery are powered by diesel/ gasoline engines, pollutants such as CO₂, NO_x, SO_x, VOC and particulates are expected to be emitted thus monitoring of air quality is necessary especially during construction phase.</p>	<p>There will be no burning of polythene or any other material for that matter which could led to high carbon emissions thus causing air pollution. Maintenance of vehicles and other equipment to minimize emissions has been proposed as a mitigation measure. Regular air quality monitoring will be undertaken.</p>
<p>Water Resources Regulations, 1998</p>	<p>The regulations apply to motorized water abstraction from boreholes or surface watercourses or diverting, impounding or using more that 400 cubic meters of water within a period of 24 hours. Part II, Regulation 3 requires a water permit for operation of motorized water pump from a borehole or waterway. Under Regulation 6, application for permit may be granted on conditions of projected availability of water in the area, existing and projected quality of water in the area and any adverse effect which the facility may cause among other considerations.</p>	<p>The contractor will be using water from the NWSC network for construction water need. However, in the event that the contractor decides to abstract water for the construction purposes, a water abstraction permit must be obtained from MWE/DWRM as per provisions of this regulation.</p>
<p>The National Environment Regulations (Soil Management), 2001</p>	<p>Regulation 3 sets out the purpose of these Regulations which is, as specified under sub-regulation (a) to establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term.</p>	<p>Soil sampling and analysis was done thus a baseline has been established for future monitoring purposes. Recommended fertilizer application ratios will be observed in an event these suppliments are to be applied.</p>

4.4 INSTITUTIONAL FRAMEWORK

Table 10: Institutions with an interest in the Wadelai Irrigation Scheme

Institution	Responsibility/Mandate	Application in ESIA
Ministry of Water and Environment (MWE)	MWE has the responsibility for setting national policies and standards, managing and regulating water resources and determining priorities for water development and management. It also monitors and evaluates sector development programmes to keep track of their performance, efficiency and effectiveness in service delivery. MWE has three directorates: Directorate of Water Resources Management (DWRM), Directorate of Water Development (DWD) and the Directorate of Environmental Affairs (DEA).	MWE is the principal Executing Agency for the project and will be responsible for the overall monitoring and management of the project during both construction and operation, including ensuring the implementation of the mitigation and enhancement measures and adherence to Uganda's environmental regulations and the Bank's Operational Safeguards.
Directorate of Water Development (DWD)	Water for Production Department is working towards development and utilization of water resources for productive use in crop irrigation, livestock, aquaculture, rural industries and other commercial uses. The Ministry of Water and Environment is in the process of developing an irrigation master plan. Currently, the Ministry is overseeing reconstruction of four irrigation schemes of Mobuku in Kasese District, Doho in Butaleja District, Agolo in Kitgum District and Orweny in Lira District under the Farm Income Enhancement Forestry Conservation (FIEFCO) Project. These proposed projects are under this department.	DWD will monitor implementation activities to ensure water resources are not polluted and degraded by ensuring that environmental flows are maintained.
Directorate of Water Resources Management (DWRM)	Directorate of Water Resources Management (DWRM) will monitor all activities and will be involved in the project as a key stakeholder from preconstruction to decommission phase. The department also sets the quota of allowable abstraction/diversion of the river based on ecosystem need.	Responsible for monitoring water resources specifically water quality assessments, monitoring surface water resources, laboratory and field works and ultimately water pollution control.

<p>Directorate of Environmental Affairs (DEA).</p>	<p>Wetlands Management Department (WMD) is mandated to manage wetland resources and its goal is to sustain the biophysical and socio-economic values of the wetlands in Uganda for present and future generations. Wetlands are a source of livelihood to the majority of Ugandans and hence</p>	<p>WMD will ensure that any alterations of the wetland resources follow conditions of the wetland permit issued.</p>
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Institution	Responsibility/Mandate	Application in ESIA
	<p>directly contribute to National Development plan, vision 2040 and attainment of the Millennium Development Goals.</p>	
<p>The National Environment Management Authority (NEMA)</p>	<p>NEMA responsible for the regulatory functions and activities that focus on compliance and enforcement of the existing legal and institutional frameworks on environmental management in Uganda. NEMA's mandate covers both green and brown issues of environmental management. It oversees the implementation of all environment conservation programmes and activities of the relevant agencies both at the national and local Government level.</p>	<p>NEMA will be responsible for review, comment and overall approval of the ESIA/ESMPs reports for the respective irrigation schemes. Once approved, NEMA will issue Conditional Approval Certificates for the ESIA for the proposed construction and operation of the irrigation scheme.</p>
<p>Ministry of Agriculture Animal Industry and Fisheries(MAAIF)</p>	<p>MAAIF is responsible for managing and coordinating agricultural policies and interventions. It does so through the Ministry's autonomous and semi-autonomous agencies, local governments, farmers and farmers' organizations, other ministries, departments and agencies (MDAs), the private agribusiness and agro-processing sector, civil society, development partners and academia.</p>	<p>MAAIF will ensure that project implementation activities including use of agro chemicals are procured, stored and applied as per manufacturer's recommendations.</p>

<p>The National Agricultural Advisory Services (NAADS)</p>	<p>As provided for under the NAADS Act, 2001, the mandate of NAADS is to contribute to the modernisation of the agricultural sector in order to increase total factor productivity of both the land and labour for the benefit of the farmers. Its objectives and functions are to: Promote food security, nutrition and household incomes through increased productivity and market oriented farming; Empower farmers to access and utilise contracted agricultural advisory services; Develop private sector agricultural advisory delivery capacity and systems and assure quality of advice. NAADS is one of the seven components under the Plan for Modernization of Agriculture (PMA), the planning framework of the government for the transformation of subsistence agriculture to market oriented for commercial production.</p>	<p>Empower farmers to access and utilise contracted agricultural advisory services; Value chain addition and develop private sector agricultural advisory delivery capacity and systems and assure quality.</p>
<p>Plan For Modernisation</p>	<p>Provides technical support and cross-Sectoral coordination for</p>	<p>Provide technical support and cross-sectoral</p>

Institution	Responsibility/Mandate	Application in ESIA
<p>of Agriculture Secretariat (PMA)</p>	<p>implementation of Agriculture policy. The PMA Secretariat was established as the administrative arm of the Plan for Modernisation of Agriculture (PMA) and its current mandate and functions were derived from the PMA framework which envisaged a strong cross-sectoral approach to agriculture policy discourse. The emphasis of PMA was on coordination of cross sectoral activities based on seven identified pillars. Over time, however, its role has evolved to a more agriculture-sector focus. A functional and institutional analysis of the PMA Secretariat was conducted earlier this year by a member of the consultancy team and arising from that exercise it was proposed to rename the institution as the National Agriculture Sector Secretariat (NASSEC).</p>	<p>coordination for implementation of the irrigation scheme.</p>

The Ministry of Gender, Labour and Social Development (MGLSD)	The Mandate of the ministry is to evaluate and Control the Physical, Chemical, Physiological, Social, and Technical factors that affect a person at Work and the Working Environment. The objectives of the MGLSD are to minimize Occupational Accidents, Diseases and Injuries. promote good Health of the Worker at the Workplace promote good Working Conditions, promote construction of Safe and Healthy workplaces, promote awareness of Occupational Safety and Health among Workers, Employers and the General Public through Training. The ministry, through its department of Occupational Health and Safety (OHS) will be responsible for registering the workplace and monitoring of conditions under which employees on the project are subjected.	The OHS Department in this Ministry will be responsible for undertaking inspections of construction sites to ensure safe working conditions.
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Institution	Responsibility/Mandate	Application in ESIA
The Ministry of Health (MoH)	MoH has a mandate of policy formulation and policy dialogue with Health Development Partners, resource mobilization and budgeting, strategic planning, regulation, advising other ministries on health matters, setting standards and quality assurance, capacity development and technical support, provision of nationally coordinated services such as epidemic control, coordination of health research and monitoring and evaluation of the overall sector performance.	Monitoring and evaluation of irrigation activities to ensure zero disease incidences by farmers in coordination with the Ministry of Water and Environment.

<p>District Governments</p>	<p>Local</p> <p>District Water Officers (DWO) in the Local Governments are key stakeholders and are tasked to: Participate actively in the development and implementation of catchment management plans for the river/lake basins; Promote integrated planning in management of land, water, and environmental resources; promote and facilitate the mainstreaming of IWRM into district and town development plans, district environmental action plans, investment plans, and other relevant plans; Carry out monitoring and evaluation of IWRM activities in their respective areas and Raise public awareness within their jurisdictions on water and environmental issues.</p>	<p>Participate in the monitoring and enforcement of the environmental regulations, provision of extension services, mobilization of communities, sensitization and capacity building activities. The District will designate a Project Support Officer (PSO) among its staff, who will support the implementation and technical supervision of the Project, including sensitization of farmers, training, and monitoring and evaluation in the respective local governments. An identified district environment officer will be responsible for ensuring the compliance of all the projects components in line with relevant regulations and conditions during construction and the operation of the irrigaton schemes. The district environment officer will relay environmental and/or social concerns on the project to NEMA for technical guidance. The district officers will report periodically to the MWE/PCU on all issues related to the irrigation scheme activites including environmental and social safeguards.</p>
<p>The Ministry of Finance, Planning and Economic Development (MFPED)</p>	<p>MFPED is the key Ministry for economic development/macroeconomic development and it is responsible for mobilizing and financing investments in water resources development and management. It is responsible for</p>	<p>Ensure that the project is implemented as planned and provide financial support in time for timely</p>

Institution	Responsibility/Mandate	Application in ESIA
	the development of the National Development Plan and Vision 2040.	execution of the project.
The National Planning Authority (NPA)	NPA was established by the NPA Act 15 of 2002. It is mandated to produce comprehensive and integrated development plans for the country elaborated in terms of the perspective vision, and long- and medium-term plans. It is also responsible for overseeing the implementation of the five-year National Development Plan (NDP) and Uganda's new development blueprint dubbed Vision2040. Thus there is need for coordination with NPA to implement the Water Resources Strategy.	Ensure that the project is implemented in line with the NDP and Vision 2040 specifically the requirements for water resources management and strategies.
Contractor(s)	Responsible for construction activities of the irrigation infrastructure.	The Contractor(s) must include in their schedule of works, all proposed mitigation measures. The Contractor(s) must have designated personnel (Supervising Consultants) to monitor environmental, safety and health matters during construction works, and report regularly to MWE. It is recommended that the Supervising Consultant Team include an Environment Management Specialists, who will be responsible for the day-to-day guidance of the project activities on environment and social compliance to the requirements of the Contract and the Bank's policies. Under this arrangement, the Contractor(s) will have the obligation to ensure that the mitigation measures as well as project Conditions of Approvals are included in the Bidding documents. The Bills of Quantities (BoQs) will specify budget needs for the implementation of the mitigation measures in line with the ESIA and the ESMPs for the Project.

4.5 AFRICAN DEVELOPMENT BANK AND ITS RELEVANT POLICIES

The African Development Bank Group (AfDB) policy on environmentally sustainable development in Africa is described in the 2013 Bank Group Policy on the Environment. The policy acknowledges the need to preserve and enhance ecological capital to sustain and enrich economic growth in Africa. The main goals of the new policy are to:

- i. Promote a long-term view and perspective of economic and social development;
- ii. Reverse, where possible, and halt the impoverishment process in Africa by enhancing the access of the poor to environmental resources;
- iii. Help Regional Member Countries to build their human capacity and sensitize policymakers on environmental issues and bring about institutional changes to achieve sustainable development; and,
- iv. Reinforce the existing partnerships with international institutions and network also with regional and sub-regional organizations to coordinate interventions in environmental sustainable development.
- v. Two procedural guidelines central to the new Policy on the Environment were completed in 2004, namely the Strategic Impact Assessment Guidelines (SIA) and the Integrated Environmental and Social Assessment Guidelines (IESA). The SIA is a systematic process of evaluating the environmental consequences of any proposed policy or programme, as well as a tool for assessing social and environmental sustainability of policy-based lending, structural adjustment, and sector investment lending. The IESA Guidelines are designed to ensure the inclusion of environmental and social issues in Bank projects throughout the project cycle. These provide guidelines for sector-specific issues and impacts that should be taken into account during the preparation and assessment phases of a project.
- vi. The companion documents to the IESA Guidelines are the Environmental and Social Assessment Procedures for African Development Bank's Public Sector Operations (2001) of the African Development Bank and the AfDB's Policies on Environment and Involuntary Resettlement (2003). These documents provide the procedural process by which public sector sponsored projects are categorized and assessed.

- vii. AfDB presents its Integrated Safeguards System (ISS) of 2013, a cornerstone of its strategy to promote growth that is socially inclusive and environmentally sustainable. Safeguards are a powerful tool for identifying risks, reducing development costs and improving project sustainability, thus benefiting affected communities and helping to preserve the environment. The ISS builds on the two previous safeguard policies i.e. Involuntary Resettlement (2003) and Environment (2004) and on three cross-cutting policies and strategies: Gender (2001), the Climate Risk Management and Adaptation Strategy (2009) and the Civil Society Engagement Framework (2012). It also builds on the Bank's sector policies: Health (1996), Integrated Water Resources Management (2000), Agriculture and Rural Development (2000, 2010), and Poverty Reduction (2004). It brings these policies and strategies into a consolidated framework that is intended to enhance the effectiveness and relevance of the Bank's work. A summary of safeguard operational policies to be triggered by the project are as described below.

Table 11: AfDB Operational Safeguards

Operational Safeguard (OS)	Trigger	Requirements	Remarks
OS 1: Environmental and Social Assessment	√	This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements: the scope of application; categorization; use of a SESA and ESIA, where appropriate; Environmental and Social Management Plans; climate change vulnerability assessment; public consultation; community impacts; appraisal and treatment of vulnerable groups; and grievance procedures. It updates and consolidates the policy commitments set out in the Bank's policy on the environment.	The developer has undertaken an ESIA given category 1 projects of the AfDB which require a full Environmental and Social Impact Assessment (ESIA), including the preparation of an Environmental and Social Management Plan (ESMP).
OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation	X	In particular, it embraces comprehensive and forward-looking notions of livelihood and assets, accounting for their social, cultural, and economic dimensions. It also adopts a definition of community and common property that emphasizes the need to maintain social cohesion, community structures, and the social inter-linkages that common property provides.	No communities will be affected by the project thus no resettlements or compensations
OS 3: Biodiversity and Ecosystem Services	√	The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. It translates into OS requirements the Bank's Commitments in its policy on integrated water resources management and the UN Convention on Biological Diversity.	Biodiversity surveys were undertaken and an impact assessment has been asseed in the event the project has negative effects on natural environment.
OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency	√	This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed international conventions and comprehensive industryspecific standards that other multilateral development banks follow. It also introduces vulnerability analysis and monitoring of greenhouse gas emissions levels and provides a detailed analysis of the possible reduction or compensatory measures framework.	The developer is required to comply with all national standards especially those on water and soil quality during construction and operation

OS 5: Labour Conditions, Health and Safety	√	This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It covers working conditions, workers' organizations, occupational health and safety, and avoidance of child or forced labour.	The developer will be required to implement this safeguard integrated with the occupational health and safety act of Uganda
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4.5 MULTILATERAL DEVELOPMENT BANK'S SAFEGUARDS

Also take note that the IFC adopted its Performance Standards on Environmental and Social Sustainability in 2006 and revised them in 2011. Since 2006, the IADB, EBRD, EIB and AsDB have all upgraded their safeguard systems, and the World Bank and the Islamic Development Bank have upgraded theirs. In addition, major private banks providing international project finance and bilateral development finance institutions (such as the Dutch FMO or German DEG), with which the Bank often co-finances projects, have adopted the Equator Principles, which are based on the IFC's Performance Standards on Environmental and Social Sustainability. The multilateral development banks' safeguards include the following key common features.

Table 12: Multilateral Development Bank's Safeguards

Area	WB	IFC	EBRD	EIB	IADB	AsDB	AfDB	MFIWGE
Environmental and social assessment(ESA)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Involuntary resettlement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pollution prevention	Yes	Yes	Yes	Yes	Yes	(in ESA)	Yes	Yes
Biodiversity	Yes ^c	Yes	Yes	Yes	Yes	(in ESA)	Yes	Yes ^d
Community impacts	No	Yes	Yes	Yes	No	(in ESA)	(in ESA)	Yes
Labour conditions	No	Yes	Yes	Yes	No	(in ESA)	Yes	Yes
Indigenous peoples	Yes	Yes	Yes	Yes	Yes	Yes	(in ESA)	Yes
Cultural heritage	Yes	Yes	Yes	Yes	Yes	(in ESA)	(in ESA)	No ^e
Environmental flows	Yes ^f	No	No	No	No	No	(in ESA)	Yes

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm
Income Enhancement & Forestry Conservation Project

a As proposed in the ISS. b As contained in the Common Framework for
Environmental and Social Assessment.

c World Bank has safeguards on natural habitats and forests.

d Split into pollution and toxic and hazardous substances.

e Proposes safeguard on vulnerable groups, which includes indigenous peoples. f

Safeguard is on water resource management.

4.6 CONVENTIONS AND PROTOCOLS

Table 13: Conventions and Protocols to which Uganda is a Signatory Relevant to the Project

Conventions and Protocols	Provision
The Treaty for the Establishment of the East African Community 1999	The East African Community (EAC) treaty covers five partner States of Kenya, Uganda and Tanzania, Burundi and Rwanda. One of the objectives of the treaty is promotion of a sustainable growth and equitable development of partner States including rational utilization of the region's natural resources and protection of the environment. The treaty provides that States agree take measures to control trans-boundary water pollution arising from developmental activities adopt common environmental standards for the control of water pollution arising from urban and industrial development activities and exchange information on water and harmonize their policies and regulations for the sustainable and integrated management of shared natural resources and ecosystems. This implies that Uganda as a party state is required to control pollution of shared water resources.
EAC Protocol on Environment and Natural Resources Management 2006	The Protocol is designed to govern the Partner States in their cooperation in the management of environment and natural resources over areas within their jurisdiction including trans-boundary environment and natural resources. For water management, it requires the Partner States to cooperate in the management of shared water resources.
The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal	This was adopted in 1989, came into force in 1992 and Uganda acceded to it on 11th March 1999. The overall goal of the Basel Convention is to protect, by strictly control, human health and the environment against the adverse effects which may result from the generation, trans-boundary movement and management of hazardous and other wastes. The implications of this Convention for control pollution is that Uganda as a party is required ensure that hazardous and other wastes are managed and disposed of in an Environmentally Sound Manner (ESM).

Bamako Convention 1991	The Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement of Hazardous Wastes within Africa was adopted in Bamako, Mali, on 30 January 1991 and came into force on 10 March 1999. The objectives of the Convention are to protect human health and the environment from dangers posed by hazardous wastes by reducing their generation to a minimum in terms of quantity and/or hazard potential. The implications of this Convention for control pollution is that Uganda as a party is required to prohibit dumping of hazardous wastes and take appropriate measures to implement the precautionary principle to pollution prevention through the application of clean production methods, rather than the pursuit of a permissible emissions approach based on assimilative capacity assumptions. These hazardous chemicals can be in form of fertilizers, pesticides, etc
The Stockholm Convention on Persistent Organic Pollutants	The Stockholm Convention was adopted in May 2001 and entered into force in May 2004. It deals specifically with chemical management and in particular with POPs, PCBs and dioxides. The objective of this convention is to protect human health and the environment. Parties are required to take action on an initial group of 12 specified chemicals. The implications of this Convention for control pollution is that Uganda as a party is required to reduce or eliminate release from stockpiles and waste and develop and implement strategies to identify stockpiles and wastes containing POPs and to manage these in an environmentally-sound manner. This is relevant since the operation of the irrigation schemes may demand the use of pesticides, inorganic fertilizers and herbicides.
The Rotterdam Convention (1998)	The Rotterdam Convention on the Prior Informed Consent Procedure (PIC) for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in 1998 in response to gaps within international law related to trade in hazardous chemicals and entered into force in 2004. The implications of this Convention for control pollution is that Uganda as a party is required to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm.
The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972	The main objective of the London Convention is to prevent indiscriminate disposal at sea of wastes that could be liable for creating hazards to human health; harming living resources and marine life; damaging amenities; or interfering with other legitimate uses of the sea. The implications of this Convention for control pollution is that Uganda as a party is required prohibits the marine dumping of certain hazardous materials, requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter.

5. BIOPHYSICAL AND SOCIAL ECONOMIC BASELINE

5.1 PHYSICAL ENVIRONMENT

5.1.1 Topography and Drainage

Nebbi district's topography is characterized by low plains and flat topped hills along the shores of River Nile, standing at 900metres above sea level. The district lies at an average altitude of 1150mm above sea level. River Nile, Wadelai, and Okole swamps provide the main drainage within the district. In general, the project area has a flat topography.

5.1.2 Geology and landform

Geological activities produced a conspicuous morphology in Nebbi and Aruva district. Faulting and rifting along the western arm of the East African rift valley zone extends from Panyimur into Jukia hills in Nebbi Town Council. Up-arching and tilting affected the uplands of Erussi and Goli. As a result, differences in localized diastrophic forces led to a variation in relief with a marked ascend towards the Democratic Republic of Congo. Jonam County has a flat relief. Padyere is a raised plateau and part of Padyere especially Erussi is a highland. Metamorphic rocks are widespread and sedimentary rocks predominate most parts of Jonam County along Lake Albert and Albert Nile basin. Ranitic intrusions are common features in Padyere County.

The geographic and environmental differences noted above have produced different soils. Thus, Jonam is dominated with young and immature lithosols unlike soils in parts of Padyere that are mainly ferallitic soils. Along the slopes and valleys hydromorphic soils exists while vertisols and ferruginous soils of negligible productivity predominate in Jonam. The command area of the irrigation scheme is having sediments, alluvium, black soils, morains, rift valley sediments, undifferentiated gneisses including elements of P(B) and in the north granite facies rocks. See Figure 4 below.

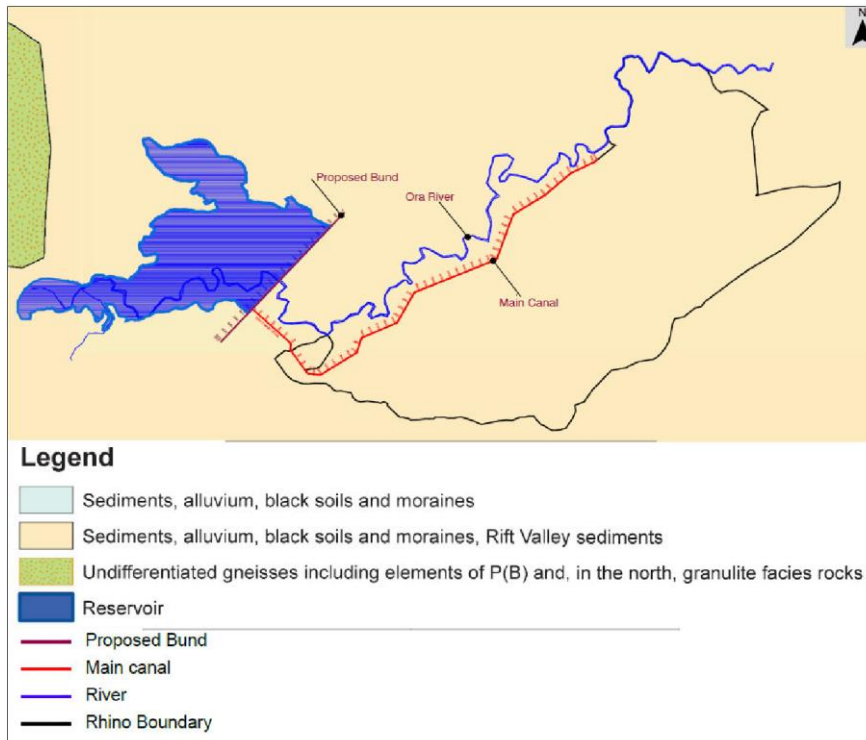


Figure 4: Geology of Command area for Rhino

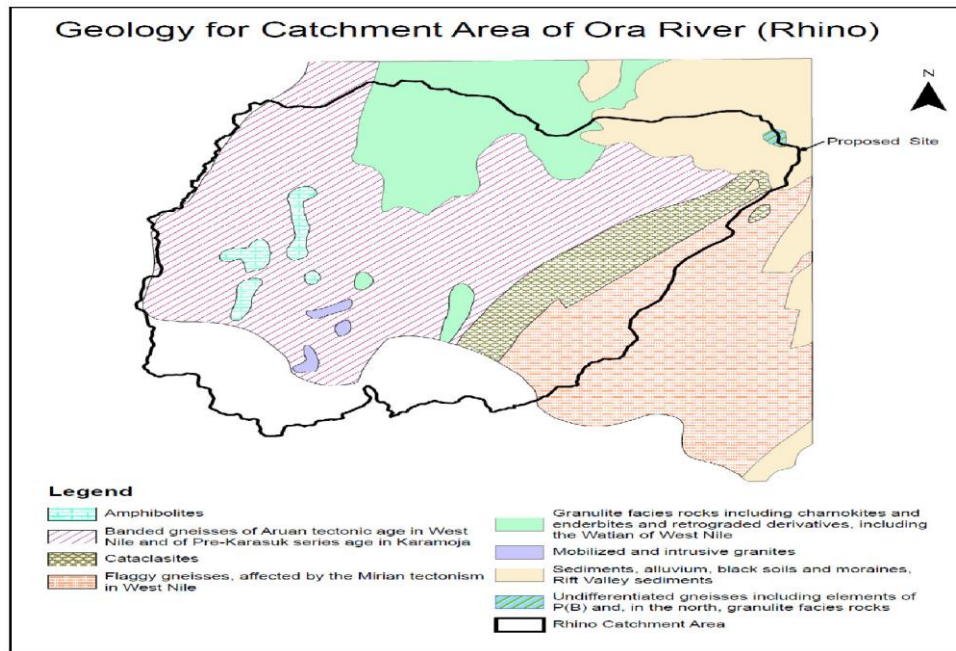


Figure 5: Geology Map for Rhino Camp - Wadelai Command & Catchment area

5.1.3 Soil Physical Characteristics

i. **Effective Rooting Depth**

The effective soil depth of the surveyed area is characterized as moderately deep to very deep. The extensive area is covered by deep rooting depth, more than 100 cm. Hence, the rooting depth is suitable for rice crop and the soil depth will not be a constraint for the present irrigation development project.

ii. **Soil Erosion Hazard**

In the project area, at some places slight soil erosion has been noticed due to intense rainstorm, bush burning, soil type and steep landform.

iii. **Surface Stoniness**

The cover of surface in the proposed command area is having few to none coarse fragments and it may not be a problem for irrigated development particularly rice crop.

iv. **Soil Drainage**

The depth of ground water of the survey area is very deep and the drainage is not a problem in the proposed project area.

v. **Soil Texture**

Soil texture implies a relative proportion of sand, silt and clay in the fine earth fraction (the soil material smaller than 2mm in diameter). It was described by hydrometer method in the laboratory. The particle size analysis using USDA standards showed that the texture of soils in the study area is sandy clay loams. The average value was 71%, the silt content was 14%, and the clay content was 12% (Table 14).

Table 14: Soil textural class of Rhino camp - wadelai soils

Mean	%Sand	%Clay	%Silt	Texture
	71	17	12	SL

On the other hand, the information generated from the maps obtained from National Forest Academy indicate that soils in majority of the command area are dark grey calcareous soils followed by red sandy and sandy loam soils. The soils are grey, skeletal sandy and extensively drained.

The greyish-brown sands over weathered rock, reddish-brown sandy clay loams and shallow skeletal loams often on steep slopes are occupying more than 80% of the catchment area. The dark grey calcareous clays, Red sands and loamy sands and reddish-brown and red sandy clay loams are occupying balance area of the catchment.

vi. **Bulk Density**

Bulk-density of a soil is the weight of a known soil volume compared to the weight of an equal volume of water, or weight per unit volume. To measure bulk density of the soils undisturbed soil samples were taken by using pF core sampling cylinder, were sent to Soil Laboratory. If the value of soil bulk density exceeding than 1.65 g/cm³ is expecting compaction. Concerning the bulk density of the soils of Wadelai irrigation project area is 1.53 g/cm³. Hence, any soil compaction will not be expected.

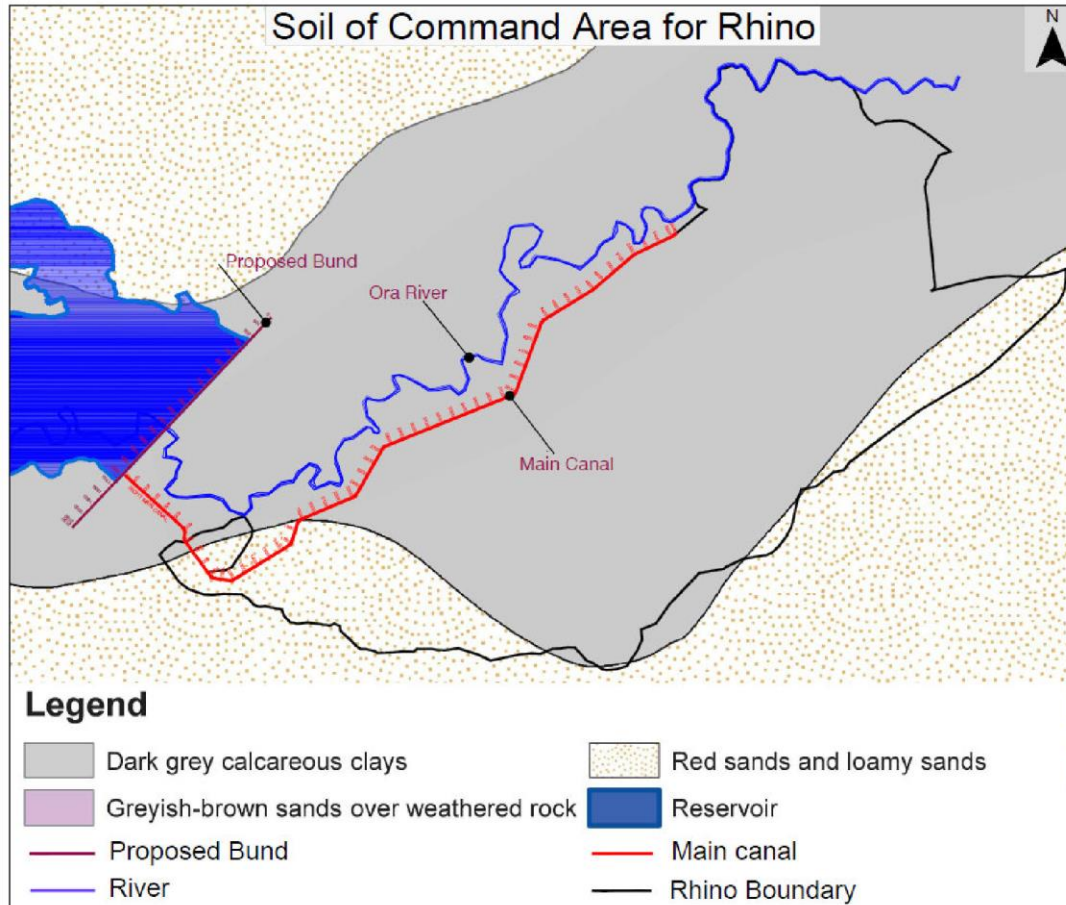


Figure 6: Soil of Command area for Wadelai vii.

Hydraulic Conductivity

Permeability of a soil is the volume of water which will pass through unit cross sectional area of a soil unit time, given a unit difference in water potential. It is expressed in cm h⁻¹ or m day⁻¹. The tests were carried out according to inverse auger hole method, near to representative soil profile. Animals create the presence of cracks and holes or roots influence on permeability. The saturated hydraulic conductivity was 1.67 cm /hr for the study area.

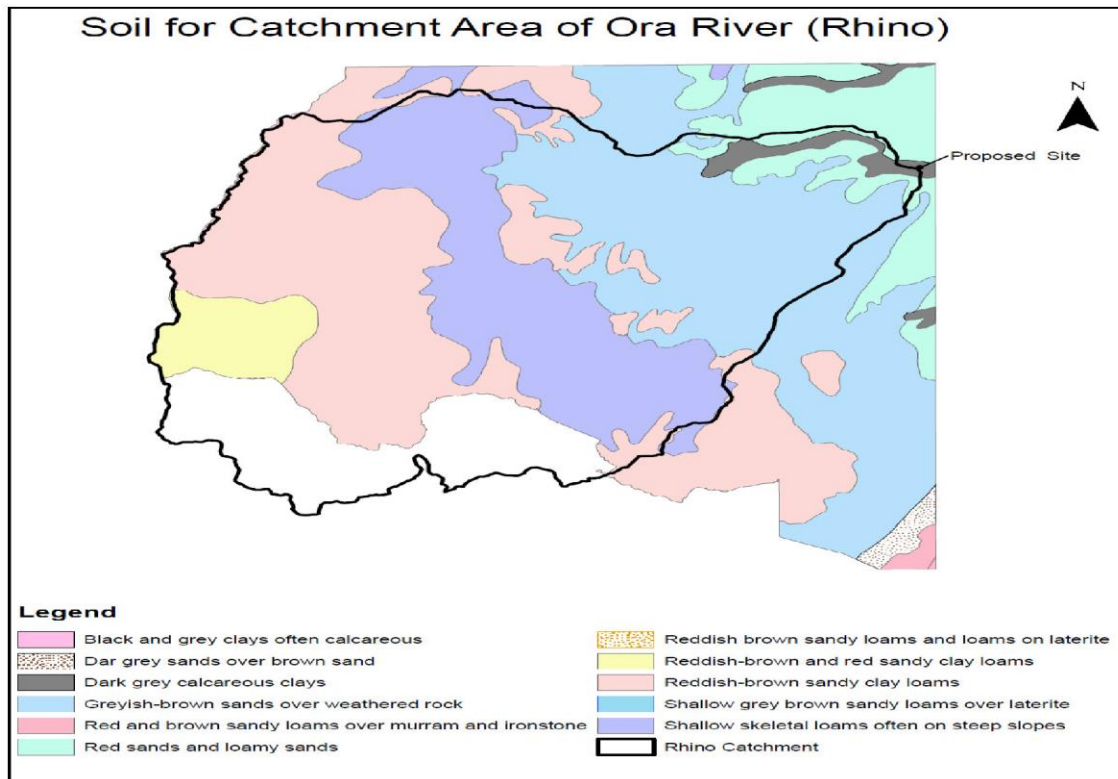


Figure 7: Soil map for Wadelai Command and Catchment area

5.1.4 Chemical Characteristics of Soil

✚ General

Soil chemical properties have a great influence on planning soil and agronomic programs best suited to the proposed irrigation projects, and evaluation and monitoring of the schemes. The soil chemical characteristics of each soil had been analyzed and discussed based on laboratory analytical results of soil samples collected from the field.

✚ Soil Reaction

One of the physiological characteristics of the soil solution is its reaction. The soil reaction is expressed through pH value. The pH value of soil is an important indicator, which describes acidity and alkalinity of the soil and the availability and toxicity of macro and micronutrients. Moreover, it is used to appraise correctable soil deficiencies relating to economic correlation such as lime for acid soil and gypsum for sodic soils. pH value is determined by pH-meter in a 1: 2.5 soil-water suspensions. The reaction of the soils in the present work is slightly acidic and the range of pH value that was 6.0 to 6.2 and the mean was 6.1. However, the acidity of these soils not a constraint for rice crop growth.

✚ Electrical Conductivity (ECe)

The electrical conductivity (ECe) is measured in a saturation of an extract of the soil water suspension using a conductivity meter. The electrical conductivity measurements are used as an indicator of total soluble salts in the soil. If the value of EC is below 2mS/cm then the soils are not saline. Regarding to the studied soil, the range of EC value 132 μScm^{-1} and the soil salinity rated as minimum.

Organic Carbon

Organic carbon contains an acid that can make plant roots more permeable, improving their uptake of water and nutrients, and can dissolve minerals within the soil, leaving them available for plant roots. It also helps make a good environment for all the soil microbes and organisms that work with and enhance a plant's health and growth. And organic matter can improve the texture of all types of soils, from gritty sand to heavy clay. Sequestration of carbon in agricultural soils through appropriate management actions has been recognized as an important tool to mitigate climate change. Carbon is the main element present in soil organic matter, on average making up 58% by weight. Organic carbon is the principal storehouse for nutrient influencing soil structure and biological activity. It has been determined by using Walkly and Black method in the laboratory and has been expressed in percentage (%). The critical level of organic carbon is 1.2%. The rate of organic matter content of the soil varied from 0.88 to 2.06% and an average value of 1.47 % in the top soil indicating that the level of organic carbon is high .

Total Nitrogen

Nitrogen is an essential nutrient element, which highly influences the plant growth. It is a constituent of chlorophyll, plant proteins and nucleic acid. The total nitrogen content of the project area has been determined by using Kjeldahi method in the laboratory. The threshold value of TN is 0.125%. The total nitrogen status of Rhino camp - Wadelai irrigation scheme soils is high, which ranged from 0.01 to 0.15 % with an average of 0.08%.

Available Phosphorus

Available phosphorus is the amount of phosphorus readily available for absorption by plant roots. Three different phosphorus ions are formed by ionization of one, two, or all of the three hydrogen from phosphoric acid (H_2PO_4) to form HPO_2^- . The predominance of one or another of or PO_4 is the one most readily absorbed by the concentration of the HPO_4 ion increases at high pH value because it becomes the dominant ion in solution above pH 7.2 The PO_4^{3-} ion occurs at pH value too high for it to be significant in plant nutrition.

The overall available phosphorus content of the soil of the study ranged from 13.5 to 16.9 ppm with an average value of 15.2 ppm, which indicates that P content is high.

Cation Exchange Capacity (CEC)

Cation Exchange Capacity (CEC) is the ability of the soil to hold onto nutrients and prevent them from leaching beyond the roots. The more cation exchange capacity a soil has, the more likely the soil will have a higher fertility level. When combined with other measures of soil fertility, CEC is a good indicator of soil quality and productivity. The cation exchange capacity of a soil is simply a measure of the quantity of sites on soil surfaces that can retain positively charged ions by electrostatic forces. Cations retained electrostatically are easily exchangeable with other cations in the soil solution and are thus readily available for plant uptake. Thus, CEC is important for maintaining adequate quantities of plant available

calcium (Ca⁺⁺), magnesium (Mg⁺⁺) and potassium (K⁺) in soils. The CEC value is obtained by using ammonium acetate method at pH value 7 and is expressed in milli equivalents per 100 grams (meq/100g) of soil. CEC values that fall below 15 meq/ 100g are low; poor in organic matter may have high leaching problems because of poor capacity to retain cations, and they may require careful management of the fertilization process. The CEC value between 15 and 25 meq/100g soil considered as medium level and the value ranges from 25 to 40 meq/100 g soil categorized as high level.

The range of CEC values for upper horizon 22 meq/ 100 g soil. Therefore, the CEC value of the studied area falls into medium level, which means that the mineral soils have a good plant nutrient storage and water holding capacity. The CEC can also prevent the soil nutrient from leaching beyond the roots.

✚ Exchangeable cations

The level of the exchangeable cations in soil indicates the existing nutrient status and can be used to assess balance among the cations. Many effects on soil structure and nutrient uptake by crops are influenced by the relative concentration of cations as well as by their absolute levels. Sodium, potassium and calcium ions were determined by flame emission spectrophotometer, while magnesium ions were measured by calorimetricates.

Table 15: The exchangeable cations of Rhino camp - Wadelai soils

K	Na	Ca	Mg
Cmoles/kg of soil			
0.77	0.08	5.6	6.10
0.27	0.05	4.5	4.10

✚ Exchangeable Sodium

The value of exchangeable sodium content from 0.05 to 0.08cmol/kg soil and in general rated as low.

✚ Exchangeable Potassium

Potassium has a counter balancing effect on the result of nitrogen excess. It enhances the synthesis and translocation of carbohydrates, thereby encouraging cell wall thickness and stalk strength. The overall content of potassium considers as very high category, which ranged from 0.27 to 0.77 cmol/kg soil.

✚ Exchangeable Calcium (Ca²⁺)

Calcium is an essential element for the growth and functioning of root tips. It helps movement of carbohydrates from one part of the plant to the other and for helping to regulate sap acidity. The exchangeable calcium of the soils ranged from 4.5 to 5.6 cmol/kg soil.

✚ Exchangeable Magnesium (Mg²⁺)

The exchangeable calcium of the soils ranged from 4.10 to 6.10 cmol/kg soil.

5.2 BIOLOGICAL ENVIRONMENT

5.2.1 Overview to Biodiversity Studies

Oraa River ecosystem in which the proposed irrigation project area lies is within a flat terrain, at geographical location 36N0437688; 0266855 with largely savannah vegetation. Both the terrestrial and aquatic ecosystems, harbor biological life whose diversity and richness is vital to investigate to ascertain the flora and fauna that are present and evaluate their conservation value, prior to the implementation of the project. To this effect a comprehensive study was conducted to generate an overview on the biodiversity status with focus on avifauna, mammals and herpetiles, aquatic fauna and plant species within the project boundaries

5.2.2 Vegetation

The purpose was to contribute vegetation/ flora inputs into the ESIA for informed decision-making by taking into consideration the possible environmental, biodiversity impacts due to the proposed project developments.

Plants are used as a bench mark for monitoring changes/ modifications in ecosystems (Tushabe et al., 2006), since animals all depend, directly or indirectly on plants. Species diversity has greatly changed in many areas, mainly because of alterations in the environment, for which some are naturally influenced while others are triggered by developmental activities. Principle threats to biodiversity in Uganda continue to exist, including habitat loss, modification and alteration along with unsustainable harvesting, pollution and introduction of alien species (NEMA 2006/7).

The assessments aimed at identifying potential impacts to vegetation & flora and propose mitigation measures, and also lead to the development of an Environmental Management & Monitoring Plan to guide project implementation.

The map below (Fig 8) shows the vegetation and land use, within the project area and areas that are considered to be ecologically sensitivity.

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

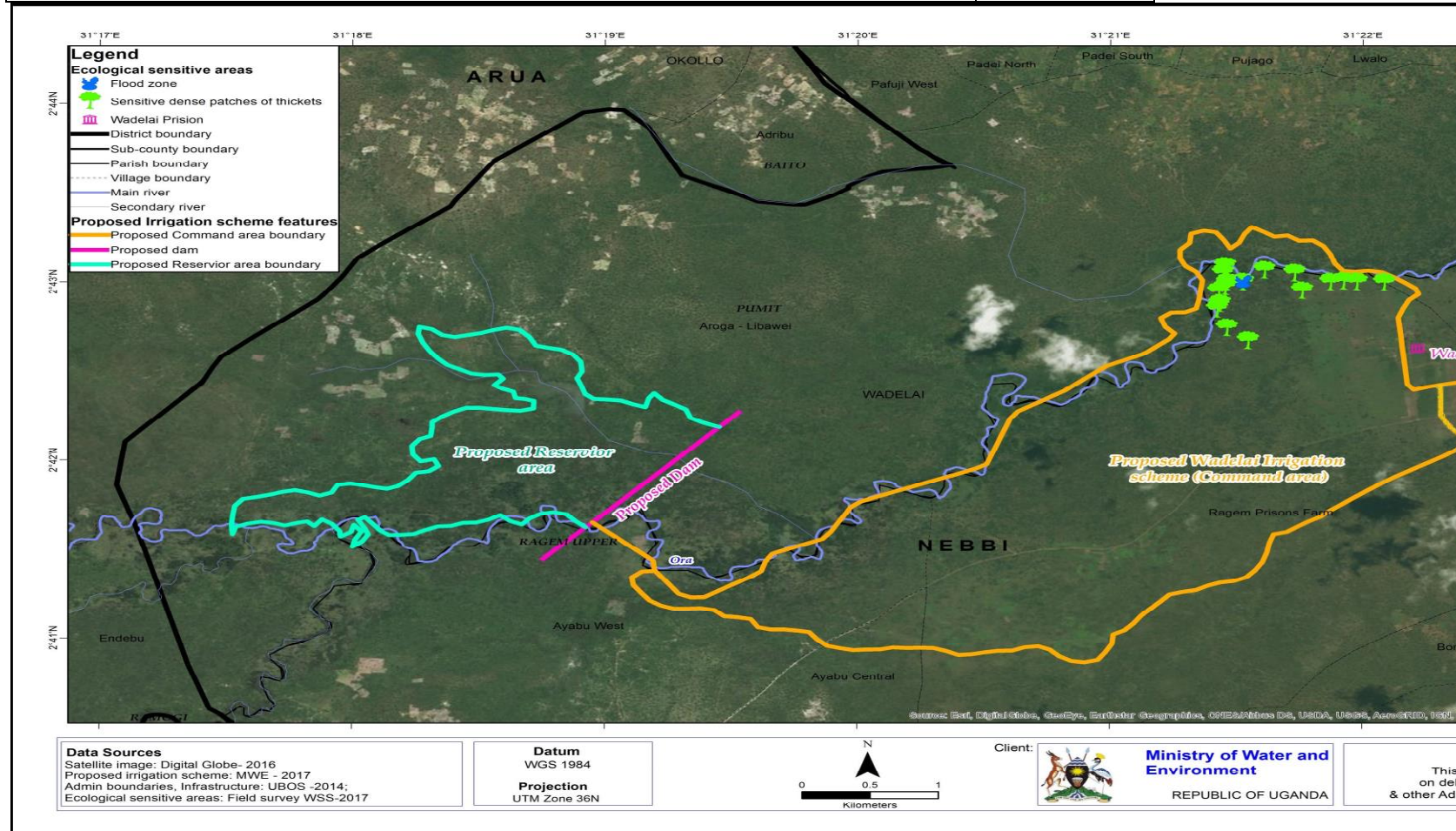


Figure 8: Ecologically Sensitive Areas around the proposed Wadelai Irrigation Scheme

Species Diversity and Richness

A total of 138 species were recorded from 52 families and 100 genera (Annex 1). Among all the species recorded shrubs species were the highest in plant life forms, with a representation of 55 species, followed by trees (38 species), then herbs (23 species) and climbers 15 species, while Grasses constituted of 07 species (Fig 8). The woody species altogether contributed 67.4 % by species richness as compared to 32.6% of the non-woody species. The woody species constituted of small trees and shrubs while the non-woody species were composed of herbs and grasses.

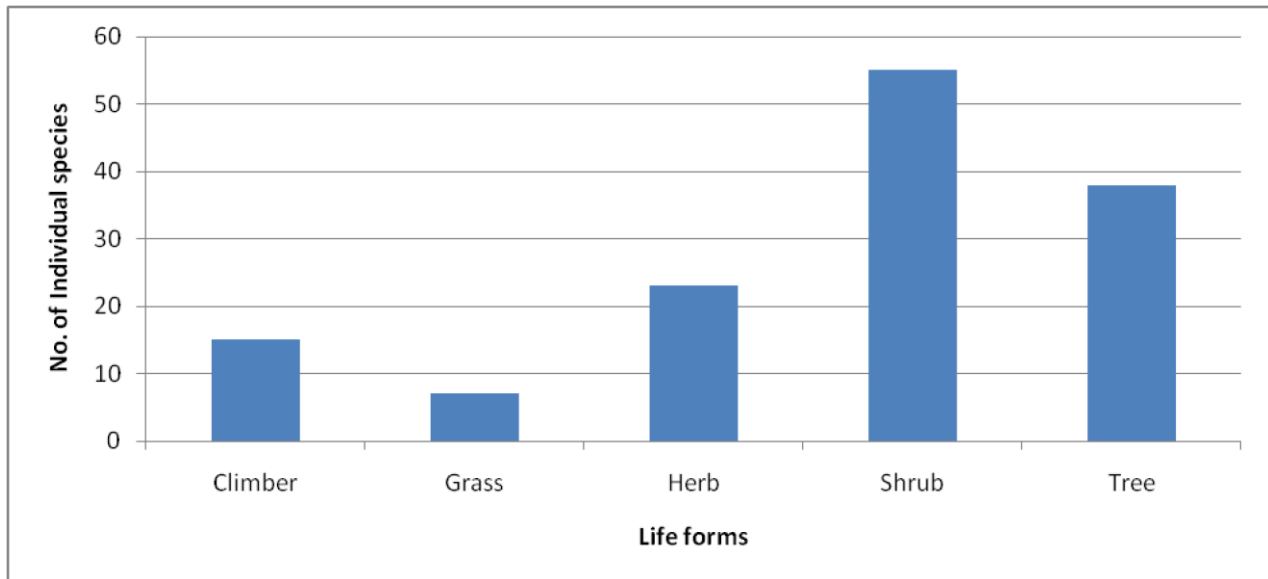


Figure 9: Plant life form distribution within the project area

The project area had a fairly good representation in species diversity and richness that was attributed to relatively varied forms in habitat heterogeneity. Habitat classifications included the expansive riverine vegetation that constituted of the forested and thicketed vegetation, Open-Dense bushy vegetation, and distinctive scrublands. However there were observed threats that negatively impact on biodiversity within the project area, and these are described below.

Livestock grazing and charcoal burning exert pressures on the habitats causing degradations and rendering sections of the project area to be of low biodiversity value.

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

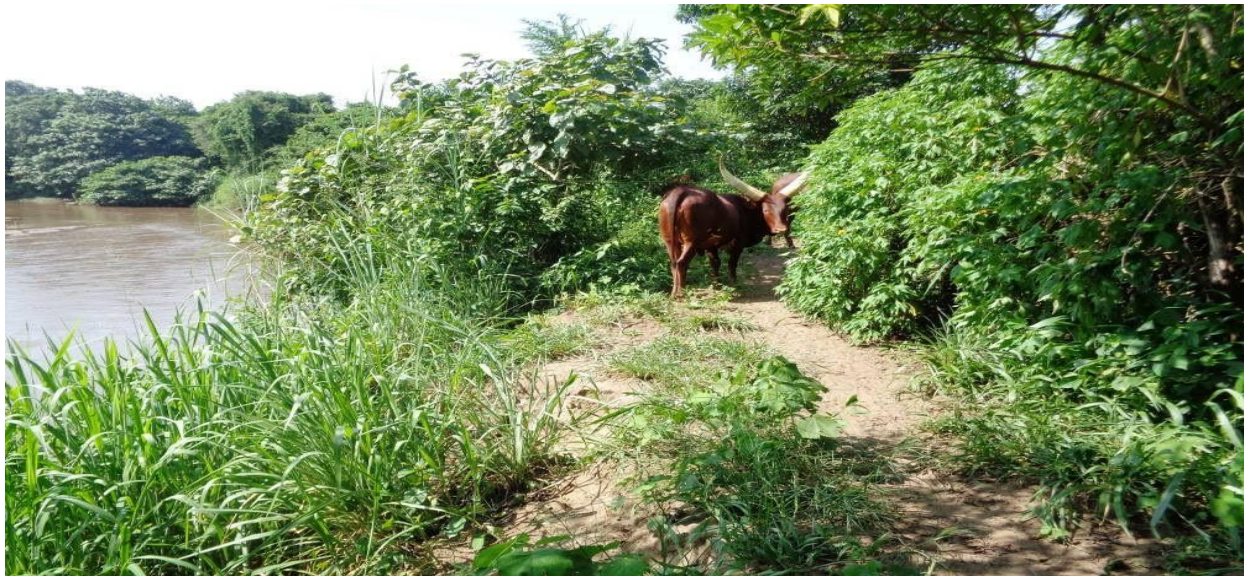


Plate 1: Livestock grazing and charcoal burning were mostly observed within the command and reservoir areas.

The Acacia dominated woodlands appeared degraded and in a regenerating mode, with just a handful of mature trees left.

Seasonal fires; fire is a limiting factor to natural plant regeneration processes-permitting a few plant species that are fire tolerant to co-exist.



Plate 2: Bush burning in the project area

Fire severely damages seeds and vegetative parts of certain plants impairing their ability to reproduce and manifest into new plants (while is some few plants, fire is instead a stimulant to the reproductive processes, particularly in the breaking of seed dormancy).

Land use change and habitat modifications to support agriculture i.e. cultivation of crops on commercial and subsistence scales also encroaches on biodiversity habitats and its subsequent impacts on conservation. These are activities are already exhibited in the habitat descriptions above. Also livestock kraals exist within the project command areas at 315216/ 297973 and at 316346/ 301508 (UTM) in the vicinity of the dam area



Plate 3: Kraals within the project command area

✚ Main Vegetation/ habitat descriptions in the project area

Wadelai ecosystem is characterized of; The Riverine vegetation that constitutes of forested and scrubland vegetation. The forested vegetation was largely *Acacia* spp dominated with other variable tree species that included; *Tamarindus indica*, *Balanites aegyptiaca*, *Albizia* spp, *Combretum* spp, *Ficus* spp, *Celtis durandii*, *Trichilia* sp, *Crateva adansoniana*, *Terminalia brownii*, *Piliostigma thonningii*, *Grewia similis*, *Antiaris toxicaria*, *Bridelia scleroneura*, *Blighia unijugata* and *Kigelia africana*. While the scrubland that comprised of *Scutia myrtina*, *Rhus natalensis*, *Ziziphus pubescens*, *Monathotaxis buchananii*, *Harrisonia abyssinica*, *Combretum aculeatum*, *Flueggea virosa*, *Grewia mollis* *Acalypha* spp, *Cadaba farinosa*, *Allophylus africana*, *Capparis* spp among others, formed open to dense

thickets along the river banks, to blend with the riverine forest. Both the forest and scrubland had variable herbaceous-weedy species that enhanced dense vegetation coverages in the understory, with common species being *Asystasia gagentica*, *Panicum spp*, *Hibiscus ovalifolius*, *Senna hirsuta*, *Abutilon mauritianum*, *Hoslundia opposita*, *Cyanthula sp*, *Sida spp*, *Tithonia diversifolia*, *Triumfetta spp*, *Jasminium spp*, *Setaria poiretia* among others.

Other vegetation types were the bushy vegetation dominated by *Panicum-Setaria-Sprobolus* with several variable herbaceous-weedy species and the *Acacia* dominated woodlands and farmlands as per the table of habitat illustrations below.

Table 16: Distribution of Vegetation/ Habitat types within Project Components

Project Component	Vegetation/ Habitat types
Water Spread Reservoir	

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project



Dam area





Riverine vegetation in Ayabo East village



Scrubland vegetation a distance away from the river bank in Ayabo East village



Riverine vegetation in Aroga village



Scrubland vegetation a distance away from the river bank in Aroga village

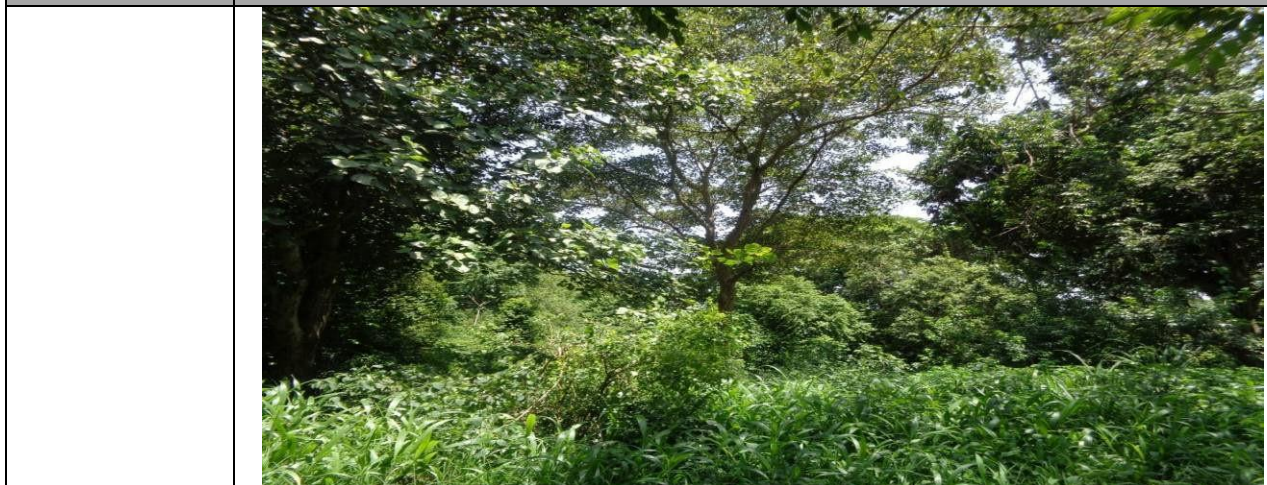
Project command area: along the river





Vegetation in the far ends away from the river:

Riverine forest within 200-300 metres width on the right canal in the command area along 1 to 3 Km downstream of the dam



Riverine forest with understory growths of bushy vegetation



Acacia spp riverine forest with understory growths of bushy vegetation
Habitats illustrations within 1 & 2 Km range away from the river on the right canal



Acacia spp dominated woodlands with variable thickets



Acacia spp dominated woodlands with variable thickets



Subsistence farmlands surrounded by degraded Acacia woodlands



Acacia spp dominated woodlands with variable thickets

Habitat illustrations within the command area downstream of the dam covering 3-5 km stretch

Right canal

Left canal





Sections of the Prison Farmlands (on the right canal), within the command area

✚ Species of conservation concern

With regard to biodiversity /genetic loss, the project area does not have species of conservation concern both regionally and nationally, as well as internationally as per the IUCN red list (IUCN, 2016). It is only *Albizia coriaria* and *Tamarindus indica* that is listed on National Forestry Authority's list of reserved species. These do not have a restricted habitat range, but it is critical that their habitats are protected. Otherwise all plant species recorded within the project area are widely distributed in the country.

✚ Invasive Plant Species recorded

There was only one invasive plant species of *Mimosa pigra* within the project area. *Mimosa* reproduces via buoyant seed pods that can be spread long distances in flood waters. *Mimosa pigra* has the potential to spread through natural grassland floodplain ecosystems and pastures, converting them into unproductive scrublands which are only able to sustain lower levels of biodiversity (<http://www.issg.org>). *Mimosa* is more likely to colonize and eventually cause problems in disturbed areas, due to the ability of the seeds to establish rapidly on bare soils, which lack competitive pressures imposed by other seedlings (Lonsdale and Braithwaite et al. 1989)

The spread of invasive plants is often triggered by disturbances in the ecological systems. Invasive plants are potential threats to conservation, and may cause economic or environmental damage (NARO, 2007). They displace native species through aggressive and altered recruitments in natural ecosystems. Therefore their management is critical. The International Finance Corporation (IFC, 2012) Performance Standard 6; on biodiversity conservation and sustainable management of living resources, provides that any project that wishes to be in compliance with the provisions therein in the standard, endeavors to address concerns related to invasive aliens.

5.2.3 Avian Fauna

✚ Conservation value of birds

Species of conservation concern were assessed/ identified based on habitat use/ dependance and whether they are listed on the IUCN RedList Species. The assessment indicates eighteen species of birds, with only one species recorded to be of conservation significance. Habitat ranges for the birds were classified into riverine, open woodland, plantation forest, scrubland, wooded grassland, farmland and bushy savannah. Riverine had the highest number of bird species, followed by plantation forest and wooded grassland yet bushy savannah had the least number of birds. See (Table 17) below for the list of bird species recorded.

Table 17: Bird Species within the project area

Scientific name	Common name	Species occurrence in habitats					Conservation status	
		R	Pf	S	f	wg		S
<i>Balearica regulorum</i>	Grey crowned crane	x	-	-	-	-	-	EN (IUCN, 2015)
<i>Alcedo cristata</i>	Malachite kingfisher	x	-	-	-	-	-	LC
<i>Alseonax adustus</i>	Dusky flycatcher	x	x	x	-	x	-	LC
<i>Andropadus tephrolaemus</i>	Yellow-vented bulbul	x	x	x	x	x	-	LC

Apalis jacksoni	Black throated apalis	x	x	-	-	-	-	LC
Aplopelia larvata	Lemon dove	x	x	x	x	x	x	LC
Apus affinis	Little swift	-	-	x	-	x	-	LC
Apus caffer	White rumped swift	-	-	x	-	x	-	LC
Centropus superciliosus	White -browed coucal	x	-	x	-	x	-	LC
Corythaxiodes leucogaster	White-bellied Goaway-bird	x	x	-	-	x	-	LC
Guttera edouardi	Crested guineafowl	-	x	-	x	x	x	LC
Indicator indicator	Greater honey-guide	x	x	-	x	-	-	LC
linurgus oiraceus	Oriole finch	x	-	x	-	-	-	LC
Nectarinia hunteri	Hunter's sunbird	X	x	-	x	x	-	LC
Oriolus larvatus	Black headed oriole	-	x	-	-	x	-	LC
Pluvianus aegyptius	Egyptian plover	x	x	-	-	-	-	LC
Pogoniulus pusillus	Moustached green tinkerbird	x	x	-	-	-	-	LC
Rhodopheneus cruentus	Rosy-patched shrike	-	x	-	-	x	-	LC

R- Riverine forest; pf- Plantation forest; Sc- Scrubland; f- Fallow land; Wg- Wooded grassland; S- Savannah; X= present, -= absent in the habitat; LC- Least concern; EN- Endangered

The proposed project area had a fairly rich avian species. But only one species was of conservation concern namely; *Balearica regulorum* found at geographical coordinates 36N 0300409, 0317472(UTM). It is categorized as endangered according to IUCN RedList (IUCN, 2015, BirdLife International, 2013). This implies that the species population is under decline for various reasons, some of which may be attributed to the already evident destructions of habitat as a result of farming, land reclamation and hunting. The rest of the bird species were cosmopolitan-with a wide range of geographical habitat across the Country.

There is a likelihood of damage to the habitats and the associated species following project implementation, but the impacts will be of low magnitude. Hence it is important that mitigation measures as recommended are adopted. In the case of *Balearica regulorum* whose population is not only endangered locally but both at national and international levels, effective measures must be taken to protect the species and enhance habitat conditions to foster its survival and replication processes.

5.2.4 Mammalian Fauna

The survey revealed twelve species of mammals, four of which were primates, one antelope, five rodent species, one hippopotamus and a wild pig (Table 18). The primates were the most common species of mammals. Among the records were the *Hippopotamus amphibius*, whose conservation status is red listed as Vulnerable (IUCN, 2016). The presence of Hippos, was captured from local consultations. The locals mentioned that occasionally some Hippos would range within river. This could be true, owing to the fact that River Oraa has connectivity with Nile, where Hippos are known to occur. The mammal species

were recorded in different habitats namely; riverine forest, plantation forest, scrubland, farm land, wooded grassland, bushy savannah

Table 18: Mammal species within the project area

Species	Common name	Species occurrence in habitats						Conservation status
		R	Pf	Sc	f	w	S	
Hippopotamus amphibius	Common hippopotamus	x	-	-	-	x	-	VU
Cercopithecus ascanius	Red tailed monkey	x	-	-	-	-	-	LC
Chlorocebus pygerythrus	Vervet monkey	x	-	-	-	-	-	LC
Colobus quereza	Black and white colobus monkey	x	x	-	-	-	-	LC
Felis silvestris	Wildcats	x	x	x	x		X	LC
Papio anubis	Olive baboon	x	x	-	-	-	-	LC
Leporidae lepus	Wild rabbits	x	x	x	x	-	X	LC
Arvicanthis niloticus	Nile grass rat	-		x	x	-	x	LC
Paraxerus cepapi	African bush squirrel	-	-	x	x	-	x	LC
Sus scrofa	Wild pig	x	-	x	x	x	x	LC
Kobus kob thomasi	Uganda kob	-	-	x	x	-	x	LC
Rattus rattus	Black rat	-	-	x	x	x	-	LC

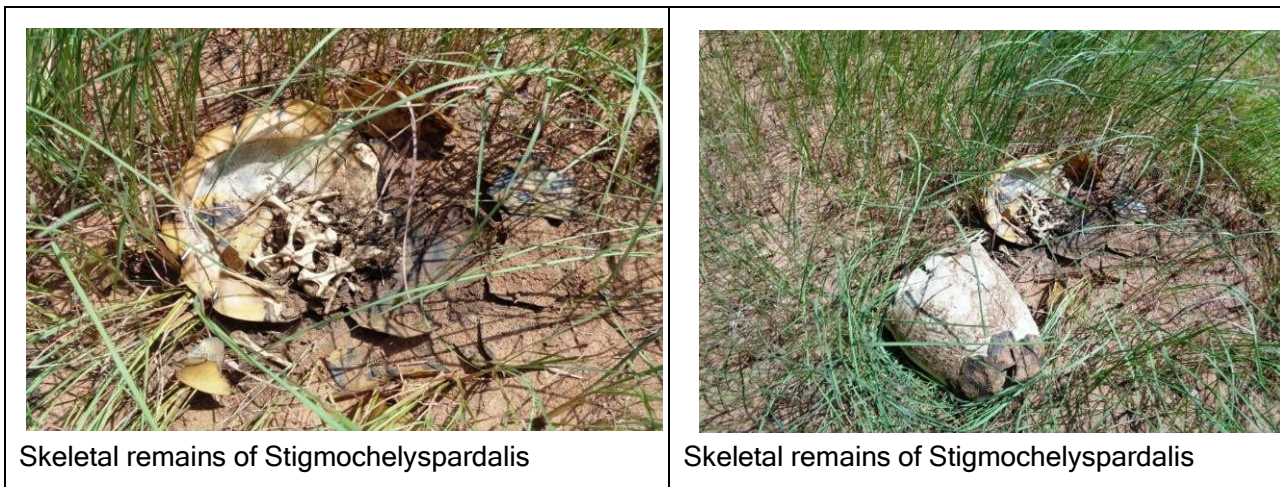
R- Riverine forest; pf- Plantation forest; Sc- Scrubland; f- Fallow land; Wg- Wooded grassland; S- Savannah; LC- Least concern (according to IUCN RedList of Threatened Species)
X = observed, - = not observed; LC- Less concern; VU- Vulnerable

All mammals recorded in the project area are widely spread and are of least concern according to IUCN RedList of Threatened species (IUCN, 2015; Bennun et al., 2004), except for Hippopotamus amphibius which has restricted habitat range (both in water and on land). This animal is categorized as vulnerable by (IUCN, 2015). Its population is drastically declining with the resulting habitat loss world-wide. Lewison (2008) attributed habitat loss to increased agriculture and large scale developments like irrigation. Bennun et al., 2004 also reported that the increasing threats on fresh water put the animal on threats of extinction. Monkeys also had restricted range as almost all monkey species were found within riverine forest. Studies conducted by Kingdon (2008) and Olupot (2010) show that, white and black colobus monkey, vervet monkeys have a preference of dense canopies, though sometimes are sighted occupying the edge of forests and along the road sides. Olive baboons had a general distribution as they were found evenly outside the forest and along the road, and have a wide range of habitat tolerance (Kingdon, 2008). Olive baboons preferred disturbed riverine vegetation and alongside road paths. Previous studies by (Laurance et al., 2006; Goldsmith, 2006 and Olupot, 2010) cited that baboons prefer roads and foot paths although they may be found deep inside the forests with poor undergrowth. Other animals such as Uganda kob and rodent species had low abundances and were observed in open grassland and fallow land respectively.

Mammals are being threatened by some human activities such as bush burning, farming, charcoal burning, cattle grazing and brick making which all have great damage on the habitat through destruction of vegetation cover that act as foraging and breeding grounds. It was also reported by the locals that there are communal hunting activities organized in the Wadelai area every year. The activity involves hunting of delicious game for meat during dry seasons. The activities follow burning of a vast area of land to enable the hunting, which has negatively impacted on fauna diversity, their distribution and abundance in the area.

5.2.5 Hepetofauna

Eight reptile species were recorded; *Crocodylus niloticus*, *Amblyodipsas polylepis* Hildebrand, *Leptotyphlops bicolor*, *Psammophis phillipsi*, *Varanus niloticus*, *Python sebae natalensis*, *Caucus maculate* and *Grayia ornata*. While amphibians *Bufo regularis* and *Ptychadena achietae* were the only species found. Some of the skeletal remains of *Stigmochelyspardalis* found along the river bank.



The low abundances in herptiles could be attributed to seasonality since it was hot at the time of surveys yet most areas had been burnt. Refer to Table 17 for the reptiles recorded within the project area.

Table 19: Reptile species within the project area

Scientific name	Common name	Species occurrence in habitats						Conservation status
		R	Pf	Sc	f	wg	S	
<i>Crocodylus niloticus</i>	Nile crocodile	x	-	-	-	-	-	LC
<i>Amblyodipsas polylepis</i> hildebrand	**snake**	x	-	-	x	-	x	LC
<i>Psammophis phillipsi</i>	**snake**	x	-	-	-	x	x	LC
<i>Varanus niloticus</i>	Nile monitor lizard	x	x	-	-	x	-	LC
<i>Typhlops sp.</i>	Blind snake	x	-	x	-		-	LC

Stigmochelys pardalis	Leopard tortoise	x	-	-	-	-	x	LC
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b- Bushy vegetation; s- Scrubland; fp- flood plains

LC- Least Concern according to IUCN RedList of Threatened species; X = observed, - = not observed

None of the herptiles recorded within the project area was found to be of conservation significance

The fallow land and riverine habitats consisted of the majority of reptile species. But none of the species was of conservation value locally, or nationally though this is still a challenge since herptiles are least studied in Uganda. At a global level (IUCN, 2015), still none of the species is referenced in the redlist category. A number of reptiles especially ghekos and skinks were observed in refugia like logs of trees and rocks and very few reptiles were found in the flood plains. Therefore in terms of habitat value visa-viz biodiversity richness, Wadelai project area was considered of very low conservation significance.

Amphibians inhabited bush land and scrubland at riverbanks and marshy habitats. Lamotte (1992) suggested that areas with both a high diversity and abundance of amphibians are moist areas. Existence of amphibians in these areas is threatened by the severe drought prevalent in the region. This was demonstrated by the vegetation scorched by the sun, which under ideal conditions forms shade or suitable niches for the species. This of course affects the breeding of amphibians and their possibilities to camouflage from predators. Overgrazing by cattle causes trampling of vegetation especially at the banks where amphibians live and breed. This may not only impact on the breeding grounds but may cause loss of tadpoles and eggs. Therefore development of an irrigation scheme will in addition to the existing threats to biodiversity species as highlighted in this report, compromise the survival of herptiles by impacting on them negatively.

5.2.6 Aquatic Fauna

This assessment specifically aimed at the following activities:

- Generate baseline data on aquatic biodiversity within the project area;
- Assess the potential impacts of the proposed project on the aquatic biodiversity
- Formulate appropriate counter-measures against potential impacts to minimize possible negative impacts on aquatic biodiversity due to project activities

i. Fish

One fish species, *Bagrus docmac*, was caught at different sites (Table 20) within the project area along river Oraa.

Table 20: Distribution of fish species within the project area

Species name	Sampling sites					Consevation status by IUCN, 2015
	1	2	3	4	5	
<i>Bagrus docmac</i>	√	√	X	X	√	Least Concern



The identified fish species (*Bagrus docmac*) was moderately distributed within the project area with no major threats impacting on its population. Thus, it is of no much conservation concern within the project area. Azeroual et al. (2010) also report that this fish species have a wide distribution with no known major threats impacting on all parts of its population. As such, it is currently listed as a species of least conservation concern by the IUCN red list (Azeroual et al., 2010). According to IUCN (2015), threats to this fish species include fishing with small meshed nets, silting and destruction of spawning/nursery grounds, loss of marginal vegetation around lakes and rivers. This means that the proposed project needs to be implemented following appropriate practices to avoid emanation of the aforementioned threats to the identified fish species. Aquatic organisms (i.e. algae, zooplanktons, macro-invertebrates and fish) play a significant role in indicating water quality due to their sensitivity to different levels of disturbances. Thus, aquatic biodiversity assessments are important in environmental assessments because of their interrelatedness in support of the functioning of ecological systems and help in understanding the mechanisms and effects of environmental disturbances (McGill et al., 2007; Tokeshi and Arakaki, 2007; Moraet al., 2008). Therefore it was important to determine baselines of aquatic biodiversity in the project area to generate data for decision making processes with an aim of maintaining stable ecosystem functioning.

ii. Phytoplanktons

Two major taxonomic groups namely; Blue-green (Figure 10) and Green algae (Figure 11) constituted the algal community within the project area along river Ora. Green algae dominated the species richness and abundance compared to the Blue Green algae at all the sites sampled. Widely recorded genera were *Oscillatoria*, *Tolypothrix*, *Microcystis* and *Anabaena* among the Blue-greens algae while *Spirogyra*, *Desmidium* and *Zygnema* dominated the green algae.

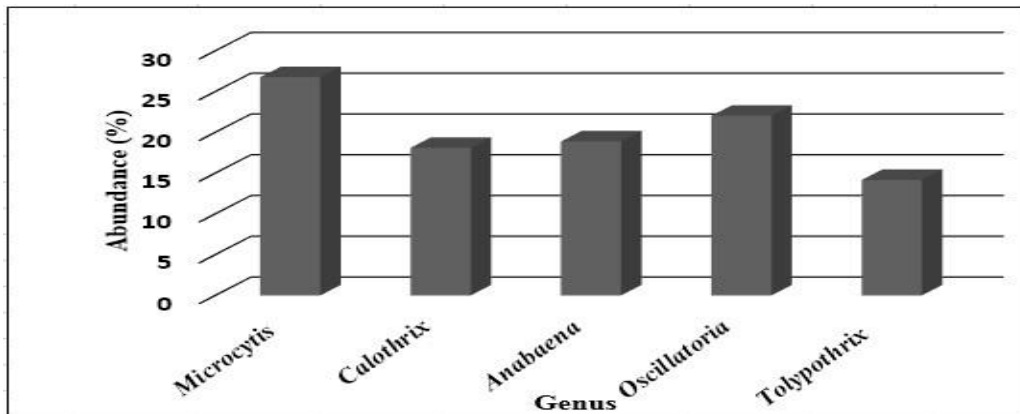


Figure 10: Relative abundance of blue-green algae within the project area along River Oraa

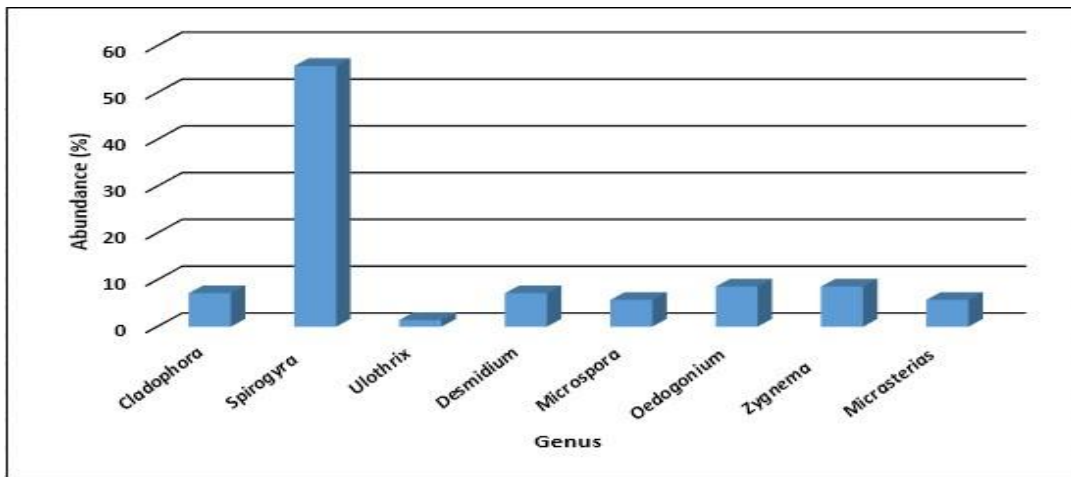


Figure 11: Relative abundance of green algae within the project area along river Oraa

The dominance of green algae compared to blue green algae indicates that water within the project area along the stretch of river Ora is not eutrophic requiring that the proposed project be implemented following appropriate practices minimizing pollution to the adjacent aquatic ecosystem. Algae are the base of most aquatic food chains, and are reported vital in biogeochemical cycling in aquatic ecosystems (Minshall, 1978; Wetzel, 1983; Lamberti, 1996) hence a need to maintain them within ranges essential for maintaining the ecological integrity of the riverine ecosystems.

iii. Zooplanktons

Seven Rotifers namely; Branchionus angularis, Euclanis, Keratella, Proales, Lecane bulla, and Trichocerca were recorded within the project area along river Ora (Figure 9). Two crustaceans ie Cyclops and Bosmina were also recorded from samples collected within the project area (Figure 10). The keystone species were Branchionus angularis, Euclanis, Ascomorpha, Cyclops and Trichocerca recorded in all samples collected.

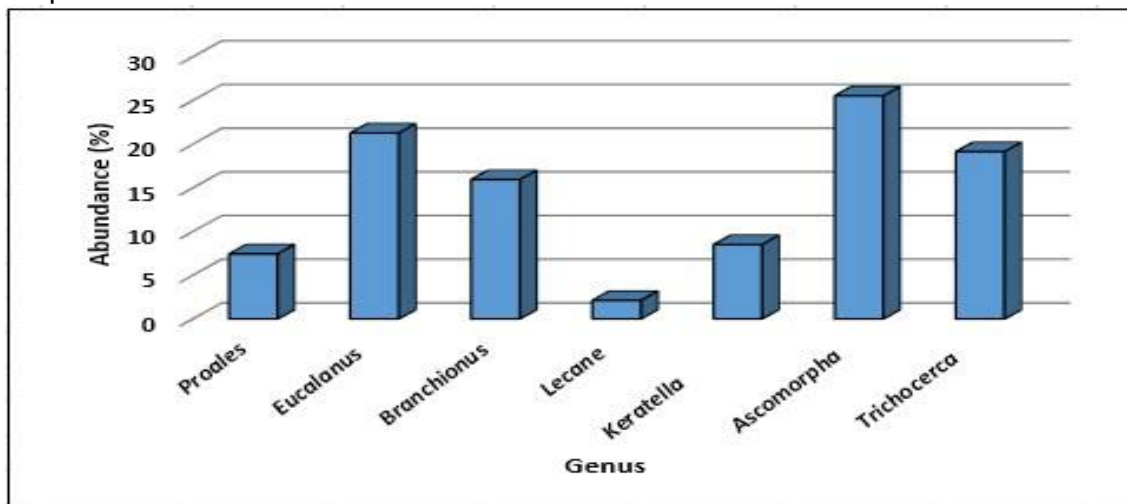


Figure 12: Relative abundance of rotifers in the project area along river Oraa.

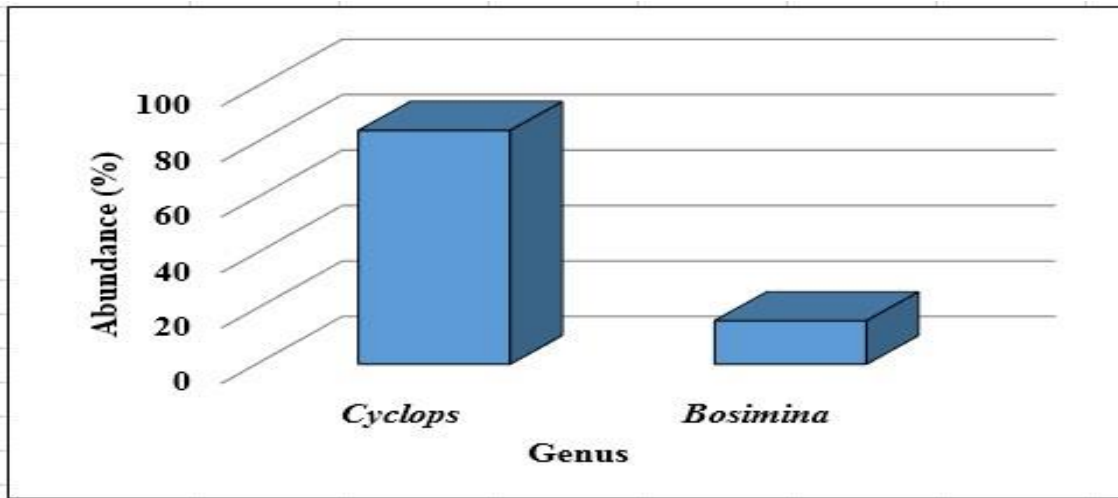


Figure 13: Relative abundance of crustaceans in project area along river Oraa.

The observed aquatic diversity and abundance patterns for zooplankton within the project area, is a trend typical for riverine communities (Mwebaza-Ndawula et al., 2005, Baranyi et al., 2002). Zooplanktons especially rotifers plays a crucial role in the aquatic food chains by acting as food for fish and other aquatic organisms. Therefore, the proposed Ora Irrigation project should be implemented with marginal disturbance to the aquatic environment to avoid a shift in identified zooplankton populations and maintain the ecological balance of the riverine ecosystem within the project area.

iv. Benthic macro-invertebrates

Two major taxonomic groups (Orders) of macro-invertebrates were identified. These include Decapoda (fresh water shrimps), and Ephemeroptera (Mayfly). Ephemeroptera was the most abundant compared to Decapoda (Figure 14).

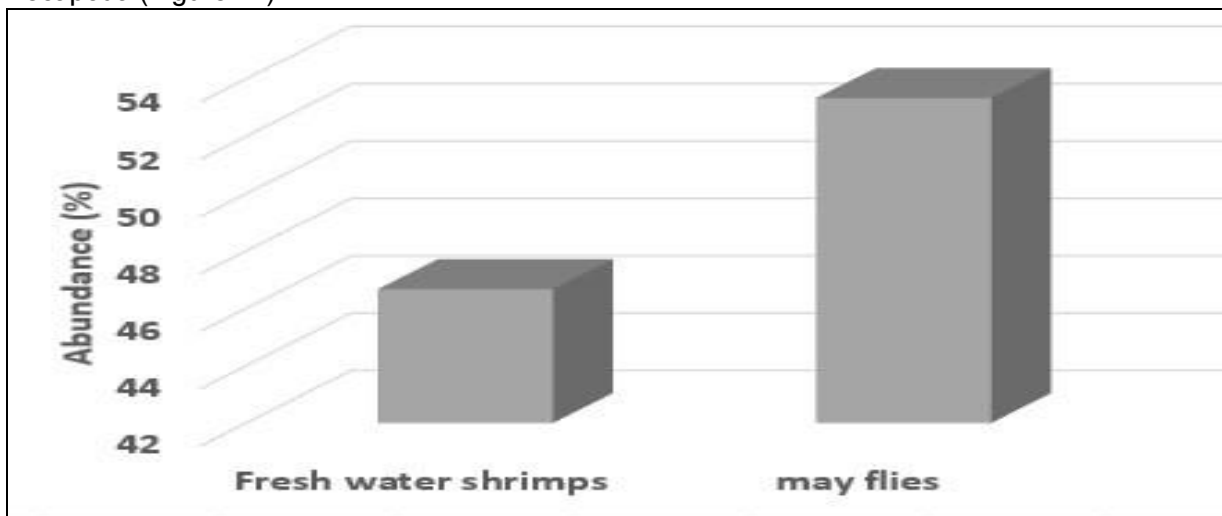


Figure 14: Relative abundance of benthic macroinvertebrates in river Oraa within the project area

The identified benthic macroinvertebrates are important component of tropical streams (Hunte 1978; March et al., 2001). Fresh water shrimps play a leading role in determining the benthic community composition and the rate of organic matter processing (March et al., 2001) hence very significant in nutrient recycling with in an aquatic ecosystem. Invertebrate feeding activities coupled with high turnover rates are believed to influence the regeneration and recycling of nutrients, which in turn enhance algal production and subsequent fish production. The taxa of macro-invertebrates observed by the present study are prey items for the identified fish species (*Bagrus docmac*) in the river within the project area hence important in energy flow (Corbert, 1961; Mwambungu et al., 2001). This requires that the proposed project be implemented with least disturbance to the aquatic environment so as to maintain the ecological functions of the riverine ecosystem within the project area.

v. Ecologically sensitive habitats

The ecologically sensitive habitats in Wadelai were along the entire riverine ecosystem that constitutes of forested and scrubland vegetation. These are considered sensitive because of the distinct microclimatic conditions that prevail in them. Thus they are varied from the far areas away from the river banks that are characterized by open to degraded vegetation habitats that are quite dry and warm. During the dry conditions of the year these vegetation types dry up, leaving the riverine as the only refugia for shelter, foraging, roosting grounds for birds and drinking water above all. Therefore the riverine ecosystem is very much supportive to the existing fauna population within the project area.

Also at location 317559/ 300413 (UTM), a sharp bend exists along the river (Fig 15), and it is presumed to be a trigger point for the floods along the greater part of Wadelai within the command area, especially when the river swells (Pers. Comm., Sunday Anguyo-Ragem Prison Farm Village).



Figure 15. Google map section showing the sharp bend within the command area at 317559/ 300413 (UTM)

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General field observations and reviews from literature are indicative that the fauna and flora within the Oraa river ecosystem are not of any conservation concern, since none is red-listed (IUCN, 2016). Therefore the site is an appropriate location for the irrigation scheme.

5.3 WATER RESOURCES ASSESSMENT

5.3.1 Water Quality Analysis

Water quality analysis was carried out to determine the baseline condition for future monitoring of the impact of agro-chemicals on the river ecosystem. Water samples were picked at both upstream and downstream of River Oraa within the project command area. Water samples were analysed at the Department of Chemistry Makerere University for Physical chemical, nutrients, pesticides and bacteriological parameters.

Results of physico-chemical analysis as indicated on the certificate of analysis (Annex 3) show normal River Oraa water quality characteristics. The level of fertilizer residues in the river water is low. There are no pesticide residues. The coliform count is characteristic of normal river waters

5.3.2 Catchment characteristics

Using topographic sheets, Google Earth (SRTM DEM) data and Google Imagery, the catchment area of Oraa River contributing to the flows up to the project site was estimated as 2528.5 km², and shown in Figure 16. Catchment lies in two countries namely Republic of Uganda and Republic of Congo, with major part of it lying in Uganda.

About 14% of the catchment (about 350 sq km) lies in Republic of Congo and the remaining catchment is in Uganda. More than 90 % of the catchment is covered by natural vegetation and agricultural fields. Less than 2% of the area is villages or urban areas and the remaining land are barren. The, maximum and minimum elevations within the catchment are 1858 m and 659 m respectively. The catchment is relatively flat except a hillock at the southern most end. Catchment is completely rainfed. The data collection included the following:

- Topographic survey sheets of the catchment;
- Rainfall data from nearby Rain Gauges for from 1943-1978 and 2000-2014; and
- Stream flow measurement data on Oraa River from 1956-1984 and 1997-2013



Figure 16: Catchment Delineation for Rhino Camp-Wadelai Site

5.3.3 Hydrological Analysis

Rainfall pattern at the project site is studied using mean annual rainfall. Mean annual rainfall is shown in Figure 17 and Table 19. It can be seen from this data that Wadelai, the mean monthly rain fall varies from 95mm to 130mm from March to July. There are two peaks one in May and other in November. This clearly shows a Bi-modal rainfall pattern for this station. However, mean monthly rainfall in August and September is 69 mm. During Dec, Jan and Feb mean monthly rainfall is between 79 mm to 50 mm.

Table 21: Mean Rainfall (mm) at Wadelai Rain Gauge Station

Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	TOTAL
65.2	50.4	101.0	108.9	129.9	114.9	95.2	68.3	69.6	92.5	120.2	79.6	1095.6

Plenty of surface water is envisaged to be contained around the project area, due to heavy rainfall distributed throughout the year. In order to confirm this, two methods are used: • Analysis of stream flow data; and • Analysis of rainfall data.

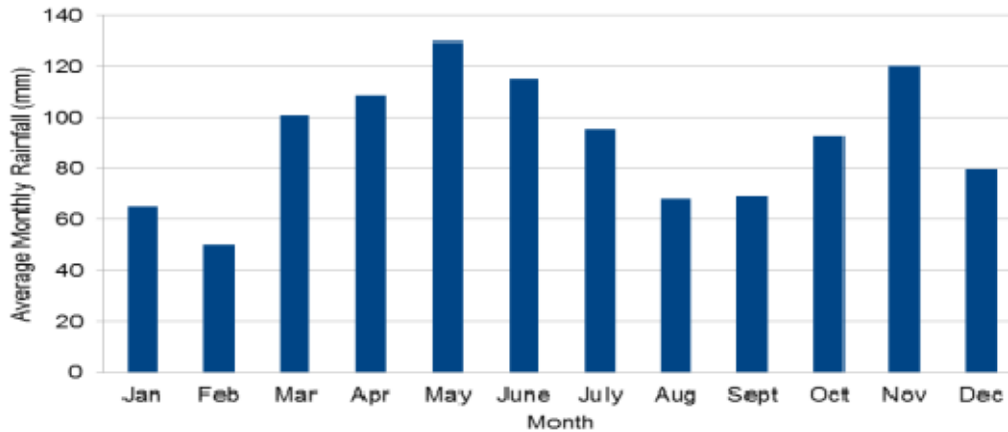


Figure 17: Mean Monthly Rainfall at Wadelai Rain Gauge Station

5.3.4 Stream Flow Data Analysis

The gauge-discharge data collected, is utilised to estimate the annual water availability at the Wadelai site. The salient features of the data are presented in Table 23.

Table 22: Gauge-Discharge Station at the Project Area

Project Location	Station over River/ ID	of Years of Data Availability	catchment at G&D Station (sq.km)	Catchment Area at Project Site (sq.km)	coordinates
Wadealai	Ora/ 87212	46 956-1984/19972013)	2,775.0	2,528.5	2° 43' 4" N 81° 23' 34" E

The above data corresponds to discharge rates measured daily at a point of time. On filling the few missing data assuming linear variation in flow rates, and discarding those years with large gaps, time series have been constructed and the annual volumes of water flowing downstream of the above sites are analysed.

5.3.5 Rainfall Data Analysis

Rainfall over the catchment areas of project site is monitored through multiple rain-gauge stations in the project area. The data so available is presented in Table 23.

Table 23: Rain-Gauge Stations around the Project Area

Project Location	Rain-Gauge Station	Latitude	Longitude	Years of Data Availability
Wadelai	Paidha	2° 24' 58" N	30° 59' 6" E	1943-1978

Nebbi	2° 26' 20" N	31° 21' 11" E	
Okollo	2° 39' 4" N	31° 8' 42" E	
Wadelai	2° 43' 26" N	31° 23' 46" E	2000-2011
Arua	3° 2' 17" N	30° 54' 40" E	2000-2014

The rainfall data is used to build rainfall-runoff relationships for the catchment. It can be seen from the above table that multiple rain-gauge stations can be used to estimate the surface-water at the project site.

5.4 SOCIAL SURVEY

5.4.1 Introduction

The project design is hinged on community-based participation with the districts and sub-counties as focus of implementation, and the private sector as main technical service providers. The project's objectives and expectations cannot be realized unless farmers' considerations on benefits and costs, feasibility and desirability and their priorities in life match that which the project requires of them. At times, smallholders' priorities differ from the project's priorities. Hence the need to assess the acceptability and desirability of the farmers to participate in the development of the irrigation schemes. The nature of the population must be understood in order to match the rate of development with the absorptive capacity. Elements such as the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes to change shall be among the several parameters to be considered by the Consultant when analyzing the social aspects of the project.

In this regard, the consultant carried out a baseline, socio - economic survey that fully addresses socio - economic status, gender, sanitation of the beneficiaries in Pumit Parish and Ragem Upper Parish of Wadelai Sub-County. This was intended to assess their ability to operate and manage the irrigation facilities. To understand the nature of population and match the rate of development with the farmers' absorptive capacity, the consultant assessed farmers on the level of literacy, farming knowledge and skills, past experience with irrigation, gender issues and attitudes or their ability to embrace change.

Irrigation development brings cultural shock to a smallholder community. With monomodal rainfall conditions, smallholders work for a few months in a year under rainfed conditions and in a sense they are underemployed and have ample time to attend to their social aspects of the society. In contrast to this, irrigated crop production requires almost daily attention throughout the year if it is to be profitable. How able the community is to adjust to these and other changes becomes critically important and should be thoroughly discussed with the farmers by the Consultant. With the introduction of irrigation, the farmers' social time shall be encroached on. The consultant will thus assess the acceptability and desirability of the farmers to participate in the development of the irrigation schemes.

Irrigated crop production is a high input high output system and therefore farmers need to procure seeds, fertilizers and chemicals in order to optimize their production system. The consultant reviews potential options and makes recommendations under the prevailing land tenure system. The consultant shall assess the existing markets and transport system as well as their potential for development. Market prices, transport costs and farm prices will be predicted as related to the expected increased volume of production. Processing / storage facilities will be considered as part of a marketing strategy.

5.4.1 Demographic Characteristics

In order to understand the socio-economic conditions in the project area, a random household survey was undertaken using a sample size of 60, 10 in each village of the project area. The questionnaires were administered by research assistants within the project area having received one day training on the tool and sampling strategy. The demographic characteristics given an indication of how populations behave within their landscapes and this case, whether they will be able to adopt irrigated agriculture and sustain the responsibility that comes with operating and maintaining the infrastructure. 🚧 Household Data

Most of the questionnaires were administered to household heads (67%), which implies that most information collected in this survey is representative of decision making persons within the project area.

Table 24: Status of Respondent

Status in the household of respondent:	Frequency	Percentage
Head	40	67%
Spouse	20	33%
Other (specify)	0	0%
Missing	0	0%
<u>TOTAL</u>	<u>60</u>	<u>100%</u>

Understanding the characteristics of the household head aids in determining how feasible the proposal to irrigate in the Waldelai area will be. In terms of access to household heads, presence of the households within the project area implies that most homes have their household heads living and working within the community of the project and therefore full time farmers. 🚧 Gender of Household Head

In terms of gender, of those interviewed, majority were found to be females which seems to suggest that most households interviewed were female headed as shown in the graph below.

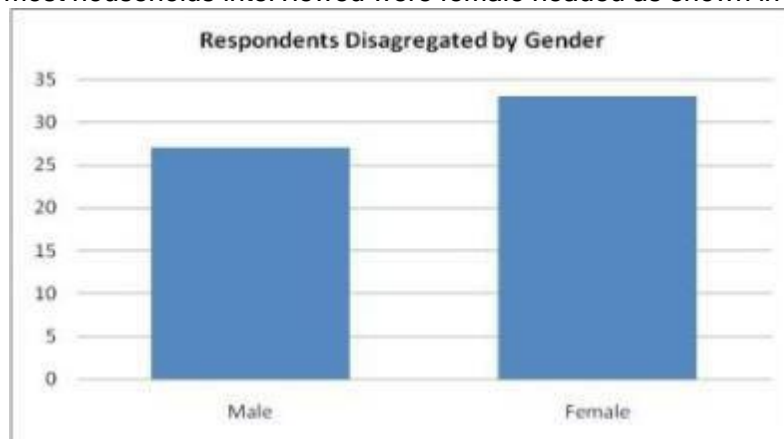


Figure 18: Respondents Disaggregated By Gender

The overall objective of this project is to contribute towards improvement of farm incomes, rural livelihood and food security. Females are normally charged with food production at household level while men normally engage in commercial aspects, requiring an input of men and women, but more importantly the women because they provide a lot of the farm labor from planting to harvesting.

✚ Age

Regarding the age, 58% of those interviewed fall within the 26 - 49 years age group, this is an economically active age group which is the main target for the proposed project. These were followed by those with 60+ years at 17% and then 56 - 60 years at 10%.

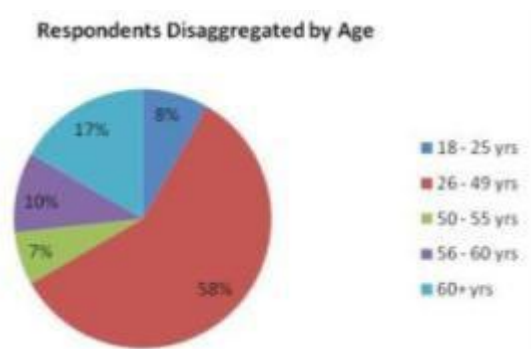


Figure 19: Respondents Disaggregated By Age

Age can influence the production and productivity of irrigated crop production and might create production difference among the irrigation areas. Given that the most are economically active they can easily adopt better farming practices and related activities that come with irrigation agriculture given that their overall goal is to increase productivity and be able to sustain the household expenditures including school fees, medical fees, transport amongst others.

5.4.2 Household Characteristics ✚

Household Composition

Results suggest as shown in the table below that most households have more people below the age of eighteen years living within their households which implies that majority of household members are school going and can only be available for farming during the holidays.

Table 25: Distribution of Household Members Disaggregated By Age Group

Age group	0- 5 yrs	6 -15 yrs	16 - 25 yrs	26-45 yrs	46-65yrs	Over 65
Household members	99	112	79	92	26	11
Average distribution per household	1.68	1.90	1.34	1.56	0.44	0.19

It also implies that most household heads still have children for whom they are catering for in terms of school fees, medical and other needs and are hence more motivated to improve their yields in order to meet these needs.

🏠 Construction Materials of Dwelling Units

The different materials used for the construction of a house are usually viewed as a proxy measure of the quality of housing as well as an indicator of health risk. Respondents were asked to give a description of the houses their living conditions.

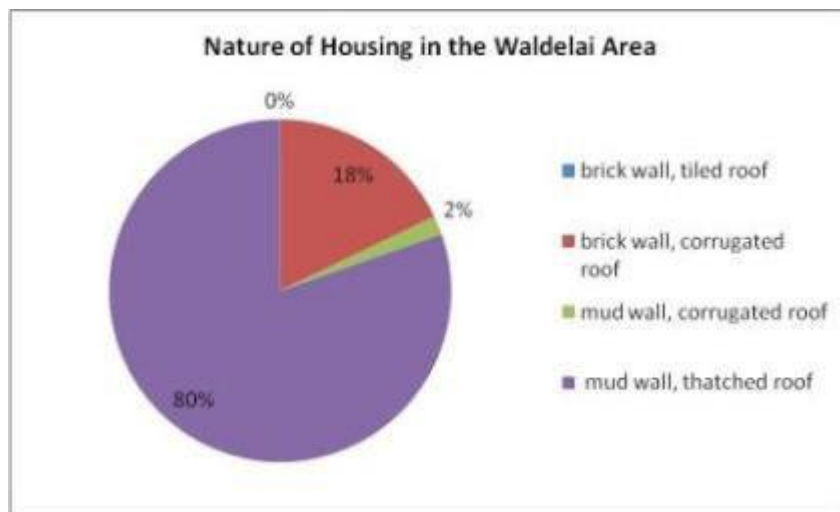


Figure 20: Nature of Construction of Dwelling Units in the Project Area

Results suggest that majority of respondents (80%) have mud wall and thatched houses which implies higher health risk as is characteristic of rural areas unlike in urban areas. 🏠 Household Occupation

The number of rooms used for sleeping gives an indication of the extent of crowding in households. Crowding in one sleeping room increases the risks of infectious diseases.

Table 26: Number of Rooms in Houses

Number of rooms	Frequency	Percentage
1	15	25%
2	17	28%
3	10	17%
4	3	5%
5	3	5%
Over 5	10	17%
Missing	2	3%
TOTAL	60	100%

Results from the survey seem to suggest that 28% of households have two rooms which implies that health risk is not as high as in the case when household members reside in one room. Considering that most household depend on family labor, having health family that are not susceptible diseases does not have an implication of labor availability especially in planting and harvesting periods. 🚧 Occupancy Tenure

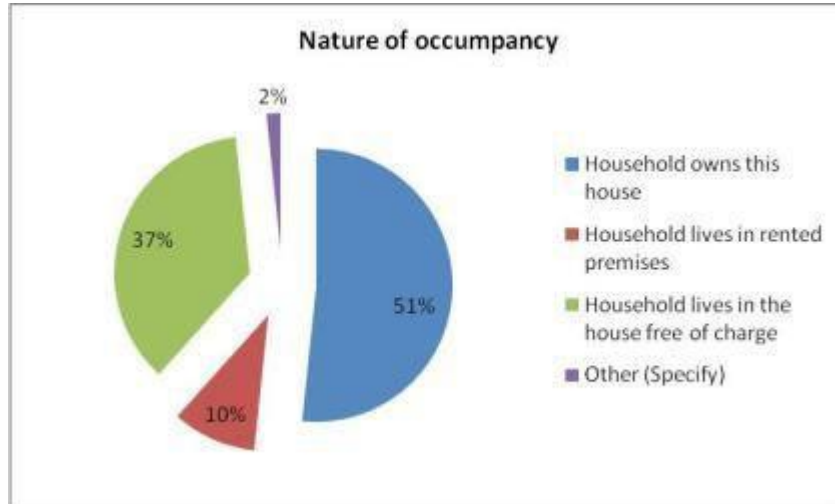


Figure 21: Nature of Occupancy for Dwelling Units

Occupation tenure identifies a basic feature of the housing inventory, whether a unit is owner or renter occupied. It refers to the arrangements under which the household resides in a dwelling and these include renting, owner occupancy and dwelling supplied free. Ownership of a dwelling unit represents security of tenure of a household and tenure type is important for planning housing assistance and is also used in national data collections as a key housing variable. Results suggest as shown in the figure above that 51% of household heads own the houses that they live which imply the following:

- That they are permanently residing within the project area and are therefore more likely to actively participate in the operation and maintenance of the irrigation infrastructure
- That the land they have for agriculture is only available for profit making other than for provision of housing
- 37% live in the houses where they dwell free of charge while 10% live in rented premises.

5.4.3 Land Tenure Arrangements

Land is vital resource for production of crops for farmers who rely their livelihood on it. Besides the holding size, land arrangement is crucial to cultivate, manage and produce agricultural products and also it has influence on net income gain from each plot of land. Land arrangement is a kind of consensus made between the land owner and the renter either in cash or as share cropping. The land arrangement is made when the farmer; who owns the land face short of labour or lack of oxen used to plough; rent to his fellow farmer who faces shortage of land to cultivate.

Security of tenure normally determines whether a household activity is willing to engage in income generating activities or not. Proposals for growing of rice and cotton are being made and there is need to understand whether land tenure arrangements will permit farmers to venture into these crops.

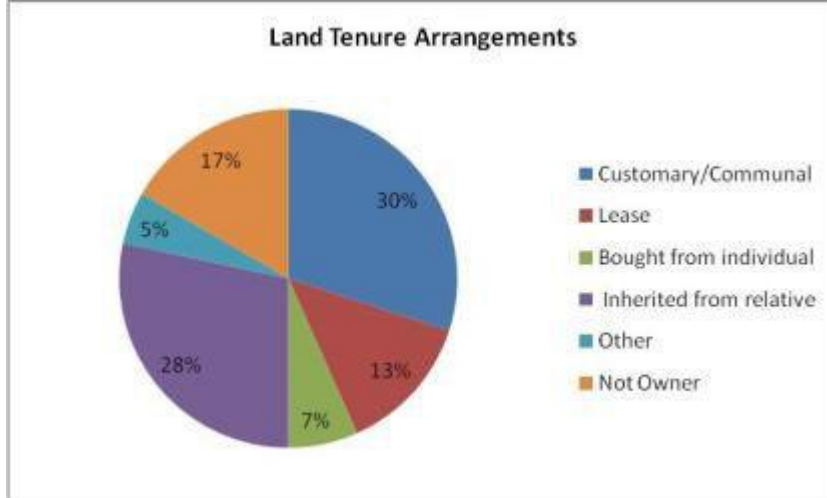


Figure 22: Land Tenure Arrangements for Household Heads

Results suggest as is the case with the Northern and West Nile Region most land is communal or customary. 30% of those interviewed have communal land, while 28 percent have inherited land from a relative implying that transfer rights. Under communal tenure, exclusive rights are assigned to a group. Individual or family rights are also assigned under most traditional tenure systems.

This implies that the households who have user rights which include rights to grow crops, trees, make permanent improvement, harvest trees and fruits, and so on can actively participate in this project. It is important to note that there a considerable percentage (17%) that are not owners of the land that they live which implies that they are either still living within their parents' homestead and if to be considered for the project their tenure arrangements need to be understood better.

However, for the rest, farmers targeted are able to engage in the proposed crops and cannot sell. It means that community members when consulted can provide land for the farm infrastructure if their traditional institutions including clans are adequately engaged. Emerging from this tenure arrangement that requires further discussion are the following:

Size of land

Results from the survey suggest that most farmers have on average 1-2 acres that is available for farming as shown in the figure below.

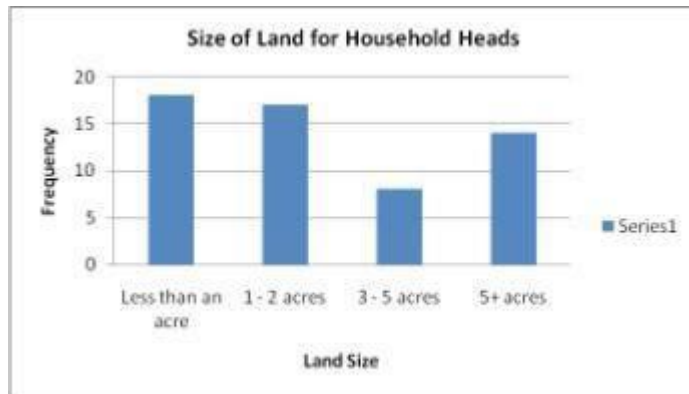


Figure 23: Land Holding Size in the Project Area

Yet most engage in subsistence agriculture, with limited improved technology, including the use of fertilizers and improved seeds. With the aspect of water being addressed, coupled with improved management practices, farmers will be presented with the opportunity to improve their productivity even on small pieces of land. In fact, there is ample international evidence that small holdings are often more productive than larger units, i.e. in terms of yield per hectare and profit per hectare. 🚧 Percentage of land covered by Houses

Results that suggest that for most household heads, about 75% of their land is available for income generating activities including agriculture, storage and post-harvest handling of their produce as shown in the figure below.

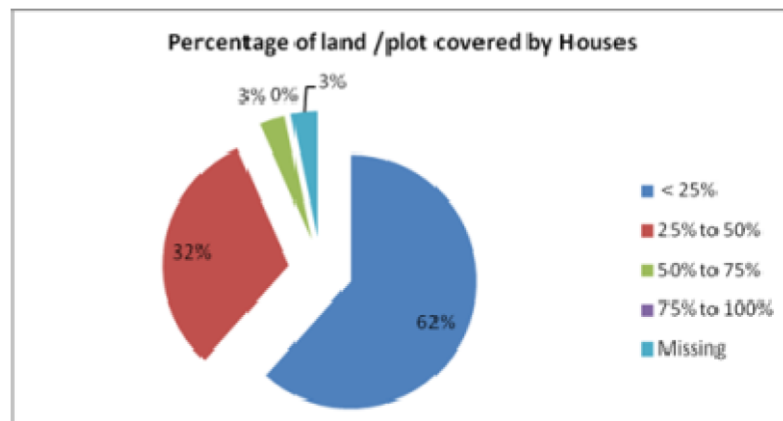


Figure 24: Percentage Land Covered by Houses

Sixty two percent of respondents said that the land on which their houses are located is less than 25% of their total land size.

5.4.4 Characteristics of Household Head

🚧 Highest Level of Educational Attainment

Basic education is a fundamental human right and a component of wellbeing. Education is also a key determinant of the lifestyle and status an individual enjoys in a society. Studies have consistently shown

that educational attainment has a strong effect on the behavior and attitude of individuals. In general, the higher the level of education an individual has attained, the more knowledgeable they are about the need and use of available facilities in their communities.

Results suggest that the majority 55% of household heads have attained primary education. Regarding farming experience, it is an informal education on agricultural practices and production patterns from their surrounding environment, that is, households and community. On average when farmers complete their education at primary level then they are about 13 years and by the time they are between the ages of 26 and 49, they have attained informal education on farming that would benefit the project.

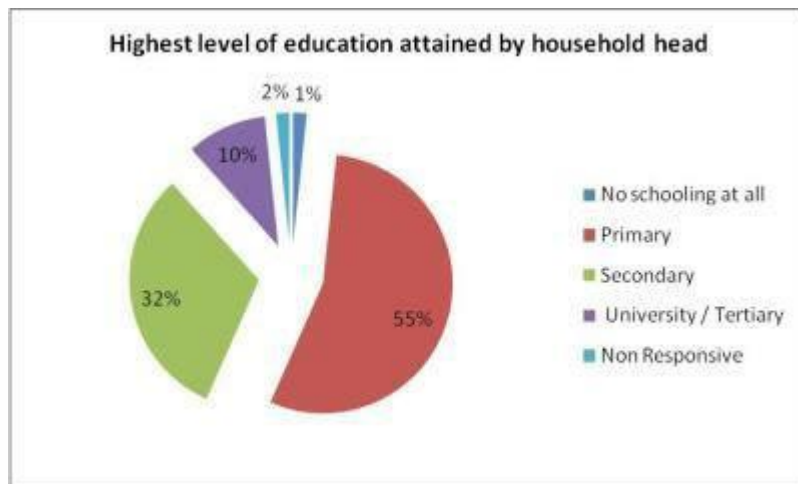


Figure 25: Highest Level of Educational Attainment for Household Head

Although farmers will have experiential knowledge on agricultural production, they may not have knowledge on irrigation management which implies that many of the farmers do not have the basic know how of practicing irrigation agriculture and would require their capacity built in the following:

- Crop water needs
- Water application method
- Irrigation intervals

Knowledge of irrigation water management aspects will help reduce wastage of irrigation water, deterioration of some structures and water logging problems on some farms.

✚ Occupation of Household Head

Results suggest that 53% of the household heads are farmers which imply that most of the household heads have farming experience.

Table 27: Occupation of Household Head in the Project Area

Occupation of the household head	Frequency	Percentage
Technical / Professional / Managerial	2	3%
Formal trader (with a shop)	5	8%

Informal trader (stall at the roadside or at home)	4	7%
Casual laborer	3	5%
Fishing	1	2%
Farmer	32	53%
Sales / administrator (private)	2	3%
Civil servant (working at the district or sub county)	6	10%
Transport / bodaboda	2	3%
Other	3	5%
TOTAL	60	100%

In terms of livelihood strategies, most farmers depend on farming as their primary source of income, very few engage in retail trade or any other activities. Therefore, farmers have an opportunity for irrigation agriculture in order to enable them increase their productivity and hence incomes. 📊 Income of Household Head

The major income source is agriculture which includes livestock and crop production. Crop production in the study areas is the major income source. As shown in the table below most farmers interviewed earn less than 100,000 Uganda Shillings.

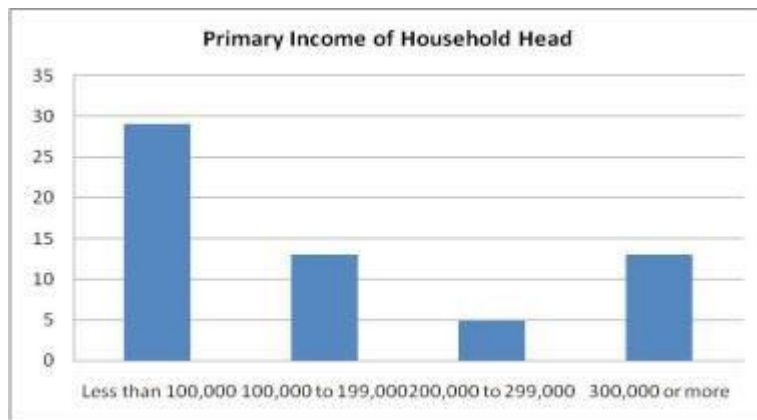


Figure 26: Primary Income Sources for Household Heads

Farmers complained that their low incomes were attributed to reducing soil fertility and unreliable rains which presents opportunity for irrigation agriculture because there is motivation to increase agricultural productivity.

📊 Expenditure of Household Head

Results suggest that they spend less than 50,000 on their household needs but definitely spend more on medical, school, transportation and clothing. This means that most household heads have to depend on informal debt financing to support their expenditures.

Table 28: Expenditure on Household Needs

Expenditure on household needs	Frequency	Percentage
Less than 5,000	1	2%
5,000 - 10,000	7	12%
11,000 - 20,000	13	22%
21,000 - 30,000	13	22%
31,000 - 50,000	15	25%
51,000 - 100,000	9	15%
over 100,000	2	3%
TOTAL	60	100%

Goods and Assets Owned

Access to credit for financing investment and farm operations is crucial for the commercialization of small holder agriculture. In line with this, it provides the facility of accessing inputs to the farmers and produce good and sufficient production without constrain by shortage of money. Because most lending institutions require collateral to borrow money, respondents were asked what assets they have at household level.

Table 29: Goods and Assets Owned at Household Level

Household Assets	Frequency	Percentage
TV	3	5%
Bicycle	30	50%
Car	0	0%
Motorcycle	7	12%
Foam mattress	11	18%
Furniture	3	5%
Radio	3	5%
Mobile Phone	1	2%
Missing	2	3%
TOTAL	60	100%

As shown in the table above, most household heads have bicycles as assets, additionally, as shown in the figure below for those who have livestock, most have cows, goats and poultry.

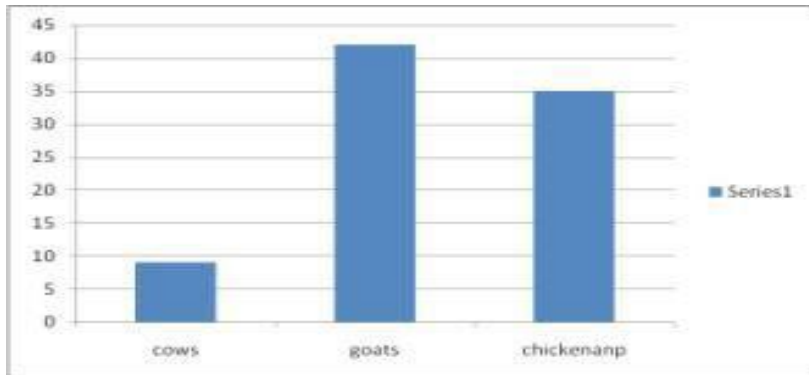


Figure 27: Livestock Owned By Household Heads

This implies that some household head can access financing but in order to ensure that all farmers have access, village savings schemes should be considered by the project. In this regard, supporting farmers to get credit access should include the following:

- Training each group in commercial, marketing and financial matters - including through the creation of a 'marketing committee' in each group and the building of contacts with all the commercial buyers in the area.
- Helping these groups to set up Village Savings and Loans Associations (VSLAs) to pool and lend funds to each other.
- Supporting the famers to get organized into registered Farmers' Cooperative Societies, large enough to have real negotiating power with companies. This will ensure collective buying and marketing of produce.

🚩 Social Cohesion

Respondents were asked whether they had recently moved into the project area or were born there and as shown in the figure below, majority were born there. Forming of groups and associations require trust from fellow group members which is best attained when community members live together for a considerable period of time. In West Nile, community members live with family or clan members based on their land tenure system that is clan based. When forming water user associations and enforcing water use requirements, there is an opportunity to utilize the traditional systems to sustain the system because most community members appreciate these systems.

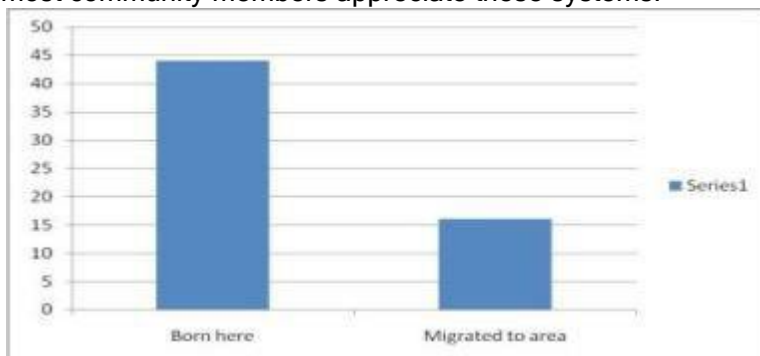


Figure 28: Distribution of respondents based on their origin

5.4.5 Agricultural Production and Constraint Analysis

Agricultural production is the mainstay of most communities in Nebbi district and therefore understanding the current farming systems and their constraints would best inform the feasibility of the proposed irrigation scheme in the Waldelai area.

Current Farming Systems

According to the Nebbi District Senior agricultural officer the current production systems are mainly subsistence farmers; no commercial farming was observed. The crops grown around the site area are sweet potatoes, sim sim, rice, cotton as the cash crop, sugar cane, cow peas, fruit trees, cassava both mainly in the first and second seasons. On the issue of farming practices, the Nebbi District senior agricultural officer said that the majority of people use hand hoes, there is rampant over cultivation of land which is severely affecting the soil. He further said that fertilizers are rarely used and a few people use crop rotation. “ The problem is that the communities are slow at acquiring new and improved farming methods like optimal utilization of land in order to successfully increase on the yields, District Senior Agricultural Officer, Nebbi District. Farmers also rear animals like cattle, goats, sheep, and poultry, other economic activities they engage in include brick making, charcoal burning, and retail trading. According to the household survey, maize, millet and cassava are normally grown in the first season as shown in the table below.

Table 30: Crops Grown By Households in the Project Area in the First Season

Crops grown in household	Frequency	Percentage
Maize	43	72%
Millet	3	5%
Cassava	12	20%
Others	1	2%
Non Responsive	1	2%
Total	60	100%

In the second season, most farmers interviewed planted maize, millet and cassava in the second season as shown in the table below

Table 31: Crops Grown By Households in the Second Season

Crops second season	Frequency	Percentage
Maize	41	68%
Millet	5	8%
Cassava	4	7%
Beans	1	2%

Cotton	3	5%
Rice	1	2%
Groundnuts	0	0%
Sweet potatoes	1	2%
Sim sim	2	3%
Non Responsive	2	3%
TOTAL	60	100%

Major animals reared include cows and goats; others include poultry, pigs and apiary [Table 32: Animals Reared at Household Level in Project Area](#)

Animals reared	Frequency	Percentage
Cows	8	13%
Goats	37	62%
Sheep	0	0%
Poultry	6	10%
Pigs	1	2%
Apiary	1	2%
Others	2	3%
Non Responsive	5	8%
TOTAL	60	100%

Constraints

Given that majority of of Uganda depend on agriculture; increasing agricultural production is key to the primary source of poverty reduction. It has already been observed that farmers in the Waldelai areare subsistence farmers, not utilizing modern farming methods, depending on rainfall for their water and growing crops on small pieces of land. In order to understand the performance of their production systems, farmers were asked how they felt their units were performing.

42% of the farmers said that their production units were medium yielding. According to participants in focused group discussions for women in Waldelai, drought is the main constraint to production additionally the the soils are infertile and yet many lack of inputs like fertilizers. Lack of adequate market access was also identified as a major challenge to productivity because there is not much to gain from productivity as well as landlessness was identified as a major challenge as this means that some people do not have where to grow crops or rear animals as well as lack storage facilities was said to be a problem. “Transport is also a problem as there are limited cars, as we talk now some of us here were supposed to go to the market (Kicwinyi) but failed to get means of transport”, Participant in a female group discussion in Waldelai.

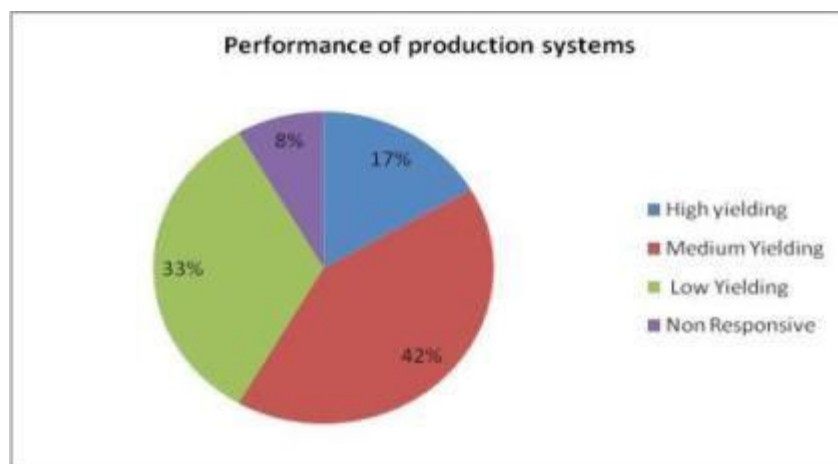


Figure 29: Performance of Production Systems in the Wadelai Area

The challenges raised during the focused group discussion for males include the following:

- **Water challenge:** The most prominent production constraint in Wadelai is drought. Respondents claim that the persistent lack of rain affects crop production, animal rearing as well as other income generating activities such as brick making which all require water
- **Pests and diseases** were also identified as constraint to crop production and animal rearing. Although respondents were not specific on the pests and diseases that affect their crops and animals, they stressed that these had had made production a very difficult
- **Marketing challenges:** Marketing challenges were majorly as a result of poor road network. The challenge of poor transport affects the farmers in such terms of high transport cost incurred as Transporters ask for high fees. They also observed that sometimes the vehicles are not even available to take all produce to the market. "...sometimes even when you have the money to take commodities to the market, it is not a guarantee that the means will be available, because there are a few motorists who can endure the bad roads especially during the wet season" Male Participant in the focused group discussion, Wadelai, Nebbi.
- **Low prices for commodities** affect production both for crops and animals. "...sometimes the amounts we are given for our crops are very low, here at home middlemen buy at giveaway prices, but even in the market places like Ilego, you find that the rates are very low" Participant in the focused group discussion for males, Nebbi
- Participants also said that rice is the main commercial crop, but that processing rice is very costly because there is not enough machinery. "Processing rice is a major problem here, we waste a lot of time queuing to process the rice and yet the cost of processing is also very high. At the end of the day you realize you have made a loss instead. So if the government could find a way of helping us build very good processing machines in this place, I believe that would help a lot" Male Respondent, Wadelai
- Participants also observed that they don't have storage facilities for their rice and other crops, which means that losses are made on the crop. In addition they are forced to sell immediately after harvest when the prices are still low. If they had better storage facilities they could store and sell during times of scarcity when it's much profitable

- **Land shortage:** Some residents of Wadelai rent agricultural land from their neighbors because they don't own adequate land. "...some of us don't have land for agriculture which means that even when the irrigation scheme comes, we may not benefit like our colleagues who have a lot of land. What you know is that even those who claim to have land some have just a few acres" Participant in the focused group discussion for males, Wadelai
- **Animal Challenges:** As regards animal rearing, the residents of Wadelai claim that the rampant diseases affect animals. In addition they have limited land space for the animals to graze and finally there is a social problem of thieves.

According to the household survey, 39% felt that their biggest challenge was land; however, it was not related to tenure of security or access which implies that in terms of shortage of land.

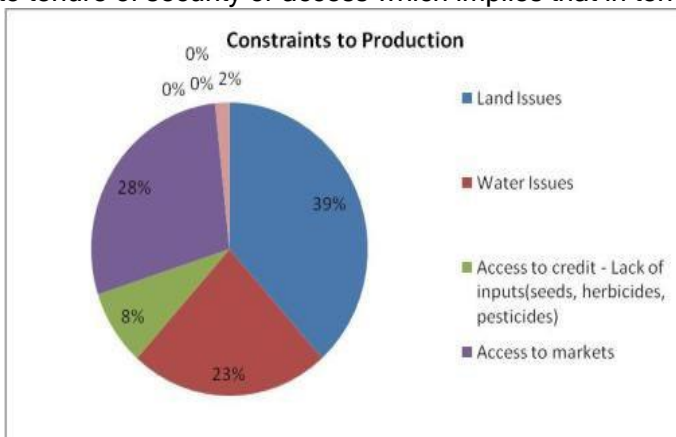


Figure 30: Constraints to agricultural production

According to the senior agricultural officer Nebbi district, on the issue of land access he said that in some places the land is available, people are cooperative and there is group farming but there is a problem of land fragmentation.

Feedback from stakeholders on climate related constraints

Results from the household survey suggest that majority of respondents 50% felt that in the case of climate change impacts, the challenges were related to unpredictable rains and weather fluctuations as shown in the figure below. 45% of the respondents felt that the challenge was related to inadequate water quantities.

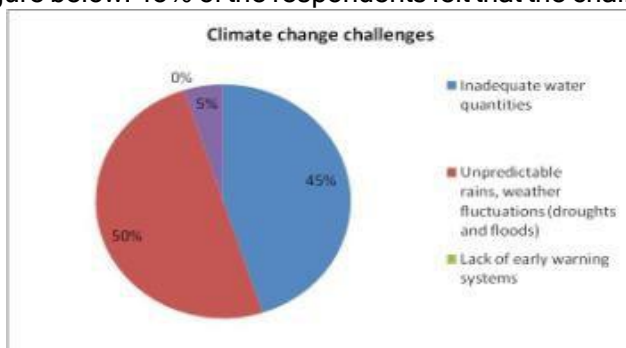


Figure 31: Climate change related challenges

Flooding was cited as a major challenge. "There is shortage of water due to uneven rainfall patterns that's why most of the seasons are dry. When it rains the river overflows and people's crops are destroyed." Senior Agricultural Officer, Nebbi District. On his part, the wetlands officer Nebbi District highlights the following challenges:

- There is a problem of floods during rainy seasons which mostly affect rice and cassava growing, this mostly affects the downstream part mainly between September and December.
- The dry spell is very long during the first season for example now, it would be raining but it's not been raining.
- The irrigation scheme should solve the problem of floods as it will help reduce on the pressure of the water.
- The soils in Waldalai are fertile but because of flooding, it runs away top soils. This therefore needs to be mitigated by restoring river banks so that the runoff could reduce.

There is growing evidence that climate change, specifically higher temperatures, altered patterns of precipitation and increased frequency of extreme events such as drought and floods, is likely to depress crop yields and increase production risks. In relation to crop production, the problem of climate change is compounded by poor soils caused by poor production techniques, limited access to inputs and access to credit. In order to address this vulnerability there is need for farmers to adopt adaptation strategies that would also help them cope with climate change impacts in addition to irrigating crops including the following:

- change in crop varieties and species;
- change in timing of activities;
- change in production techniques;
- change in location and
- changes in resources and/or life styles in the case of emergency situations such as droughts.
- In relation to irrigation, farmers will need training on the following aspects in order to ensure that they obtain sustainable benefits:
 - minimizing of water losses and irrigation efficiency
 - building strong institutions to manage, operate and maintain the irrigation infrastructure
 - developing of by-laws to enforce management measures
 - general environment management

🚧 On competing water needs the community development officer, Nebbi district noted that all the production systems compete for the basic resources like water. Regarding access to water, he thinks that the river is big enough to provide adequate water for all the needs, the only challenge is how to manage utilization. At the moment, the water is wasted, but when the scheme kicks off then there will be better utilization of water.

🚧 Credit Related Constraints

Increasing agricultural production may require more capital meaning that some members of the community might require gaining access to credit. Results from the household survey suggest that majority of respondents feel that the problem of credit is related to lack of collateral as shown in the figure below.

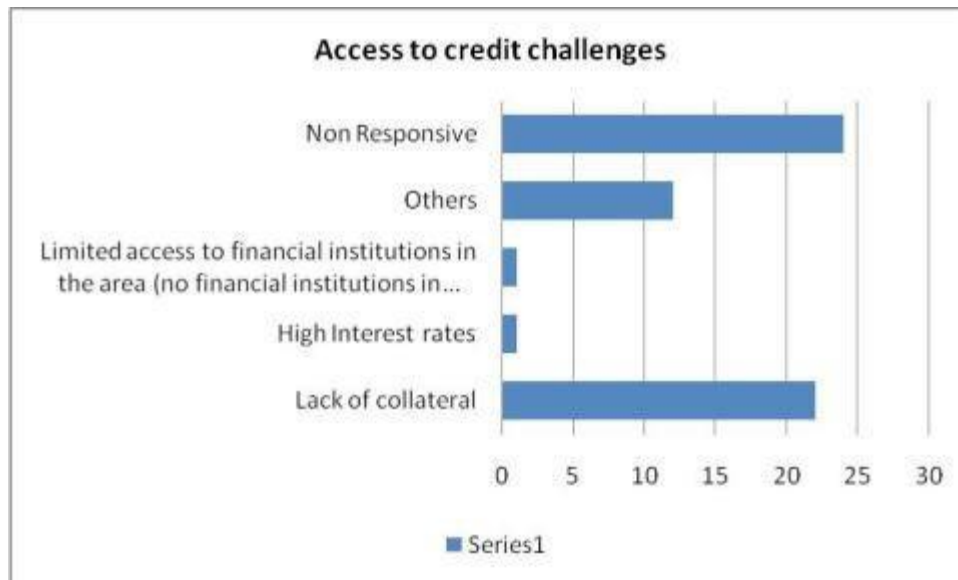


Figure 32: Credit Related Constraints in the Wadelai Area

According to female participants in a focused group discussion, there are very few of their colleagues borrow from centenary bank (located in Pakwach town). Other than that there are no other credit facilities available to them. They said women are engaged in small scale savings and credit associations, but that they had no details on how these operate since its women who participate. Barriers to use of credit facilities include loan amounts being very small and therefore not adequate to solve their problems, lack of collateral, payback period is very short which often leads to defaulting and the fact that culture does not favor use of credit facilities. On the part of the male they observed that other than small scale savings and loan schemes, the village bank collapsed; there are also no money lenders.

Access to credit for financing investment and farm operations is crucial for the commercialization of small holder agriculture. In line with this, it provides the facility of accessing inputs to the farmers and produce good and sufficient production without constrain by shortage of money. It can be provided in kind or cash based on the type of institutions and their rules and regulations. Therefore, helping these groups to set up Village Savings and Loans Associations (VSLAs) to pool and lend funds to each other would benefit the project better, or better still strengthen the existing ones. 🚧 Market Related Constraints

Market place is the vital socio-economic factor for marketing agricultural products and to buy inputs for agriculture. On markets, community members said that the nearest markets are

- Ojigo market area located at site of interview
- Pawor is approximately 5 kilometers (Market is located in neighboring Arua district)
- Pakich is 4 kilometers away
- Victorious is approximately one and half kilometers away
- Pakwenyo is approximately three kilometers away
- Pakwer is between 8-10 kilometers away
- Kicwinyi is about 17 kilometers away

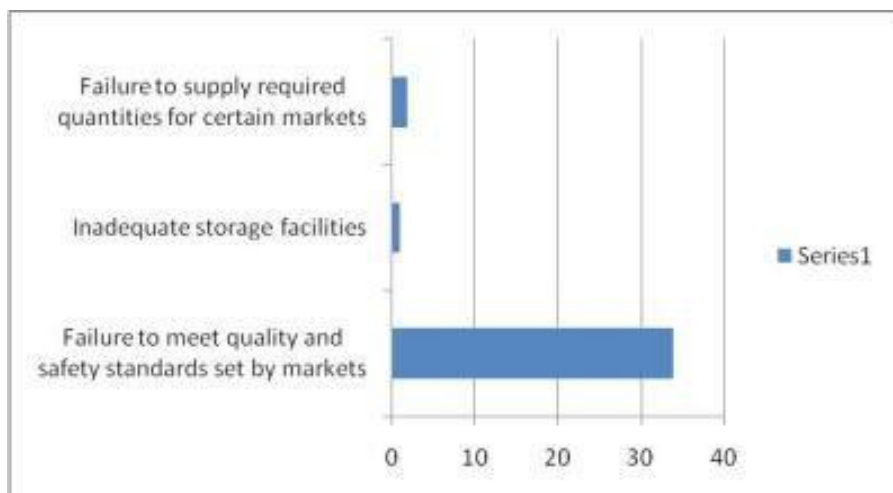


Figure 33: Market Related Constraints in the Wadelai Area

Results from the household survey revealed that their major challenge was failure to meet market standard and required quantities for the market. In order to transport their produce farmers use cars, motor cycles, bicycles or human loading.

Women in Wadelai identified lack of storage facilities as one of the challenges to marketing. “Crops get destroyed when stored in a poor way. In addition we cannot store for sale during time of scarcity. Now we just harvest and sale immediately” Female participant in a focused group discussion, Wadelai. Transport is a big challenge to the people of Wadelai even for the vehicles which are hired to take goods to the market place, there is often limited space. One respondent stated that “...for example today we failed to go to Kicwinyi market because the vehicles got full, we just had to stay home and wait”. Respondents also stated that when they get to the market, they are charged very high market dues and yet the structures at the market place are very poor without shades for sitting under when selling. The men also raised the same concerns.

Improved access to input and output markets is a key precondition for the transformation of the agricultural sector from subsistence to commercial production. Smallholder farmers must be able to benefit more from efficient markets and local-level value-addition, and be more exposed to competition. Therefore, in order to address issues related to market, farmers can be supported to form a Farmers’ Cooperative Societies, large enough to have real negotiating power to ensure collective buying and marketing of produce. Additionally, there is need to put up a store so that farmers stop storing their produce in their houses where they easily get mold.

🔧 Constraints Relating to Access of Extension Services and Innovation

According to the household survey, farmers felt that the biggest challenge that training is inadequate with limited extension visits and limited access to research results as shown in the figure below.

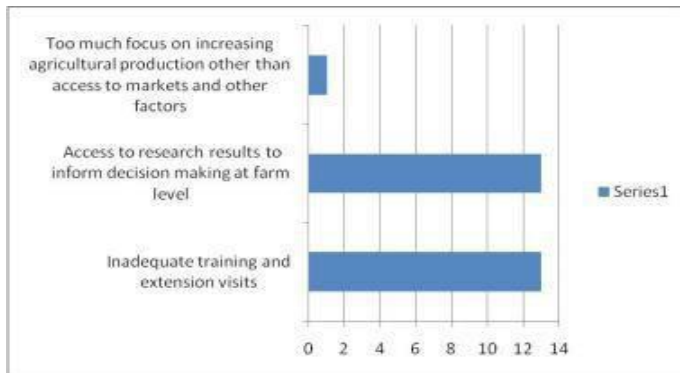


Figure 34: Constraints Related to Access to Extension Services and Innovation

Farmers need to be supported to form partnerships with the district production department so that they get more information on addressing other constraints for examples access to inputs, training in production, research and innovation. In this way they will be able to get any information that would help them improve their yields. Other recommendations that were made include the following:

- Training of farmers on better agricultural technologies and better marketing strategies
- Formation of cooperatives which will help farmers market their produce better through collective bargaining. In addition cooperatives will help with bulking in order to get the maximum from their produce
- Access roads should be improved on by the government in order to help farmers transport their produce with ease to market areas
- Group formation at the community level
- Formation of demonstration farms to guide the local beneficiaries
- Sensitization of the local population on all aspects of the irrigation project
- Training of farmers among other things

5.4.6 Labor Issues

As shown in the figure below, most household heads (55%) depend on family labor to work on their farms, 55% of the respondents did not answer this question. Labor is mostly family but there are some who hire people for example for those who are engaged in commercial farming hire labor from the prisons.

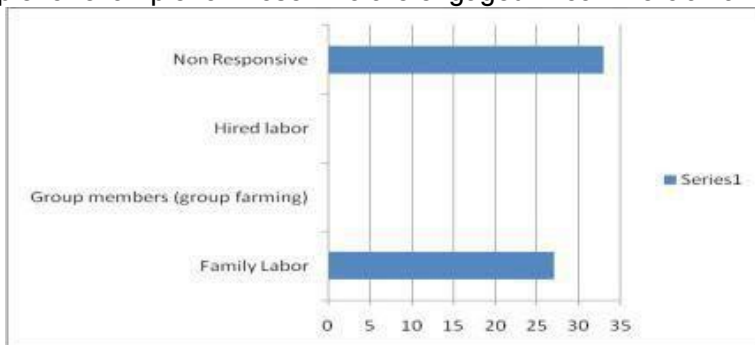


Figure 35: Source of Labor on Farms in the Wadelai Area

According to the male participants in a focused group discussion on the farm clearing the garden for agriculture is work reserved for men. Weeding, sowing, harvesting and marketing are carried out by both men and women. “We perform the marketing role together with our wives, but we leave the money with the women because they are more careful in using the money and are not wasteful” Male Participant, Wadelai

On the livestock part, “As men we participate in looking after animals and even marketing them, but after sell we give all the money to the women so that they plan and manage it” Male Participant, Wadelai

Off farm both men and women both participate brick making. Women participate in only collecting bricks to burning sites and the rest is men’s work. Both men and women in Wadelai participate in charcoal burning and selling. Fishing is dominated by men, retail trading is performed by both men and women, hawking is carried out by both men and women; sand mining is carried out by both men and women and stone Quarrying is carried out by both men and women.

Contrary to what the men were saying, the ladies claimed that they do majority of the activities associated related to land clearing, sowing, weeding, harvesting and marketing. The women also said that sometimes they spare some money which they use to hire labor.

Although women are allowed to market their produce, the men will keep all the proceeds from the sales. A respondent stated that “...it is true that we are often allowed to sell, but the men will follow us to know how much is earned and they take and keep this money. Some men contribute to domestic expenditure but others just want women to bear the entire burden”

Regarding gender roles in rearing animals men only take care of cattle but the rest of the animals like goats, chicken sheep are looked after by the women. Men dominate the sale of of animals and keep the money as a respondent observed, “...women only sell small domestic animals like goats and poultry”. There is balanced participation in public affairs. Women even occupy leadership positions (the team observed that the LC-I deputy chairperson is a woman-DominaTwape). Women do not participate because there is no time for leisure. Usually women are busy planning for the family and taking care of the home. During the festive big days like the Easter weekend and Christmas time, some women are given time off by their husbands and they are also provided with the needed money to spend on what they desire. More training on gender roles and joint planning should be emphasized during project implementation.

5.4.7 Beliefs and Value Systems

Beliefs and value systems also determine the productivity of crop and livestock systems. Economically we shall be in position to contribute towards the maintenance of the irrigation scheme, but usually there are those who may want to stubbornly frustrate the project. “We have a habit of participating in public affairs especially in those things we are sure will benefit us” Female Participant, Wadelai. The males noted that the culture supports communal responsibility for common good. Therefore according to them, the community will be ready to receive the project and actively participate within their means. 5.4.8 Domestic Water Supply Facilities

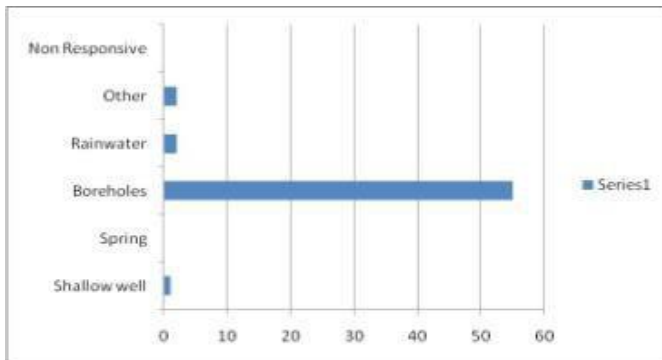


Figure 36: Sources of Water for Domestic Use

In order to understand nature of access for water for domestic respondents were asked where they get their water.

The majority get their water from boreholes as shown in the figure above. 65% of the respondents said they were satisfied with the water and 35% said that they were not satisfied with the water sources. For those that were not satisfied with the water that they use attributed the dissatisfaction to the poor quality of water and low water supply. In terms of access, 82% of the respondents said that they have 24 hours' access to water. This implies that in terms of future competition with irrigation water, chances are low that communities will vandalize property while trying to get water for domestic use.

5.4.9 Sanitation Facilities

Considering that irrigation schemes come with spread of diseases, it was important to find out whether there is general awareness about poor sanitation and health hazards.

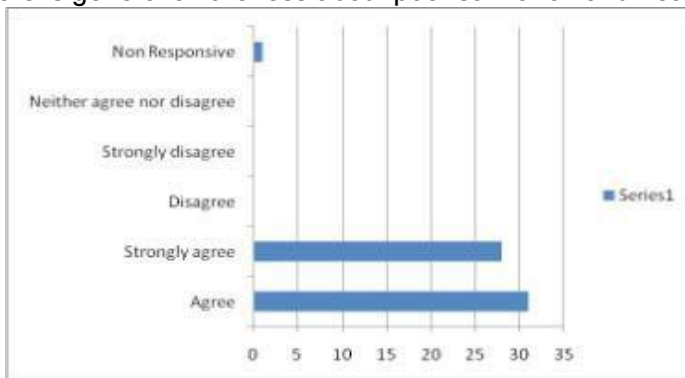


Figure 37: Linkage between poor sanitation and health hazards

As shown in the figure above majority of the respondents strongly agree that poor sanitation is linked with health hazards. As shown in the table below for most predominant diseases, affect the children below 15 years of age

✚ Latrine facilities

For Latrine facilities, 88% of those interviewed have latrine facilities, for the 7% that do not have some say they are planning to put up one. 88% of those that have latrines have ordinary pit latrines; twelve percent have VIP latrines, while 7% did not respond. As shown in the figure below, most of the structures are mud and wattle with grass thatched roofs however there are some permanent structures as well as semi-permanent structures.

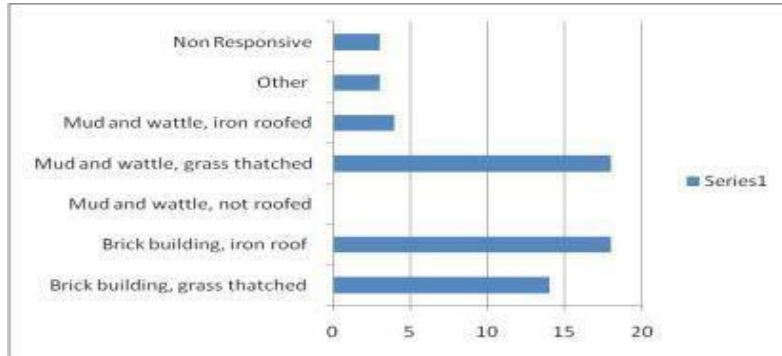


Figure 38: Nature of superstructure for pit latrines

For the sub structure, 72% have sub structures that are at ground level, while 22% have sub structures that are raised.

🚰 Hygiene Practices

83% of the respondents have hand washing facilities while 22% do not have one, when asked how often they use this facility, 88% said that they use it often, 5% said they never use and 7% were none responsive. On bathing facilities, 95% said that they have a facility for bathing while 5% said they did not have such a facility, like the pit latrines, most bathing facilities 48% are permanent while 45 percent are temporary in nature.

83% of the respondents say that they have cooking facilities while 17% do not have. On the type, most 75% have the traditional cooking stoves while 8% have energy saving stoves. This means that the demand for biomass is high as a source of fuelwood. On average, the cooking facility is 30 meters away from the latrine which limits the chances of spreading diseases. When asked where respondents dispose their dirty water, majority dispose in the compound and in sinks as shown in the figure below.

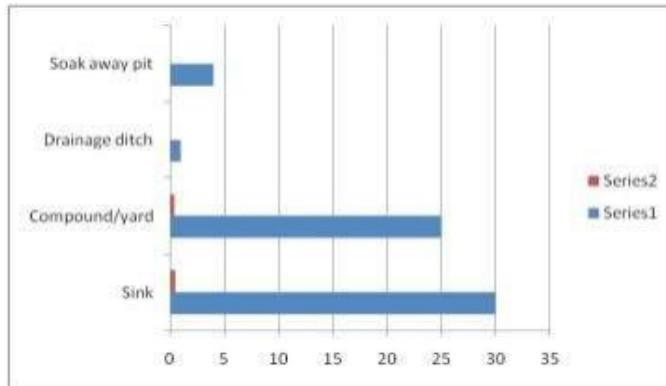


Figure 39: Methods used by Households to dispose of dirty water

In the case of rubbish, most households burn their rubbish as shown in the figure below.

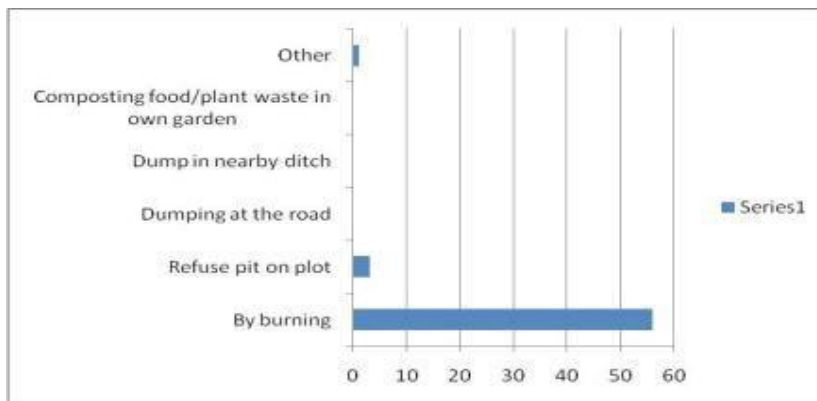


Figure 40: Disposal of Rubbish at Household Level

5.4.10 Desire and Willingness to Pay

Willingness to pay for water is a product of four factors: (i) the profit that can be gained from using the water; this factor should be reflected in the fluctuations in prices for the main commodities produced within the region in which water can be traded; (ii) supply of water; this is measured by the allocation level announced at the beginning of the season and then revised during the season depending on availability of water within the reservoirs supplying the region. The allocation level is announced as the proportion of their entitlements that irrigators can use during that season; (iii) demand for water; this would be influenced by the level of the seasonal allocation and commodity prices as discussed above, but also by the level of natural precipitation and evaporation. Finally demand for water could be determined by the price of substitute goods, within the study region (iv) the potential loss irrigators would suffer if insufficient water is applied during periods of water scarcity. Farmers were asked whether they needed the irrigation scheme in order to increase their yields and 97% of the respondents interviewed expressed the need for the irrigation scheme.

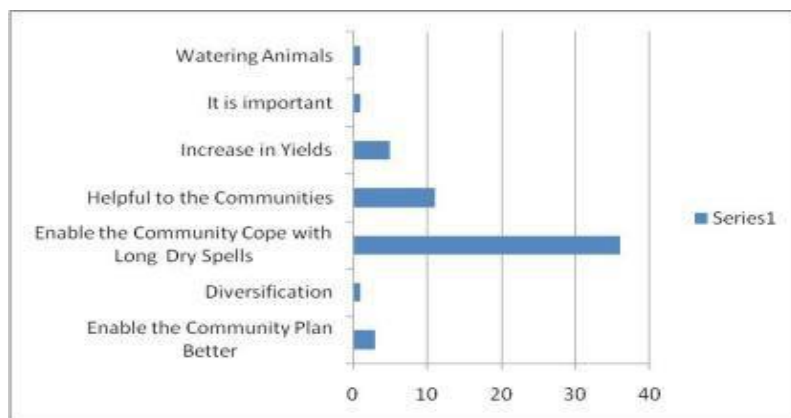


Figure 41: Basis for the Need for the Irrigation Scheme

On the reason why they expressed the need for the irrigation scheme, majority said help the cope with the long dry spells while other said that that it would helpful to the community and other said that it would help increase yield.

On willingness to pay 85% said that they are as well as members of their families are willing to pay and participate, the rest where non responsive. On how much they are will to pay, on average those who are willing to make monetary contributions said they would pay about 9,500 per month. According to the senior agricultural officer Nebbi district, communities may not be comfortable with the payments until they are sensitized; for the case of labor there already an agreement about labor so it will be available. The challenge here may be how much to pay. Some people may not be willing to pay if they cannot afford. If something is from outside people perceive it to be government thing and they expect everything free. Therefore from the planning, the communities should be involved so that they know that it is their facility and need to maintain it. Citing programmes like NAADS, where the community contributes 5% so the programme, the wetlands officer, Nebbi district was positive that the communities will be willing to contribute.

5.4.11 Proposed Management Structure for Wadelai Area

Literature shows that the performance of irrigation schemes depend on four major factors including the following:

- a. Planning: Those schemes, which were planned and implemented with full farmer participation, normally perform well. Schemes which were planned by consultants without Participatory Rural Appraisal (PRA) experience may not perform as well.
- b. Group Cohesion is important for successful irrigation management. Cooperative action is important when undertaking activities like marketing, transport hiring, operation and maintenance
- c. Type of Management is important, schemes that are farmer managed given the farmers a sense of ownership and belonging and as such they will invest in them, those that are Government managed make farmers feel that they have no sense of ownership
- d. Type of technology, whether sprinkler or surface affects the labor inputs and leisure time for farmers. Surface systems are more labor intensive that limit the time available for weeding, spraying and organizing markets for produce.

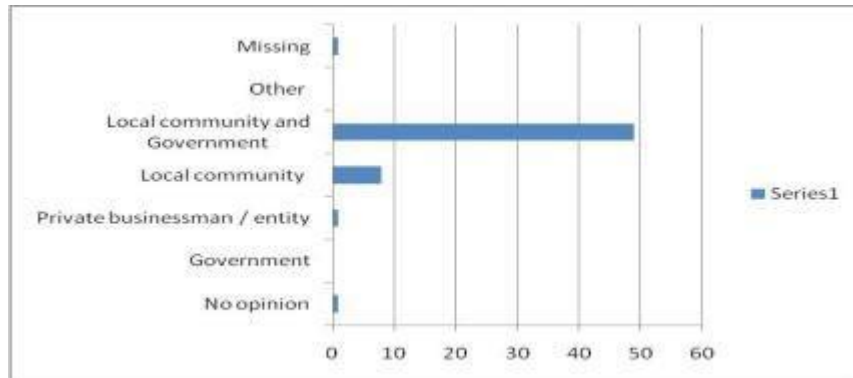


Figure 42: Proposals for Management of the Scheme

During the household survey, farmers were asked what management structure should be adopted and as shown below, majority said that the structure should comprise of the local community and Government. According to the district forest officer, the management of the scheme should be institutionalized such that at the farm level, farmers should be encouraged to form groups (as is the case with NUSAF and NAADS) and engage in block farming. Local farmers also form small pressure groups for marketing their products that is when they will be able to gain more. With awareness raising and capacity building there is likely to occur social-cultural change towards the adoption of modern technologies. If attitudes change then the locals can adopt mechanized and sustainable agriculture.

In order to prepare communities and Local Governments to manage the facility the following should be undertaken:

- Training in management of irrigation schemes
- Sensitization of local leadership
- Sensitization is most essential so that the government moves together with the beneficiaries. The locals should also be trained on team working, resource management and modern agricultural practices. "...If you want people not to cut the metals at the dam for making cigiri, then you need to make them understand the importance of the project and possibly appreciate that it is there for them to take care of." District Community Development Officer, Nebbi District
- Training on records keeping
- Training on roles and responsibility for example on the basis of gender
- Financial management training
- Leadership training
- Linkage and networking tips
- Reporting channels should be established within the community
- Training on the preparedness for impact

🚧 Stakeholders in Operation and Maintenance

According to the sub county leadership, both implementers and beneficiaries should come together and put by-laws binding the two parties. There should be committees to manage the project from the community level, supervised by the sub-county and the district. Some issues came out clearly:

- a) There are farmers organized in groups cultivating from the project area and some of them are even registered.
- b) Training people on the usage of the usage of the irrigation scheme.
- c) People should be sensitized and there should be a responsive team in place to tackle and outbreak of diseases.
- d) Bring on board both men and women. Sensitive the management team and train them to manage it well.
- e) Train the farmers on all the aspects farming like harvesting and how to well manage the irrigation scheme.
- f) Change the attitudes of the people through education and mobilization.
- g) Bring on board both men and women. Sensitive the management team and train them to manage it well. Although power struggles may arise, some members could refuse to come to meetings because they expect an allowance.
- h) Train the farmers on all the aspects farming like harvesting and how to well manage the irrigation scheme.
- i) Change the attitudes of the people through education and mobilization.
- j) There is need for increased labour at the household and the community through mobilization
- k) Many people who are engaged in farming need to be sensitized on better farming methods.
- l) There is need for increased labour at the household and the community through mobilization
- m) Many people who are engaged in farming need to be sensitized on better farming methods.
- n) Farmers should manage pricing and payment other than private persons or government
- o) Poor performance of leadership of water associations is likely to be a problem so institutional strengthening is needed.
- p) There is none (agreements) at the moment but this need to be put in place for this particular project.
- q) The most important capacity need is community awareness, community should be made aware of the benefits that will come a long with this project and be trained as well.
- r) Socio-cultural concerns in that people are resettling and the clan claims that the project land is theirs. He said that middle ground should be sought to solve or avert the problems. There could be a need to cleanse the land before the construction starts.

In addition to the above issues, communities should be sensitized on how to increase production, and an association is key so that training farmers on how to use irrigation is given high priority. Management of water needs for different enterprise is key as communities rely on livestock as well.

6. ALTERNATIVES ANALYSIS

The study of alternatives focused on information derived from the assessment of other Irrigation development in Uganda and the feasibility study for the Wadelai Irrigation Scheme (2015). Among the alternatives, different irrigation schemes were analysed, technology options, location.

6.1 NO PROJECT ALTERNATIVE

In the area proposed for the Wadelai irrigation scheme, the farmers are growing different crops including maize, millet, sesame, beans, cotton, ground nut and cassava under rain fed conditions. The proposed irrigation area is under the customary and communal land tenure systems. The farmers are using family labor and practicing subsistence farming under rain fed agriculture. Discussion made with the target community showed that productivity of crops is lower due to lack of improved farm practices and lack of water for irrigation. They also explained that limited intensity of farming and erratic rainfall as contributing factors for low production and productivity.

The development of the irrigation scheme will benefit the local community in two forms; an increase in productivity due to an introduction of improving agricultural practices and an increase in cropping intensity. As mentioned in the feasibility study report, without the project, benefits of an additional ≥ 2000 kg rice/acre would be lost as currently the area doesn't produce rice. Tochi area would therefore miss out on annual farm return upwards of ≥ 9 million Uganda shillings over a 5 year period if the project is not implemented.

6.2 ALTERNATIVE BASED ON THE MULTI-CRITERIA ANALYSIS

The findings of different aspects - technical, social, environmental and economic criteria have been analyzed using multi-criteria analysis model based on the proposal during the feasibility study phase in order to select the best two most viable projects for further study. The evaluation of the different criteria was made for four schemes namely Pabbo, Wadelai, Tochi and Biiso. This evaluation was carried out to be able to select two viable and feasible irrigation schemes of which Wadelai was among them. The model used for Multi-Criteria analysis is given in Table 33.

Table 33: The Model used for Multi-Criteria Analysis

Technical Criteria	Economic Criteria	Environmental Criteria	Social Criteria
Water availability	Benefit -Cost	+ve impacts	Social desirability
Land Suitability & availability	Market Potential & Access	-ve impacts	Social benefits
Crop production & potential	Unit Investment cost	Mitigation & Management costs	Adverse Social Impacts
O & M Maintenance & Management	Financial & Economic Viability		Socio mitigation costs

Engineering Feasibility			
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Each of the above technical, social, environmental and economic criteria was given weightages and the aggregate score indicates the most feasible scheme. The following weightages were utilized for each discipline.

Table 34: The Model used for Multi-Criteria Analysis

S.No		% of Weightage
1	Technical Criteria	35
2	Economic Criteria	30
3	Environmental Criteria	15
4	Social Criteria	20

🚧 Multi-criteria Analysis

The evaluation of the different criteria for the four schemes was done taking into consideration of various outputs from the sectorial studies.

Table 35: The Model used for Multi-Criteria Analysis

		% weightage	Pabbo	Wadelai	Tochi	Biiso
I	TECHNICAL	35	24.45	29.43	26.67	21.80
1	Water availability	15	5.9	12.1	12.2	6.3
2	Land Suitability & availability	15	12.0	14.0	12.0	11.0
3	Crop production & potential	30	20.0	27.0	21.0	12.0
4	O & M Maintenance & Management	10	7.0	7.0	7.0	7.0
5	Engineering Feasibility	30	25.0	24.0	24.0	26.0
		100	69.9	84.1	76.2	62.3
II	ECONOMIC	30	16.38	22.61	11.44	21.57
1	Benefit -Cost	20	11.48	16.2	7.06	17.08
2	Market Potential & Access	20	15.00	18.00	16.00	11.00
3	Unit Investment cost	10	3.06	4.93	3.07	6.29
4	Financial & Economic Viability	50	25.07	36.23	12.01	37.53
		100	54.61	75.36	38.14	71.91

III	Environmental	15	14.1	10.5	14.1	7.5
1	+ve impacts	25	25	25	25	20
2	-ve impacts	45	45	27	45	18
3	Mitigation & Management costs	30	24	18	24	12
		100	94	70	94	50
IV	Social	20	13.5	20	20	7.45
1	Social desirability	20	20	20	20	8
2	Social benefits	30	22.5	30	30	18
3	Adverse Social Impacts	25	12.5	25	25	6.25
4	Socio mitigation costs	25	12.5	25	25	5
			67.5	100	100	37.25
	TOTAL		68.43	82.54	72.21	58.32

Based on the sectorial criteria analysis the aggregate for the four projects was prepared (table 36).

Table 36: Aggregate of multi criteria analysis of four irrigation schemes (%)

		% weightage	Pabbo	Wadelai	Tochi	Biiso
I	Technical	35	24.45	29.43	26.67	21.80
II	Economic	30	16.38	22.61	11.44	21.57
III	Environmental	15	14.1	10.5	14.1	7.5
IV	Social	20	13.5	20	20	7.45
	Total	100	68.43	82.54	72.21	58.32

✚ Conclusions

Based on the multi-criteria analysis and Financial and Economic findings, Wadelai irrigation scheme was the most feasible

Table 37: Result of financial and economic analysis of irrigation projects

Irrigation Schemes				
	Pabbo	Rhino camp - Wadelai	Tochi	Biiso
Financial Analysis				
FIRR	47.58 %	57.86 %	26.21 %	63.92 %
NPV	58,599,830,330	129,456,200,448	42,570,775,021	66,674,232,461

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

B-C ratio	3.24	3.81	1.84	4.19
Economic Analysis				
EIRR	40.47 %	49.94 %	22.06 %	56.03 %
NPV	46,709,705,758	106,191,923,540	30,984,054,473	56,024,471,246
B-CRatio	2.84	3.34	1.61	3.67

7. STAKEHOLDER CONSULTATION AND PARTICIPATION

7.1 INTRODUCTION

This chapter provides details of the public consultation and participation activities undertaken during the ESIA for the proposed Wadelai Irrigation Scheme. The project is in Wadelai Sub-County and covers two parishes of Pumit and Ragem Upper parish (see table 38) for Sub-Counties, Parishes where consultations were carried out). Emphasis was placed on a fully-inclusive, open and transparent public participation process in the transfer of information regarding the Wadelai Irrigation Scheme project. A number of stakeholders are involved in this project ranging from the Lead Agencies, district officials, Sub-County officials, the community and other stakeholders. Public consultation process started in 2015 during preparation of the scoping report through to the preparation of the Environmental and Social Impact Statement.

Table 38: Project area boundaries where consultations were carried out

SUB-COUNTY	PARISH	VILLAGE
WADELAI SUB-COUNTY	RAGEM UPPER PARISH	5) Prison Farm Village 6) Ayabu East Village 7) Ayabu central 8) Ayabu West
	PUMIT PARISH	4) Aroga LC1 5) Agu South Village 6) Lwalo LC1

7.2 Classification of Relevant Stakeholder

Stakeholders can be divided into two very broad groups: those ultimately affected, primary stakeholders (who expect to benefit from or will be adversely affected by development of proposed Wadelai Irrigation Scheme and related interventions) - and those with some intermediary role - secondary stakeholders.

Primary stakeholders include; Nebbi District Local Government, Wadelai Sub-County Chief and the local communities whose activities directly rely on or impact on natural resources available where the proposed project and its supporting infrastructure is expected to be developed. The Ministry of Water and Environment together with the Ministry of Agriculture Animal Industry and Fisheries are themselves primary stakeholder

Secondary Stakeholders include the Funders, public sector agencies (ministries, regional/provincial or local governments, government mandated agencies, etc.), private sector, and NGOs.

Stakeholders can further be classified by the scope of geographical coverage to identify four categories of key stakeholders:

- a) Key Nationwide stakeholders comprise basically of national institutions within Uganda in charge of providing and enforcement of regulatory framework, planning, implementation and monitoring in relation to the proposed project. They comprise basically institutions with nationwide scope of operation and influence in Uganda. Their activities often have significant nationwide effect on the direction of the Agriculture sector, water usage and irrigation activities. Many public sector institutions MWE, MAAIF (and other line ministries), NEMA and Parliamentary committee on Natural Resources fall within this category. Their activities may affect resource use and activities. An analysis of these stakeholders is presented in Table 37 below.
- b) Key International Stakeholders: likely to have stake in the Agriculture sector like regional institutions, these comprise major Technical Support organizations with a global perspective such as the African Development Bank and NFT (the project funders), They stress coordination and compliance with international environmental and Climate change related obligations and are very influential in project planning and implementation processes as they provide financial and technical support based on internationally applied regulations and guidelines (often have strict terms under which they provide their financial and technical support to guard against environmental and social damage and mismanagement of funds).
- c) Local Stakeholders The majority of local stakeholders likely to be directly affected include the Indigenous people and Community (Men, women, youth) actively utilizing resources within the area and eking out a living from exploiting natural resources or whose source of livelihood is affected by the establishment and development of irrigation scheme activities. Most notable in this category are; the communities and Local Governments within and surrounding the proposed project site. Based on their individual mandates, consensus needs to be arrived regarding their interests as they influence in the decision-making and planning processes. An analysis of these stakeholders is presented in Table 37.
- d) Education and Research Based stakeholders undertaking studies related to Environment, ecology such as:
 - Makerere College of Agriculture and Environmental Sciences- The college offers graduate level training courses in Agriculture, Environmental Management and Wetlands Conservation.
 - National Meteorological Training Centre - Offers certificate and diploma level technical and practical training to meteorology observers, technicians and officers.
- e) Private Sector and Civil Society Organizations (CSO) The private sector is not very influential in the decision- making and planning processes since their main interest is to do business and make a profit. Their most noticeable influence is in lobbying for contracts and for policies and laws that enhance their participation. However, the CSO form an important advocacy front with strong capacity to disseminate and mobilize local community support.

7.3 Mobilization

In order to plan for the stakeholder engagement exercise, stakeholder analysis and mapping was undertaken. Based on the different interest of the stakeholders, the table below outlines the stakeholders groups that were consulted by the members of the ESIA team summary of the information requirement.

Table 39: Description of stakeholders, consultation purpose and the information required for the proposed Wadelai Irrigation Scheme

Stakeholder	Project Interest	Information Requirements	Engagement Mechanism
MWE	Need for Irrigation scheme, water resource utilization and sustainable project implementation including catchment management and protection	Irrigation Potential of the country, growing demand for water resources, climate challenges	Formal/Periodic Meetings
MAAIF	Implementation of the project at the operational phase	Policy guidance in the development and operation of the irrigation project,	Formal/Periodic Meetings and Site visit
Ministry of Gender, Labor and Social Development	Protection of women, orphans, elderly and physically challenged and other vulnerable groups	Aspects related to equity and equal access to water sources, How the project will address social injustices in access to irrigation services and current guidelines for gender mainstreaming and budgeting.	Meeting
Nebbi District Local Government and Wadelai Sub-County	Project benefits to the local community, Improvement in local community infrastructure, resolution of disputes on land holding	Basic infrastructure facilities in the affected project area.	Periodic Meetings and Site visit
Ragem Prison Farm Village	Project will benefit the prison at Ragem. The prison is involved in intensive farming and is constrained by unreliable rainfall in the area	Aspects related management of the irrigation scheme at prison level	Periodic Meetings and Site visit

Private Sector	Valuable resource for design, construction, operation and maintenance of water and sanitation facilities. Conduct training and capacity building for both central and local government staff. Provision of other commercial services including mobilization of financial resources for irrigation development activities.	Current capacity development needs, Existing financial services for the water user groups.	Meetings and Informal discussions
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The mechanisms used for this assignment included information sharing meetings with the national and district officials of Nebbi, communities and local government staff and local leaders. The concerns and issues raised during consultation are discussed as below:

7.4. Consultation Activities

Consultation was undertaken with local, regional, national and international interests and stakeholders. The purpose of these consultative meetings was to introduce the project with the stakeholders and to identify their comments and expectations with respect to the proposed Wadelai Irrigation Scheme and ESIA process. Annex 5 provides the details of the issues captured during consultative meetings and a list of individuals consulted.

7.4.1 Summary of Major Concerns Raised by Stakeholders

The views of the national and district official are discussed in line with negative and positive impacts that the project would have on their sectors. These include impact on local communities, watershed and catchment management, water flow management in River Oraa and irrigation scheme management issues as well. The major concerns raised by the officials are discussed as follows:

i. Impacts on Local Communities

The main concern of stakeholders from the local communities was mainly about how they will benefit from the project and how they will be involved right from construction stage to operation phase of the Wadelai Irrigation Project. The community members emphasized the need to provide local youth with jobs during construction of the irrigation scheme. The community members also want the contractor to source raw materials locally

The ESIA team Consultations with the Local Leaders in Ragem Upper Parish revealed that the community should benefit from contractor social responsibility by for example rehabilitating the only borehole in Ayabu West Village which got a mechanical problem thus people trek long distances to River Oraa to fetch water.

ii. Natural Resource Management and Catchment Management Concerns

Consultations with National Environment Management Authority focused on compliance of the project plan to the existing environmental legislation. NEMA will review the ESIA and they are also concerned that aspects of the river banks would be adequately addressed in the ESIA process. The agency would also be interested in knowing whether there is degradation at the moment and whether then 100 meters buffer zone is observed by community members since the current trend is that people living or cultivating up to the river bank do not respect it. National Environment Management Authority (NEMA) was also concerned about the impacts on other water users downstream the proposed irrigation scheme. As regards to the protection of catchment areas of River Oraa, consultations with NEMA revealed that there should be a comprehensive plan to protect and manage the catchments of river oraa and the Wadelai Irrigation Scheme for sustainability.

iii. Vulnerability, Equity, Responsiveness and Rights Concerns

During the field visits and the consultation process, it was noticed that communities within the proposed Wadelai Irrigation Scheme area already experience different forms of vulnerabilities given that they are in an area which is drought prone and flood prone whenever it rains. Consultations with the Ministry of Gender Labor and Social Development focused on exploring the options to include local communities in the establishment of the Wadelai irrigation scheme. The ministry recommended that staff (Community Development Officers-CDOs) to be established within the Wadelai Sub-County. These staff will be responsible for community mobilization, sensitization etc. These CDOs have to be oriented and trained in social mobilization, and should become part of the project management team. The people at the management level should make sure that they will include a CDO, who will take care of gender responsiveness and inclusion. In terms of gender responsiveness, the ministry has policy guidelines which require that gender impact analysis should be undertaken as part of the project appraisal. It was recommended that a consultant, who can do gender analysis and include the specific heads of people, should also be brought on board. Additionally, occupational safety and health should be assessed and addressed in the project design and implementation

Consultations with the Equity and Rights Department of the Ministry of Gender, Labor and Social Development suggested that the local people need to be consulted and sensitized about the project. The people should be kept updated about the progress of the project right from construction to operation. In case of displacement, they need to address the economic activities of the people, and the project should support income generating activities as well as provision of social services like construction of farmer schools, etc. The local people in the Parshes of Punit and Upper ragem who depend on River Oraa as a source of their water should be put into consideration in ESIA. Safety measures should also be taken into consideration, as the project authority will use fertilizers and pesticides during operation of the Wadelai Irrigation Scheme. Finally, the project implementation unit of FIEFOC under MWE should liaise with the equal opportunities commission on issues of complaints and alternative disputes resolutions and mandated institutions should also be involved in the project implementation process.

iv. Water Abstraction and Diversion of River Oraa

Consultations with the Ministry of Water and Environment (MWE) raised concerns regarding the construction processes of the proposed Wadelai Irrigation Scheme that could divert the flow of water in River Oraa. The team recommended that unnecessary/ diversions of River Oraa be avoided such that

water flow continues normally having no or limited effects on water ecosystem and access for community members and downstream water users.

v. Irrigation Scheme Operational Concerns

Consultations with the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) focused on the impact of the irrigation scheme when it is operational. MAAIF will have a duty to make sure the Wadelai Irrigation Scheme is productive and is operational and well maintained. It will have a duty to empower farmers and farmer groups and avail extension services to the farmers.

vi. Other Socio-economic Issues

Concerns raised by Non-Governmental Organizations involved in the project area recommended that the design execution of the project should have adequate considerations for environmental like social, cultural and minority groups. Furthermore, there should be clear and sound interests and political interests should also be put into consideration because of the nature of the community. The community should be given a chance to access and appraise the project. There should be EIA and there should be participatory mechanisms of implementing the project at the communities so that people’s views/stakeholders are taken into account. In terms of site specific concerns, staff at Future Dialogues international noted that project approaches should be multidimensional given their site specific conditions.

The LC 1 Chairman of Aroga Village raised concerns relating to potential population increase as a result of the project especially during construction phase of the irrigation scheme. He recommended that a plan be put in place to ensure that local communities are able to cope with the sudden surge in population in the area with its associated impacts. Issues of defilement, HIV/AIDS should be seriously addressed at the initial stages of the project through sensitization of all workers. Demand for services (hospitals) and utilities (e.g water) is likely to increase and therefore a hospital and more boreholes would be needed in the immediate areas of the project area.

7.5. Community Meetings

At the community meetings, information on the socio-economic studies, environment impact studies and other engineering issues related to the Wadelai Irrigation Scheme were discussed. The stakeholders and community members were then given an opportunity to raise their concerns regarding the proposed project. See table 40 above for the viillages that were consulted in the project areas .The key issues raised by the local community are presented in Table 40. The details are presented under Annex 5.

Table 40: Major issues raised by the local community during consultative meetings

Issue	Community concern
Employment opportunities	<ul style="list-style-type: none"> • Will the youth within neighboring project area be given first priority during the recruitment exercise and how many workers will be required? • There is need for entrepreneurship training and provision of loans to the youth so that they can engage in the project during its operations

<p>Utilities and Social Services</p>	<ul style="list-style-type: none"> • There is need for the communities to benefit from the project for example improve access to safe water through establishment of boreholes • Will accessing the irrigation facilities be free or for payment?
<p>Grievances over Possibility of Compensation</p>	<ul style="list-style-type: none"> • Some individuals staying close to the proposed project area especially close to the River Banks and near the proposed reservoir area fear of displacement and thus worried on whether they will be compensated • When water overflows the reservoir during operation of the irrigation scheme, who will be responsible for compensation of property destroyed • Concerns over destruction of people's gardens especially along access routes since they are not well established and whether compensations will be made for destroyed crops
<p>Concerns over Management of Irrigation Scheme</p>	<ul style="list-style-type: none"> • Concerns over who will get land in the project area and what criteria will be used to allocate land to farmers and farmer groups • Whether there will be available markets for the farmers' produce • The established dam and the reservoir will have fish, will the fish be available for the community members free of charge
<p>Concerns over water related disease outbreaks</p>	<ul style="list-style-type: none"> • Water related diseases are most likely to affect the locals in the area for example malaria, bilharzia and diseases may become prominent due to the establishment of the dam and reservoir



Plate 4: Meeting with Local community in Pumit Parish



Plate 5: Meeting with Ragem Upper Parish Local community



Plate 6: Consultations with the Officer in Charge of Ragem Prison at Prison Farm village and below a FGD of Women in Punit parish



8. IMPACT ASSESSMENT AND MITIGATION MEASURES

This section presents the discussion of impacts, the identification and the mitigation that are likely to affect the environment is based on the period of

- Pre-construction and construction of project facilities, and
- Operation of the Irrigation Scheme

The environmental impacts are analyzed for three major elements,

- the social environment (including the positive impacts)
- the physical environment
- the biological environment

8.1 IMPACT ASSESSMENT

This is the process of identifying the anticipated or actual impacts of a development intervention, on those social, economic and environmental factors which the intervention is designed to affect or may inadvertently affect. Potential impacts have been identified based on proposed activities to be undertaken, through specialist studies and through a consultative process with key stakeholders. To establish impact significance, the following key concepts will be utilized as follows:

The identification of all the possible impacts of the Project followed a systematic approach, which included consideration of the following:

- Project Description- an analysis of the Project design, Project phases and activities and the processes involved, which has resulted in a clear understanding of the Project activities that have the potential to give rise to impacts;
- Project Scope of Assessment - the scope of assessment has highlighted the potential environmental and social/socioeconomic components that may be impacted upon during a certain timeframe and over a certain distance;
- Stakeholder Input - the input of key stakeholders was considered in identifying the potential impacts that are of concern to those parties that may be impacted by the Project;
- Expert knowledge - expert knowledge from scientists and regulators familiar with the project as well as prior experience of EIA specialists with experience gained from similar projects has contributed to the preliminary identification of impacts;
- Project/Environment Interactions - A Project activity/environment interaction matrix was developed, which summarized the possible interactions between Project activities and the main resource/receptor types during the phases of the Project.
- Cumulative impacts: are those arising from a large number of activities that are for the most part individually insignificant, but together have had regional or even global repercussions. Discussion

of these impacts will be done qualitatively and possible mitigations suggested banking on similar projects, in the absence of the national framework for identifying/addressing cumulative impacts. Two different forms of impact are assessed within this ESIA:

- Planned impacts; those impacts that result from a planned event. Such impacts are expected to occur during the course of the Project (e.g. an increase in turbidity levels in the water column due to a disruption of seabed sediments);
- Unplanned impacts; those impacts that result from an unplanned or non-routine event. Such impacts are not expected during the Project but nevertheless the probability of the impact occurring is assessed (e.g. occupational hazards).

8.2 EXPECTED POSITIVE IMPACTS

These are the positive impacts anticipated at the onset of project activities;-

A. Increased Job Opportunities for Local Populations

The project will provide substantive employment opportunities to local populations especially in Ragem Upper Parish and Pumit Parish, particularly during the construction phase of the irrigation schemes. An influx of labourers and construction workers will characterize the construction phase, which will drive the demand for basic services including housing, transport, food and healthcare. The local communities will meet these needs; local women can provide food-vending services, homes can be rented out for the new population and small enterprises will benefit from increased sales of products and/or services. It is anticipated that the project will provide up to 500 direct employment opportunities over the entire construction cycle to ensure its completion, with a sizable locally contracted workforce of between 100200 persons at any one time.

B. Improved Rural Livelihoods and food security

During operation of the irrigation schemes, increased agricultural employment and non-farm activities in Ragem Upper Parish and Pumit Parish and Nebbi District at large is also expected to occur as a result of increased agricultural acreage. Entrepreneurial activities in supplying inputs and other support services to the production activity will generate multiplier effects on the targeted communities through increased income and creation of job opportunities especially to 50% of the targeted youth and women.

C. Increased Agricultural Production and Acreage

The construction of the irrigation infrastructure and proper management of the irrigation scheme (through efficient water application and sustainable irrigation practices) is expected to yield considerable increase in the agricultural output e.g. rice, maize, fruits. The irrigation scheme will particularly encourage the rise of out growers in Ragem Upper Parish and Pumit Parish that can support the supply of agricultural crops to the regional markets and will contribute to local revenue to the communities, district and the overall economy of the regions and country as a whole.

D. Restoration and Protection of Catchment

The proposed project will be based on a catchment approach that will not only improve the livelihood of people living in the catchment area specifically in the villages of Ayabu East, Ayabu central, Ayabu West, Aroga LC1, Agu South and Lwalo LC1, but also promote sustainable development of the watershed to address environmental challenges i.e. land degradation in the project area. Tree planting and other watershed management activities planned as part of the project will contribute to restoration of forest cover and ecosystems, thus reducing soil erosion, water pollution, combat desertification and deforestation as well as enhance water catchment functions. These activities will mitigate climate risks and contribute to reduced vulnerability to extreme weather events and provide a more secure social environment for targeted populations.

E. Improved Water for Productive Uses

Improved water for production through the construction of irrigation infrastructure will be one of the major benefits. With the development of the proposed Wadelai irrigation scheme, smallholder farmers will have access to water for agricultural production, which will help them counter the problems of frequent dry periods, thereby smoothening the cyclical impacts of droughts. In addition, the rehabilitation measures are expected to improve the efficiency of water diversion, conveyance and application and thus reduce water wasting. Apart from improving agricultural production this will avail additional water that would have been wasted to downstream users and thereby reduces water pressure and conflicts. There will also be improved flood water utilization in the area and flood control specifically in Wadelai Sub-County.

It should be noted that the above mentioned positive impacts will be enhanced during the onset of project activities to offset some of the negative impacts.

8.3 POTENTIAL NEGATIVE IMPACTS

This section presents the potential negative impacts anticipated to occur during pre-construction, construction, operation and decommissioning phases of the project. It's important to note that most of the negative impacts to the environment will be attributed to construction activities with minimal operation and post operation effects. Mitigation measures have also been proposed in reference to feedback from consulted stakeholders and international best practice standards.

8.3.1 Pre-Construction Phase Impacts

These are anticipated impacts that are likely to occur in the period preceding construction activities.

A. Loss of Land

The area proposed for irrigation infrastructure is currently being utilized for grazing domestic animals especially cows. Also livestock kraals exist within the project command areas at 315216/ 297973 and at 316346/ 301508 (UTM) in the vicinity of the dam area. Converting this land into agricultural fields will deny pasture for animals and access to water. The impact intensity is high as already there are tensions between farmers and grazers for the flood plain and access to water. The receptor sensitivity is high also because the area has known some volatile tribal clashes in the past over land.

Mitigation Measures

- Siting of the road and support facilities (Construction Camps) to avoid critical terrestrial and aquatic habitat that are used for cattle grazing by herders (e.g. thick wooded grassland the riverine forests, wetlands, and fish spawning habitat);
- Ensure cattle keepers have access to water points and doesn't prolong the distance originally covered by the herders. Water points can also be constructed close to grazing fields for ease of access to avoid conflicts and destruction of croplands;
- Continious sensitization should be undertaken by the MWE together with MAAIF and Local Government to inform stakeholders of the benefits of the irrigation project and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time.
- While opening new areas for access, the top soil shall be stockpiled and preserved for future restoration use;
- The developer will utilize existing transport corridors whenever possible;
- The developer will provide adequate protection (e.g rip rap, grassing, gabions, settlement ponds etc) against scour and erosion; and giving consideration to the onset of the rainy season with respect to construction schedules;
- Encourage native vegetation to re-grow after the construction. The following species can be planted to restore riverine habitants e.g. Bridelia brideliifolia; Carapa grandiflora; Croton megalocarpus; Prunus africana; Psychotria bugoyensis.

B. Increased Noise Generation from Equipment

Heavy trucks moving equipment and materials in preparation for the construction will generate a considerable amount of noise and vibration within the park. The measured noise levels are typical of undisturbed environments except at busy road junctions therefore any increment from the norm will inevitably lead to varying degrees of disturbance to the wildlife. The receptor sensitivity in this case low and impact intensity is low because already there is other vehicles on the road transporting community members to and fro the site.

Mitigation Measures

- Construction activities that may generate harmful noise should be limited only to day time, e.g. 6 am to 6 pm;
- Sound-control devices on equipments should be maintained in good condition. Regular servicing of equipment and machinery shall be emphasized;
- Appropriate and sufficient PPE for noise protection shall be provided to all workers and visitors to highly active sites;
- The contractor shall be required to obtain a license from NEMA incase he emits noise beyond the permissible noise levels;
- Put in place signages for reduction of speed in highly sensitive areas like corners, areas of known trails, breeding grounds so that shock events are reduced to manageable levels by animals;
- Adhere to the speed limit of 25kph within the project area;
- Selecting equipment with lower sound power levels and installing suitable mufflers on engine exhausts is highly recommended.

The proponent will develop a mechanism to record and respond to complaints especially from communities to check on effectiveness of the applied mitigations and to get insight on how to address these concerns in due time.

8.3.2 Construction Phase Impacts

Typical activities during the construction phase of the irrigation project include civil work that will result into vegetation clearing, channeling, installation of measuring devices land levelling, some concrete works, water diversion, wastewater collection. The following impacts are envisaged.

A. Air Pollution

Potential impacts to air quality will occur due to construction activities. The sources of air emissions may include (i) exhaust emissions from internal combustion engines of gases and (ii) dust and particulate matter generated during construction and vehicle traffic can lead to adverse health effects. However; the impact intensity in this case is low because the project will be more human labour intensive than machine. Few or no Sections of the areas where particulate material was observed included those with vehicles on murrum roads however the rest of the areas had no detectable levels of SO_x, NO_x and H₂S. This presents a good quality environment and a high dilution potential for any pollutants produced. The receptor sensitivity is therefore medium, with a moderate impact severity before mitigation.

Mitigation Measures

- All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to a vehicle in active movement;
- All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO₂, SO_x CO, and NO from vehicle exhausts;
- Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement;
- The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes.
- Apply daily water sprays to suppress dust.
- No bonfires for waste will be encouraged in the project area, as this causes dust raising situations;
- Cover excavated soils especially on windy days to reduce dust exposure to workers and neighboring areas;
- All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site;
- Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors;
- Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase;
- Areas near exposed surfaces of stockpiled materials should be vegetated.

B. Soil Compaction and Erosion

Soil erosion is expected to arise from excavations to enable channeling of water from the reservoir to the plantations. The use of heavy machineries and increased traffic during the construction work within the project area is likely to lead to compaction of the soil structure which may lead to reduced soil infiltration capacities and subsequently resulting in increased run-off. The increased run-off may lead to soil erosion. Soil erosion will result in degradation of the land, loss of fertile soil, siltation and pollution of water as a result of silt accumulation. Siltation will affect hydraulic structures and will incur additional cost for silt removal on the users. The impact intensity in this case is medium, since large areas are scheduled for the excavation and the receptor sensitivity is medium because of the nature of the soils, predisposes them to a high susceptibility to erosion. The impact magnitude is therefore moderate before mitigations are applied.

Mitigation Measures

- Project activities will be scheduled to avoid heavy rainfall periods (i.e. more activities during the dry season) to the extent practical;
- The developer will encourage contouring and minimizing length and steepness of slopes to reduce erodibility;
- Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places;
- Re-vegetating areas promptly after activities. This helps to stabilize soils after excavation activities. The following species can be planted to restore riverine habitats e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
-
- Spoil and stock piling areas should have properly designed channels to direct runoff away from the areas to prevent material erosion;
- Designing channels and ditches for post- construction flows especially in periods of high flow;
- Lining steep channel and slopes and removal of all the excess spoil to a designated place is advisable to mitigate run off.

C. Contamination of Surface Water

The laboratory results of physico-chemical analysis as indicated on the certificate of analysis (Annex 3) show normal River Oraa water quality characteristics i.e. the level of fertilizer residues in the river water is low, no pesticide residues were found and the coliform count is characteristic of normal river waters. However; the construction phase will involve the use of construction vehicles and machinery that will require refueling and engine repairs. Accidental spills and discharges during these activities may potentially lead to pollution of soil and water sources. Contamination of water is potentially more serious since pollutants may move fast, destroying aquatic life and rendering water unsafe for domestic and livestock use. The receptor sensitivity is medium, because the Oraa river pours into the Nile, which is an internationally shared system therefore any negative impact will affect not only a regional area, but may travel across international boundaries.

Communities will mainly carry out project construction with little mechanical works, so little amount of wastewater and waste gases is expected to be produced almost has no effects on the environment. The possible solid wastes are sands, stone blocks, bricks and soil. Since the little demand on sands and stones, there will be no much solid waste left by rational purchase on such stuffs. The main solid wastes are the disused soil in field projects.

Measures

Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season (ie when the seasonal rivers like Chobe are dry) to reduce sediment/contaminant delivery to the river and eventually to the Nile;

- All working areas need to have runoff control systems including silt traps and storm water drainage systems.
- Sanitation facilities need to be located away from streams, rivers, dam area to avoid contamination. The designs of these needs to take into account the permeability of the soils as well as the water table level.
- Application of appropriate construction practices and creating awareness among the community of the need to maintain high water quality;
- All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities);
- Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;
- When water quality criteria allow, storm water should be managed as a resource in holding lagoons, either for groundwater recharge or for meeting water needs at the site;
- Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health;
- Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials.
- Diversion of storm water flows from construction sites

D. Contamination of Ground Water

Waste storage areas for the construction crew may leak nutrients and biological pollutants into ground water resources. Other sources of pollution maybe spoil storage areas on site for contaminated soils. The impact magnitude in this case is low, because no waste materials will be stored on site therefore any leachates will not have reached ground aquifers before the camps are removed and restoration commences. The Receptor sensitivity is low.

Mitigation Measures

- Waste collection points for workers at the construction site will be located out of the high water table sections of the area;
- All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources

E. Loss of Vegetation

Vegetation clearance is anticipated during the construction phase of the infrastructure development including irrigation infrastructure and access roads. The construction sites will be established in areas with prevalent vegetation that are mostly characterized by riverine forests, dry savannah woodlands, and bushy vegetation. Vegetation cover will be lost from the excavation of earth materials and cutting of

Mitigation

indigenous trees. These activities will expose the land to elements of erosion such as wind and water and thus will trigger the process of land degradation. The areas identified for these facilities are within the grassland cover and therefore the impact magnitude is rated as medium, and the receptor is medium because grasses easily re-vegetate after disturbance as compared to higher plant species.

Mitigation Measures

- To maintain the ecological integrity of the project area, it is recommended that only disturbed sites that are susceptible to erosion will be planted with wildlings of the characteristic species from the nearby areas, including Paper Bark Thorn (*Acacia sieberiana*), Mvule (*Milicia excelsa*), Cape Mahogany (*Trichilia dregeana*) and West African Albizia (*Albizia zygia*). The following species can be planted to restore riverine habitats e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
- The developer will select appropriate low- impact extraction (e.g. excavation,) methods that should result in final site contours supportive of habitat restoration principles and grasses reestablishment;
- Establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities;
- Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement;
- During extraction, ecological niches should be preserved and protected as far as possible.
- The local community should be allowed to harvest the areas of natural vegetation as fodder for cattle that are to be cleared prior to clearing.
- Areas of natural vegetation that are to be excluded from the development should be clearly demarcated to avoid illegal harvesting of vegetation and or wetland degradation.
- All belts of riparian woodland and forest along the River should be excluded from the development and a buffer of 100 metres on either side of the river be maintained.
- All riparian zones of smaller tributaries of the River, whether perennial or non-perennial, should be excluded from development and a 30 metre-wide buffer should be implemented; these will then act as ecological corridors through fauna can move across transformed habitat.
- Minimize number of trees cut

F. Construction Incessant Traffic

The construction phase will entail materials haulage that will put varying number of heavy trucks on the main roads to the project site. Traffic congestion from construction activities could potentially cause disruption, health and safety impacts, as well as economic impacts. The use of heavy moving construction vehicles and machineries in project sites is generally known to cause traffic, reducing movement and flow of vehicles. It is also envisaged that with the improvement of the transportation due to expansion and construction of new access roads, highways and bridges, the traffic volumes and speeds will increase. This will likely increase the frequency and severity of accidents in the project area. The impact intensity is

medium, because the construction is to take place in phases, which will necessitate the usage of only a small number of vehicles at a particular time. The receptor sensitivity is low on producing a combined receptor sensitivity of medium ranking. The impact severity is moderate before mitigations.

Measures

In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one-way traffic routes if needed, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic;

- Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;
- Ensuring moving equipment is outfitted with audible back-up alarms;
- Using inspected and well-maintained lifting devices that are appropriate for the load, such that there are no breakdowns in the middle of the road;
- Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users.

G. Increased generation of Noise Levels

Most water conservancy projects, like enforcement of the construction of agriculture irrigation project and integrated protection and management for small rivers, are earthwork, most of which are far away from residential areas. Thus there is almost no noise pollution. For the projects that are located near to residential areas, noisy mechanics should be avoided for use. Noise impact from one vehicle will be low, given the vegetative barriers and remoteness of the construction site from receptors and the receptor sensitivity is low given there are no neighbouring houses in the vicinity.

Mitigation Measures

- Night time activities will be avoided at all costs in as far as is practical, because sound travels further during night than during the day;
- In order to limit noise due to haulage traffic, the construction fleet will be kept in good condition well fitted with efficient silencers;
- Hand held tools will mostly be used therefore incidences of noise increment will be avoided.

H. Occupational Health and Safety Risks

Construction and operation activities at the project that involve handling of heavy equipment, working in an area that is prone to flooding, being exposed to the sun for long hours. There are a number of health and safety concerns relating to construction works, including injuries to workers, incidences of disease including malaria and water borne diseases. The irrigation system may create favorable habitats for water-borne diseases such as malaria, which is endemic in the area. The irrigation structures are likely to result in increased accumulation of water (water-logging), which may have several negative impacts such as water-borne diseases (typhoid, bilhazia, etc) and also result in accidental deaths through drowning of people and livestock. The probability of occurrence is high, due to the remoteness of the site, which may present a variety of challenges sanitation and safety-wise. The significance of consequence is moderate given that most workers will be locally sourced so the negative impacts arising out of exposure of foreign people to the local climate, food and area, are reduced. The overall significance is major, therefore necessitating stringent mitigations as proposed below.

Mitigation Measures

- Carry out risk assessments and prepare a risk management plan of all activities at work site and purchase fit for purpose PPE for use by the workers.
- Provide dust suppression measures and have a daily monitoring of dust caused by construction vehicles.
- Establish an appropriate emergency response and emergency medical stabilization facilities at the project site.
- The project will require a small standalone medical service to cater for emergency and limited occupational health care for the workforce at a minimum. This is because the local health care facilities are not equipped to support these activities.
- Develop training programs on First Aid based on local requirements and international best practice. Standardized first aid kits must be available in all vehicles, work areas and offices. The medical staff on site must check and replenish the kits. The kits must be sealed so when they are opened it triggers a notification of an incident and prevents pilferage (stealing in small quantities).
- Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks);
- Any large excavated pits will be guarded to prevent falling into the pit by community members/animals;
- Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement);
- Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary;
- Planning work site layout to minimize the need for manual transfer of heavy loads. This reduces over exertion of project workers;
- Job rotations and rest or stretch breaks;
- Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths

I. Animal Habitant Alteration and Loss

Disturbance in the area would change animal behaviour in the instance that sediments are released into the Oraa River. This may destabilize normal ecosystem function, which may lead to a low fish yield from the river and eventual loss of income for many downstream community members that depend primarily on fishing. From the global reference of IUCN redlist (IUCN 2015), the mammalian species recorded in the site were of least conservation concern. However threats to habitat and animals were observed in the area which if not attended to may cause serious impacts on biodiversity. The assessment on bird's foreexample indicates eighteen species of birds, with only one species recorded i.e. *Balearica regulorum* (IUCN, 2015) to be of conservation significance. Other species of least concern included: *Alcedo cristata*, *Alseonax adustus*, *Andropadus tephrolaemus*. There is a likelihood of damage to the habitats and the associated species following project implementation, but the impacts will be of low magnitude. The impact intensity on fauna species will be medium, because most activities will be a distance from the main river, therefore the aquatic organisms will have the riverine wetland plant shielding most of the nightlights however the terrestrial mammals may move from their habitats into neighbouring gardens or residences and the receptor sensitivity is low, since none of these species are of conservation concern

Mitigation Measures

Barriers between sensitive habitats and worksites will be maintained to enable the separation of project activities from habitats within the river/wetlands;

- All facilities will be located outside of known/established animal corridors to prevent animal disorientation;
- Known animal foraging areas should be left intact to enable grazing at the same time construction of the irrigation scheme;
- Sediment traps should be placed at the end of the drainage channel before runoff is re-directed into the river
- The following species can be planted to restore riverine habitats e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.

J. Loss of Faunal Species

Construction of the reservoir and associated infrastructure could harm animals in the sense that channels would be left open to allow water flow to the scheme. Grazing animals moving towards the river for watering risk falling into open channels or drowning in the reservoir. The identified fish specie (*Bagrus docmac*) along river Oraa was moderately distributed within the project area with no major threats impacting on its population however; fish could be injured or killed due to increased sedimentation downstream. Mammals are being threatened by some human activities such as bush burning, farming, charcoal burning, cattle grazing and brick making which all have great damage on the habitat through destruction of vegetation cover that act as foraging and breeding grounds. It was also reported by the locals that there are communal hunting activities organized in the Wadelai area every year. The activity involves hunting of delicious game for meat during dry seasons. The activities follow burning of a vast area of land to enable the hunting, which has negatively impacted on fauna diversity, their distribution and abundance in the area. The locals mentioned that occasionally some Hippos would range within river. The fallow land and riverine habitats consisted of the majority of reptile species. But none of the species was of conservation value. None of the herptiles recorded within the project area was found to be of conservation significance. The impact magnitude is low, since the construction will be phased that any structures nearest the river will be constructed last, to prevent water inflow into incomplete structures and associated consequences. The receptor sensitivity is low, since the areas proposed for the development have lowest diversity of fishes and or other animals.

Mitigation Measures

- The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river;
- Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and placed in the main river to prevent injury;
- Grazers will have alternative areas to find pasture for their animals and water
- The proposed activities should be implemented with marginal disturbance to the aquatic environment to avoid a shift in identified zooplankton populations and maintain the ecological balance of the riverine ecosystem within the project area.

K. Impacts on Hydrology and Water Resources The proposed construction works will require diversion of water that may modify natural flow regimes and thus affect downstream water users. Poorly

planned drainage channels in some areas may also lead to reduction or rise in the water table. The reduction in water table (draining out wet areas) will consequently affect other ground water beneficiaries while the raise in water table (draining to wet areas) may cause water logging in the scheme area. The proposed activities may therefore in one way or another have detrimental effects on water quality, water availability for production, aquatic life forms, water table and riverine vegetation, and may result in flooding of fields and possible water conflicts with downstream users. The impact intensity is low, because the water will be maintained within the naturally existing flood plain; however the receptor sensitivity is low as there are no communities living within the flood zone.

Mitigation Measures

- Put in place a Water Source Protection Plan in reference to the Framework and Guidelines for Water Source Protection specifically Volume 4: Guidelines for Protecting Water Sources for Multipurpose Reservoirs. This is also a requirement in application for a Water use Permit from DWRM.
- Collect and propagate a wide range of common and uncommon native varieties of plant within the catchment for future rehabilitation of the construction footprint. The following species can be planted to restore riverine habitants e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
- The minimum rehabilitation aim should be to return the vegetation to at least the state (and level of species diversity) that existed prior to construction;
- The distance between reservoir and flow-back should be limited to areas of low animal interaction in as far as is practical, without compromising the integrity of the environment or project effort;
- Normal hydrological functions like transportation of sediments downstream will be maintained to sustain the downstream ecological functions like siltation in the wetlands, that are areas for breeding/feeding for various birds and wildlife; this is so because the water will not be dammed at anytime during scheme operation;
- Optimization of the use of flood waters will be undertaken to prevent flooding downstream and slow release of waters during the dry season.
- The dominance of green algae compared to blue green algae indicates that water within the project area along the stretch of river Oraa is not eutrophic thus appropriate practices minimizing pollution to the adjacent aquatic ecosystem will be required.
- Before dredging, the Contractor should obtain the necessary statutory permits from the relevant Agencies and Government Departments i.e. Dredging and wetland use permits.
- Provide a write up on the hydrological regime upstream of the dam and the extent of inundation. River flow data should also be maintained to ensure environmental flows especially downstream are maintained.

L. Influx of Migrants to Project Area

Influx of population can strain the already existing weak resource base, health and educational facilities due to increased demand for social services such as water, health care and schools. Construction activities will draw residents from the neighbouring areas into the Wadelai area in search of employment. This influx could result in secondary effects such as increased spread of diseases like HIV/AIDS and other STDs. This could also result into deforestation and wetland encroachment. The impact magnitude is high, because a large number of people is expected to be engaged in the construction process. Along with the

expected workforce, associated developments complementary to the project will be set up, like airtime booths, along the route to the worksite, restaurants, among others.

Mitigation Measures

- The contractor shall develop an HIV/AIDS prevention and awareness plan
- In line with the developed plan, the Contractor will continuously sensitize workers and community members on HIV/AIDS and STDs prevention and the dangers of unsafe sexual relations;
- Workers housing will be planned and located strategically so that access by community members is limited to official reasons only, like delivery of goods/services. This will prevent social visits by residents to workers camp and potential engagement in disagreeable behavior.
- The contractor will provide a communication forum with the local leaders, with women and youth groups to monitor any changes in social structure and population.
- The contractor shall engage in social co-operate responsibility activities to mitigate the effects of influx of immigrants in the project area.
- Issues of security should be handled hand in hand with the local Council administration to ensure that suspicious elements are dealt with lawfully to avoid disrupting project activities
- Capacity building of Local Authorities shall be done to strengthen in order to deal with their ability to deal with the social impacts that will result from the population influx.

M. Loss of Aesthetic Quality / Landscape

Changes in aesthetics (landscape/visual beauty) are another potential direct effect from the development. The current land use practice is grassland, however with the scheme installation, the land use will change to commercial rice production. Ground disturbance and vegetation removal may produce contrasts of water color, form and soil texture. Such disturbances could occur as a result of excavation for channels and ancillary structures; clearing and leveling staging areas; stockpiling soil and spoils (if not removed); resulting from excavation, leveling, and equipment movement. It is anticipated that the project will change the visual quality of the Oraa River in the proposed area significantly by introducing structure and channels. The change in land use may also bring about conflict as the area is used for grazing; therefore turning to farmland may cause grievances among the cattle keepers. The alteration will therefore have a negative impact on the activities in the area. The receptor sensitivity is high since land wrangles in most areas of the country have resulted in death or civil war.

Mitigation Measures

- All cleared areas and pits will be backfilled and trees, grass planted at the end of construction of the canals and associated facilities to avoid further land degradation and rugged terrain; The following species can be planted to restore riverine habitats e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
- Erosion control measures shall be implemented by the contractor to prevent siltation of the river which could affect its visual beauty. Conflicting land use should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect;
- Minimize number of trees cut.

N. Generation of Solid Wastes

Construction activities will result in the creation of various solid wastes, including surplus earth and rock (soil debris), metal scraps, plastics (wrappings and containers). Effects of mismanaged wastes include public nuisance due to littering or smell from rotting and creation of breeding grounds for vermin like rats and roaches. Unmanaged disposal of spoil can result in sterilization of productive land and the creation of on-going erosion, sedimentation or drainage problems. The impact magnitude is expected to be moderate.

Mitigation Measures

The contractor shall be required to develop a a modern waste handling area and waste should be disposed of in a gazette landfill;

- Composting should be done for organic waste;
- Sanitary facilities should be provided for the project human fecal material treatment;
- The contractor will be procured to be responsible for the handling and transporting of hazardous waste.
- Transportation of all waste from the project area to areas of disposal and recycling shall be done by licenced contractors
- Biodegradable, and Non-toxic non-biodegradable waste, including glass, plastic and metal cans, bottle tops, foil wraps, etc. will be bundled and transported to the nearest designated area by a licensed handler.
- Toxic, non-biodegradable waste such as spent machine oil and batteries will be stored in sealed drums, which in turn will be stored within a bund having 110% storage capacity volume, until they can be removed for safe long term disposal at the nearest designated area;
- Hazardous wastes such as: torch batteries, motor vehicle batteries and any other waste classified as hazardous will be disposed off in accordance with the manufacturer's specifications. Initially it will be contained in sealed drums before it can be transported to designated points by a licensed handler;
- All waste water and effluent released to environment must be first treated to meet the required standards (National Environment (Standards for discharge of effluent into water or land) (regulations).

O. Proliferation of Invansive Species

There was only one invasive plant species of *Mimosa pigra* within the project area. The spread of invasive plants is often triggered by disturbances in the ecological systems. *Mimosa pigra* reproduces via buoyant seed pods that can be spread long distances in flood waters. *Mimosa pigra* has the potential to spread through natural grassland floodplain ecosystems and pastures, converting them into unproductive scrublands which are only able to sustain lower levels of biodiversity. *Mimosa pigra* is more likely to colonize and eventually cause problems in disturbed areas during construction activities, due to the ability of the seeds to establish rapidly on bare soils, which lack competitive pressures imposed by other seedlings. The impact magnitude is expected to be low.

Mitigation Measures

Deliberate effort will be made by the contractor to uproot any invasives and stop their spread in the project area and farmlands. Invasives including *Lantana camara* and *Senna spectabilis* can be very destructive

in any natural ecosystems and their spread should be checked as much as possible through uprooting, burning and prevention of growth to reproductive stage.

8.3.3 Operation Phase Impacts

These are impacts anticipated during the operation of the Wadelai Irrigation Scheme, including impacts on aquatic flora and fauna, river ecology, and hydrology.

A. Loss of Aquatic Fauna

The water retention dam and canals will likely create new habitats for biota (such as groups of invertebrates, fish, amphibians and water birds) in River Oraa. This could have both positive and negative impacts for biota. Intensification of crop growing with increased use of fertilizers will likely result into chemicals finding their way into the water flowing through the wetlands and floodplains. This will likely impact on the receiving water bodies thus resulting into high nutrient levels in the receiving water bodies such as River Oraa, which could lead to increased primary productivity and eventual eutrication of such water. The loss of natural habitats will result in the loss of components of the biota that are important for crop production such as pollinators and top predators. Diversion of a section of the river will change flow characteristics from free-flow to static waters at the reservoir. At the reservoir, it is anticipated that stratification will occur, resulting in formation of oxygen limited hypolimnion. This reduces the vertical space available for fisheries habitation, which may lead to incidences of over predation if the fish are limited to living only in the Epi & Metalimnion. Fish such as catfish and some tilapine eggs which are buried in sediment may be flow into the channels and be lost in the fields. All mammals recorded in the project area are widely spread and are of least concern according to IUCN RedList of Threatened species (IUCN, 2015), except for Hippopotamus Amphibus which has restricted habitat range and categorized as vulnerable by (IUCN, 2015). Its population will drastically declining due to habitat loss. The impact intensity is medium, and receptor sensitivity will be low, since the Oraa river has for over along time been turbid, and of low fish diversity.

Mitigation Measures

- The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification;
- The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized;
- Enhancing the habitat by tree planting to increase shelter cover, shade and drift food;
- Promote organic farming and use of recommended artificial fertilisers purchased from recommended government suppliers;
- Maintaining sediment transport in as far as applicable a natural state to prevent sudden flushes that could shock ecosystems.

B. Water Pollution

The laboratory results of physico-chemical analysis as indicated in Annex 3 show normal River Oraa water quality characteristics i.e. the level of fertilizer residues in the river water is low, no pesticide residues were found and the coliform count is characteristic of normal river waters. However; during the operational phase, the irrigation scheme will involve the use of fertilizers in order to improve agricultural production. Pollution of irrigation and drainage water by residual chemicals is a potential problem, especially, residuals of persistent organic chemicals that can potentially pose debilitating effect on downstream users

(human/livestock) and aquatic organisms. Paddies store nutrients over long periods of time especially from the remanant grasses of rice after harvesting. These biodegrade and release nutrients into the water that eventually flows out of the scheme back to the Oraa River which drains into River Nile. Infiltration of irrigation water in excess of available root zone storage will penetrate beyond the reach of roots and eventually recharge groundwater. Nitrates, salts, and other chemicals dissolved in the soil water will move with the water. Crops with high water and N requirements tend to increase the potential risk of nitrate pollution to groundwater. Light-textured soils and intensive production of shallowrooted crops under irrigation can lead to considerable nitrate losses by leaching. The impact magnitude is high as there will be constant activities in the paddies year out and the receptor sensitivity is medium.

Mitigation Measures

- Adhere to wastewater discharge standards
- Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the river and eventually to the Nile;
- Desilting drainage channels supplying water to the paddies occasionally will remove nutrient rich sediments from the main water ways and returned back to the gardens.
- Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;
- When water quality criteria allow, storm water should be managed as a resource in holding lagoons, either for groundwater recharge or for meeting water needs at the site;
- Water from the paddies should be channeled through a constructed wetland to remove impurities before discharge to the environment

C. Soil Erosion and Siltation

During the operation phase there will not be significant impact on soil. However, proper and continuous maintenance is called for to prevent erosion from the steep areas or areas cultivated in the flood plain. The dam is bound to have a relatively higher silting rate because of the nature of the soils within the catchment area. Keeping the indigenous vegetation and covering the hill slopes should be able to slow the rate. Downstream of the dam, the river will cease to deposit the sediments. In most cases these sediments come along with fertile humose soils. The potential impact of this is that the deposition of fresh fertile soils will not occur as has been the case previously. Upstream erosion may result in the delivery of fertile sediments to down stream areas. However, this gain is a measure of the loss of fertility of upstream eroded lands. A major negative impact of erosion and the associated transport of soil particles is the sedimentation of reservoirs and abstraction points downstream, such as irrigation intakes and pumping stations. The impact magnitude will be very low and the receptor sensitivity will be low, giving a minor impact severity.

Mitigation Measures

- It is expected that all earthworks for site preparation and levelling will be carried out during the dry season including access road constructions. In the event that this work will not be completed before the start of the rain season, construction of temporary drains will precede the permanent drainage system such that storm water is controlled and directed appropriately as phased construction proceeds.

- Keeping the indigenous vegetation and covering the catchment areas should be able to slow the siltation rate. The following species can be planted to restore riverine habitants e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
- All the drainage paths that have been constructed will be maintained and de-silted on a regular basis;
- Native herb and grasses species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river;
- Maintaining flood zones within the cultivated area helps with reduction of erosion.
- Ensure water application rate does not exceed soil intake rate.
- Ensure appropriate terracing if possible.
- Ensure proper design and layout of field to avoid steep gradients
- Use lined canals to avoid leakage leading to water logging to prevent water logging of soils.
- Use better quality water (blend problem water).
- Practice crop rotation and incorporation of organic fertilizers
Avoid over watering the field.
- To mitigate salinization of watercourses, apply water at a rate equal to soil infiltration rate.

D. Alteration of River Flow

River diversion will reduce the water in the main river channel. This may lead to collapse of bank slopes due to decreased flow especially during the dry season. Depletion of water resources due to flow disruptions is also anticipated. The effect is local and can be overcome to some extent by releasing compensation flow downstream. The newly created reservoir has more holding capacity than the river would have had, and therefore more evaporation occurs than previously. Through evaporation, a significant amount of water can be lost. In most cases, reservoirs can also contribute to greenhouse gas emissions. However, given the small size of the reservoir and the fact that being an irrigation reservoir it is not likely that there will be significant plant growth and subsequent significant emissions from any decomposing biomass. The consequences of impacts resulting from a change in the flow regime of river Oraa, or a change in the movement of the water table, through the seasons directly affects the ecosystem and other users of the river water along the river flow path. Thus the interrelationship between river flows, uses latter on users should be well appreciated prior to undertaking any major abstraction from the stream. In both cases of low flows and high flows, the operation of dams offers excellent opportunities to mitigate the potential negative impacts of changes to flows. The increased sediment load is likely to change the river morphology which, together with the increased turbidity, will affect the downstream ecology. Mitigation Measures

- Ensure very minimal disruption of natural vegetation and allow re-vegetation activities of indigenous species and or natural regeneration of flora. The following species can be planted to restore riverine habitants e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.
- During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river;
- Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season
- Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established.

- To avoid impacting on the ecology and to keep the system in a health state, it is recommended that a fixed discharge of 100cumecs be maintained all the time.
- Compensation flow for the conservation of microflora, aquatic insects and fish in the river system should be within 10-20% of the regular flow;
- Maintenance of the drainage network will involve regular clearing of drains of sediment and other waste, and flushing of canals and culverts. Abstract at a rate to match recharge but also observe abstraction rate as per Permit from DWRM.

E. Increased generation of Noise Levels

Sound from the project operations could include the chatter of farmers as they go about planting, harvesting, maintenance, and the noise from the occasional vehicle from the funders and consultants during monitoring and auditing. The Impact intensity will be very low and the receptor sensitivity is low.

Measures

No noise and vibration is expected at this stage, therefore no mitigation has been offered as operational activities will not generate noise levels above the recommended 85db as per legislation.

F. Increased Traffic and Air Quality

It is not anticipated that traffic will increase or be a nuisance during the operation of the rice scheme. The vehicle requirement in and out of the area may be high during harvesting as trucks will be required to ferry rice to the market areas, however this is not expected to be high or significant. No major air quality issues are anticipated.

Mitigation Measures

- Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring transportation of project staff and the occasional maintenance workers;
- The Project drivers will abide by the speed limits of 25KPH within the project site for all vehicles accessing the area;
- The developer will orient visitors to the Irrigation scheme so that safety road rules are followed in close coordination by project staff;
- As mentioned, dust nuisance to communities is likely to be localised and higher at certain strategic locations on the site where construction activities are on-going and impacts on adjacent communities are expected to be intermittent.
- All work areas and access roads on site will be regularly watered by water bowser in order to reduce dust levels. Large stockpiles of materials such as sand and gravel will also be watered regularly.

G. Occupational Health and Safety Risks

Accidents arising from working in soggy areas may arise. There is a high likelihood of emergence of vector borne diseases like malaria and other water related illnesses. The most common diseases associated with contaminated irrigation waters are cholera, typhoid, ascariasis, amoebiasis, giardiasis,

and enteroinvasive E. Coli. Workers scheduled to work within the paddies or those engaged in maintenance on the exterior will be exposed to flooded areas. There is a likely hood of children/animals falling into the flooded area of the paddy and road accidents during transportation of harvested crops. There is is also a potential exposure of farmers to agrochemicals due to poor use and handling. The impact intensity in this case will be evaluated using a probability of occurrence as accidents are a result of unplanned activities.

Mitigation Measures

- Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning.
- Strengthen the malaria control activities by providing funding to maintain the malaria surveillance system and interventions in the project area. There is need to establish community based health education committees to facilitate the malaria control programme or use already existing health care facilities.
Vector control activities should also occur at the construction site to prevent vector proliferation. This should include larval control, net use and indoor residual spray.
- Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals
- Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be undertaken;
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.
- Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs.
- Develop emergency response plans for both community and work place related accidents management.
- Initiate and facilitate community education programs on road safety.
- Use of diamond mesh fence where canal passes close to dense settlements to prevent access by children.
- Involve the communities to guard and maintain the fencing along the canal.
- Design and construction of adequate and safe bridges for people and vehicles.
- Train famers on chemicals handling and management. They should manage chemicals and hydrocarbons as per material safety data sheet to avoid environmental and safety risks.
- Provide an environmental monitoring programme to monitor agriculture chemicals through runoffs from the fields and the airborne.
- Storage structures to restrict exposure of workers to dangerous chemicals.

H. Land Degradation due to Poor Agronomic Practices

A wide range of agronomic activities associated with an increased intensity of production can contribute to reduction in soil fertility and subsequently lead to soil erodability and land degradation. The increased use of agro-chemicals, needed to retain productivity under intensification, can introduce toxic elements present in fertilizers and pesticides. Other agronomic practices that could lead to reduction in soil fertility include mono-cropping with no fallow periods, lack of crop rotation, inadequate soil conservation measures, water logging, bush burning, inadequate use of soil amendments and lack of training and

raising awareness for farmers on good practices. There is also disturbance of agricultural fields by cattle mainly.

Mitigation Measures

- Promote use of integrated pest management (IPM) such as cultural and biological measures. Potential pest management efforts include: Growing a Healthy Crop by Starting with Healthy Seed, Good Farming Practices to Ensure Vigorous Crops, Making the Crop Unattractive or Unavailable to Pests, Crop Diversity or Rotation, Early Planting etc.
- Training of farmers on agrochemicals management and environmentally sound chemicals management (pesticides and fertilizers) and proper irrigation practices.
- Training of farmers on application and management of residues, wastewater from cleaning, proper irrigation practices.
- Putting in place Simple Operation Procedures for management of spillages and designation of areas for maintaining of farm machinery.
- Regular monitoring of water quality.
- Identification of pollution hotspots and implementation of corrective measures.
- Efficient use of irrigation and agrochemicals to minimise leaching into groundwater
- Fence off the grazing land to prevent further disturbances. The land should then be left undisturbed to allow the native grass and other plant species to be re-established. The grass should be allowed to grow, flower and disperse seeds.
- All pesticides for the irrigation schemes must be purchased from registered pesticides dealers. Pesticides for the irrigation schemes must be purchased strictly according to the requirements to avoid over-stocking. A follow up system for the procurement, transportation, receipt and custody of pesticides must be established at the irrigation schemes.
- All pesticide mixing containers and spraying equipment must be washed and cleaned in a safeguarded central point.
- Pesticides may be used with care to ensure their toxicity to non-target organisms is as low as possible. The effectiveness of pesticides should be as selective as possible. Certain pesticides of natural origin are compatible with integrated pest management (IPM), causing minimum disturbance to natural biological and ecological pest control mechanisms.

I. Impact on Downstream Water Users

As all dams result in reduced sediment load downstream, a dammed Oraa River turns out to be “hungry” for sediment. Because the rate of deposition of sediment is greatly reduced since there is less to deposit but the rate of erosion remains nearly constant, the water flow eats away at the river shores and riverbed putting a lot at risk including the farms nearby, ecosystems and sometimes deepening the riverbed. The resulting water tables and the stream flow are thus affected. The implementation of Wadelai irrigation scheme might affect the following communities/villages which are outside the project area namely: Oraa LC 1, Pader, Pabego, Aparanyo, Mangala, Padigo and Kolokolo villages. The above villages fall under Pakuinyu Parish and grow rice, maize etc and it was reported by stakeholders that they depend on flooding of River Oraa to grow rice. Issues identified during stakeholder consultations include: Farmers sensitivity on land and water rights, lack of water user associations, lack of water flow control mechanisms e.g. meters and the need for payment for ecosystem services and or water source protection. The Impact intensity likely to be high and the receptor sensitivity is high due to rice growing activities downstream outside the project area.

Mitigation Measures

- Installation of control and water metering,
- Establish and strengthen Water User Associations
- Establishment of payment mechanism for water use
- Establish water scheduling protocol based on irrigation policy

J. Breakdown of Irrigation Infrastructure

It is anticipated that if maintenance plans for the irrigation infrastructure is not put in place, there might be an infrastructure breakdown that can result into flooding and destruction of crop lands. A major negative impact of erosion and the associated transport of soil particles is the sedimentation of reservoirs and abstraction points downstream, such as irrigation intakes and pumping stations. Desilting intakes and irrigation canals is often the major annual maintenance cost on irrigation schemes. The impact will however be moderate if operation and maintenance is not put in place.

Mitigation Measures

- Training of farmers on maintenance and operation of irrigation structures.
- Provision of incentives to maintain infrastructures e.g access to silt from traps, seeds
- Provision of equipment, tools and manuals.

K. Impacts on Groundwater Resource

A continued reduction in the water table level due to the establishment of the irrigation scheme at Wadelai may lead to: depletion of an important resource and significant land subsidence with consequent damage to structures and difficulties in operating hydraulic structures for flood defense, drainage and irrigation. In such cases, vulnerable areas are those with compressible strata, such as clays and some fine-grained sediment. Any structural change in the soil is often irreversible. The ground level can fall with a lowering of the water table if the soils are organic. However, lowering the water table by the provision of drainage to irrigation schemes with high water tables brings benefits to agriculture. However, lowering the groundwater table by only a few meters adversely affects existing users of groundwater whether it is required for drinking water or other uses. Within the confines of the project area, there is minimal use of groundwater for other purposes other than irrigation. Although this is unlikely to occur, lowering of the water table will have direct consequences to the crop farming on going in the area. Poor irrigation techniques and works usually lead to rise of the water table.

Mitigation Measures

- The rise of groundwater is bound to be significant and particular attention should be given to increasing the efficiency of the irrigation systems to help drain the marshlands of excess water.
- The following species can be planted to restore riverine habitats e.g. *Bridelia brideliifolia*; *Carapa grandiflora*; *Croton megalocarpus*; *Prunus africana*; *Psychotria bugoyensis*.

8.4 POTENTIAL CUMULATIVE IMPACTS

The proposed irrigation scheme and other interventions planned do not have significant irreversible impacts. Hence, the project interventions are unlikely to contribute to cumulative impacts in the project area. However, to avoid/mitigate possible cumulative impacts (particularly likely for deforestation, and surface water depletion), all negative impacts will be addressed in the site-specific ESMPs to be developed during the implementation stage of the project. The project will contribute to long-term environmental positive impacts in the project areas including:

- Improved land conditions due to improved land management from sustainable land management activities promoted through the project to reduce land degradation and improve soil fertility; and
- Enhanced soil and water conservation measures and activities as well as improved watershed management programmes whose net impact will be improved soil and water conditions.

8.5 CLIMATE CHANGE RISKS, MITIGATION AND ADAPTATION

According to the African Development Bank's Climate Safeguard Screening System, the project was assessed as Category 2 indicating that the project may be vulnerable to climate risk and will require the integration of practical risk management and adaptation options into the project design and implementation plans in order to increase the resilience of the project infrastructure and beneficiaries to withstand the impacts of climate change. Uganda's agriculture based economy makes it highly vulnerable to the risks of climate variability and change, particularly given the high proportion of the country's population dependent on rain-fed agriculture. Climatic impacts in Uganda have been linked with more frequent and longer lasting droughts and flood events like it is currently in Wadelai SubCounty and surrounding areas, This definitely has prevented farmers in Wadelai from engaging in all year round farming activities. In the last century, the frequency and intensity of extreme climatic events has been on the rise. The Uganda's National Adaptation Programme of Action (NAPA) noted an average temperature increase of 0.28°C per decade in the Uganda, with the months of January and February most affected by this warming trend, averaging an increase of 0.37°C per decade.

Any future climate change may have relatively strong impacts on the hydrology of the region and agricultural/irrigation activities. Rainfall has also decreased and become more unreliable and less evenly distributed. Recent years have seen erratic arrivals and endings of rainfall seasons, and individual rainfalls have been heavier and more violent. Floods and landslides are on the rise and are increasing in intensity.

This proposed Wadelai Irrigation Scheme is by design a strategic response to the impact of climate change in the vulnerable project area evidenced by land degradation, dry spells and floods. Under Component 2 of the project, catchment management activities including integrated soil and water conservation and sustainable forest management activities should be implemented to control land degradation and flood impacts, and thereby contribute to reduced climate change vulnerability of the community and the irrigation infrastructures. Specifically, the proposed activities under this component should seek to improve and restore vegetation cover in the catchment area to sustain water quality and quantity for agriculture irrigation and other uses.

8.6 DE-COMMISSIONING PHASE

On completion of construction, the reservoir, channels, paddies will need to be safely and securely removed and the areas stabilized to minimize risks of release to the environment of toxic or polluting materials, All disturbed sites which are no longer being used will need to be rehabilitated and revegetated.

During the removal of debris, there will be adverse impacts if the materials such as scrap iron, glass, polythene materials, planks, The concrete layers (cemented/concreted floors/areas of temporary structures and access roads) should be removed; the materials should be safely disposed off at sites previously agreed upon with NEMA. Transport of both salvaged materials and disposable materials will increase vehicular traffic, noise and disturbances to the communities along the main access roads. The impacts are of very temporary in nature and precautions or mitigations suggested earlier in the impacts discussion should be enforced to minimize such disturbance further.

The following are the foreseeable impacts, who management should take a precautionary term, referring to the mitigations/recommendations suggested in this section:

- Soil, erosion impacts caused by demolition of reservoir structures and debris removal.
- Noise and vibration on structure demolition
- Flooding of downstream areas due to reservoir removal
- Damages to access roads from vehicles with heavy loading.
- Aesthetic impacts on debris amassing and denudation of the structure environment

A summary of anticipated impacts and mitigation measures are presented in Table below:

Table 41: Summary of anticipated impacts and Mitigation Measures

Environmental Impact Component	Nature of	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
Pre-Construction											
Land	Loss of land	Reservoir construction and farm set up	Flood plain				<ul style="list-style-type: none"> Ensure cattle keepers have access to water and doesn't prolong the distance originally covered by the herders Sensitization should be undertaken to inform stakeholders of the benefits of the proposed Wadelai irrigation Scheme and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time The proponent will develop a mechanism to record and respond to complaints especially from communities to check on effectiveness of the applied mitigations and to get insight on how to address these concerns in due time. 				<p>Mitigations will reduce impact to moderate levels. Precaution is to be taken to ensure any unforeseen issues are addressed as and when they arise.</p> <p>Impact intensity is reduced to moderate ranking, therefore post-assessment monitoring as prescribed in the EMMP is essential to ensure that mitigations achieve the desired results.</p>
Ambient environment	Noise of activities involving heavy machinery use during clearing, grading	<ul style="list-style-type: none"> Cutting and land excavation Equipment mobilization 	<ul style="list-style-type: none"> Neighbouring communities Route communities 				<ul style="list-style-type: none"> Limit construction to day time only i.e. from 8.00am to 5.00pm Provide appropriate PPE to workers e.g. ear plugs 				Impact intensity is reduced to minor ranking, therefore post-assessment monitoring as prescribed in the EMMP is essential to ensure that mitigations achieve the desired results.
Construction Phase											
Air quality	Increased emissions from vehicles	<ul style="list-style-type: none"> Mobile vehicle engines (emissions) 	<ul style="list-style-type: none"> Construction area Neighboring communities to access route 				<ul style="list-style-type: none"> All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to a vehicle in active movement; All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO2, SOx CO, and NO from vehicle exhausts; Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement; The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes 				No further mitigations are anticipated however regular monitoring will be undertaken.

Air quality (dust emissions)	Increased dust particles and fugitive dust to atmosphere	<ul style="list-style-type: none"> Moving soils Excavations, dumping Road traffic on unsealed murrum surface 	<ul style="list-style-type: none"> Materials haulage route Homesteads along haulage route Immediate vicinity to 				<ul style="list-style-type: none"> No bonfires for waste will be encouraged in the project area, as this causes dust raising situations; Dust generating activities will be minimized especially on windy days to prevent dust raising in the area; Water will be used as dust suppressant where 				No further mitigations are anticipated however regular monitoring will be undertaken.
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Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
			Construction site				<ul style="list-style-type: none"> applicable to subdue any dry particles from becoming airborne during windy days in the dry period; Cover excavated soils especially on windy days to reduce dust exposure to workers and neighboring areas; All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site; Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors; Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase; Areas near exposed surfaces of stockpiled materials should be vegetated. 				
Soil	Erosion	<ul style="list-style-type: none"> Excavations for the facilities Runoff from spoil, materials storage area 	<ul style="list-style-type: none"> River banks, Excavated sections of water way (drainage channels) 				<ul style="list-style-type: none"> Project activities will be scheduled to avoid heavy rainfall periods (i.e. more activities during the dry season) to the extent practical; The developer will encourage contouring and minimizing length and steepness of slopes to reduce erodibility; Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places; Any spoils (Boulders) in the reservoir area will be used for the backfilling of the weir 				No further mitigations are anticipated however regular monitoring will be undertaken.
Water	Surface Water contamination	<ul style="list-style-type: none"> Accidental petrol/diesel spills Soil erosion Domestic waste from workers 	<p>River Oraa</p> <p>Streams Neighboring the construction or transit site</p>				<ul style="list-style-type: none"> Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season (ie when the seasonal rivers like Chobe are dry) to reduce sediment/contaminant delivery to the river and eventually to the Nile; Application of appropriate construction practices and creating awareness among the community of the need to maintain high water quality; All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities); Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination; When water quality criteria allow, storm water 				<p>Impact intensity is reduced to moderate ranking , therefore post-assessment monitoring as prescribed in the EMMP is essential to ensure that mitigations achieve the desired results.</p> <p>The developer will develop a mechanism to record and respond to complaints especially from wildlife officials and or tourists and tour operators to check on effectiveness of the applied mitigations and to get insight on how to address these concerns in due time.</p>

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
							should be managed as a resource in holding lagoons, either for groundwater recharge or for meeting water needs at the site; <ul style="list-style-type: none"> Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health; Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials; 				
	Groundwater contamination	<ul style="list-style-type: none"> Leaching from waste storage areas 	Below ground aquifers				<ul style="list-style-type: none"> Waste collection points for workers at the construction site will be located out of the high water table sections of the area; All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources 	-	-	-	-
Vegetation	Loss of vegetation	Clearing for <ul style="list-style-type: none"> The reservoir, drainage channels 	<ul style="list-style-type: none"> River banks, Riparian vegetation 				<ul style="list-style-type: none"> The developer will select appropriate low-impact extraction (e.g. excavation,) methods that should result in final site contours supportive of habitat restoration principles and grasses re-establishment; Establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities; Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement; During extraction, ecological niches should be preserved and protected as far as possible; 				No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations

Traffic	Increased vehicular traffic enroute to site	<ul style="list-style-type: none"> Material, equipment haulage, Workers transportation 	Access route			<ul style="list-style-type: none"> In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one -way traffic routes if needed, and on- site trained flag- people wearing high- visibility vests or outer clothing covering to direct traffic; Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle; 			No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations
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Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
							<ul style="list-style-type: none"> Ensuring moving equipment is outfitted with audible back-up alarms; Using inspected and well-maintained lifting devices that are appropriate for the load, such that there are no breakdowns in the middle of the road; Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users. 				
Noise	Noise from construction activities, Equipment,	Construction activities, drilling, excavation, concrete mixing	<ul style="list-style-type: none"> Animal habitats around river banks, Camps within the vicinity, Recreational areas on the river 				<ul style="list-style-type: none"> Night time activities will be avoided at all costs in as far as is practical, because sound travels further during night than during the day; In order to limit noise due to haulage traffic, the construction fleet will be kept in good condition well fitted with efficient silencers; Hand held tools will mostly be used therefore incidences of noise increment will be avoided. 	-	-	-	-

Occupational Health and Safety	Injuries from accidents	<ul style="list-style-type: none"> Heavy machinery handling Slips and falls Drowning, Hazardous materials 	<ul style="list-style-type: none"> Workers Community members 				<ul style="list-style-type: none"> Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities; Surfaces, structures and installations should be easy to clean and maintained, and not allow for accumulation of hazardous microorganisms. Therefore surfaces in food preparation areas will be maintained with a highest level of cleanliness to prevent food poisoning due to ingestion of contaminated food stuffs; Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks); Any large excavated pits will be guarded to prevent falling into the pit by community members/animals; Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement); Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary; Planning work site layout to minimize the need for manual transfer of heavy loads. This 			No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations
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Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
							reduces over exertion of project workers; <ul style="list-style-type: none"> Job rotations and rest or stretch breaks; Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths/; 				

Animals	Behaviour alteration and habitant loss	Disturbance from noise, human presence,	Neighboring habitats to construction site			<ul style="list-style-type: none"> Barriers between sensitive habitats and worksites will be maintained to enable the separation of project activities from habitats within the river/wetlands; All facilities will be located outside of known/established animal corridors to prevent animal disorientation; Known animal foraging areas should be left intact to enable grazing at the same time construction of the irrigation scheme; Sediment traps should be placed at the end of the drainage channel before runoff is redirected into the river 			No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations
Fauna	Injury to fauna	Reservoir construction	Reservoir area, driainage channels			<ul style="list-style-type: none"> The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river; Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and placed in the main river to prevent injury; Grazers will have alternative areas to find pasture for their animals and water 			
Hydrology and water resources	Flow alteration	<ul style="list-style-type: none"> Reservoir construction Diversion of water 	<ul style="list-style-type: none"> Oraa river 			<ul style="list-style-type: none"> Put in place a Water Source Protection Plan The distance between reservoir and flow-back should be limited to areas of low animal interaction in as far as is practical, without compromising the integrity of the environment or project effort; Normal hydrological functions like transportation of sediments downstream will be maintained to sustain the downstream ecological functions like siltation in the wetlands, that are areas for breeding/feeding for various birds and wildlife; this is so because the water will not be dammed at anytime during scheme operation; Optimization of the use of flood waters will be undertaken to prevent flooding downstream and slow release of waters during the dry season 			No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations
Land and Water	Generation of	<ul style="list-style-type: none"> Construction 	<ul style="list-style-type: none"> Reservoir 			<ul style="list-style-type: none"> The contractor shall be required to 			Put in place a waste management plan

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	

	waste	activities and material usage by workers • Waste soils	area, drainage channels				<ul style="list-style-type: none"> develop a a modern waste handling area and waste should be disposed of in a gazette landfill; Composting should be done for organic waste; Sanitary facilities should be provided for the project human fecal material treatment; The contractor will be procured to be responsible for the handling and transporting of hazardous waste. All waste water and effluent released to environment must be first treated to meet the required standards (National Environment (Standards for discharge of effluent into water or land) (regulations). 			
Flora	Proliferation of Invasive Species	Site clearing and construction activities	Wetland and river system				<ul style="list-style-type: none"> Deliberate effort will be made by the contractor to uproot any invasives and stop their spread in the project area and farmlands. Invasives including Lantana camara and Senna spectabilis can be very destructive in any natural ecosystems and their spread should be checked as much as possible through uprooting, burning and prevention of growth to reproductive stage. 			
Social Impacts										
							<ul style="list-style-type: none"> 			
Migration	Influx of migrants	Increase in project workforce, Migrations from neighboring areas	Project area - Kiryanongo				<ul style="list-style-type: none"> The developer will continuously sensitize workers and community members alike on HIV/AIDS and the dangers of unsafe relations; Workers will be encouraged to be disciplined when on company assignments in the villages and prevent risky interactions with community members. The developer will keep in close communication with women and youth groups to monitor any changes in social structure and communication with local leaders to monitor any changes in population. 			Regular screening and monitoring of communicable diseases amongst the workforce and regular treatment for ill workers.
							<ul style="list-style-type: none"> 			
Aesthetics	Loss of aesthetic quality	Change in landuse from grazing to rice paddy	River Wadelai				<ul style="list-style-type: none"> The entire process will take into consideration the preferred land-use proposed by communities and government initiative; Access to excavation areas will be closed off to all but construction crew to prevent accidents 			No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
		Ground disturbance and vegetation removal					<ul style="list-style-type: none"> like falls, or exposure to unsightly conditions within the park; Conflicting landuse should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect; 				

Table 42: Summary of Potential impacts and mitigations arising from Operation Phase

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
Operations											
Aquatic fauna	Impact on fisheries	Temporary damming of the river at the reservoir	Reservoir				<ul style="list-style-type: none"> The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification; The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized ; 				Periodic monitoring of species diversity
Water quality	Negative impacts on water quality	Release of water from the farms into the Oraa river	River Oraa				<ul style="list-style-type: none"> Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season (ie when the seasonal rivers like Chobe are dry) to reduce sediment/contaminant delivery to the river and eventually to the Nile; Desilting drainage channels supplying water to the paddies occasionally will remove nutrient rich sediments from the main water ways and returned back to the gardens. Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination; When water quality criteria allow, storm water should be managed as a resource in holding lagoons, either for groundwater recharge or for meeting water needs at the site; Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of wildlife, 				No further mitigations are anticipated however regular monitoring will be undertaken to assess the effectiveness of mitigations

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
							aquatic ecology and public health; <ul style="list-style-type: none"> Water from the paddies should be channeled through a constructed wetland to remove impurities before discharge to the environment 				
Soil	Erosion	<ul style="list-style-type: none"> Loss of soil from paddies /drainage channels 	<ul style="list-style-type: none"> Irrigated area 				<ul style="list-style-type: none"> All the drainage paths that have been constructed will be maintained and de-silted on a regular basis; Native herb and grasses species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river; Maintaining flood zones within the cultivated area helps with reduction of erosion. 	-	-	-	-
Hydrology	Alteration of river flow	<ul style="list-style-type: none"> River diversion 	<ul style="list-style-type: none"> Upstream and midstream from the intake 				<ul style="list-style-type: none"> During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river; Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established; 	-	-	-	-
Traffic	Vehicle access to the site	<ul style="list-style-type: none"> Farming in the paddies 	Flood plain				<ul style="list-style-type: none"> Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring transportation of project staff and the occasional maintenance workers; The Project drivers will abide by the speed limits set forth by the UNRA for all vehicle access to the area; The developer will orient visitors to the scheme so that safety road rules are followed in close coordination by project staff; 	-	-	-	-

Environmental Component	Nature of Impact	Concerned Activities (that would cause impacts)	Impact Area	Impact Significance			Proposed Mitigation Measures	Impact Significance			Further Mitigation requirement
				Minor	Moderate	Major		Minor	Moderate	Major	
Occupational health and safety	Injuries from accidents on site,	<ul style="list-style-type: none"> Farming in the paddies 	Flood plain				<ul style="list-style-type: none"> Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning. Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be 				Periodic monitoring to check on health and safety issues at the plant is required to ensure worker safety measures are implemented
							undertaken;				
Impact on Downstream Water Users	Reduced water flow downstream	Water retention for irrigation activities upstream	Downstream of Irrigation area				<ul style="list-style-type: none"> For the case of diseases like malaria, the project will put in place strategies to control the disease through issuance of mosquito nets and education on their usage. The developer will have a clinic stationed at the worksite to address any illness. There will also be an emergency evacuation plan to remove any injured worker from the field for urgent treatment; Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites. Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease reservoirs. 				Periodic monitoring of flow levels downstream
Irrigation infrastructure	Breakdown of Irrigation Infrastructure	Lack of operation and maintainace plan	Irrigation infrastructure				<ul style="list-style-type: none"> Training of farmers on maintenance and operation of irrigation structures. Provision of incentives to maintain infrastructures e.g access to silt from traps, seeds Provision of equipment, tools and manuals. 				Ensure maintaince activities are carried out as scheduled.

8.7 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The overall responsibility of the environmental and social monitoring will lie with the Ministry of Water and Environment - MWE (project executing agency). MWE, in liaison with technical personnel at Nebbi Districts Local Government, NEMA (the overall national authority on the environment), Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Ministry of Works, Department of Water Resources Management, Wetlands Management Department, National Forestry Authority (NFA) Department of Occupational Health and Safety of Ministry of Gender Labor and Social Development (MoGLSD), Civil Society and the Farmers' Organization will undertake regular environmental, social, safety and health inspections. A monitoring committee will be established comprising the above stakeholders to undertake quarterly environmental and social monitoring of project implementation. Environmental monitoring will be carried out at three levels.

1. Daily or regular monitoring of activities and conditions in construction and operation by the project developer. For all preconstruction activities and during construction and operations, the Developer, Contractor, and Subcontractors will monitor their activities on a regular basis. For all their work, the Developer, Contractor, and Subcontractors are to monitor for potential adverse impacts, including but not limited to those that have been identified by the EIA of this project, and they are to comply fully with all standards and safeguards. This may necessitate a full time environmental and health and safety personnel engaged and funded by the developer to oversee the activities of the developer and propose adequate mitigations in line with.
2. Periodic (sometimes unscheduled) monitoring of impacts and of compliance by government organizations established for the MWE/Department of Water Resource Management (DWRM), MAAIF, NEMA and the Environmental Management Office under the Developer's Environmental and Social Department.
3. Occasional monitoring of impacts and of compliance by a third party external monitor. An external monitor will be engaged and funded by the Developer, to conduct annual reviews of the effectiveness of the environmental measures carried out by the project. The external monitor should have international experience in environmental auditing and monitoring. The external monitor should be engaged throughout the construction phase and for the first years of operations phase (at a much reduced level reflecting the significantly fewer environmental impacts during this phase), until the hydrological and water quality have stabilized.

Using the environmental monitoring plan presented below, the control mission will seek to measure the project's progress, in a manner that highlights the various objectives in line with national goals and the Bank's Integrated Safeguards System (ISS). An annual monitoring report will be submitted to the MWE and the African Development Bank for review.

Table 43: Monitoring Activities and Criteria

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
Pre-construction							
Loss of land	Provide the cattle keepers with watering points that do not prolong the distance originally covered by the herders	ESIA Document, this report, Land Act Cap 227, 1998	Visual observation	√	√	√	Before onset of construction activities
			Design documentation				
			Stakeholder engagement				
		√	√	√			
Sensitization should be undertaken to inform stakeholders of the benefits of agriculture and demonstrations given on integrated agricultural practices (farming and cattle keeping) existing in the same place at the same time	ESIA Document, this report, Land Act Cap 227, 1998	Visual observation	√	√	√		

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	The proponent will develop a mechanism to record and respond to complaints especially from communities to check on effectiveness of the applied mitigations and to get insight on how to address these concerns in due time.		Stakeholder engagement	√	√		Before onset of construction activities
Noise & Vibration	Limit mobilization of equipment to day time only	The National Environment (Noise Standards and Control) Regulations, 2003, EMMP, this report	Report on the land rights in the area	√	√		Monthly
	Provide PPE to workers;		Visual Observation, Reports on wrangles due to access to water	√	√		During time of mobilization
	Monitor noise from equipment						
Construction Phase							
Air Quality (Gaseous Emissions)	All vehicles will be instructed to switch off engines on arrival at site. More pollutants are released during idling as compared to	EMMP, this report,	Visual observation	√	√		Bi Monthly reports to be audited monthly

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	a vehicle in active movement;						
	All trucks delivering materials to the site will be maintained in good working order as inefficient fuel combustion is key in the release of NO ₂ , SO _x CO, and NO from vehicle exhausts;	EMMP, this report	Observation and vehicle maintenance reports	√	√	√	
	Vehicle drivers will be encouraged switch engines off when not in use because an idling truck releases more emissions than one in active movement;		Regular inspections and checks on service lists	√	√		
	The project will employ community members using hand held tools to reduce on the need for excavators or heavy equipment that release fumes		Visual observation of community activity in the project area	√	√		
Air quality (dust)	No bonfires for waste will be encouraged in the project area, as this causes dust raising situations;	EMMP, this report	Daily Visual inspections, by staff EHS supervisor, Environmental documentation	√	√	√	As required
	Dust generating activities will be minimized especially on windy days to prevent dust raising in the area;			√		√	
	Water will be used as dust suppressant where applicable to subdue any dry particles from becoming airborne during windy days in the dry period;		Daily visual observations by Staff EHS personnel	√	√	√	Daily throughout construction phase

	Cover excavated soils especially on windy days to reduce dust exposure to workers and neighboring areas;			√	√		Daily
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Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	All loads/materials entering and leaving site to be covered to prevent windblown dust along the route to and fro the site;			√	√	√	Daily
	Land clearing, removal of topsoil and excess materials, tips and stock piles, will be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) as well as the locations of sensitive receptors;			√	√		Daily. As required during windy dry days
	Workers engaged in activities likely to raise dust will wear dust masks at all times during this phase;				√		During excavations

	Areas near exposed surfaces of stockpiled materials should be vegetated.			√	√		Afterconstruction
Archeology	Where the proponent has encountered tangible cultural heritage that is replicable	EMMP this report	Visual observation,				As required

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	and not critical, the personnel will apply mitigation measures that favor avoidance;		Collection of artefacts from site	√		√	As required
	Minimize adverse impacts and implement restoration measures, in situ, that ensure maintenance of the value and functionality of the cultural heritage, including maintaining or restoring any ecosystem processes needed to support it;				√		
	Where restoration in situ is not possible, restore the functionality of the cultural heritage, in a different location, including the ecosystem processes needed to support it;		Visual observation		√	√	As required

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	Where the project site contains cultural heritage or prevents access to previously accessible cultural heritage sites being used by, or that have been used by, Affected Communities within living memory for long-standing cultural purposes, the developer will, based on consultations allow continued access to the cultural site or will provide an alternative access route, subject to overriding health, safety, and security considerations;			√	√		As required
	Where an encounter has been made with artefacts, the developer will ensure that						As required

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	the project personnel doesnot disturb any chance find until further assessment by competent professionals has been made and the find has been rendered replicable in another area or be preserved in its current state;				√	√	
Soil erosion	Project activities will be scheduled to avoid heavy rainfall periods (i.e. more activities during the dry season) to the extent practical;	EMMP, this report	Visual observation, design documentation	√	√		Monthly

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	The developer will encourage contouring and minimizing length and steepness of slopes to reduce erodibility;		Design documentation		√		
	Mulching using vegetation previously cleared from the areas will be used to stabilize exposed places;		Visual observation		√		Weekly
	Any spoils (Boulders) in the reservoir area will be used for the backfilling of the weir		Visual Observation	√	√		As required
Surface water contamination	Activities that may destabilize soils/sediments should be done in as far as practicable in the dry season (ie when the seasonal rivers like Chobe are dry) to reduce sediment/contaminant delivery to the river and eventually to the Nile;	EMMP, this report	Visual check of activity schedule		√		Dry season
	Application of appropriate construction practices and creating awareness among	EMMP, this report	Vehicle service sheet checks				As required

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	the community of the need to maintain high water quality;			√	√		
	All project vehicles scheduled to work near water resources will be cleaned prior to use (during the dredging activities);	EMMP, this report	Visual observation, Species used are suitable		√		As required

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	Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;	EMMP, this report	Absence of pollution indicators in dredged areas		√		As needed
	When water quality criteria allow, storm water should be managed as a resource in holing lagoons, either for groundwater recharge or for meeting water needs at the site;	EMMP, this report	Presence of Pollution indicators		√		Rainy season
	Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health;						
	Maintenance of vegetative buffer between the water and construction works to help trap loose sediments and or materials;			√	√		
Ground water contamination	Waste collection points for workers at the construction site will be located out of the	EMMP, this report	Pollution indicators in monitoring wells at				Monthly or during rainy

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	high water table sections of the area;		site	√	√	√	

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	All waste areas will be bunded during temporary storage to prevent pollutant leaching to below ground water resources	EMMP, this report	Visual inspection of the bunding material	√	√		season when ground water table rises
Loss of vegetation	The developer will select appropriate low-impact extraction (e.g. excavation,) methods that should result in final site contours supportive of habitat restoration principles and grasses re-establishment;	EMMP, this report,	Visual inspection of excavation sites	√	√		As required
	Establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities;		Visual observation		√		Weekly/Monthly
	Vegetation translocation and relocation techniques will be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement;	EMMP, this report	Numbers of native plants remaining on site after construction	√	√		Annually
	During extraction, ecological niches should be preserved and protected as far as possible;	EMMP, this report, IFC guidelines for Materials Extraction	Visual observation		√		Weekly

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	

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Traffic	In the case that there is an overlap of public and project vehicles, the developer will be charged with controlling vehicle traffic through the use of one -way traffic routes if needed, and on- site trained flag-people wearing high- visibility vests or outer clothing covering to direct traffic;	EMMP, this report	Flag men on road during activities	√	√	√	As required during vehicle transit
	Ensuring the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and training of workers to verify eye contact with equipment operators before approaching the operating vehicle;	EMMP, this report	Visual observation	√	√		Daily, or as required during heavy traffic requirements on site
	Ensuring moving equipment is outfitted with audible back-up alarms;	EMMP, this report	Site observation,	√	√		
	Using inspected and well-maintained lifting devices that are appropriate for the load, such that there are no breakdowns in the middle of the road;	EMMP, this report	Audio measurements of equipment on site	√	√		
	Contractor shall provide temporary road signage during construction and ensure drivers observe speed limits and for safety of other road users.	EMMP, this report,	Visual observations	√	√		
Noise	Night time activities will be avoided at all costs in as far as is practical, because	EMMP, this report,	Audio measurements at receptors near site				As required

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	sound travels further during night than during the day;	The National Environment (Noise Standards and Control) Regulations, 2003 Occupational Health and Safety Act 2006			√		
	In order to limit noise due to haulage traffic, the construction fleet will be kept in good condition well fitted with efficient silencers;		Visual inspections and Observation	√	√		As needed
	Hand held tools will mostly be used therefore incidences of noise increment will be avoided.		Audio measurements at sources and receptors	√		√	Annually
Waste	Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities; There is need to consider set-up of a waste treatment plant for the project human fecal material treatment before discharge to the environment;	EMMP, this report	Presence of organic pollution indicators in surface waters	√	√		As required
	Toxic, non-biodegradable waste such as spent machine oil and batteries will be stored in sealed drums, which in turn will be stored within a bund having 110% storage capacity volume, until they can be removed for safe long term disposal at the	EMMP, this report, Waste transfer forms, Waste receipt forms at disposal site Waste	Presence of empty oil cans	√	√		Weekly

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	nearest designated District/Sub county solid waste storage site	management Regulations, 1999					
	Biodegradable, and Non-toxic nonbiodegradable waste, including glass, plastic and metal cans, bottle tops, foil wraps, etc. will be bundled and transported to the nearest designated District/Sub county Solid Waste dump site.		Visual observation of waste collection areas	√	√		Weekly, or as required
	All domestic solid waste (i.e. trash and garbage) will be source separated into organic, paper and non-biodegradable fractions.		Visual observation at site	√		√	Weekly
	The proposed development will be responsible for the handling and transporting of its entire production of solid waste.		Periodic monitoring of site waste transfer notes	√		√	Annually
Occupational health and safety	Because of the remoteness of the site location, any human fecal material waste produced will be contained in temporary sealed septic tanks before collection by licensed waste collection agency and disposed at NEMA approved facilities;	EMMP, this report, IFC EHS guidelines, 2007	Visual observation, absence of houseflies and other pests, incidence of disease among workers	√	√		Daily

	Surfaces, structures and installations should be easy to clean and maintained, and not allow for accumulation of hazardous microorganisms. Therefore surfaces in food preparation areas will be	IFC, EHS guidelines 2007, EMMP of this report	Visual inspection of work place	√	√		Monthly
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Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	maintained with a highest level of cleanliness to prevent food poisoning due to ingestion of contaminated food stuffs;						
	Only highly skilled workers will be allowed to operate heavy machinery (cranes, excavators, graders) and heavy trucks (Tipper trucks);			√	√	√	Monthly
	Any large excavated pits will be guarded to prevent falling into the pit by community members/animals;	IFC EHS guidelines 2007, EMMP of this report	Visual observation, checks on workers skills		√		Monthly
	Worksites especially those posing a greater danger to humans/animals will have limited access (i.e. excavation areas, worksites with heavy vehicular movement);	EMMP, this report	Visual observation, Employee knowledge	√	√		Monthly

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	Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary;	EMMP, of this report	Visual observation,	√	√	√	Monthly
Alteration of wildlife behavior	Barriers between sensitive habitats and worksites will be maintained to enable the separation of project activities from habitats within the river/wetlands;	EMMP of this report	Visual observation	√	√		Throughout construction phase
	All facilities will be located outside of known/established animal corridors to	EMMP of this report, Uganda	Visual observation and barrier integrity				

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	prevent animal disorientation;	Wildlife Act CAP 200, 1996	Visual observation		√		
	Known animal foraging areas should be left intact to enable grazing at the same time construction of the irrigation scheme;				√		
	Sediment traps should be placed at the end of the drainage channel before runoff is re-directed into the river	EMMP, of this report, Uganda Wildlife Act CAP 200, 1996		√	√		
Fauna	The construction will be timed during the dry period so that runoff doesnot flood the excavated sections to transport sediments downstream into the main river;	EMMP of this report	Design documentation	√	√		Project onset

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	Incase any fish are caught in the excavated sections for the reservoir facilities, they will be removed and placed in the main river to prevent injury;	EMMP of this report	Design documentation	√	√		Whenever necessary
	Grazers will have alternative areas to find pasture for their animals and water	EMMP, of this report, Uganda Wildlife Act CAP 200, 1996	Visual inspection,	√	√		Monthly
Hydrology	The distance between reservoir and flowback should be limited to areas of low animal interaction in as far as is practical, without compromising the integrity of the environment or project effort;	EMMP of this report	Visual inspections, design documentation	√	√		Rainy and Dry season

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	Normal hydrological functions like transportation of sediments downstream will be maintained to sustain the downstream ecological functions like siltation in the wetlands, that are areas for breeding/feeding for various birds and wildlife; this is so because the water will not be dammed at anytime during scheme operation;	DWRM requirement	Flow measurements up and down stream the river at the proposed site	√	√	√	Peak and low peak flow measurements
	Optimization of the use of flood waters will be undertaken to prevent flooding downstream and slow release of waters during the dry season	EMMP of this report					

Social Impacts

Employment opportunities	Priority should be given to residents of the communities within close proximity of the development;	EMMP of this report	Project Documentation	√	√		Project onset
	Women should be considered equally as men during the employment process, with due consideration to community structures and norms;	National Child Labour Policy, 2006/2010, Children's Act Cap 59, 2000	Employee documentation	√	√		Throughout project implementation
	No children will be hired on the project for any work in keeping with the International Labor Organization, (ILO) Convention No. 138, (1973), that defines the minimum age of employment;		Employee documentation	√	√	√	
Influx of migrants	The developer will continuously sensitize	EMMP, of this	Documentation of				Throughout

Project Component Impact	or Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	workers and community members alike on HIV/AIDS and the dangers of unsafe relations;	report	Minutes of awareness meetings/campaigns	√		√	project implementation
	Workers will be encouraged to be disciplined when on company assignments in the villages and prevent risky interactions with community members.	EMMP, of this report	Documentation on discipline requirement at worksite	√	√		

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	The developer will keep in close communication with women and youth groups to monitor any changes in social structure and communication with local leaders to monitor any changes in population.	EMMP, of this report	Documentation	√	√	√	
Disruption of Cultural norms and practice	Any foreign project workers will be informed on cultural norms of the local communities before encounter, to avoid conflicts with communities;	EMMP of this report	Documentation of minutes from awareness rising within workers	√	√	√	Project Onset
	Gender issues will be considered during the hiring process to ensure equality in income provisions;	Environmental and Social Policy, June, 2013	Number of women/men employed at the site	√	√	√	
	Local authorities shall need to be strengthened in order to deal with the increased cases of indiscipline brought about by the increased population influx, and any disputes that are likely to ensue;	EMMP of this report	Security personnel stationed at work site	√	√	√	
	Gender issues will be considered during	Environmental	Number of	√	√	√	

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	the hiring process to ensure equality in income provisions;	and Social Policy, June, 2013	women/men employed at the site				
	Existing community members will be prioritized for employment so that cultural norms are not drastically altered to maintain social cohesion	EMMP of this report	Number of foreigners at worksite				During construction

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Loss of Aesthetic Quality	The entire process will take into consideration the preferred land-use proposed by communities and government initiative;	EMMP of this report,	Visual inspections of site		√		Throughout project construction
	Access to excavation areas will be closed off to all but construction crew to prevent accidents like falls, or exposure to unsightly conditions within the park;		Visual observation of barriers to site		√		
	Conflicting landuse should be integrated in the overall management of the flood plain so that grazers and rice farmers' views are given due respect;		Visual inspections on site		√		
Operation phase							
Impact on Aquatic organisms	The reservoir will have an overhead flow, allowing for continuous flow of water, except at a reduced speed, though not slow enough to induce stratification;	EMMP, of this report	Visual observation		√	√	At commissioning stage
	The scheme will maximize utilization of flood waters therefore drawing water from the main river will be minimized ;	This report, Feasibility study for the scheme	Design documentation		√		N/A
Water quality	Activities that may destabilize	EMMP, this	Presence of spawning				Throughout
Project Component Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
	soils/sediments should be done in as far as practicable in the dry season to reduce sediment/contaminant delivery to the Oraa river and eventually to the Nile;	report	grounds for fish and benthos	Developer	Contractor	External monitor	operational period. Preferably annually

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	Desilting drainage channels supplying water to the paddies occasionally will remove nutrient rich sediments from the main water ways and returned back to the gardens.		Presence of silts in drainage channels	√	√	
	Surface runoff from process areas or potential sources of contamination will be prevented to prevent rain water contamination;		Water quality downstream of paddy area	√		√
	When water quality criteria allow, storm water should be managed as a resource in holding lagoons, either for groundwater recharge or for meeting water needs at the site;	EMMP, this report	Water quality downstream of paddy area	√		√
	Sludge from storm water catchment areas or collection and treatment systems may contain elevated levels of pollutants and should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of wildlife, aquatic ecology and public health;	EMMP, this report	Water quality downstream of paddy area	√		√
	Water from the paddies should be channeled through a constructed wetland	EMMP, this report	Water quality downstream of paddy	√		√

Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	
	to remove impurities before discharge to the environment		area				

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Soil Contamination	All the drainage paths that have been constructed will be maintained and desilted on a regular basis;	EMMP, this report	Visual observation, slope angle measurement	√		√	Operation phase, especially flood events
	Native herb and grasses species will be encouraged to re-grow in previously cleared areas to help trap loose soils and prevent their progression downstream into the waterway or the river;		Visual inspections	√		√	
	Maintaining flood zones within the cultivated area helps with reduction of erosion.		Visual observation,	√		√	
Alteration of river flow	During the operational phase, technical staff will continuously monitor the slopes especially those at the banks of the river;	Feasibility study report, EMMP of this report	Visual observation	√			Seasonal flood events
	Flood water will be maximized (stored) for usage to reduce stress on river water during the dry season	EMMP of this report	Field monitoring activities	√			Monthly checks
	Land clearing and slope stabilization activities should be conducted in their proper sequence and disturbed areas are to be suitably protected and maintained until permanent protection is established;	EMMP of this report		√			As required
Noise from Vehicles accessing the site	Developer will reduce the required number of trips to and fro the site to only necessary incidences requiring	EMMP of this report	Noise measurements at source and nearest receptor				Annually or as advised by Lead agency

Project Component Impact	or	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
					Developer	Contractor	External monitor	

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	transportation of project staff and the occasional maintenance workers;			√		√	
	The Project drivers will abide by the speed limits set forth by the UNRA for all vehicle access to the area;	EMMP of this report	Visual observation	√		√	Before project commences
	The developer will orient visitors to the Scheme so that safety road rules are followed in close coordination by project staff						
Occupational Health and Safety	Workers in the paddies will be instructed on how to respond to emergencies and situations of near drowning or drowning.	Visual observation	Training records of workers	√	√	√	Throughout project life cycle
	Workers will be trained on the recognition and prevention of hazards specifically applicable to work in remote areas, and in areas with dangerous wild animals like snakes; Working in groups gives safety in numbers, since the area harbors known dangerous wild animals	This report	Training records of workers	√	√		Throughout project life cycle
	Swimming as a pre-requisite for working across river/stream sections will be needed and where lack of the skill is observed, training will be undertaken;	EMMP of this report	Training records of workers for swimming	√	√		
	For the case of diseases like malaria, the project will put in place strategies to control the disease through issuance of	Emergency evacuation plan, EMMP of this	Mosquito net usage in the area Emergency	√	√		
Project Component or Impact	Mitigation measures / Action	Reference Document	Monitoring Criteria	Responsibility			Timing
				Developer	Contractor	External monitor	

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

	mosquito nets and education on their usage. The developer will have a clinic stationed at the worksite to address any illness. There will also be an emergency evacuation plan to remove any injured worker from the field for urgent treatment;	report	evacuation plan documentation			
	Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.	Employee records, EMMP of this report	Training records for employees	√	√	√
	Use of chemoprophylaxis drugs by nonimmune workers and collaborating with public health officials to help eradicate disease reservoirs	EMMP of this report, Developer's Environmental safety policy	Visual inspection of first aid kits on site	√	√	√

*External Monitor is a lead Agency/stakeholder like NEMA, DWRM, DEO or a private consultant whom the developer will engage on matters arising like noise, biodiversity, air and water quality monitoring. Lead Agencies will make their own arrangements on inspections on site to ensure compliance with set guidelines and standards.

8.8 ENVIRONMENTAL AND SOCIAL MITIGATION BUDGET

The provision under this section covers the cost for biodiversity conservation & management, catchment area management, fishery conservation & management, public health delivery system, solid waste and sewage management, fuel and energy conservation measures, muck disposal, landscaping and restoration of construction areas & quarry sites, environmental monitoring programme etc. The various budgeted provisions for mitigation activities and related costs are outlined in Table 42 below. These budget estimates have been made with adequate provisions for contingencies and is an integral part of the financial requirement of the project.

The project proponent (MWE) will be responsible for ensuring that the budgeted resources for implementing the environmental and social components of the project are provided. The budgeted funds are indicative and part of the overall cost for the project and should be accessible to the contractor who should prepare actual budgets according to the implementation schedules of the different proposed Management and Monitoring plans, which will also have to be adjusted and put in place.

The day today (local level) management and monitoring will be done by the contractor and the representative of the proponent. The proponent will liaise with NEMA to form a joint monitoring team. This joint monitoring team can constitute representatives from MWE, NEMA, Ministry of Gender Labour and Social Development (MoGLSD), Nebbi District Environment Officer, MAAIF, etc. MWE will pay to NEMA the certificate/ approval fees that form part of their monitoring budget, but in addition the MWE will provide the budget for the facilitation of the monitoring activities of the committee. Other individual Central Government and local government agencies and institutions that will not be part of the committee shall retain their monitoring roles and mandates and will cover their costs from their annual budgets.

Table 44: Summary of costs in implementing the Environmental and Social Management activities

No.	Activity	USD
1	Soil and water conservation measures	25,000.00
2	Soil and water quality monitoring	12,000.00
3	Atmosphere environment protection and monitoring	9,000.00
4	Sound environment protection and monitoring	9,000.00
5	Solid waste management	7,500.00
6	Public Safety including signage	55,000.00
7	Restoration of material sourcing sites	15,000.00
8	Monitoring of Aquatic and Terrestrial Resources	12,000.00
9	Aesthetics and Landscape Rehabilitation	6,500.00
10	Social environment including community sensitization	10,000.00
	Sub Total	161,000.00

 <p style="margin: 0;">architects engineers & consultants pvt. ltd.</p> <p style="margin: 0; text-align: right;">In association with Case international Consultancy Pvt. Ltd.</p> <p style="margin: 0;">Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project</p>	<p>July, 2017</p> <p>Revision: R0</p>
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	Contingency (10%)	16,100.00
	Total Budget	177,100.00

8.9 INSTITUTIONAL CAPACITY FOR ESMP IMPLEMENTATION

To address technical staff shortages, it is recommended that the MWE and NEMA liaise with Nebbi DLGs to appoint/recruit environmental specialists to undertake the responsibility of managing the ESMP process at the district level before commencement of the project activities since capacity gaps at the district level were identified during the field visits. Stakeholders further reported that, weakness in implementation of the ESMP is further compounded by lack of funding, equipment and qualified staff. A capacity building programme should be included as part of this project to help train the district and Ministry officers engaged in the implementation of this project in various aspects of environmental assessments. The capacity building programme for the relevant staffs will enable them to monitor environmental issues in the sub-projects and ensure compliance with requirements of the Uganda environmental regulations as well as the AfDB safeguard policies. It is proposed that the training and capacity building activities be facilitated by NEMA, MWE and the Environmental Specialists at the Bank. This ESIA proposes capacity building in the form of awareness creation and sensitization, actual training through workshops and seminars for the different stakeholder and implementing partners.

Contractor(s) and Supervising Consultants will also need to be provided with awareness raising and environmental and OHS training on-site. This should focus not only on the construction phase but also operational phase of the Project. The Contractor should also prepare site specific ESMPs based on EHS aspects identified at the time of commencement of construction activities.

9. CONCLUSION

The proposed Wadelai Irrigation Scheme is part of the government's plan to establish new irrigation schemes distributed over the country. Several beneficial impacts envisaged will include: Employment of local communities during the pre-construction/mobilization and the construction phase; The project will contribute towards improvement of farm incomes, rural livelihood and food security; Local revenue to the communities, District; Improved flood water utilization in the area; Income generation; water will be availed throughout the year to ensure productivity even in dry season; Increased of Agricultural Production; Minimize Soil Deterioration; Crop diversification; Provision of Livestock Feed and; Restoration and Protection of Catchments. However, the ESIA findings indicate that direct impacts will be fairly benign and limited to the project area where construction works will be undertaken. Direct negative impacts will include:

- The physical construction of irrigation systems. This involves issues such as human resettlement; watershed degradation; encroachment of unique ecosystems and historical and cultural sites; biodiversity loss and change (including wildlife and fishery resources); proliferation of invertebrate and vertebrate pests and disease carriers; soil erosion and sedimentation), Noise during construction.
- The management of irrigation systems. This depends on the nature of the water source (surface or ground water or both), quality of the water, and its delivery to the irrigated land. The withdrawal of ground water can lead to land subsidence, salinization, and increased pollution by other chemical contaminants. Withdrawal of surface water leads to changes in river hydrology (e.g., water quantity, flow regime and quality) that can affect these and other associated aquatic ecosystems. Water delivery to the irrigated land and agricultural run-off can lead to soil erosion, impacts on aquifers, waterlogging, and salinization of soil and water.
- Agricultural management practices. These may contribute to the pollution of groundwater and downstream surface water through inputs of salts, agrochemicals, and toxic leachates. • Increased sediment loads into the river especially during construction phase
- Improper disposal of cut out spoil and other construction wastes.
- Other concerns include occupational safety hazards, and HIV/AIDS risk associated with construction labour.

The proposed Wadelai Irrigation Scheme is environmentally and socially feasible for implementation provided the recommended mitigation and monitoring measures are implemented, and the proposed implementation arrangements are upheld.

During this ESIA study, thorough consultations were conducted with relevant stakeholders and MWE will liaise with them to ensure effective implementation of the proposed mitigation measures for the anticipated negative impacts. MWE should work closely with the local leaders and government agencies to ensure smooth implementation of the Environmental Management and Monitoring Plan and if impacts not contemplated during this ESIA arise, MWE should immediately address them in consultation with NEMA. If any other structures/ expansion not described in this report takes place, it will be considered separate and an EIS/ Project brief will be prepared by MWE and submitted to NEMA for approval. It is recommended that the MWE and NEMA liaise with the relevant DLGs to appoint/recruit environmental specialists to undertake the responsibility of managing the ESMP process at the district level before commencement of the project activities. Contractor(s) and Supervising Consultants will also need to be provided with awareness raising and environmental and OHS training on-site. This should focus not only on the construction phase but also operational phase of the Project.


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ANNEXES

ANNEX1: APPROVED TERMS OF REFERENCE FOR EIA BY NEMA


NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA/4.5
3rd September, 2015

The Permanent Secretary,
Ministry of Water and Environment,
KAMPALA.
Tel: +256 (0)414 505945 / 221198

NEMA House
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Tel: 256-414-251064, 251065, 251068
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RE: REVIEW OF TERMS OF REFERENCE PERTAINING TO THE PROPOSED REHABILITATION/RECONSTRUCTION OF FIVE SELECTED IRRIGATION SCHEMES, UNDER THE FARM INCOME ENHANCEMENT AND FOREST CONSERVATION PROJECT – PHASE-II

This is in reference to the Terms of Reference (TOR) for carrying out an environmental and social impact assessments (ESIAs) for proposed rehabilitation/reconstruction of **five selected irrigation schemes**, which you submitted to this Authority for review and consideration for approval. This Authority has finalised the review and grants formal **APPROVAL** of the said TOR, relating to the project sites listed in the table below.

Irrigation Scheme	Project / Location	District
1. Doho-II	Doho Parish, Nazimasa Sub-county, Bunyole East County.	Butaleja
2. Mubuku-II	Sebwe Parish, Nyamwamba Division, Kasese Municipal Council	Kasese
3. Wadelai	Regem and Pakwinyo Parishes, Wadelai Sub-county, Jonam County	Nebbi
4. Ngenge	Kapkwat, Sikwo, Sosho and Cheptarre Parishes, Ngenge Sub-county, Kween County.	Kween
5. Tochi	Abanya Parish, Acaba, Oyam Sub-county, Oyam County.	Oyam

In addition, you are advised to consider the key aspects outlined below, during the conduct of the ESIAs and preparation of the ESIA reports.

- (i) Note that the ESIA reports for the five proposed project areas **should be submitted separately for review.**
- (ii) Carry out comprehensive stakeholder consultations involving, among others, the respective District Local Government Authorities, the concerned local communities in the targeted project areas that will accommodate the projects, and other Authorities responsible for provision and management of public utilities (*road network, among others*), respectively; and, ensure that the concerns/views of the stakeholders **are well-documented and appended to the ESIA reports.**

1 of 2


Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm
Income Enhancement & Forestry Conservation Project

- (iii) Provide **correct citation of details of the location of the project areas** that will accommodate the project components / infrastructure, preferably in tabulated format – by names of villages, zones, wards, parishes, sub-counties, division, county – whichever is applicable.
- (iv) Present the narratives on **any identified project-affected communities/entities** and the related compensation aspects, land-take aspects, shared resources, respectively, in a comprehensive manner.
- (v) Provide comprehensive **baseline information/data** relating to the project areas and their environs, public utilities, regulated and sensitive/fragile areas, settlements, **water source** (supplying water for irrigation); and, **a set of coloured photographs** showing the current state of some of the critical sections of the targeted project area, respectively.
- (vi) Include in the ESIA reports **coloured location/google maps** (*preferably covering A-4 or A-3 paper size*) that are clear, well-labelled and legible and showing the alignment of the project infrastructure, as well as sets of **GPS coordinates.**
- (vii) Provide comprehensive narratives on all the **proposed project components, activities**, and the size of the workforce.
- (viii) Include in the ESIA reports comprehensive **analyses of alternatives** in terms of project design, type of technologies, among other aspects.
- (ix) Provide **detailed evaluation of the identified potential environmental impacts, residual impacts and risks** associated with the project components and activities.
- (x) Ensure that **comprehensive mitigation and environmental management and monitoring plans** are well presented, respectively, that relate to the identified potential environmental impacts.
- (xi) Consider any other critical environmental aspects/concerns not initially foreseen during the preparation of the TOR, and **include evaluations of such aspects/concerns** in the respective ESIA reports.
- (xii) Indicate the **total project (investment) cost** covering all the project components and activities.

This is, therefore, to recommend that you proceed with carrying out the ESIA's for the proposed projects. We look forward to receipt of five sets of copies of comprehensive environmental and social impact statements, for our further action.



Margaret Anyu
FOR: EXECUTIVE DIRECTOR

c.c The Director,
Directorate of Water Resources Management,
ENTEBBE.

ANNEX 2: SOIL ANALYSIS REPORT



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COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
SCHOOL OF AGRICULTURAL SCIENCES
Department of Agricultural Production

SOIL ANALYSIS RESULTS

PROJECT NAME: Feasibility Study and Detailed Engineering Design of Irrigation Schemes 'Under the FIEFCO Project

LOCATION: Tochi(Oyam), Pabbo(Gulu), Biiso(Bullisa) Wadelai(Nebbi)

Laboratory Analysis

The air-dried soil samples were pounded, sieved through 2 mm to remove any debris then subjected to physical and chemical analysis following standard methods described by Okalebo *et al.* (2002)¹. Soil pH was measured in a soil water solution ratio of 1:2.5; Organic matter by potassium dichromate wet acid oxidation method; total N determined by Kjeldhal digestion; Extractable P by Bray P1 method; exchangeable bases from an ammonium acetate extract by flame photometry (K^+ , Na^+) and atomic absorption spectrophotometer (Ca^{2+} , Mg^{2+}); and particle size distribution (texture) using the Bouyoucos (hydrometer) method. Heavy Metals and trace elements by AAS from an EDTA extract

TRACE ELEMENTS AND HEAVY METALS

Lab No	Fe	Cu	Mn	Zn	Cr	Ni	Pb	Cd
	ppm(mg/kg)							
1	130.6	2.81	49.6	2.49	1.00	0.00	0.00	0.02
2	110.5	2.98	33.9	5.24	2.02	0.00	0.00	0.00
3	120.7	2.66	28.2	2.50	1.01	0.00	0.00	0.01
4	156.9	2.47	25.4	4.54	2.12	0.00	0.00	0.00
5	161.2	2.53	22.2	2.87	1.14	0.00	0.00	0.01
6	105.2	1.35	32.0	3.25	0.96	0.00	0.00	0.00

ROUTINE ANALYSIS

	pH	OM	N	P	K	Na	Ca	Mg	CEC
		%age	ppm	Cmoles/kg					
1	6.0	0.88	0.01	16.9	0.77	0.08	5.6	6.10	15
2	6.0	1.49	0.08	17.8	0.65	0.10	6.5	4.20	32
3	6.2	8.46	0.34	14.6	0.54	0.09	5.3	2.90	49
4	6.1	2.06	0.15	13.5	0.27	0.05	4.5	4.10	29
5	5.0	2.11	0.11	19.3	0.35	0.07	2.4	3.80	26
6	6.0	6.94	0.21	11	0.85	0.12	3.2	1.22	21


PHYSICAL PROPERTIES

	%sand	%Clay	%Silt	TEXTURE CLASS	BD g/cm ³	K _{SAT} Cm/hr	EC μScm ⁻¹	WP cm ³ water/cm ³ soil	Water holding capacity
1	76.0	10.0	14.0	SCL	1.59	2.91	140	0.10	0.20
2	48.0	28.0	24.0	SCL	1.38	0.41	210	0.19	0.31
3	34.0	56.0	10.0	C	1.20	0.19	136	0.36	0.62
4	66.0	24.0	10.0	SCL	1.46	0.45	124	0.19	0.26
5	56.0	28.0	16.0	SCL	1.35	0.30	110	0.20	0.29
6	58.0	24.0	18.0	SCL	1.40	0.48	120	0.18	0.26

1	WADELAI COMMAND AREA
2	BIISO COMMANDA AREA
3	PABBO COMMAND AREA
4	WADELAI COMMAND AREA
5	TOCHI COMMAND AREA
6	PABBO COMMAND AREA

Bonny Balikuddembe
Senior Laboratory Technician
Soil, Water and Plant Analytical Laboratory

Annex 3: WATER QUALITY ANALYSIS CERTIFICATE



MAKERERE
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: 256-041-540992
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DEPARTMENT OF CHEMISTRY

22/08/2016
CLIENT: WSS SERVICES (U) LTD
PROJECT: PROPOSED WADELAI IRRIGATION SCHEME IN NEBBI DISTRICT
SAMPLE MATRIX: Water Samples from River Oraa
 Table of analysis Results

NO	PARAMETER	UNITS	UPSTREAM	DOWNSTREAM
1	pH	-	6.19	6.18
2	Ec	µS/cm	202	232
3	Turbidity	NTU	0	5
4	Colour	Pt-Co units	16	26
5	TDS	mg/l	98	166
6	Iron	mg/l	0.02	0.03
7	Ammonia-N	mg/l	0.011	0.036
8	Nitrate-N	mg/l	0.105	0.118
9	Nitrite-N	mg/l	0.034	0.045
10	Aluminium	mg/l	0	0
11	Potassium	mg/l	3.64	3.68
12	Sodium	mg/l	4.2	4.6
13	Fluoride	mg/l	0.01	0.02
14	Chloride	mg/l	6.55	7.24

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm
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15	Sulphate	mg/l	6	9
16	Magnesium	mg/l	3.92	2.98
17	Calcium	mg/l	8.36	9.58
18	Chromium	mg/l	0.00	0.01
19	Manganese	mg/l	0	0.01
20	Copper	mg/l	0.01	0.02
21	Arsenic	mg/l	0	0
22	Lead	mg/l	0	0

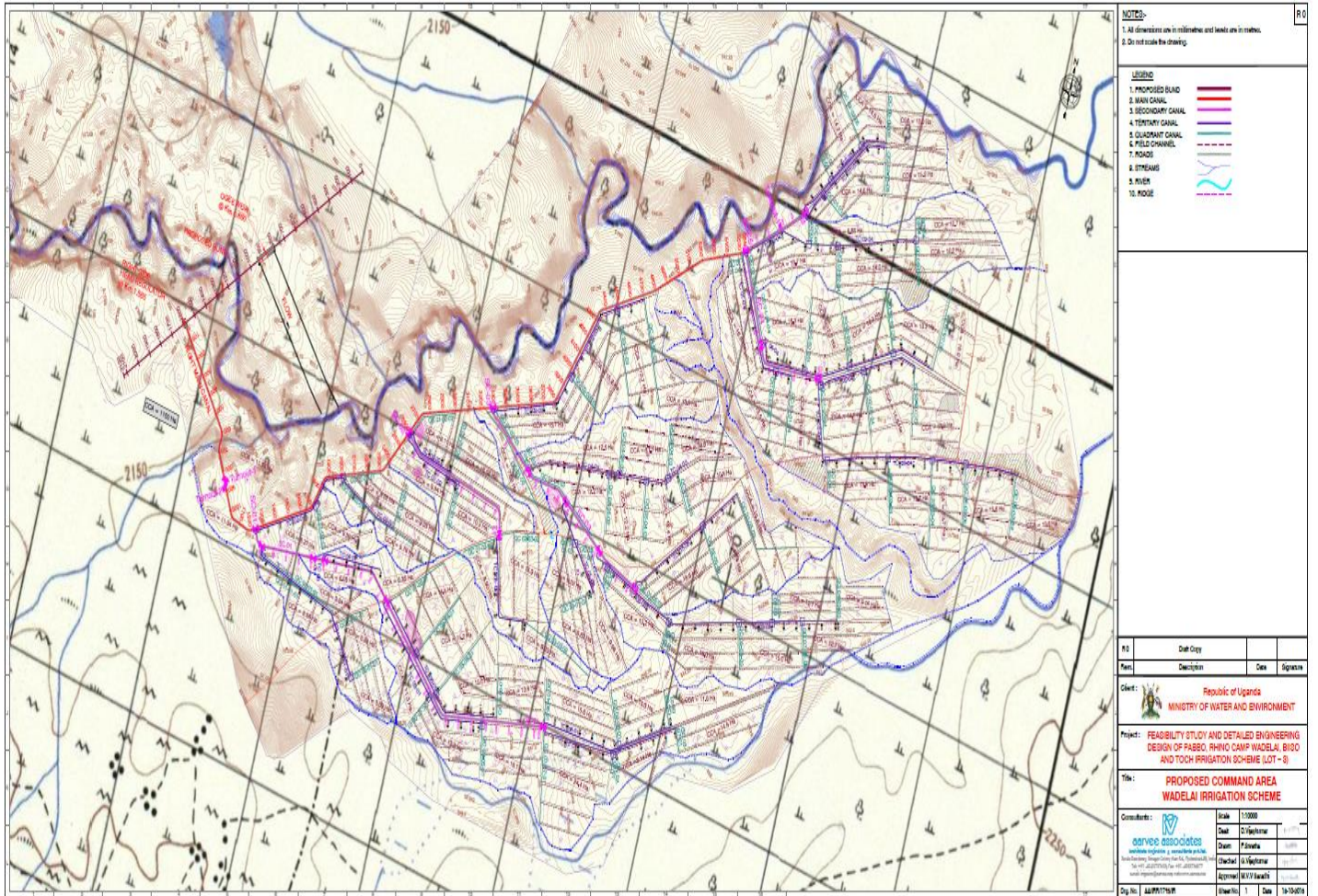
ANALYSIS BY

Ruharara Budigi
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R. Budigara



ANNEX 4: PROJECT LAYOUT PLANS AND DRAWINGS



ANNEX 5: RECORDS OF STAKEHOLDER CONSULTATIONS

Focused Group Discussion Guide

Focused Group Discussion Guide for ESIA of the proposed Wadelai Irrigation Scheme Background

The Farm Income Enhancement and Forestry Conservation Project was established in 2005 with the aim of contributing to poverty reduction and livelihood improvement for the people of Uganda. Its overall objective is to improve farm incomes, rural livelihood and food security through sustainable natural resources management and agricultural enterprises development. The project intends to develop the identified sites like this one into modern irrigation schemes with farmer based sustainable institutional management arrangements. It required that relevant technical investigations and studies (comprising of but not limited to hydrological and hydraulic studies, topographical surveys, geotechnical investigations, socio-economic assessment), and prepare engineering designs and tender documents to facilitate the construction of civil and hydraulic structures. The aim of this engagement is to establish the current situation regarding farming in these areas of interest, production constraints, agricultural markets, gender and social aspects that could present barriers or opportunities for the sustainability of the proposed irrigation systems.

Total Participant time required: 1 hour + 10 minutes - 1 hour + 50 minutes

Total focus group time: 1 hour + 10 minutes - 1 hour + 50 minutes

Break: 0 minutes

1.1 Introduction (10 m)

This session will include the following procedures:

- Introductions (including the interviewers observers and FGD participants)
- Explanation of the purpose of the study is to conduct baseline study as a means to provide baseline for evaluating the outcomes and impacts of the programme.
- Explanation of the presence and purpose of recording equipment and introduce observers. Additionally, the need for the discussion to be informal, so there's no need to wait for us to call on you to respond. Information on the identity of participants, participation and remarks that are to be private. Finally introduction of assistants to take notes

Current Production Systems

- What are the current production systems in this area? Probe for both crop and animal production systems
- What are the current production constraints? Probe for water, soil productivity, land access, access to markets.
- How best can each of the challenges identified above be addressed at farm level and community level? Probe for constraint specific recommendations

Agricultural Markets

- Describe the location of agro-produce markets in each district, county where the project sites are located.

- How far is the agri-produce markets from the project sites & mode of transport /roads available
- Any challenges that communities face in accessing these markets (Probe for storage facilities, transport facilities that limit them to selling their produce at farm gate)
- Are there any domestic animals available in farm households for cultivation / transporting farm products to market in the event that productivity increases?

Gender Roles and Responsibilities

Let us discuss the gender roles associated with agricultural production. What activities are associated with the different genders at household level? Probe for:

- Current activities for both men and women activities related to land clearing: sowing, weeding, harvesting and marketing
- Activities related to livestock management and marketing of livestock products
- income generating activities
- participation in public and social affairs, leisure for women
- other

Beliefs and Value Systems

Beliefs and value systems also determine the productivity of crop and livestock systems. In your view, how do people in this community view the existing challenges and solutions? (Irrigation systems require a lot of community participation). What is the general perception towards group dynamics, probe for recent observations in different groups while focusing on intended outcomes visà-vis value systems of the members. When the scheme is fully functional, beneficiaries might be required to contribute towards the cost of maintenance. In your view what do you think would the social, economic and cultural challenges that may come with this requirement? How best can these be addressed.

Credit Access

Increasing agricultural production may require more capital meaning that some members of the community might require to gain access to credit. What credits services are available to small scale farmers and women's access to and control over credit? Probe for credit scheme barriers, collateral, loan amounts and repayment time, cultural, social and legal barriers. What alternative sources of financial services are available within this community? Probe for grants, SACCOs, money lenders etc.

Impacts of the Irrigation Schemes

Generally, what is your view regarding the proposed irrigation scheme. Probe for the specific benefits in terms of production, income diversification, access to markets, amongst others. Any homesteads that are likely to be affected during construction, operation and maintenance. Probe for upstream and downstream communities and activities engaged in. In your view, what would be the best option for managing constraints to production at farm level? Probe for the need for increased labor input, adoption of more productive technologies, shifts in value systems, behavior modification or farmers redefining their attitudes and perceptions towards farming.

Closing (10 m)

- Closing remarks
- Thank the participants

Key informant Interview Guide

Key Informant Interview Guide at District/Sub -County Level for ESIA proposed Wadelai Irrigation Scheme

General Information: As appropriate completes this information prior to interview.

- Institution/Agency: _____
- Name of person being interviewed: _____
- Occupation _____ Phone number: _____
- Date of interview: _____
- Interview conducted: (tick one) In person _____ By phone _____
- Interviewer: _____
- Interview start time: _____ Interview end time: _____
- Total time for interview: _____

(Total number of minutes)

Introduction

Good morning / Good Afternoon / Good evening Sir/Madam, My name isand I am part of a team conducting ESIA for the feasibility study and detailed design for the proposed Wadelai irrigation scheme in Wadelai Sub-County, Nebbi District. The aim of this engagement is to establish the current situation regarding farming in these areas of interest, production constraints, agricultural markers, gender and social aspects that could present barriers or opportunities for the sustainability of the proposed irrigation systems. This meeting will also focus on institutional aspects for potential operation and maintenance.

Current Situation

- a. In order to understand the feasibility of the proposed irrigation schemes there is, there is need to understand the current situation within project area. In your view what are the current production systems, farming practices and crops grown per seasons amongst others
- b. How would you describe the type of farmers in the area? Probe for commercial or subsistence farmers.
- c. What are the current production constraints? Probe for water, soil productivity, land access, access to markets.
- d. Do you think that there are competing needs for the different production systems? Probe for hydropower generation, tourism, livestock, crop, aquaculture, commercial or subsistence water demands on the proposed river system.

- e. Let us discuss the gender roles associated with crop production. In your view, do what are the differentiated gender roles regarding crop production? Probe for aspects of irrigated agriculture vis-à-vis rain fed agriculture given irrigation is likely to come with increased labor demands?
Challenges of getting hired labor
- f. What is your view regarding the proposed irrigation scheme. Probe for the socio-cultural, institutional and management issues.

Impacts Related to Irrigation Scheme

- g. The construction is likely to include the following construction activities (land clearing, excavation, extracting, filling, compacting, waterways crossing, uses of heavy machinery, construction of facilities etc). In your view, do you feel that there any specific of the current situation diversions of water from the river, flooding, loss of income in some seasons, increased spread of diseases, involuntary resettlement of some people? Are there any people that need to be compensated
- h. Now let's talk about gender issues in irrigation production. What gender considerations have you put in place regarding operation and maintenance phase? Any cultural issues that should be considered under irrigation agriculture in terms of increased demand for time.
- i. Some production systems like rice are high water consumption crops while others are not. In your view, how best would this competition for resources could be managed?
- j. It is hoped that when the schemes is constructed, the agricultural productivity will increase in this area. In your view, what are the current market systems and what capacity demands that are likely to arise, noting that the proposed crops are rice and cotton.
- k. When the scheme is fully functional, beneficiaries might be required to contribute towards the cost of maintenance. In your view what do you think would the social, economic and cultural challenges that may come with this requirement? How best can these be addressed. 1.

Institutional Arrangements

- m. For the sustainable and efficient functioning of water markets, it is necessary to have an institutional and legal system that is compatible with water marketing as well as with the nature of the water resource itself. One of the challenges that have been observed with surface irrigation systems has been the poor cost recovery from farmers and limited return on investments on the part of Governments. The cost recovery could be due to the sub optimal use of the existing irrigation facilities, wrong pricing and inadequate attention paid to the level

and form of water charges. Therefore in your view, which system of management do you propose should be adopted? Probe for different options like Government, private or farmer managed. Explain why?

- How are the targeted farmers organized in the proposed scheme area?
- Are there any water allocation and agreements exist, if any, for the river basin where the project sites are located
- If water user associations are to be formed to ensure sustainability of the irrigation schemes what capacity needs can you identify and how best can they be addressed (if at district level, probe for gaps related to different sectors)
- In particular, what capacity needs do envisage for all stakeholders within your project area.

Sustainability

- n. One of the issues that determine the sustainability of a system is the institutional strength of the management body. In your view what sort of capacity would be required by the different management options identified?
- o. In some instances, water related diseases could increase, which diseases do you anticipate and how best can they be managed.
- p. Some irrigation systems could fail to function due to labor deficiency, in your view, how best can labor resources be allocated both at household and at scheme level?
- q. In your view, what would be the best option for managing constraints to production at farm level? Probe for the need for increased labor input, adoption of more productive technologies, shifts in value systems, behavior modification or farmers redefining their attitudes and perceptions towards farming.

MINUTES OF MEETINGS HELD IN WADELAI

12/6/2017 STAKE HOLDER. MEETING AROGA IRRIGATION SCHEME
12/6/2017

LCE VILLAGE PUMI PARISH WADELAI SUB COUNTY.

AGENDA:

- 1- PRAYER ✓
- 2- INTRODUCTION & REGISTRATION ✓
- 3- CHAIRMAN (AROGA) WEL COMING ✓
- 4- CONSULTANTS PRESENTATION ✓
- 5- DISCUSSION / COMMENTS
- 6- AOB.
- 7- CLOSING REMARKS



The meeting starts by prayer this time at 2:30pm introduction has pass well this time. AND chairperson Mr. Okello Aroga has talked about respect and place of helping them selfe for public use such as latrine using shelters.

This Irrigation we have two only in wadelai sub-county

This Dam will take one year without dry up and supply all the Garden of ~~the~~ the people to help them for their live, you can work throughout the year to help you in your life. And benefit of this project can bring jobs and so on in your areas. What they want is you to give out your commet in this project. to assist this project- in order to work well not to fail at all.

This project is not going to spoil any body's properties or houses and the land etc.

Those who have farms also will be in groups you can work together in your community about project.

He wants to know whether this project will take for how long? or is a property of Government? because it will take 1000 acres. This acres is for community
Chairperson he will be responsible for this work to see them
This project will help you not any others in your community.

CHAIRMAN L.C. 1
AROGA
12th JUN 2017
WADELAI S/COUNTY

AYABU EAST VILL,
RABEM UPPER,
WADLAI - DIV,
12-06-2017

RE: STAKEHOLDERS MEETINGS AT AYABU EAST
VILLAGE CONCERNING DAM IRRIGATION PROJECT.

AGENDA:

1. Opening prayer.
2. Welcome remark by LCI
3. Introduction and Registration.
4. Highlights of project by consultant.
5. Discussion.
6. AOB.
7. Closing Remarks.

DISCUSSION ON THE AGENDA:

min I / JUNE / 2017: Opening prayer: The meeting was opened with a short prayer led by deochrist Ayoma Williams at 10:30 AM.

min II / JUNE / 2017: Welcome remark by LCI: The LCI Ayabu East Mr. Gato toba Michael welcome the Consultant and all members present. He said, everybody should feel free during the discussion.

min III / JUNE / 2017: Introduction and Registration: Every members introduced themselves irrespective of their positions and were all registered in the attendance sheet.

min IV / JUNE / 2017: Highlights of projects by consultant: The Consultant Mr. Herbert HASSAN from environmental department, give the below project highlights:

purposes of the projects: The project is called Wadlai Irrigation Dam project.

1. To stop flooding in the area.
2. To improve on Agricultural production.
3. Improvement of farmer skills (Capacity building).
4. Formation of farmer groups.

Technical views: RUNIT (PARISH), CHAALS

L.C.I. AYABU EAST
VILLAGE
SIGN: M. G. T. O. A.
DATE: 12/06/2017
RABEM PARISH

Min V/June/2017: Discussion: The following issues were raised and resolved:

- All farmers will be in groups not individual
- Contractor will come to meet community.
- Workers/handymen will be recruited from the community with help of local Councils
- Community or groups will access finance, fertilizers and chemicals.
- Business people will raise their standards.
- The farmers should be tough with good records and behaviours.
- Compensation will be made when contractor will come and talk to community where roads have passed.
- Since the issue of water problem is a very serious. He will inform his superiors to first of all engage in repairing the broken bore holes.
- Another issue to raise is long distance to health centres or clinics (public health care) and the results be got later.
- Community farmers will be the one to do the farming. LC's are Government. Gov't prison will also do farming.
- Community should be present when contractor is carrying out his/her project work. An important body (Committee) will be formed together with sub community teams in order to supervise and monitor the project work. Eg Committee comprise of LC's, parish chief, LC III, Area Councillor, Subcommunity chief, CD, Criso, etc.
- Even him self the consultant will also be visiting the project work.
- After recruiting the workers, they will train them on health issues, protective

(2)

- (13)
- There is going to be no Compensation on Dam area because it's a Community project. If the land belongs to individual. Local leaders/Elders/subcommunity can convince the owner and later on put a school for example in the name of such person for remembrance in future. Cash ~~can~~ be wasted at a shorter time.
 - The river is a natural gift by God, and rain comes from God. So, when you dig well help to be improved from various crops, since your income is now improved, Gov't will begin to tax you. Even you buy any thing for your family in that way you are paying also taxes. That is why Gov't puts up such schemes so that human living standards are improved and later pay taxes to Gov't.
 - The Contractor will first put a camp for workers or tent ready built houses.
 - No outside groups will come to farm without community notice. Each community groups have got their by-laws to follow in all proceedings to maintain or less arrears.
 - Consultant Daxly said, all the community concerns are noted and important. Good enough there are some contacts which will be need for future engagements. He thanks all the Elders and youth present.
- Min VII/June/2017: Crossing Remarks. The Chairman


Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm
Income Enhancement & Forestry Conservation Project

LCI Ayabu East. Thanked the consultants
for keeping and arrived early, thanked God for
helping him to move safely along journey from
Ministry and then back.
Hoping to meet consultant again.
MR GAYO YABA EDMAN LCI AYABU EAST

L.C.I AYABU EAST
VILLAGE
SIGN: *[Signature]*
DATE: 21/8/2017
RABBIT PARTISH

(14)

LIST OF STAKEHOLDERS CONSULTED











REPUBLIC OF UGANDA
MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT
FEASIBILITY STUDY AND DETAILED DESIGN OF IRRIGATION SCHEMES (TOCHI, AND WADELAI)
ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

STAKEHOLDER CONSULTATION SHEET

Village Parish Ragam Upper Sub-County Wadelai District Nebbi

Date:

Sl. No.	Names	Designation	Contact	Signature
1	NUNATABA EMMANUEL	Dic- Ragam Prison Farm	0789797127	
2	GAYO YOBA	L.C. I MAN AYABA EAST	0777448560	W.D.
3	Hessam Lubega	Consultant	0782741000	
4	Obida Justice	Elder Ayaba West	-	
5	OBIDA NUSKA ALIGA	Elder Ayaba West	-	
6	OTUA ALFRED	Elder Ayaba West	-	
7	ATOMIA WILLIAM	ELDER AYABA WEST	-	
8	OMOBA FRED	YOUTH AYABA EAST	-	
9	BAYIDA WILLIAM	-100TH AYABA EAST	077772259	

L.C. I AYABA EAST
VILLAGE
SIGNATURE
DATE 12/15/2017
PARISH

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

No	Name	Position	Cultural Leader	Phone	Signature
10	DEBUKU KASIM	CULTURAL LEADER AYABU	-	-	OMABO
11	CHINYATH VICENSIO	ELDER CIP MABU EAST	-	-	Ido Cumyao
12	OKUMI MICHEAL	ELDER AYABU	-	-	Ido
13	ABRIKO ISATA	ELDER AYABU EAST	0777237244	Ido	Ido
14	GATO TOBA	LCIP AYABU EAST	077748560	MGR	Ido
15	ATOMA HILLARY	LCIP AYABU WEST	-	-	Ido
16	INDIA JESSE	LCIP AYABU CENTRAL	0789760542	Ido	Ido
17	KIARA OMBATA KIRACUS	ELDER AYABU WEST	0776371296	Ido	Ido
18	ARUMARI DEONIS	YOUTH AYABU EAST	-	-	Ido
19	APILI STEPHEN	VHT AYABU EAST	0794485223	Ido	Ido
20	LUKUA JUSTO	ELDER AYABU EAST	-	-	Ido
21	OMBIA MATILIA	ELDER CENTRAL	-	-	Ido
22					
23					
24					
25					

L.C.I
SUSI
DATE 16/08/17
PAREY PAREY

Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project



REPUBLIC OF UGANDA

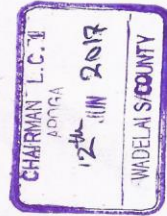
MINISTRY OF WATER AND ENVIRONMENT

FARM INCOME ENHANCEMENT AND FORESTRY CONSERVATION PROJECT
FEASIBILITY STUDY AND DETAILED DESIGN OF IRRIGATION SCHEMES (TOCHI, AND WADELAI)
ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT
STAKEHOLDER CONSULTATION SHEET

Village Parish PUMIT Sub-County WADELAI District NEBBI

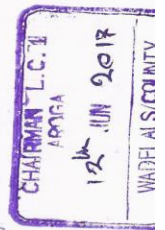
Date:

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1	Hassan Lubega	Consultant	0782741000	
2	OKELLO RICHARD	Chairman of Area Committee	0788671006	
3	DDONGO JOSEPH	ELDER MIAAGUWEI	0774968415	
4	DNBYER ESTIMMA ABU	ELDER ARAGA	-	
5	PACU TITO NODDERI			
6	ABWA CHARISPUS	ELDER KISANEE	0789292069	
7	OKAKACON KORAPO			
8	EDDICH DINGOR	Youth		
9	ODALIA ISSACK	-	-	







Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
10	UKUMU ADO	Elder	AROGA	UKUMU ADO
11	UTA MARK	YOUTH	077965182	UTA MARK
12	ARIMA YACOB	YOUTH CLIPMAN	0787571076	ARIMA YACOB
13	AULINI SIMON	ELDER	=	AULINI SIMON
14	OVON OWACHI	AGRI	=	OVON OWACHI
15	OKUMU FRANCIS	AROCIA	=	OKUMU FRANCIS
16	OWACHU FRANCIS	AGRI	0774282033	OWACHU FRANCIS
17	LINO ONYETA	ELDER	=	LINO ONYETA
18	OWAC JEM	AROGA	=	OWAC JEM
19	WATHUM APOLO	ELDER	0772820953	WATHUM APOLO
20	KINTU RAFAL	YOUTH	0772820953	KINTU RAFAL
21	ONIBA ROBERT	ELDER	=	ONIBA ROBERT
22	OWACHI GABRIEL	ELDER	=	OWACHI GABRIEL
23	DOL	ELDER	=	DOL
24	HAJ			
25	KUMARECH JAMES	ELDER	0772-786602	KUMARECH JAMES
26	OTEMBI	CHAIRMAN	0781907778	OTEMBI



Feasibility Study and Detailed Engineering Design of Irrigation Schemes under the Farm Income Enhancement & Forestry Conservation Project

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
27	DYEGUY FERNANDES	GEN. SECRETARY AREGA	-	
28	LEMATIA BOSCO	-	-	
29	UMAKI M	-	-	
30	WAROM JUSTINE	-	-	
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