SCOPING STUDY REPORT
WATER RESOURCES MANAGEMENT NEEDS AND OPPORTUNITIES IN ASWA I AND II SUB-CATCHMENTS
LIRA DISTRICT – NORTHERN UGANDA

THE REPUBLIC OF UGANDA

Join For Water

WORLD RESOURCES INSTITUTE

SCOPING STUDY REPORT

WATER RESOURCES MANAGEMENT NEEDS AND OPPORTUNITIES IN ASWA I AND II SUB-CATCHMENTS LIRA DISTRICT – NORTHERN UGANDA

2025

CONRAD N. Hilton FOUNDATION

TABLE OF CONTENTS

LIST OF TABLES ..... **IV**

LIST OF FIGURES ..... **V**

LIST OF PLATES ..... **I**

EXECUTIVE SUMMARY ..... **II**

1. INTRODUCTION **4**

1.1. BACKGROUND 4
1.2. CONTEXT 4
1.3. PROBLEM STATEMENT 5
1.4. GOAL AND OBJECTIVES 5

2. MATERIALS AND METHODS **7**

2.1. INCEPTION MEETING AND PREPARATIONS 7
2.1.1. Kick-off Meeting *7*
2.1.2. Preliminary Field Visits *7*
2.1.3. Training of the Enumerators *7*
2.1.4. Field practicum *7*
2.2. POLICY ANALYSIS 1
2.3. STAKEHOLDER ANALYSIS AND ENGAGEMENT 1
2.3.1. Stakeholder engagement approach *1*
2.4. SOCIO-ECONOMIC ANALYSIS 2
2.4.1. Process *2*
2.4.2. Data collection approach *2*
2.4.3. Sample strategy and size *3*
2.4.4. Data analysis and reporting *3*
2.4.5. Quality assurance *4*
2.5. ANALYSIS OF GEOGRAPHY, ENVIRONMENTAL CONTEXT, AND WATER RESOURCES 4
2.5.1. Geography and Environment *7*
2.5.2. Land use/cover change assessment *7*
2.5.3. Environmental resources and context assessment *8*
2.5.4. Climate risk assessment *9*
2.5.5. Local Water Resources *9*
2.5.6. State of Water Resources *10*
2.6. STAKEHOLDER VALIDATION MEETING 11
2.7. STUDY LIMITATIONS 11

3. RESULTS AND FINDINGS **12**

3.1. GEOGRAPHY AND ENVIRONMENT 12
3.1.1. Location *12*
3.1.2. Topography *13*
3.1.3. Climate *13*
3.1.4. Geology *15*
3.1.5. Soils *15*

3.1.6. Vegetation 16
3.1.7. Biodiversity 16
3.1.8. Ecosystems 19
3.1.9. Land use/cover changes 6
3.2. Environment risks 9
3.2.1. Drought risk 9
3.2.2. Flood risk 10
3.2.3. Land degradation 10
3.2.4. Soil erosion 11
3.2.5. Conflicts over use of Natural Resources 11
3.2.6. Mining 12
3.3. Water resources analysis 14
3.3.1. Hydrological analysis 14
3.3.2. Water resources and ecosystems 16
3.3.3. Water availability and balance 24
3.3.4. Water access and demand 27
3.3.5. Water quality 32
3.3.6. Challenges for water resources management 35
3.3.7. Stakeholder Inventory 37
3.4. Socio-economic analysis 3
3.4.1. Demography 3
3.4.2. Social-economic characteristics 3
3.4.3. Education 4
3.4.4. Land tenure 5
3.4.5. Summary of the socio-economic issues in the project area 5
3.5. Institutional and policy analysis 5
3.5.1. Legal framework for water resources management in Uganda 5
3.5.2. Institutional framework for water resources management in Uganda 9
3.5.3. Legislative and institutional challenges 12
3.6. Summary overview 13
4. DEVELOPMENT OF PLANNING OBJECTIVES 15
4.1. Introduction 15
4.2. Vision and strategic objectives 15
4.2.1. Vision 15
4.2.2. Strategic Objectives 15
4.3. Action portfolio 15
4.3.1. Overall recommendations 16
4.3.2. Specific recommendations 16
4.4. SWOT Analysis of Water Resources Management in the Aswa I and II Sub-catchments 22
5. OPTIONS ANALYSIS 25
5.1. Introduction 25
5.2. Description of Proposed Options and Interventions 40
5.2.1. Addressing issues/ threats related to Water and Sanitation Services in Aswa I & II Sub catchments. 40
5.2.2. Addressing issues/ threats related to Ecosystem Restoration and Protection in Aswa I & II Sub catchments. 43
6. CONCLUSIONS 47

7. APPENDICES....48

APPENDIX I: TOPOGRAPHY OF THE FOCUS AREA IN ASWA I AND ASWA II SUB-CATCHMENTS 48
APPENDIX II: HEAT MAP OF MAXIMUM TEMPERATURES IN LIRA CITY AND LIRA DISTRICT....49
APPENDIX III: GEOLOGY IN LIRA CITY AND LIRA DISTRICT....50
APPENDIX IV: DISTRIBUTION OF SOILS IN ASWA I AND ASWA II SUB-CATCHMENTS....51
APPENDIX V: ORIGINAL VEGETATION TYPES IN LIRA CITY AND LIRA DISTRICT (1964) 52
APPENDIX VI: WETLAND USE/COVER TYPES AND WETLAND STATUS IN LIRA CITY AND LIRA DISTRICT 53
APPENDIX VII: FOREST RESERVES IN LIRA DISTRICT....54
APPENDIX VIII: FOREST USE/COVER TYPES AND FOREST STATUS OF AYAMI, OGUR, AND OLIA CFRS 55
APPENDIX IX: RIVER CATEGORIES IN ASWA I AND ASWA II SUB-CATCHMENTS 58
APPENDIX X: DROUGHT, FLOODS, AND SOIL EROSION IN ASWA I AND ASWA II SUB-CATCHMENTS....59
APENDIX XI. DATA COLLECTION TOOLS -QUESTIONNAIRE....61
ANNEX XII: INTERVIEW GUIDE (KIIS)....67
ANNEX XIII: FOCUS GROUP DISCUSSION (FGD) GUIDE....70
ANNEX XIV: OBSERVATION CHECKLIST....71
APENDIX XV. - STAKEHOLDER ASSESSMENT AND ENGAGEMENT REPORT....73
APPENDIX XVI: HOUSEHOLD SURVEY RAW DATA....123

LIST OF TABLES

Table 1-1: Scoping study's research objectives and research focus 5
Table 2-1: Hotspots and Threats Identified during the Transect Walks with Local Leaders and Land Owners 9
Table 2-2: Steps followed during the analysis 2
Table 2-3: Description of Spatial and Non-spatial Datasets 5
Table 2-4: Geographical and environmental variables utilised in this study 7
Table 2-5: Mapped land use/cover types in Aswa I and Aswa II sub-catchments 8
Table 2-6: Threshold values for categorization of soil erosion risk 8
Table 3-1: Coverage (Ha) of vegetation types by sub-catchment and administrative unit 18
Table 3-2: Coverage (Ha) of wetland use/cover types by sub-catchment and administrative unit 20
Table 3-3: Forest use/cover types in Ayami Central Forest Reserve 2
Table 3-4: Forest use/cover types in Ogur CFR 3
Table 3-5: Forest use/cover types in the different villages of Olia CFR 4
Table 3-6: Categories of rivers and their length in Aswa I and Aswa II sub-catchments 5
Table 3-7: Land use/cover changes in Aswa I and Aswa II sub-catchments between 2014 and 2024 6
Table 3-8: Coverage of soil erosion risk in Lira City and Lira District 11
Table 3-9: Summary of Key Social- Economic And Environmental Issues in the Aswa 1& 2 Sub-Catchment 12
Table 3-10: Distribution of water sources in Aswa I and Aswa II sub-catchments 17
Table 3-11: Water balance in Aswa I and Aswa II sub-catchments 27
Table 3-12: Comparison of water availability and demand in Aswa catchment 29
Table 3-13: Description of Name subC. ID as applied herein 32
Table 3-14: Primary, secondary and tertiary stakeholders for the Aswa 1 & 2 sub-catchments 1
Table 3-15: Projected population in the study area of Aswa I and II 3
Table 4-1: SWOT analysis for Aswa I and II sub-catchments 22
Table 4-2: Different Development Partners with similar Interventions in Aswa I and II 23
Table 5-1: Proposed Options and Interventions for addressing issues/ threats related to Water Sanitation and Hygiene (WASH) across Aswa I & II Sub catchments 26
Table 5-2: Proposed Options and Interventions for addressing issues/ threats related to Ecosystem Protection and Restoration across Aswa I & II Sub catchments 33

LIST OF FIGURES

Figure 1-1: Location of Aswa I and Aswa II sub-catchments in Lira District and Lira City 4
Figure 3-1: Location of Aswa I and Aswa II sub-catchments in Lira District and Lira City 13
Figure 3-2: Annual rainfall and temperatures in Lira City and Lira District between 1992 and 2022..... 14
Figure 3-3: Spatial distribution of annual average rainfall and annual mean temperature in Lira City and Lira District between 1992 and 2022 Data source: NASA Prediction of Worldwide Energy Resources..... 15
Figure 3-4: Status of Ayami Central Forest Reserve 3
Figure 3-5: Status of Ogur central forest reserve..... 4
Figure 3-6: Status of Olia Central Forest Reserve by village 5
Figure 3-7: Land use/cover changes in Aswa I and Aswa II sub-catchments between 2014 and 2024..... 8
Figure 3-8: Land use/cover types in Aswa I and Aswa II sub-catchments for 2014 and 2024 9
Figure 3-9: Soil erosion risk in Aswa I and Aswa II sub-catchments 12
Figure 3-10: Rivers and micro-catchments in the focus area of Aswa I and Aswa II sub-catchments..... 15
Figure 3-11: Comparison of surface water and groundwater recharge in Aswa I and Aswa II sub-catchments between 1997 and 2023 Source: SWAT modelling..... 16
Figure 3-12: Monthly average surface water and groundwater recharge in Aswa I sub-catchment 16
Figure 3-13: Monthly average surface water and groundwater recharge in Aswa II sub-catchment 16
Figure 3-14: Water sources in Aswa I and Aswa II sub-catchments..... 18
Figure 3-15: Intra-annual stream flow of River Aswa and its main tributaries in Aswa I and Aswa II sub-catchments from 1997 to 2023. 25
Figure 3-16: Inter-annual average groundwater recharge rate in Aswa I sub-catchment (1997-2023). 26
Figure 3-17:Inter-annual average groundwater recharge rate in Aswa II sub-catchment (1997-2023). 26
Figure 3-18: Access to safe water in Lira city and Lira district Source: Uganda Water Supply Atlas, 2024 28
Figure 3-19: Access to improved and unimproved sources of drinking water in Lira district in 2014..... 28
Figure 3-20: Water demand for people in Aswa I and Aswa II sub-catchments in 2023..... 30
Figure 3-21: Water demand for production in Aswa I and Aswa II sub-catchments in 2023 30
Figure 3-22: BOD loads at source in t/year for each sub-catchment in 2015, 2030 and 2040. 33
Figure 3-23: Total Nitrogen loads at source in t/year for each sub-catchment in 2015, 2030 and 2040..... 34
Figure 3-24: Total Phosphorous loads at source in t/year for each sub-catchment in 2015, 2030 and 2040..... 34
Figure 4-1: Demonstration of a fenced-off borehole 20

Figure 7-1: Topography of the focus area in Aswa I and Aswa II sub-catchments..... 48
Figure 7-2: Heat map of maximum temperatures in Lira city and Lira district between 2001 and 2022..... 49
Figure 7-3: Geology of the study area in Aswa I and Aswa II sub-catchments 50
Figure 7-4: Distribution of soils in Aswa I and Aswa II sub-catchments..... 51
Figure 7-5: Original vegetation types in Lira city and Lira district in Aswa I and Aswa II sub-catchments..... 52
Figure 7-6: Wetland use/cover types and wetland status in Lira city and Lira district in Aswa I and Aswa II sub-catchments 53
Figure 7-7: Forests in Lira district in Aswa I and Aswa II sub-catchments 54
Figure 7-8: Forest use/cover types and forest status of Ayami CFR 55
Figure 7-9: Forest use/cover types and forest status of Ogur CFR..... 56
Figure 7-10: Forest use/cover types and forest status of Olia CFR 57
Figure 7-11: Rivers in Aswa I and Aswa II sub-catchments 58
Figure 7-12: Drought and flood hazards in Lira district and Lira city..... 59
Figure 7-13: Factors used in the RUSLE model..... 60

LIST OF PLATES

Plate 2-1: One of the guided transect walks in Ogur Sub County for the Anee wetland..... 8
Plate 2-2: Transect walks in Iwal ward with some of the community members and leaders for Duru wetland..... 8
Plate 2-3: Community members and leaders during one of the transect walks in Ogur Sub County for Olimi wetland..... 8
Plate 2-4: Community members during natural resource mapping in Aromo Sub County..... 8
Plate 2-5: One of the FGDs held with the Sub County officials at Ogur Sub County..... 1
Plate 3-1: Maize Garden affected by drought in Lira District 9
Plate 3-2: Okole wetland in Lira city..... 20
Plate 3-3: Cultivation in wetlands..... 20
Plate 3-4: Temporary (seasonal) Obim streamflow (Left), Sand mining (Center) and crop production at the edges (Right) in Ogur Sub- County, Lira district. 20
Plate 3-5: Groundwater public tap (Left), children pumping water from a borehole (Center) and women collecting water from a protected spring (Right) in Ogur sub-county, Lira district. 21
Plate 3-6: Collapsing of river banks or streams mainly due to uncontrolled livestock access in Ogur sub-county, Lira district..... 22
Plate 3-7: Car washing (Left) and fry observed in the oil and grease contaminated water in Okele wetland, Lira city. 23
Plate 3-8: Factory (Top-left), residential/commercial wastewater disposal site (Top-right), Aler compost plant for solid wastes (Bottom-left) and car/truck washing in Okole wetland (Bottom-right), Lira city..... 35
Plate 4-1: Apiculture practiced is the study area 18
Plate 4-2: Akilo Apiculture farm (Top-left, Top-right & Bottom-left) and soil and water conservation measures (bottom-right) in Ogur Sub- County..... 18
Plate 4-3: Concrete pillars are mainly used for wetland..... 19
Plate 4-4: micro scale irrigation program for a horticulture garden in Ogur sub-county, Lira district 21

EXECUTIVE SUMMARY

This report presents the findings from an assessment conducted between June and September 2024 to identify priority water resources management needs and opportunities in the Aswa I and II sub-catchments, Lira District and Lira City. The main objective of the study was to assess the current socio-economic, environmental, and institutional issues related to water resources management to guide the development of solutions and decision-making for sustainable water management in the Aswa I and II Sub - Catchments. The current Aswa catchment management plan (CMP 2017) does not provide sufficient guidance on priorities and needs for coordinated and targeted water resource protection and management at a lower sub-catchment level. Therefore, the study forms a highly needed knowledge base that will help stakeholders to identify priorities and an action portfolio for future interventions on protection and conservation of freshwater ecosystems and equitable access to water resource management in Lira District and Lira City. The study involved different stakeholders in order to identify and prioritize future water resource protection and management interventions with the aim of enhancing future water security in the area.

The study area

The study was conducted in the sub-catchments of Aswa I and Aswa II, within the larger Aswa Catchment with a surface area coverage of 22,821Ha and 22,603 Ha, respectively. These sub-catchments overlap with the upper Lira District and part of Lira City in Northern Uganda. In Aswa I sub-catchment, the study area covered the sub-counties of Ayami (20.9%), Agweng (37.4%), Ogur (33.2%), and Agweng Town Council (5.8%) in Lira District while Ongura (1.3%) and Iwal Wards (1.6%) in Lira City. Whereas in the Aswa II sub-catchment, the scope of the study covered Aromo (35.4%), Ayami (18.2%), Agweng (15.2%), Ogur (30.6%) and Agweng Town Council (0.5%).

Methodology

The Uganda Catchment Management Planning Guidelines (MWE 2014) gives a framework guideline to the water resources management planning process. The study employed a participatory approach to include the viewpoints of multiple key stakeholders (including those from the UNWZ, Lira DLG, Lira City and other sub-counties). In addition, different datasets were collected and analysed. The process considered gender inclusiveness and integration of local and scientific knowledge.

Main findings

Three key groups of challenges were identified:

(1) lack of institutional capacity and funds at the level of the sub-catchments,

(2) severe degradation of essential water resources, and

(3) challenging social-economical context.

First, it was noted that though the district structures have well laid out development plans, there are capacity gaps at different levels. The funding is limited, staffing inadequate, and there is a lack of harmony of structures and sector coordination. Policies are poorly popularized among stakeholders and law enforcement is difficult and conflicts with livelihood activities of

communities. The responsibility over operation and maintenance of water infrastructure is unclear, water users have limited influence on decision making and gender remains a contentious issue.

Second, water resources and ecosystems are severely degraded. Bare soils are leading to high surface runoff rates, and consequently to a low water retention capacity and siltation of rivers and wetlands. Monitoring of weather, climate and water metrics is not institutionalized, so there is lack of data on the quantity and quality of water resources. Boreholes are the predominant source of safe water supply, but many are non-functional because of poor site selection, design, operation and maintenance, which contributes to low safe water coverage. Records show water-borne diseases including dysentery, diarrhoea and typhoid fever as common illnesses, primarily attributed to poor hygiene and sanitation. There do exist safe water sources including protected springs, such as boreholes and shallow wells which are installed with UII and UIII hand pumps. These are not enough as some communities still obtain their water from open water sources like rivers, streams, ponds and wetlands. There is insufficient water to cover livestock demand, particularly in the dry season, as a consequence of which livestock migrates to different places destroying farmlands. Hydrological and agricultural droughts are recurrent and intense in the sub-catchment, mainly due to a combination of dry spells, environmental degradation and a high dependency on natural resources. Flooding seems to be linked, at least in part, to the antecedent conditions of wetlands and the fact that communities are increasingly moving into what were originally floodplain areas. In some parts of the sub-catchment, water logging occurs due to high intensity rainfall on soils with a low infiltration capacity.

Thirds, overarching challenges are population growth, high poverty, low literacy levels, land ownership which is not backed by formal documentation, poor access to basic services, weak enforcement of regulations on protection and conservation of water resources. In addition, the vulnerability to natural disasters is high, land degradation and soil erosion are severe, particularly around the riverbanks of the different rivers and streams within the study area, bush burning is not controlled, deforestation due to agriculture and settlement is problematic, conflicts over natural resources abound, and artisanal mining resulting in the clearance of vegetation and degradation of river banks.

The theory of change as well as related interventions have been incorporated following the stakeholder's validation. The assessment and analysis carried out during the Aswa Catchment management planning served as the foundation for the strategic objectives and visioning. As a result, these have been used for the scoping study area of the Aswa I and II sub catchments because the majority of the problems with the management and preservation of water resources have a similar pattern, these have been chosen for the scoping study region of the Aswa I and II sub catchments.

The Aswa Catchment Management Plan's (CMP, 2017) strategic objectives and visioning were designed to present a common, idealized, medium-to-long-term future state of the watershed from which workable, locally attainable solutions might be derived. The scoping study in the Aswa I and II Sub catchments is based on the Upper Nile WMZ Water Resources Development and Management Strategy and the Aswa CMP, both of which were developed with substantial stakeholder participation.

1. INTRODUCTION

1.1. Background

With funding from the Conrad Hilton Foundation, Join For Water (JFW) and the World Resources Institute (WRI) conducted a scoping study to assess the current socio-economic, environmental and institutional issues related to water resources management in the Aswa I & II sub-catchments in Lira, Northern Uganda. The study aimed to provide a holistic view of water resource issues in the sub-catchments to guide decision-making and lay the groundwork for sustainable water resources management in the sub-catchments.

1.2. Context

The Aswa is a major river in north-eastern Uganda, originating from the hills in north-western Katakwi District and flowing through Lira District. The Aswa catchment, which has 18.62% forest cover, is primarily characterised by subsistence agriculture and livestock grazing. The Aswa II sub-catchment, with a total area of 1,588 square kilometres spanning parts of several districts, including Lira, is located on the southwestern side of the Aswa catchment. The part of the Aswa II sub-catchment that overlaps with the Lira district will be the focus area for this project. Over half of Lira's population has limited or no access to improved water and sanitation services, and the continuous degradation of freshwater ecosystems threatens the availability of safe water for domestic use.

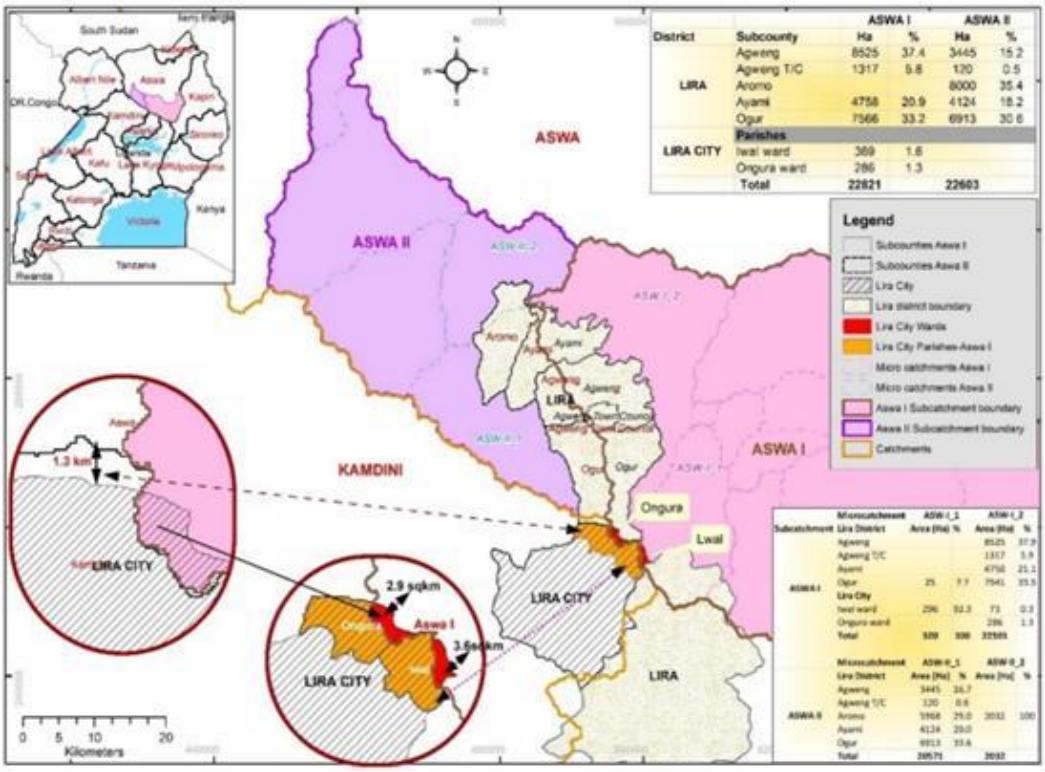


Figure 1-1: Location of Aswa I and Aswa II sub-catchments in Lira District and Lira City

1.3. Problem statement

The Aswa catchment faces significant socio-economic and environmental challenges that impact the availability and quality of local water resources, including rapid deforestation, encroachment onto natural and protected areas, wetlands, and riverbanks, and growing pollution. Moreover, soil erosion (and the resultant sedimentation of surface water sources) is increasing in the catchment. Also, flash floods, recurring droughts and other extreme weather events are intensifying because of a changing climate, further exacerbating water insecurity. Yet, institutional challenges hinder effective water governance by local stakeholders and the authorities, including limited access to data for decision-making, weak stakeholder engagement, and limited harmonisation of institutional mandates between national and local government levels.

In response to these challenges, the Ministry of Water and Environment (MWE), through its Directorate of Water Resources Management (DWRM), facilitated the stakeholders' development of a Catchment Management Plan (CMP) in 2016 for the Aswa Catchment. As intended, the CMP provides a broad framework for water resource protection and management at the catchment level without much detail at the sub-catchment level or recommendations at the intersection of sub-catchments and district administrations. This is especially the case for the part of the catchment that overlaps with Lira District (the Aswa I and II sub-catchments), which is the project's focus area. Moreover, the CMP is overdue for review[1] and some information may be outdated.

Thus, the scoping study examined the state of water and other natural resources in the Aswa I and II sub-catchments, including the presence of existing initiatives and the involvement of different stakeholders to identify and prioritise future water resource protection and management interventions to enhance future water security in the area.

1.4. Goal and objectives

The scoping study aimed to provide a holistic view of water resources issues to guide decision-making and lay the foundation for sustainable water resources management in the Aswa I and II sub-catchments. The study addressed three guiding research objectives (**Table 1-1**).

Table 1-1: Scoping study's research objectives and research focus

Research objectives	Research Focus (i.e. information to find)
1. Conduct systematic data analysis to understand the main water-related challenges in the sub-catchments	Status, extent and impact of land degradation and soil erosion
	Water resources availability and reliability and how human-induced and external factors influence it.
	Current and projected water demand and how it influences consumption and production patterns.
	Socio-economic factors and institutional arrangements influencing (or relevant to) water resources management
	Existing and potential water-related conflicts and trade-offs among water users and stakeholders
	Key stakeholders at all levels (including their interests and mandates).

[1]. According to Uganda's catchment management planning guidelines, CMPs should ideally be reviewed and updated every five years.

Research objectives	Research Focus (i.e. information to find)
2. Gain insights into the involvement of relevant stakeholders	Stakeholder power, influence and coordination dynamics.
3. Contribute to the development of an integrated vision for the Aswa I & II sub-catchments	Relevant existing interventions and their effectiveness, major gaps and needs.
	Opportunities and challenges for implementing water resource protection and conservation practices in the sub-catchments

2. MATERIALS AND METHODS

2.1. Inception meeting and preparations

2.1.1. Kick-off Meeting

The assessment was preceded by several kick-off meetings, with the first being held on the 10th of June 2024 at Margharita Palace Hotel in Lira and the second on the 4th of July 2024 at Lira District Local Government headquarters. The objectives of these meetings were to:

1) Introduce and present to key stakeholders the technical elements and approaches of the project, such as the scope, objectives, outcomes, and goals, and confirm with the stakeholders whether the project should proceed as envisaged.
2) Present the organisations and consultants working on the project, including JFW, WRI, and WSS, to the stakeholders.
3) Obtain the stakeholders' preliminary insights on the current state of the environment, social, economic, and institutional situation in relation to water resources management in the Aswa II & I sub-catchments.

During the second kick-off meeting, it was agreed that the study's scope should extend to or include the two wards (Ongura and Iwal) of Lira City Council in the Aswa I sub-catchment to help understand the probable impacts of urbanisation on the water resources in the study area.

2.1.2. Preliminary Field Visits

A preliminary field visit was conducted after the second kick-off meeting to identify and consult selected key stakeholders (Local Council III chairpersons, Local Council I leaders and some community members), obtain preliminary and critical information regarding the study area, and familiarise the consulting team with sites of interest.

The study area's basic environmental and social baseline setup was observed during this visit. Also, a rapid assessment of human and environmental factors affecting the sub-catchments and water resources was done. The team gathered preliminary information from various institutions, such as the Upper Nile Water Management Zone (UNWMZ) and Lira District Local Government (LDLG), including the Aswa Catchment Management Plan and the Lira District Development Plan. The team visited some of the sub-county local governments to gain more insights into the area.

2.1.3. Training of the Enumerators

Five locally based enumerators (04 males and 01 female) were recruited, trained and dispatched to collect household and Key Informant (KI) responses using an android-based application, epi-collect5 platform. The enumerators received supervision and technical guidance from the consultant during data collection to safeguard data quality and reliability.

2.1.4. Field practicum

1) **Transect walks and Resource Mapping**

Transect walks were conducted jointly with local leaders and landowners to collect site-specific information at selected locations. This involved trekking across and around the site for the stakeholders and the consulting team to observe the current status of natural resources in the sub-catchments and agree on the need (and potential measures) for corrective action. The hotspots and threats (**Table 2-1**) to different resources within different parishes were identified during these transect walks. Community members were guided to draw resource maps indicating the community's natural resources, including rivers, wetlands, degraded areas, and livelihood activities within and outside these resources.



Plate 2-1: One of the guided transect walks in Ogur Sub County for the Anee wetland



Plate 2-2: Transect walks in Iwal ward with some of the community members and leaders for Duru wetland



Plate 2-3: Community members and leaders during one of the transect walks in Ogur Sub County for Olimi wetland



Plate 2-4: Community members during natural resource mapping in Aromo Sub County

Table 2-1: Hotspots and Threats Identified during the Transect Walks with Local Leaders and Land Owners

S/N	THREAT	LAT	LONG	VILLAGE/CELL	PARISH/WARD	SUB COUNTY/T/C	DISTRICT / CITY
	Riverbank encroachment	2.38710416	32.98312350	Bol-Nyapo	Akangi	Ogur	Lira DLG
	Sand mining	2.385999	32.983073	Bol-Nyapo	Akangi	Ogur	
	Riverbank encroachment	2.382812	32.983014			Ogur	
	Wetland degradation and reclamation	2.37525685	32.97244429	Akot	Akot	Ogur	
	Poor Sanitation/Open Defecation			Bol-Nyapo	Akangi	Ogur	
	Watering point for cattle	2.435471	32.963498	Olimi	Adekinino	Ogur	
	Deforestation	2.433729	32.966340	Olimi	Adekinino	Ogur	
	Wetland reclamation	2.433748	32.967008	Anee	Adekinino	Ogur	
	Watering point for cattle	2.433157	32.968817	Anee	Adekinino	Ogur	
	Riverbank encroachment	2.433129	32.968841	Anee	Adekinino	Ogur	
	Wetland drainage	2.433435	32.967845	Anee	Adekinino	Ogur	
	Sand mining	2.532567	32.972379	Bardago	Abala	Agweng S/C	
	Watering point for cattle	2.532442	32.970380	Aring-Omaele B	Abala	Ogweng S/C	
	Wetland encroachment	2.532610	32.970520	Bardago	Abala	Ogweng S/C	
	Deforestation	2.523246	32.983968	Aring-Omaele B	Abala	Ogweng S/C	
	Washing bay	2.523002	32.983720	Bardago	Abala	Ogweng S/C	
	Watering point for cattle	2.536455	32.947277		Bar Oganda	Ogweng S/C	
	Sand Mining	2.506095	32.923395	Miya Abili	Miya Abili	Agweng T/C	
	Deforestation	2.505811	32.924043	Miya Abili	Miya Abili	Agweng T/C	
	Poor Sanitation/Open Defecation			Miya Abili	Miya Abili	Agweng T/C	
	Wetland encroachment	2.544229	32.827106	Widan cell	Widan Ward	Agweng T/C	
	Wetland encroachment	2.544515	32.828861	Aloc B	Adoro	Aromo	
	Watering Point for cattle	2.544270	32.827162	Aloc B	Adoro	Aromo	
	Washing bay	2.544270	32.827162	Aloc B	Adoro	Aromo	
	Riverbank encroachment	2.540579	32.834030	Aloc A	Adoro	Aromo	
	Watering point for cattle	2.539760	32.833906		Ayile	Aromo	
	Deforestation	2.540795	32.825564		Ayile	Aromo	
	Wetland reclamation and drainage	2.591589	32.891279	Aboloneno	Icutu Kumu	Ayami	
	Watering point for cattle and washing bay	2.589651	32.892456	Wen Boke C	Icutu kumu	Ayami	

S/N	THREAT	LAT	LONG	VILLAGE/CELL	PARISH/WARD	SUB COUNTY/T/C	DISTRICT / CITY
	Deforestation	2.587047	32.893047	Apuce	Apuce	Ayami	
	Watering point for cattle	2.594846	32.856512	Akuriloba B	Icutu kumu	Ayami	
	Siltation	2.594391	32.856610	Akuriloba B	Icutu kumu	Ayami	
	Riverbank Encroachment	2.545858	32.861278	Barnyang	Arwotomito	Ayami	
	Watering point for cattle and washing bay	2.544323	32.862628	Barnyang	Arwotomito	Ayami	
	Brick making	2.324675	32.986042	Aduru	Iwal	East Division	Lira City
	Wetland reclamation	2.321758	32.986433	Wilela	Iwal	East Division	
	Poor sanitation/Open Defecation			Aduru	Iwal	East Division	
	Wetland Encroachment	2.321113	32.980104	Akwoyo	Iwal	East Division	

2.2. Policy Analysis

The water sector is one of Uganda's priority policy sectors. The main goal of the water sector in Uganda is to manage and develop the water resources of Uganda in an integrated and sustainable manner to secure and provide water of adequate quantity and quality for all social and economic needs for the present and future generations with the full participation of all stakeholders. The relevant policy, legal and institutional frameworks for water management in Uganda were reviewed and challenges highlighted (**see section 3.5 in the findings**).

2.3. Stakeholder analysis and engagement

Water resources management covers multiple sectors, and various actors and stakeholders are involved and/or impacted by the state of water resources. Therefore, it is essential to gain insights into the key stakeholders in the study area. The consultant identified critical stakeholders from the preliminary consultations and desk research and ascertained their power, interests, influence, constraints, available opportunities, and recommendations. In what follows, we present our approach to stakeholder engagement and an overview of the key stakeholders identified.

2.3.1. Stakeholder engagement approach

Stakeholder engagements started with kick-off meetings at the district and city level in Lira, followed by local community, household, and key informant interviews with respondents from various categories. The District Environment Officer, City Environment Officer, District Community Development Officer and Chief Administrative Officer were consulted at the district and city levels. At the MWE level, discussions were held with the UNWMZ Senior Sociologist and Team Leader. At the sub-county level, LC III Chairpersons, Town Clerks, and Mayors were consulted as key informants before the Focus Group Discussions (FGDs).

The team held FGDs with sub-county and town council Leaders, including Senior Assistant Secretaries (Parish chiefs), Community Development Officers, Environment Officers, and Health inspectors, among others. Attendance lists are attached as appendices. Thereafter, community-level meetings were held. Nine key informant interviews, six Focus Group Discussions, and nine community meetings were held.



Plate 2-5: One of the FGDs held with the Sub County officials at Ogur Sub County

2.4. Socio-economic analysis

2.4.1. Process

The **Table 2-2** below presents the stages followed in conducting the socio-economic analysis. The process was participatory and sought to strengthen the integration of socio-economic and ecological aspects of water resource management by;

- Describing the relevant external and in-situ factors influencing water resources within the Aswa I & II sub-catchments;
- Ensuring the integration of stakeholder perspectives into the strategic vision and objectives of a future water resources management project;
- Identifying and mapping out specific habitats, natural resources and land use zones that should be conserved to ensure the survival of the fragile ecosystem; and
- Assessing the environmental quality objectives that can inform the preferred strategy for a future water resources management project.

Table 2-2: Steps followed during the analysis

Scoping Phase	Scoping Steps	Method/Instrument
Phase A: Scoping (defining the boundaries of the study area (Aswa I and II)	Defining the scope and objectives of the scoping study and spatial and temporal boundaries of the study area (Aswa I and II)	• Document analysis • Expert consultations with project team members and other stakeholders
	Organising consultations with the District and Sub-county officials and local communities (Users)	
	Revising the extent and depth of the assessment	
Phase B: Identifying major environmental and social issues within the study area	Identifying and compiling prevailing environment and social issues in the study area	• Document analysis • Expert consultations with project team members
	Analysing interrelationships between economic and social priority issues and clarifying how socio-environmental priorities are linked	
Report writing, including the recommendations and way forward	Scoping study report writing	• Document analysis • Expert Consultations with project team members

2.4.2. Data collection approach

A cross-sectional survey design was used to collect both quantitative and qualitative data. The methods included desk reviews, household interviews, key informant interviews (KIIs), focus group discussions (FGDs), and GIS mapping, each addressing specific indicators to create a comprehensive dataset. Qualitative data were collected via semi-structured interviews and FGDs in both sub-catchments, exploring contextual nuances, perceptions, and lived experiences related to the study purpose.

Desk review systematically analysed relevant documents, including project proposals. This method provided contextual insights and identified knowledge gaps, forming a foundational understanding for the study. The desk review generated secondary data that informed the development of targeted survey instruments and interview guides.

Household interviews were held with household heads or adult members who were available during the interview. Care was taken to interview an adult person from the household, especially those with information on the household's water use and general running. For the interviews, a questionnaire was uploaded to the EpiCollect5 platform and later downloaded to enabled smartphones, through which it was administered. Data were collected by trained enumerators using smartphones with Open Data Kit (ODK)-enabled EpiCollect5 App. The questionnaire captured key socio-economic data such as demography, economic activities,

Using satellite imagery and spatial data analysis, WRI conducted **GIS mapping on water resources**, including land use and land cover changes. GIS mapping generated spatial data that provided predictive insights into environmental trends that will guide the project's efforts towards water resources management.

2.4.3. Sample strategy and size

The scoping study employed a strategic sampling approach to ensure representativeness, reliability, and comparability in different locations. The initial phase involved the purposive selection of villages in the sub-counties based on a list provided by the different administrative units during the inception meeting. Subsequently, households within these villages were randomly selected using a simple random sampling technique. A questionnaire was administered through the EpiCollect5 platform to facilitate real-time data access and streamline the collection process, enhancing the reliability of the findings as indicated in the tools annexed (**Appendix XI**).

The sample size for the study was determined based on statistical power principles to detect meaningful differences and similarities within the different areas of the study. This approach ensures statistically significant results, enabling robust conclusions about the attributes of the targeted population. Inclusion criteria encompassed individuals and households within the study's geographical scope, fitting predefined demographic and socio-economic strata, and willingness to participate. Exclusion criteria involved households outside the study's scope, those not meeting the defined parameters, or unwillingness to participate. The sample distribution included a sample size of 396 respondents selected randomly from the two sub-catchments (Aswa I and II).

Cluster sampling was applied to proportionately collect samples from the local administrative units selected for the study: Agweng Sub-County, Agweng Town Council, Aromo Sub-County, Ayami Sub-county, Ogur Sub-county, and Ngetta Division (Ilwal and Ongura Wards).

2.4.4. Data analysis and reporting

Quantitative data from household surveys were securely stored on an epicollect5 server and analysed using SPSS and Advanced Excel. The analysis included descriptive statistics and predictive modelling of GIS data on land use and land cover changes. Results were presented in

accessible formats, with data disaggregated by demographic categories. Qualitative data from KIIs, FGDs, and open-ended responses were transcribed verbatim and analysed using NVivo to reveal key themes and narratives. The findings were summarised with illustrative quotes to add depth to the quantitative results. Descriptive statistics were generated in terms of frequencies, percentages and means. The results were presented as frequency distribution tables, pie charts and bar graphs.

2.4.5. Quality assurance

The data collection team was trained before the data collection. An online platform was used to monitor and review the collected data and provide the data collectors with technical assistance and feedback while in the field. Global Positioning System (GPS) readings taken during data collection enabled monitoring of the research team's location and performance. Data collection tools were pretested before actual field data collection. Moreover, the Sociologist conducted random checks on data collectors during fieldwork activities and checked the data quality before its transmission to the server. All these mechanisms ensured the quality of the data collected.

2.5. Analysis of geography, environmental context, and water resources

The World Resources Institute (WRI) was responsible for assessing the geographical, environmental, and water resources context in the target area, including through the use and application of spatial, in situ/observation, and other types of data. WRI worked with a local partner, Environment and Earth Sciences (EES) Consult Limited, to undertake these assessments and compile the spatial and non-spatial datasets for Aswa I and II sub-catchments, critical to understanding and investigating the key water and environmental resource threats, trends, and impacts at the sub-catchment level.

A series of spatial and non-spatial datasets were collected from the mandated institutions in Uganda and online sources and reviewed to identify inconsistencies and completeness regarding Aswa I and II sub-catchments that cover Lira District and City. The spatial datasets were analysed in a Geographical Information System (GIS) environment (ArcGIS 10.8), and the assessment included reviewing the metadata files and attribute tables. The non-spatial dataset (such as Aswa streamflow) was examined for inconsistencies in MS Excel. The complete and usable datasets were compiled in a spatial database with the entities categorised as administrative boundaries, hydrography, vegetation, climatology, hazards and base maps. Table 2-3 described the datasets used and the categories of data entities, sources, year of data compilation, and other information.

Table 2-3: Description of Spatial and Non-spatial Datasets

Categories	Types	Data types	Geometry	Year	Coverage	Source	Remarks	Recommendations
Administrative boundaries	Wards	Shapefiles	Polygon	2020	Aswa I and II sub catchment	Uganda Bureau of Statistics	Useable and complete	
	Parishes	Shapefiles	Polygon	2021	Aswa I and II sub catchment	Uganda Bureau of Statistics	Useable and complete	
	Sub counties	Shapefiles	Polygon	2021	Aswa I and II sub catchment	Uganda Bureau of Statistics	Useable and complete	
	Districts	Shapefiles	Polygon	2021	Aswa I and II sub catchment	Uganda Bureau of Statistics	Useable and complete	
	Regions	Shapefiles	Polygon	2021	Aswa I and II sub catchment	Uganda Bureau of Statistics	Useable and complete	
Hydrography	Rivers	Shapefiles	Line	2022	Aswa I and II sub catchment	Ministry of Water and Environment	Useable and complete	Populate nominal attributes
	Water sources	Shapefiles	Point	2022	Aswa I and II sub catchment	Ministry of Water and Environment	Useable and complete	Populate nominal attributes
	Sub catchments	Shapefiles	Polygon	2022	Aswa I and II sub catchment	Ministry of Water and Environment	Useable and complete	
	Micro-catchments	Shapefiles	Polygon	2022	Aswa I and II sub catchment	Ministry of Water and Environment	Useable and complete	
	Aswa catchment	Shapefiles	Polygon	2022	Aswa I and II sub catchment	Ministry of Water and Environment	Useable and complete	
	Streamflow	Xls	Table	Aug 2024	Aswa	Upper Nile Water Management Zone	Not usable, only one month compiled	
Vegetation	Wetland status	Shapefiles	Polygon	2021	Aswa I and II sub catchment	Department of Wetlands Management	Current and complete	
	Central Forest Reserves	Shapefiles	Polygon	2023	Aswa I and II sub catchment	National Forestry Authority	Current and complete	
	Land use/cover	Shapefiles	Polygon	2014, 2024	Aswa I and II sub catchment	Environment and Earth Sciences Consult	Current and complete	
Climatology	Rainfall	Shapefiles	Polygon	1992-2022	Aswa I and II sub catchment	Uganda National Meteorological Authority	Not current	Request for current data or use Chirps data (https://www.chc.ucsb.edu/data/chirps)

Categories	Types	Data types	Geometry	Year	Coverage	Source	Remarks	Recommendations
	Temperature	Shapefiles	Polygon	1992-2022	Aswa I and II sub catchment	Uganda National Meteorological Authority	Not current	Request for current data
Hazards	Drought	Shapefiles	Polygon	2018	Aswa I and II sub catchment	Department of Disaster Preparedness and Management	Not current	Request for current data
	Floods	Shapefiles	Polygon	2018	Aswa I and II sub catchment	Department of Disaster Preparedness and Management	Not current	Request for current data
Basemaps	Topography	Raster	Continuous raster	2000	Aswa I and II sub catchment	www.earthdata.nasa.gov/	Not current	Request for current data
	Soil	Shapefiles	Polygon	2017	Aswa I and II sub catchment	National Agricultural Research Organisation	Not current	Request for current data
	Soil (250m)	Raster	Continuous raster	2024	Global	https://soilgrids.org/	Current with low-resolution	
	Geology	Shapefiles	Polygon	2022	Aswa I and II sub catchment	Department of Geological, Survey and Mines	Useable and complete	
	Soil erosion	Shapefiles	Continuous raster	2024	Aswa I and II sub catchment	Environment and Earth Sciences Consult	Current and complete	

2.5.1. Geography and Environment

The assessment of the geographical and environmental resources context utilised a mixed-method approach based on the available data. The methods include literature review, satellite image classification, and the Revised Universal Soil Loss Equation (RUSLE) model. The datasets that were used in this assessment are presented in the **Table 2-4** below. GIS analytical techniques such as interpolation and clipping were used to extract the geographical and environmental variables for the study area.

Table 2-4: Geographical and environmental variables utilised in this study

Geography/Environmental variable	Data Source	Year
District Boundary	Uganda Bureau of Statistics (UBOS)	2021
Drought	Department of Relief, Disaster Preparedness and Management	2018
Floods	Department of Relief, Disaster Preparedness and Management	2018
Forests	National Forestry Authority (NFA)	2023
Geology	Directorate of Geological Survey and Mines (DGSM)	2022
Micro-catchments	Ministry of Water and Environment (MWE)	2022
Parish boundary	Uganda Bureau of Statistics (UBOS)	2021
Rainfall and temperature	Uganda National Meteorological Authority (UNMA) and NASA Prediction of Worldwide Energy Resources	1992-2022
Rivers	Ministry of Water and Environment (MWE)	2022
Soil types	National Agricultural Research Organisation	2017
Sub-catchments	Ministry of Water and Environment (MWE)	2022
Sub-county boundary	Uganda Bureau of Statistics (UBOS)	2021
Topography	Digital Elevation Model (DEM)	2024
Natural vegetation types	Langdale-Brown et al	1964
Wetlands	Wetland Management Department (WMD)	2021

2.5.2. Land use/cover change assessment

The land use/cover type changes in Aswa I and Aswa II sub-catchments were mapped using Google Earth Engine (GEE). GEE is a cloud-based geospatial analysis platform that supports planetary-scale environmental data analysis. To monitor changes in ecosystems such as wetlands, a period of more than 5 years has been recommended by the Ministry of Water and Environment. On that basis, for this initial study, land use/cover changes in Aswa I and Aswa II sub-catchments were mapped for ten years between 2014 and 2024. More emphasis was put on high-resolution Google Earth satellite images with reduced cloud cover. The satellite images were masked using the delineated and approved sub-catchment and administrative layers.

The satellite images were classified using the supervised maximum likelihood classification technique. Supervised classification is a process used to categorize digital images (such as satellite imagery) into different land cover types based on known training samples. Representative training areas for the different land use/cover types (built-up areas, farmlands, grasslands, wetlands, and

woodlands) (**Table 2-5**) were created to teach the classifier. These land use/cover types are based on the National Forestry Authority (NFA) classification system. The classified satellite images were then reclassified into the various land use/cover types. The classification and reclassification process was repeated for all the selected satellite images. The change detection analysis assessed the changes between the different years. Ground-truth coordinates were collected using a hand-held Garmin GPS device to determine the accuracy of the classified land use/cover types.

Table 2-5: Mapped land use/cover types in Aswa I and Aswa II sub-catchments

Land use/cover type	Description
Built-up	These are settlements in urban and rural areas and roads.
Grasslands	Savannah grasslands, savannah bushes and thickets, and savannah woodlands characterise these areas.
Farmlands	These are areas farmed for subsistence and commercial purposes.
Wetlands	These are areas seasonally or permanently waterlogged with vegetation.
Woodlands	These are areas characterised by natural tree cover (above 4m in height) and grassland patches in between.

2.5.3. Environmental resources and context assessment

The RUSLE model was used to assess soil erosion in the sub-catchments. The model estimates the annual soil loss value and the soil erosion intensity in a given area. The model is based on the USLE erosion model structure developed by Wischmeier & Smith (1978)[2], and improved and modified by Renard et al. (1997)[3]. Five parameters are used in the RUSLE model to estimate soil loss, and these include rainfall erosivity (R), soil erodibility (K), slope length and steepness factor (LS), cover management factor (C) and conservation practice factor (P). The relationship of these parameters is expressed as:

$A = R*K*LS*C*P$

Where A is the total average annual loss, R is the rainfall erosivity factor, K is the soil erodibility factor, LS is the slope length and steepness factor, C is the land surface cover management factor, and P is the erosion control factor.

The parameters for the RUSLE model are shown in the **Table 2-6**. The soil erosion risk was categorized based on threshold values by Morgan (2005)[4].

Table 2-6: Threshold values for categorization of soil erosion risk

No.	Class	Erosion rate (t/ha)	Indicator
1	Very slight	< 2	No evidence of compaction; and over 70% plant cover
2	Slight	2-5	Some crusting of soil surface; 30-70% plant cover

[2] Wischmeier, W. H., & Smith, D. D. (1978). *Predicting rainfall erosion losses: a guide to conservation planning* (No. 537). Department of Agriculture, Science and Education Administration.

[3] Renard, K. G. (1997). *Predicting soil erosion by water: a guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE)*. US Department of Agriculture, Agricultural Research Service.

[4] Morgan, R. P. C. (2009). Soil erosion and conservation. John Wiley & Sons.

3	Moderate	5-10	Wash marks; slight to moderate surface crusting; 30-70% plant cover
4	High	10-50	Connected and continuous network of rills every 5-10m; less than 30% plant cover
5	Severe	50-100	Continuous network of rills every 2-5m or gullies every 20m
6	Very severe	100-500	Continuous network of channels every 5-10m; surrounding soil heavily crusted

2.5.4. Climate risk assessment

A climate risk assessment was conducted for extreme events like droughts and floods which affect the quality and quantity of water resources within the sub-catchments. The Department of Relief, Disaster Preparedness, and Management profiled drought and flood risks in 2019, and the study takes stock of these available datasets.

- Drought was assessed using rainfall data from the Uganda National Meteorological Authority (UNMA) from 1987 to 2017. The Standardized Precipitation Index (SPI) was used to determine the magnitude of meteorological drought. The index was computed using the Drought Indices Calculator (DrinC). Drought intensities were categorised based on SPI values as described by Guttman (1999) and McKee et al. (1993)[5][6].
- Flooding was delineated using an ArcGIS-based HEC-GeoRAS tool which is used in flood analysis and modelling. The input datasets included rainfall, elevation, land use/cover, and stream geometry data. The flood extents were categorised into flood hazard intensities based on water depth: very high (>2m), high (1.5 m-2 m), moderate (1 m-1.5 m), and low (0.5 m-1 m).

2.5.5. Local Water Resources

Local water resources are crucial in water provision for domestic, industrial, and agricultural purposes. The assessment profiles the regional water resources in Aswa I and Aswa II sub-catchments, focusing significantly on Lira City and District. The profiled local water resources include rivers, micro-catchments, and water sources (boreholes, public stand posts, springs, rainwater harvest tanks, and shallow wells). Other interrelated reviewed areas include water access, water demand and supply, threats and challenges to water supply and demand in the sub-catchments. The assessment was done through a literature review and analysis of existing spatial and non-spatial datasets.

Two approaches were employed in assessing the local water resources, i.e., desk review and estimation of current water demand:

1) **Desk review**

[5] Guttman, N. B. (1999). Accepting the standardized precipitation index: a calculation algorithm 1. *JAWRA Journal of the American Water Resources Association*, *35*(2), 311-322.

[6] McKee, T. B., Doesken, N. J., & Kleist, J. (1993, January). The relationship of drought frequency and duration to time scales. In *Proceedings of the 8th Conference on Applied Climatology* (Vol. 17, No. 22, pp. 179-183).

Several pieces of literature were reviewed to understand the water sources and access in Aswa I and Aswa II sub-catchments, water use and demand, threats, and challenges to water supply and demand. Some of the reviewed literature include the Aswa Catchment Management Plan, the Uganda Water Supply Atlas, and Uganda Vision 2040.

2) Estimation of current water demand

The current water demand for Aswa I and Aswa II sub-catchments was categorised based on the following user types:

1. Water for people/domestic water: this was estimated using per capita consumption and population relative to each type of user.
2. Water for production
    a. Crop: this was calculated using the cultivated area, crop production and the crop water requirements.
    b. Water for industry; this was computed as a total of water demand for mining and quarrying, manufacturing, food processing activities, and construction.
    c. Livestock: this was estimated using per capita consumption and livestock density.

For each user category, the current water demand was computed through assumptions regarding future scenarios using 2015 as the baseline. These assumptions were mainly based on projected population growth, per capita income increase, and water consumption increase according to the development trends and national planning framework. The population growth rate for 2015-2030 is 3.2%, according to Uganda Vision 2040[7].

Per capita water consumption and population growth rates were used for domestic water. These are projected to increase since economic growth leads to increased water consumption. Therefore, to estimate per capita consumption for 2023, a yearly domestic-specific consumption growth rate of 6% (2015-2030) was assumed[8]. For crops and livestock, an annual water consumption growth rate of 2% and 5.2%, respectively, was assumed for 2015-2030.[9&10] For the industrial sector, most of the parameters were directly linked to the per capita income anticipated growth, which was assumed to be a yearly increase of 10.3% based on Uganda Vision 2040. The per capita income is anticipated to increase from US$956 in 2023 to US$9,500 in 2040. Thus, this growth rate was used to estimate the industrial water demand.

2.5.6. State of Water Resources

A mixture of methodologies was also applied to document the state of water resources in Aswa I and II. These methods included use of desktop literature, field observations, interview of key informants and hydrological modelling. This study reviewed grey and online literature that was obtained and analysed. The acquired literature about the state of water resources was thematically organized and synthesized to extract the required content. Again, field observations were made

[7] https://npa.go.ug/vision2040/

[8] Aswa catchment management plan

[9] https://www.cabi.org/wp-content/uploads/Working-Paper-26.pdf

[10] https://openknowledge.fao.org/server/api/core/bitstreams/7a6f9d83-a58d-4a9f-9a60-

during the field visits conducted in the study area. A cross-sectional transit was made in both Aswa I and II sub-catchments to observe the state of water resources and landscape degradation hotspots. Further to this, key informant interviews were held in both Lira City and District to investigate the state of water resources. A key informant guide was used to inform the interview process of officers. The respondents interviewed included officers from the natural resource units, such as the environmental officers, water officers, and planners. The other key experts interviewed in the sub-catchments included officers from the Upper Nile Water Management Zone (UNWMZ), including the Team Leader, hydrologist, water quality officer and sociologist. These were more knowledgeable about the de-concentration of water services in the sub-catchments. This information was also thematically disaggregated to represent issues related to water availability, water productivity, water governance and associated challenges.

In addition, a hydrological assessment was conducted to examine the availability of water in Aswa I and II sub-catchments, which is important in resource allocation and conservation. A hydrological investigation was conducted using the Soil & Water Assessment Tool (SWAT). This tool is widely applied to simulate surface and groundwater quality and quantity and predict the environmental impact of land use, land management practices, and climate change. Furthermore, SWAT is widely used in assessing soil erosion prevention and control, non-point source pollution control and regional management in watersheds. In this case, the datasets used to simulate the model were rainfall (1997-2023), soil data, rivers, land use/cover and the Digital Elevation Model (SRTM 30m). This data was sufficient to simulate the variations of streamflow responses because both Aswa I and Aswa II are ungauged to facilitate calibration and validation. The simulation was performed using an ArcGIS 10.5-based SWAT tool.

2.6. Stakeholder validation meeting

A stakeholders validation meeting was held on 15/10/2024 at Margharita Palace Hotel in Lira City to qualify the study's findings. Thereafter, stakeholders developed a vision for managing water resources within the Aswa 1 & 11 sub-catchments.

2.7. Study limitations

Due to the geographical spread of the target area and logistical challenges, accessing certain locations within the study area was challenging. More time was allocated to field data collection to ensure that all the targeted households and informants were reached.

The study coincided with some national events, such as public holidays, which greatly delayed the data collection exercise by three weeks. This affected the timelines for the entire exercise. The consulting team revised the work schedule in consultation with the client.

3. RESULTS AND FINDINGS

3.1. Geography and Environment

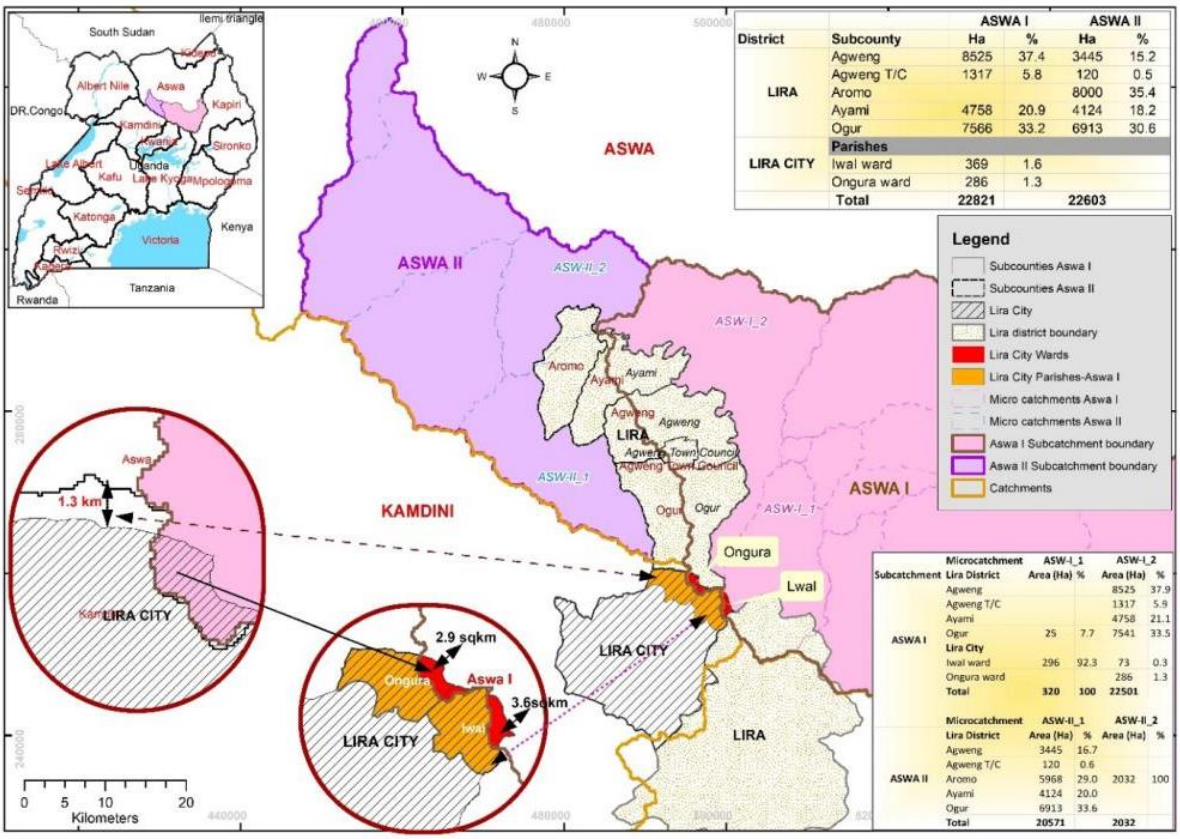
Ecosystems and environmental resources are crucial in water availability, water quality maintenance, natural water regulation, climate regulation, biodiversity, and resilience to disaster risks. This assessment profiles the topography, geology, climate, and state of environmental resources in Aswa I and Aswa II sub-catchments and how they impact water resources in the sub-catchments and broader district areas within which they fall. The ecological resources include wetlands, forests, soil, vegetation, and land. Climate hazards such as drought and floods that impact water resources in the sub-catchments are also profiled using available datasets.

3.1.1. Location

As indicated in the first chapter of this report (2.1 context), the study area is located in the primary sub-catchments of Aswa I and Aswa II, which form part of the larger Aswa Catchment. These sub-catchments overlap with the upper Lira District and part of Lira City in Northern Uganda. In Aswa I sub-catchment, the study area covers the sub-counties of Ayami (20.9%), Agweng (37.4%), Ogur (33.2%), and Agweng Town Council (5.8%) in Lira District while Ongura (1.3%) and Iwal Wards (1.6%) in Lira City, which constitutes the entire area (22,821 Ha). Whereas in the Aswa II sub-catchment, the scope of the study falls under Aromo (35.4%), Ayami (18.2%), Agweng (15.2%), Ogur (30.6%) and Agweng Town Council (0.5%), out of the total surface area (22,603 Ha) of Aswa II.

More specifically, the study area of Aswa I is comprised of Asw-I_1 and Asw-I_2 micro catchments (***Figure 3-1***) with a surface coverage of 320 Ha and 22,501 Ha, respectively. The micro catchment of ASW-1_1 only constitutes 92.3% of the Iwal ward in Lira City and 7.7% of the Ogur sub-county in Lira District. In Asw-1_2, in Lira District, Agweng sub-county has the highest percentage surface coverage area of 37.9%, followed by Ogur (33.5%), and Ayami (21.1%) sub-counties, and Agweng town council (5.9%). Ogura (1.3%) and Iwal Wards in Lira City have the lowest percentage in terms of surface coverage (***Figure 3-1***).

In contrast, the study area of Aswa II constitutes two micro catchments of Asw-II_1 and Asw-II_2 (Figure 3-1), with a surface area coverage of 20,571 Ha and 2,032 Ha, respectively. Asw-II_1 micro-catchment is entirely covered by the Lira District sub-counties of Ogur (34%), Aromo (29%), Ayami (20%), Agweng (17 %) and the Town Council of Agweng (1%). Nonetheless, 100% of Asw-11_2 is wholly made up of Aromo sub-county in the Lira District (***Figure 3-1***).



District	Subcounty	ASWA I Ha	ASWA I %	ASWA II Ha	ASWA II %
LIRA	Agweng	8525	37.4	3445	15.2
	Agweng T/C	1317	5.8	120	0.5
	Aromo			8000	35.4
	Ayami	4758	20.9	4124	18.2
	Ogur	7566	33.2	6913	30.6
LIRA CITY	Parishes				
	Iwal ward	369	1.6		
	Ongura ward	286	1.3		
	Total	22821		22603	

Subcatchment	Microcatchment Lira District	ASW-I_1 Area (Ha)	%	ASW-I_2 Area (Ha)	%
ASWA I	Agweng			8525	37.9
	Agweng T/C			1317	5.9
	Ayami			4758	21.1
	Ogur	25	7.7	7541	33.5
	Lira City				
	Iwal ward	296	92.3	73	0.3
	Ongura ward			286	1.3
	Total	320	100	22501	

Subcatchment	Microcatchment Lira District	ASW-II_1 Area (Ha)	%	ASW-II_2 Area (Ha)	%
ASWA II	Agweng	3445	16.7		
	Agweng T/C	120	0.6		
	Aromo	5968	29.0	2032	100
	Ayami	4124	20.0		
	Ogur	6913	33.6		
	Total	20571		2032	

Figure 3-1: Location of Aswa I and Aswa II sub-catchments in Lira District and Lira City

3.1.2. Topography

The topography of the area is generally low-lying, with elevation ranging between 985 meters above sea level (m.a.s.l) and 1,237 m.a.s.l. The northern and northeastern parts of the area are the lowest, especially in the Aromo and Ayami sub-counties. The areas with the highest elevation are located in the south of Ongura and Iwal Parishes, which are found in Lira City and the Ogur sub-county in Lira District. The low-lying areas are separated by hills such as Te-Arie (in Aler Parish, Ogur Subcounty of Lira District) and Walela Rock in Walela Parish (Aromo sub-county, Lira District)[11].

3.1.3. Climate

Lira City and District experience a bimodal rainfall pattern with a short rainfall season between March and May and a long rainfall season between September and November. The area receives an average annual rainfall of about 871 mm, with highest rainfall during the month of May. Lira City and District's average mean annual temperature is about 25.1 ºC. The average yearly maximum temperatures range between 36.4 ºC and 40.6 ºC whereas the average annual minimum temperatures range between 13.7 ºC and 16.8 ºC (Figure 3-2).

[11] Technical supervision of implementation of catchment management measures in Aswa II sub-catchment, 2020.

The hottest months in the Lira District and City are January, February, and March (Figure 3-2). However, due to climate change, the climate patterns in Lira City and District have changed in the recent past. For example, the dry spell, which was generally experienced in July, now more typically occurs earlier; sometimes, it comes later than expected, and sometimes it extends into August[12].

Moreover, over the last five years, the rainfall in Lira District has been unimodal, with one prolonged season from mid-March to September[13]. Both Lira City and District receive an average annual wind speed of about 1.95 m/s; the highest wind speed is experienced in the dry season of DJF (December, January, and February). The average mean annual relative humidity for the study area ranges between 52% and 73%, with maximum values in the other dry seasons of JJA (June, July, and August).

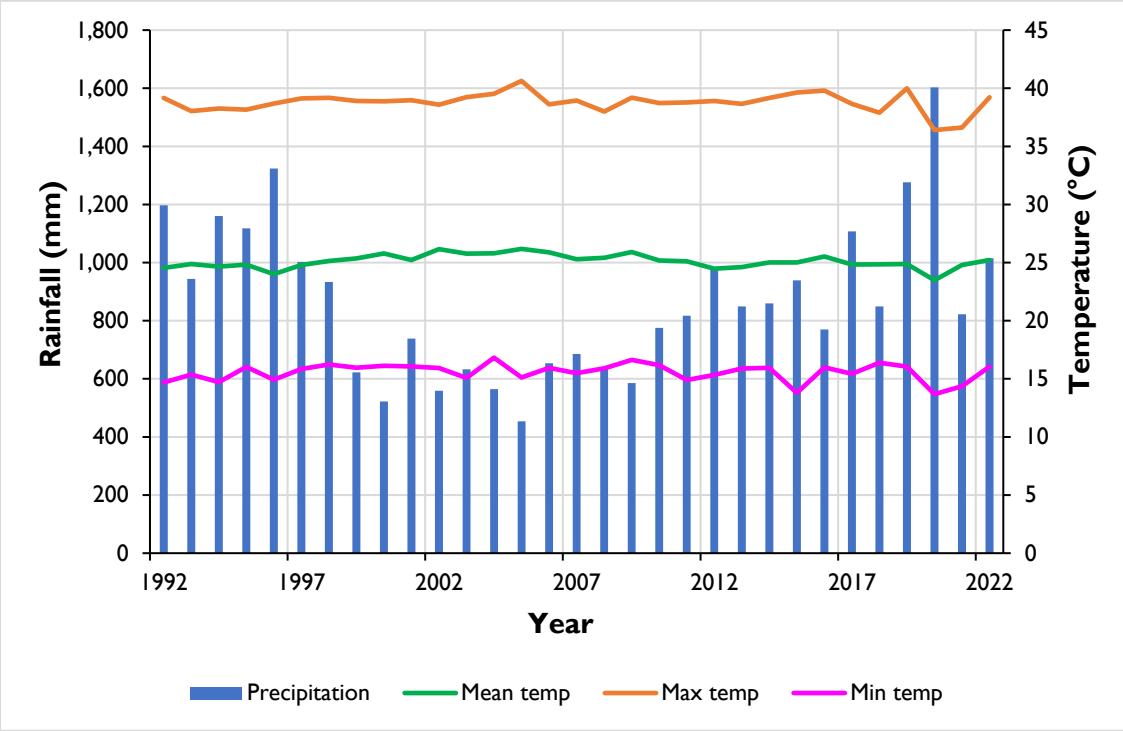


Figure 3-2: Annual rainfall and temperatures in Lira City and Lira District between 1992 and 2022

Data source: Uganda National Meteorological Authority

Spatially, the highest rainfall is received in the Aromo and Ayami sub-counties in the Aswa II sub-catchment. The areas that experience the least rainfall include Ongura and Iwal Parishes in Lira City and the Ogur sub-county in the Aswa I sub-catchment. For temperature, the Aromo and Ayami Sub-counties experience the highest mean temperatures, whereas the Ogur sub-county and the lower Ongura and Iwal parishes experience the lowest mean temperatures.

[12] https://lira.go.ug/about-us/district-profile

[13] https://lira.go.ug/about-us/district-profile

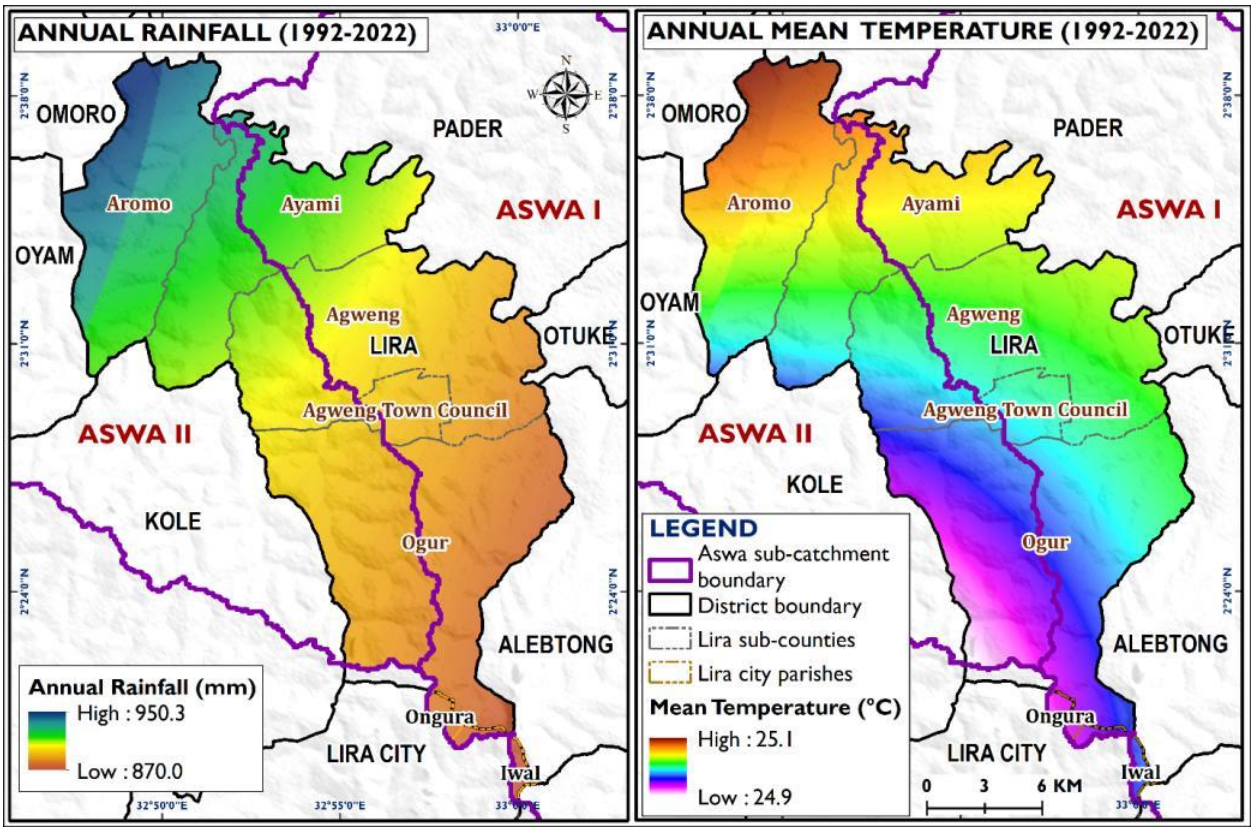


Figure 3-3: Spatial distribution of annual average rainfall and annual mean temperature in Lira City and Lira District between 1992 and 2022 Data source: NASA Prediction of Worldwide Energy Resources

3.1.4. Geology

The geology of the study area is composed of cataclasites (28.7%); granulite facies rocks (0.5%); undifferentiated gneisses (70.7%); and sediments, alluvium, black soils and moraines (0.2%). Undifferentiated gneisses and cataclasites dominate both Aswa I and Aswa II sub-catchments. The undifferentiated gneisses are part of the Precambrian basement complex of Uganda, which is composed of ancient metamorphic and igneous rocks[14]. Cataclasites facilitate the recharge and discharge of groundwater, which helps to maintain the water table and support sustainable water use[15].

3.1.5. Soils

The soil types in the Aswa I sub-catchment include vertisols (65.5%), petric plinthosols (26.4%), acric ferralsols (3.7%) and Leptosols (4.4%), with the dominant soil types being vertisols and petric plinthosols. The target parishes of Lira City only have petric plinthosols. The vertisols are characterised by grey and occasionally sandy clays with low to medium productivity, whereas the

[14] Directorate of Geological Survey and Mines,2022

[15] Banda, V. D., Mengistu, H., & Kanyerere, T. (2023). Assessment of catchment scale groundwater-surface water interaction in a non-perennial river system, Heuningnes catchment, South Africa. *Scientific African*, *20*, e01614.

petric plinthosols are characterized by shallow grey-brown sandy loams with medium productivity (with productivity referring to agricultural output per unit of land based on soil type). Studies have indicated that vertisols may experience waterlogging during the wet season, leading to reduced crop growth and increased erosion risk[16].

Aswa II Sub-catchment is dominated by acric ferralsols (53.3%), petric plinthols (34.4%), leptosols (11.7%) and vertisols (0.6%). The acric ferrasols are majorly found in Aromo and Ayami Sub-counties while the petric plinthosols are majorly observed in Ogur sub-county. Acric ferrasols have a moderate to high water-holding capacity, making them suitable for crops that require consistent moisture levels[17]. On the other hand, the petric plinthosols have a high-water table and are often saturated with water, which makes them prone to waterlogging and soil erosion.[18]

3.1.6. Vegetation

The original, natural vegetation types in Lira City and District are described in this section. There are four vegetation types, primarily grasslands, in the target areas of Lira City and District, and these include Butyrospermum wooded grassland (55.6%), dry combretum wooded grassland (0.3%), edaphic wooded grassland (12%), and moist combretum wooded grassland (32.2%). However, due to land use/cover changes, these vegetation types have been depleted in some areas, having significant impacts on soil and water quality.

More specifically, the target area of Lira District in Aswa I has three vegetation types: i.e., butyrospermum wooded grassland (87.9%), edaphic wooded grassland (12%), and moist combretum wooded grassland (0.1%). The most significant parts of butyrospermum and edaphic wooded grasslands within the target section of Lira District are found in the Agweng Sub- County. Moist combretum wooded grassland are found in Ogur Sub- County. The target area of Lira City has two vegetation types, i.e., butyrospermum wooded grassland and moist combretum wooded grassland, where the former dominates. The most significant part of butyrospermum wooded grassland in the target area of Lira City is found in Iwal Parish. Moist combretum wooded grassland in the target area of Lira City is found in Ongura Parish. In the Aswa II sub-catchment, Lira District has four vegetation types, i.e., butyrospermum (23.9%), dry combretum (0.5%), edaphic (12.4%), and moist combretum (63.3%) wooded grasslands. The dominant savannah vegetation species in the target areas of Lira city and district include *combretum spp, Acacia spp, Terminalia spp* and *Butyrospermum paradoxum*[19].

3.1.7. Biodiversity

[16] IUSS Working Group WRB (2015). World Reference Base for Soil Resources 2014 (Update 2015). International Union of Soil Sciences, Vienna.

[17] IUSS Working Group WRB (2015). World Reference Base for Soil Resources 2014 (Update 2015). International Union of Soil Sciences, Vienna

[18] Spaargaren, O. (2001, March). Major soils of the world. In *Proceedings of the International Soil Conference and Information Centre, Wageningen, The Netherlands* (pp. 2-46).

[19] https://liracity.go.ug/page/about-us

Interim observations show that the density of general vegetation is sparse, and especially where grazing, burning and farming was prominent. In Lira district, agricultural production is no longer productive as it used to be in the 1980's and before, this is basically due to the declining soil fertility and population growth. As a result many families are now encroaching the wetlands for agricultural cultivation and settlement. The wetland cover in the district had reduced from 11% to 8.9% by November 2013. The wetland degradation continues to undermine the availability of surface and underground water, caused flooding and destruction of roads, crops, reduced fi sh stock, biodiversity loss, habitat loss leading to poor ecosystem services and balance. The district's flora and fauna include patches of various plant species, birds, and small mammals. During consultations and assessment, it was reported that the area still has some wildlife such as monkeys and wild pigs. Some of the bird species observed to traverse the area include, Black collared apalis, Jackson's francolin, Moustached green tinkerbird, Bronze-napped pigeon, Tauraco hartlaubi, Nectarinia tacazze and Tacazze sunbird, while the domesticated ones included turkeys, chicken, Guinea fowl.

Table 3-1: Coverage (Ha) of vegetation types by sub-catchment and administrative unit

Sub-catchment	District/City	Sub-county	Parish	Butyrospermum wooded grassland	Dry combretum wooded grassland	Edaphic wooded grassland	Moist Combretum wooded grassland	Grand Total (ha)
Aswa I	Lira	Agweng		7,223.6	0.0	1,229.6	0.0	8,453.1
		Agweng Town Council		1,320.1	0.0	0.0	0.0	1,320.1
		Ayami		3,768.7	0.0	839.2	0.0	4,607.9
		Ogur		6,799.2	0.0	543.8	30.4	7,373.4
		Sub-total		**19,111.5**	**0.0**	**2,612.6**	**30.4**	**21,754.5**
	Lira City	Ngetta division	Iwal	389.5	0.0	0.0	0.0	389.5
		Ngetta division	Ongura	251.5	0.0	0.0	3.9	255.4
		Sub-total		**641.0**	**0.0**	**0.0**	**3.9**	**644.9**
Aswa II	Lira	Agweng		2,603.7	0.0	349.4	563.6	3,516.7
		Agweng Town Council		116.7	0.0	0.0	0.0	116.7
		Aromo		8.2	34.4	1,309.7	6,648.0	8,000.2
		Ayami		1,125.2	0.0	1,098.1	2,051.7	4,275.0
		Ogur		1,645.6	83.7	95.2	5,319.8	7,144.3
		Sub-total		**5,499.4**	**118.1**	**2,852.4**	**14,583.0**	**23,052.9**
		Grand-total		**25,252.0**	**118.1**	**5,465.0**	**14,617.3**	**45,452.3**

Data source: Langdale-Brown et al., 1964

3.1.8. Ecosystems

1) Wetlands

Wetlands play a vital role in providing water to communities in Uganda. Wetlands act as natural reservoirs, capturing and storing water during periods of rainfall. This water is slowly released over time, helping to recharge groundwater aquifers and ensuring a steadier water supply to communities during dry periods. The wetlands also provide water purification and flood control benefits. The Ministry of Water and Environment classifies wetlands in Uganda according to their land cover/land use, water regime, and complexity[20]. Here, wetlands are presented based on their land cover/land use type. This is due to the vast changes that have affected natural wetlands and vegetation in the area. In fact, the coverage of wetlands in Uganda has been declining over time due to encroachment and degradation from natural and human activities. Between 1994 and 2015, Uganda lost 6,146.6Km^2 of wetlands (2.5% of Uganda's total surface area)[21]. In developing the 2019 Status of Wetlands report, all land *use* classes (built-up areas and farmlands) were used to categorize degraded wetlands while all land *cover* classes (papyrus and floating vegetation, grasslands, bushlands, and woodlands) implied wetlands that are intact.

The wetland use/cover types in the target area include papyrus (22.5%), grasslands (14%), woodlands (3.8%), small-scale farmlands (56.2%), built-up (0.5%), and bushlands (3%) (**Table 3-2)**. Small-scale farmlands dominate both Aswa I and Aswa II sub-catchments. In Aswa I, the most considerable wetland coverage is found in the Ogur sub-county and Iwal parish for the Lira district and City, respectively. In the Aswa II sub-catchment, the Ogur sub-county in the Lira district still has the most prominent coverage of wetlands.

[20] Ministry of Water and Environment (MWE). State of Wetlands Report (2021).

[21] Ministry of Water and Environment (MWE). State of Wetlands Report (2021).

Table 3-2: Coverage (Ha) of wetland use/cover types by sub-catchment and administrative unit

Sub-catchment (District/City)	Sub-county/Division/Parish	Built-up		Bushlands		Grasslands		Papyrus		Small-scale Farmlands		Woodlands		Total	
		Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Aswa I (Lira District)	Agweng	2.7	42.1	5.8	11.0	24.7	12.1	54.3	20.7	149.6	21.6	4.2	26.7	241.4	19.6
	Agweng TC	0.7	10.5	1.5	2.9	16.7	8.2	27.1	10.3	90.6	13.1	1.1	6.8	137.7	11.2
	Ayami	0.0	0.0	11.6	22.0	32.1	15.7	33.7	12.9	108.7	15.7	0.7	4.3	186.7	15.2
	Ogur	3.1	47.4	33.8	64.2	130.2	63.9	147.0	56.1	342.4	49.5	9.9	62.3	666.4	54.1
	Sub-total	**6.5**	**100**	**52.7**	**100**	**203.7**	**100**	**262.1**	**100**	**691.3**	**100**	**15.9**	**100**	**1,232.1**	**100**
Aswa I (Lira City)	Iwal	0.0	0.0	0.4	85.1	1.6	83.8	3.8	97.3	4.3	91.8	0.1	100	10.3	92.1
	Ongura	0.0	0.0	0.1	14.9	0.3	16.2	0.1	2.7	0.4	8.2	0.0	0.0	0.9	7.9
	Sub-total	**0.0**	**0.0**	**0.5**	**100**	**2.0**	**100**	**3.9**	**100**	**4.7**	**100**	**0.1**	**100**	**11.2**	**100**
Aswa II (Lira District)	Agweng	0.0	0.0	7.0	12.8	41.3	13.6	90.5	16.4	244.4	18.1	22.6	18.6	405.8	17.0
	Agweng TC	0.0	0.0	0.3	0.5	1.0	0.3	1.2	0.2	3.5	0.3	0.4	0.3	6.3	0.3
	Aromo	5.2	42.2	15.9	29.1	119.2	39.1	178.8	32.4	404.7	30.0	25.9	21.3	749.7	31.3
	Ayami	0.1	1.0	6.4	11.8	35.0	11.5	76.4	13.9	195.0	14.5	30.9	25.4	343.8	14.4
	Ogur	7.1	56.8	25.0	45.8	108.1	35.5	204.4	37.1	501.2	37.2	41.6	34.3	887.3	37.1
	Sub-total	**12.4**	**100**	**54.7**	**100**	**304.6**	**100**	**551.3**	**100**	**1,348.7**	**100**	**121.4**	**100**	**2,393.0**	**100**

Data source: Wetland Management Department (WMD), 2021

The status of wetlands in Lira District and City can be classified as intact or degraded. Intact wetlands are natural ecosystems that have remained largely undisturbed or unaffected by significant human activities. On the other hand, degraded wetlands have been altered, damaged, or disturbed by human activities or natural events, leading to a loss or reduction in their ecological functions, structure, and biodiversity. Emerged status review indicates that 20.6 sq.km (56.7%) of wetlands is now degraded, whereas 15.7 sq.km (43.3%) is intact in both Aswa I and Aswa II sub-catchments. In the target area of Lira district in Aswa I, 6.9 sq.km (56.6%) of wetlands is degraded, while 5.3 sq.km (43.4%) is intact.

Most of the intact and degraded wetland sections are found in the Ogur sub-county. In the target section of Lira city in Aswa I, 58.2% (0.06 sq.km) of wetlands are intact, whilst 41.8% (0.05 sq.km) are degraded. The most prominent coverage of the intact and degraded wetland sections is located in Lwal parish. In the target section of Lira district in the Aswa II sub-catchment, 13.6 sq.km (56.9%) of wetlands are degraded, whereas 10.3 sq.km (43.1%) of wetlands are intact. The biggest coverage of both the intact and degraded wetlands in this section are found in the Ogur sub-county.

The significant drivers of wetland degradation in Lira City and District include rapid population growth and pressure, poverty, industrialisation and infrastructure development, crop cultivation, sand and clay mining, and overharvesting of wetland resources.[22] The impacts of wetland degradation can include reduced water levels and flow in wetlands due to blocking and diversion, decline in water quality, and increased flooding events, which can increase sewerage and wastewater treatment costs. Lira district local government, city council, and partners have implemented some interventions in response to wetland degradation, including sensitization of communities, demarcation of wetlands, eviction of encroachers, and wetland restoration[23].

2) Forests

The forest ecosystems of Uganda can be categorised into natural forests and plantations. Natural forests are owned, protected and managed by the mandated agencies of the government of Uganda, including the National Forestry Authority (NFA) and the Forest Sector Support Department (FSSD). On the other hand, forest plantations are privately owned. The natural forests can be further classified into Central Forest Reserves (CFRs), Local Forest Reserves (LFRs), and District Joint Management (DJM) areas (lands jointly manage by the Uganda Wildlife Authority/UWA and National Forestry Authority/NFA).

The study area has three (3) central forest reserves (CFR):

1. Ayami CFR (331.9 Ha) is located in the Agweng sub-county, Lira district, and Aswa I sub-catchment;
2. Ogur CFR (10.2 Ha) is situated in the Ogur sub-county, Lira district, and Aswa II sub-catchment;

[22] Ministry of Water and Environment (MWE). State of Wetlands Report (2021).

[23] These interventions have been funded by the government of Uganda through the Ministry of Water and Environment and partners. Little literature exists about the onset, extent, and success of these interventions. https://gnna.co.ug/2024/04/lira-city-restores-65-of-its-depleted-wetlands/

3. Olia CFR (211.6 Ha) located in Aromo and Ayami sub-counties, Lira district, Aswa II sub-catchment.

The status of these forest ecosystems is presented based on their current land cover/ land use types. The status of forest ecosystems in Uganda can also be categorized as intact or degraded. Intact forests are undisturbed areas of natural forest (containing trees, grasslands, and woodlands) that human activities have not significantly impacted. On the other hand, degraded forests have been substantially altered or damaged by human activities or natural disturbances (such as farmlands and built-up areas), resulting in a loss of their extent, ecological integrity, biodiversity, and ecosystem services. Forests in Uganda initially contained land cover classes such as woodlands and tree plantations; however, due to encroachment by human activities, land use classes such as farmlands and built-up areas have now become apparent. Encroached land does not belong to the community; it is still considered forest land. For this reason, the NFA indicates both the land cover classes and land use classes in the gazetted area of a forest.

The significant drivers of forest encroachment and degradation in Uganda include population increase, political interference, limited land for agriculture, and governance inadequacies (such as unclear boundaries and limited compliance monitoring).[24] Forest degradation can lead to increased erosion and sedimentation in rivers and streams, which can lead to reduced water quality, changes in hydrological cycles, and increased vulnerability of communities to climate change[25]. The status of Ayami, Ogur, and Oli central forest reserves is below.

- Ayami CFR

The forest use/cover types in Ayami CFR include built-up areas (1.3%), farmlands (66.5%), grasslands (18.7%), trees (6.9%), and wetlands (6.6%) (**Table 3-3**). Farmlands now dominate the Ayami Central Forest Reserve. Lakamor village has the most considerable coverage of the different forest use/cover types.

Table 3-3: Forest use/cover types in Ayami Central Forest Reserve

Villages	**Atera**		**Bar Oganda B**		**Barodwong**		**Lakamor**		**Total**	
Forest use/cover types	**Area (Ha)**	**%**	**Area (Ha)**	**%**	**Area (Ha)**	**%**	**Area (Ha)**	**%**	**Area (Ha)**	**%**
Built-up	0.4	9.5	0.8	19.5	0.5	10.9	2.6	60.1	4.3	1.3
Farmlands	28.4	12.9	59.9	27.1	17.3	7.8	115.2	52.2	220.8	66.5
Grasslands	7.3	11.8	13.8	22.3	4.3	6.9	36.6	59.0	62.0	18.7
Trees	0.9	4.1	9.3	40.3	0.9	3.7	11.9	51.9	23.0	6.9
Wetlands	3.4	15.6	0.6	2.8	0.0	0.2	17.7	81.4	21.8	6.6
Total	**40.4**	**12.2**	**84.4**	**25.4**	**23.0**	**6.9**	**184.1**	**55.5**	**331.9**	**100**

Data source: National Forestry Authority (NFA), 2023

[24] MWE (2016). Ministry of Water and Environment. State of Uganda's Forestry.

[25] Obubu, J. P., Odong, R., Alamerew, T., Fetahi, T., & Mengistou, S. (2022). Application of DPSIR model to identify the drivers and impacts of land use and land cover changes and climate change on land, water, and livelihoods in the L. Kyoga basin: implications for sustainable management. *Environmental Systems Research*, *11*(1), 11.

Regarding status, 67.8% (225.1 Ha) of Ayami CFR is degraded, whereas 32.2% (106.8 Ha) is intact. The most significant percentage of the degraded forest section is located in Barodwong village (77.4%) whereas most of the intact forest section is situated in Lakamor village (36%) .

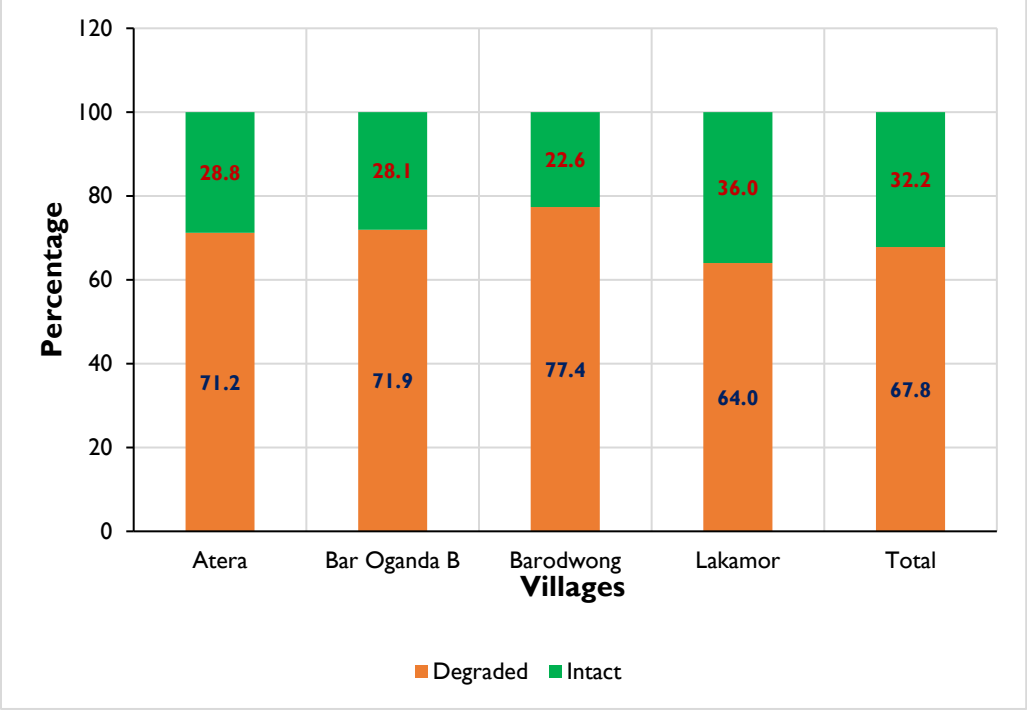


Figure 3-4: Status of Ayami Central Forest Reserve

Data source: National Forestry Authority (NFA), 2023

The forest use/cover types, as well as the status of Ayami CFR,

- Ogur CFR

The forest use/cover types in Ogur Central Forest Reserve include built-up areas (2.6%), farmlands (12.1%), grasslands (59.2%), and trees (26.1%) (**Table 3-4**). The dominant forest use/cover type in Ogur CFR is grasslands.

Table 3-4: Forest use/cover types in Ogur CFR

Forest use/cover types	Area (Ha)	Percentage (%)
Built-up	0.3	2.6
Farmlands	1.2	12.1
Grasslands	6.0	59.2
Trees	2.7	26.1
Total	**10.2**	**100**

Data source: National Forestry Authority (NFA), 2023

In terms of status, 8.7 Ha (85%) of Ogur CFR is intact, whereas 1.5 Ha (15%) is degraded (Figure 3-5).

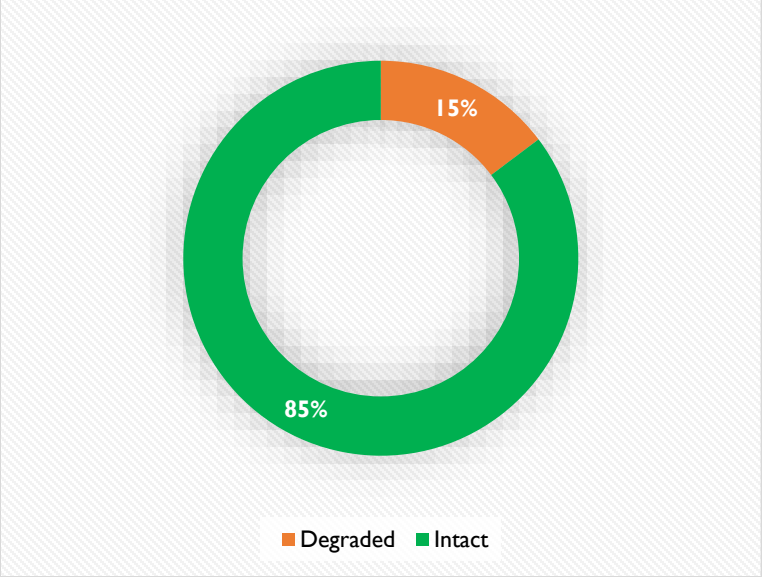


Figure 3-5: Status of Ogur central forest reserve

Data source: National Forestry Authority (NFA), 2023

The status and forest use/cover types of Ogur CFR are shown in Figure 7-9.

- Olia CFR

The forest use/cover types in Olia CFR entail built-up areas (0.7%), farmlands (85.5%), grasslands (0.8%), trees (5.9%), and wetlands (7.1%) (**Table 3-5**). Farmlands dominate Olia CFR. Most of these farmlands are in Adongidyang, Aloc A, and Obama villages. Still, the most extensive sections of Olia CFR are found in Adongidyang, Aloc A, and Obama villages.

Table 3-5: Forest use/cover types in the different villages of Olia CFR

Forest use/cover types	**Built-up**		**Farmlands**		**Grasslands**		**Trees**		**Wetlands**		**Total**	
Villages	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Abak	0.1	7.4	15.4	8.5	0.03	1.9	0.9	7.1	1.3	8.6	17.7	8.4
Abak Alito	0.0	0.0	0.0	0.0	0.01	0.4	0.07	0.6	0.2	1.0	0.2	0.1
Adongidyang	0.4	29.0	44.6	24.6	0.5	29.9	3.3	26.8	7.6	50.5	56.5	26.7
Aloc A	0.1	6.8	40.7	22.5	0.1	6.5	3.0	24.3	1.7	11.5	45.7	21.6
Atapara Dam	0.3	19.2	12.7	7.0	0.1	6.7	0.6	5.1	0.4	2.9	14.2	6.7
Obama	0.5	34.6	40.1	22.2	0.09	5.3	2.1	16.7	0.8	5.0	43.6	20.6
Olia	0.0	3.1	27.6	15.2	0.8	49.3	2.4	19.3	3.1	20.4	34.0	16.0
Total	**1.5**	**100**	**181.1**	**100**	**1.7**	**100**	**12.4**	**100**	**15.0**	**100**	**211.8**	**100**

Data source: National Forestry Authority (NFA), 2023

Status-wise, 29.2 Ha (13.8%) of Olia CFR is intact whereas 182.6 Ha (86.2%) of the forest is degraded. The most degraded forest sections of Olia CFR are found in Obama (93.3%) and Atapara

Dam (91.7%) while Abak Alito village (99.8%) has the biggest intact forest section, mainly covered by wetlands (Figure 3-6).

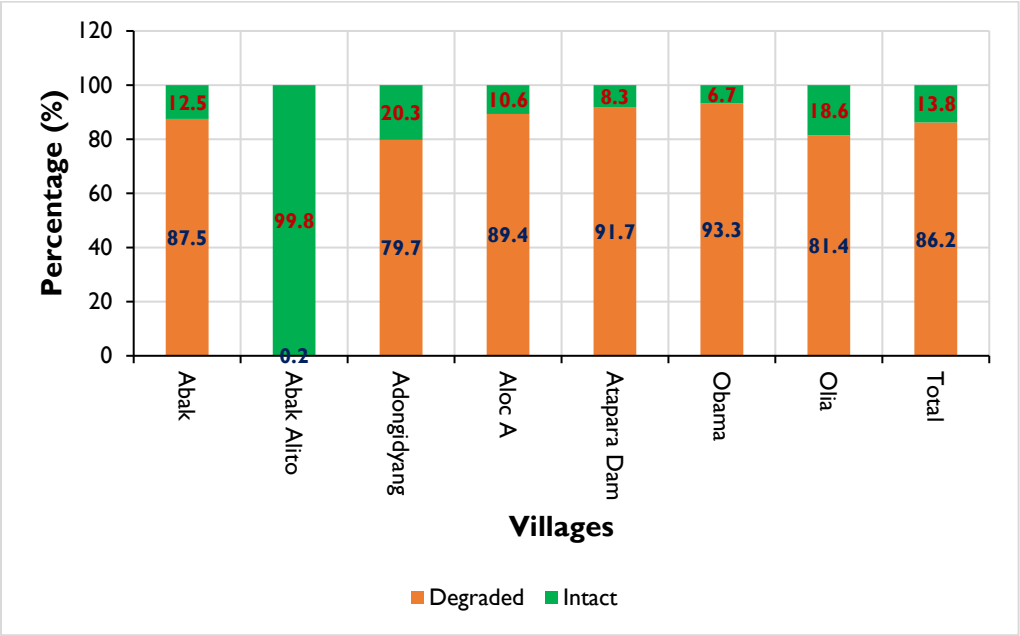


Figure 3-6: Status of Olia Central Forest Reserve by village

Data source: National Forestry Authority (NFA), 2023

The forest use/cover types, as well as the forest status of Olia CFR,

3) Rivers

The sub-catchments have various river ecosystems and these can be categorized into main rivers (34.1%), secondary rivers (19.8%), and small rivers/streams (46.1%) (**Table 3-6**). Rivers in Uganda are classified based on their size, flow, and role within a river system. For example, main rivers are the largest rivers in a region, often with significant water flow and volume, and typically with wide and deep channels. Main rivers collect water from various tributaries (smaller rivers and streams).

Some of the notable rivers in the sub-catchments include Aswa, Agweng, Aleka, Achake, and Obim . Most of the rivers and streams are found in Agweng, Aromo, and Ogur sub-counties. The target parishes of Lira City do not have main rivers.

These rivers provide water for domestic, livestock, and irrigation purposes, especially during the dry seasons. However, the water quality in most of these rivers has deteriorated in recent years, mainly due to encroachment of riverbanks, discharge of domestic and industrial effluents, and runoff from farmlands.

Table 3-6: Categories of rivers and their length in Aswa I and Aswa II sub-catchments

Sub-catchments	District/city	Sub-counties	Parishes	Main Rivers	Secondary Rivers	Small Rivers	Total
				Length (Kilometers)			
Aswa I	Lira district	Agweng		11.3	8.1	31.0	50.4
		Agweng Town Council		0.0	1.4	3.7	5.2
		Ayami		13.1	3.3	11.3	27.7

Sub-catchments	District/city	Sub-counties	Parishes	Main Rivers	Secondary Rivers	Small Rivers	Total
				Length (Kilometers)			
		Ogur		7.1	12.0	17.9	37.1
	Lira city	Ngetta division	Iwal	0.0	0.0	0.9	0.9
		Ngetta division	Ongura	0.0	0.0	1.3	1.3
Aswa II	Lira district	Agweng		3.8	5.1	7.8	16.7
		Aromo		27.6	0.1	15.9	43.6
		Ayami		12.6	1.6	3.9	18.1
		Ogur		6.3	15.6	17.2	39.1
			Total	**81.9**	**47.5**	**110.8**	**240.1**

Data source: Ministry of Water and Environment (MWE), 2022

3.1.9. Land use/cover changes

The changing land use/land cover (LULC) patterns in Lira District and City have led to considerable challenges in managing water resources in Aswa I and Aswa II sub-catchments. Changes in LULC types can significantly impact water quality and quantity, groundwater recharge, runoff, and sedimentation. It is, therefore, crucial to understand the dynamics of the land use/cover types in Aswa I and Aswa II sub-catchments to better understand, manage and predict the impacts on water resources, ensuring that water supply, quality, and ecosystem services are maintained for current and future generations.

The changes in LULC in Aswa I and Aswa II sub-catchments were mapped using high-resolution satellite images in Google Earth Engine for a period of ten years between 2014 and 2024. Significant changes were observed in these land use/cover types. The results show that between 2014 and 2024, built-up areas and farmlands increased, whereas grasslands, wetlands, and woodlands decreased in Aswa I and Aswa II sub-catchments. However, the built-up areas in the target area of the Lira District in the Aswa II sub-catchment decreased during this period. This decline in built-up areas is attributed to the migration of youth to the nearby towns and Lira City.

The most significant increase in LULC was observed in farmlands whereas the most considerable decrease was in grasslands and wetlands. The primary driver of these LULCs in the sub-catchments is population growth. Population in Lira district grows at an alarming rate of 2.88% each year[26]. Population growth creates demand for land for settlement and cultivation, converting grasslands, woodlands and wetlands mainly to farmlands. In addition, over 90% of the local population in Lira District and Lira City use fuelwood for cooking[27], leading to the cutting down trees in woodlands and grasslands for charcoal and firewood.

Table 3-7: Land use/cover changes in Aswa I and Aswa II sub-catchments between 2014 and 2024

Sub-catchment (District)	ASWA I (LIRA DISTRICT)					
Year	**2014**		**2024**		**Net Change (2014-2024)**	
Land use/cover types	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%

[26] Lira District Local Government District Profile. https://www.lira.go.ug/about-us/district-profile

[27] Technical supervision of implementation of catchment management measures in Aswa II sub-catchment, 2020.

Built-up areas	890	4.0	1,202	5.4	312	1.4
Farmlands	7,650	34.6	12,834	58.0	5,184	23.4
Grassland	8,240	37.2	4,523	20.4	-3,717	-16.8
Wetland	2,750	12.4	1,401	6.3	-1,349	-6.1
Woodland	2,600	11.7	2,180	9.8	-420	-1.9
Total	**22,140**	**100**	**22,140**	**100**		
Sub-catchment (City)	**ASWA I (LIRA CITY)**					
Year	**2014**		**2024**		**Net Change (2014-2024)**	
Land use/cover types	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Built-up areas	20	3.1	20	3.1	0	0.0
Farmlands	280	43.1	420	64.6	140	21.5
Grassland	160	24.6	120	18.5	-40	-6.2
Wetland	110	16.9	30	4.6	-80	-12.3
Woodland	70	10.8	50	7.7	-20	-3.1
Total	**650**	**100**	**650**	**100**		
Sub-catchment (District)	**ASWA II (LIRA DISTRICT)**					
Year	**2014**		**2024**		**Net Change (2014-2024)**	
Land use/cover types	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
Built-up areas	810	3.6	780	3.5	-30	-0.1
Farmlands	8,830	39.1	14,320	63.4	5,490	24.3
Grassland	7,540	33.4	4,480	19.8	-3,060	-13.6
Wetland	3,350	14.8	1,110	4.9	-2,240	-9.9
Woodland	2,050	9.1	1,890	8.4	-160	-0.7
Total	**22,580**	**100**	**22,580**	**100**		

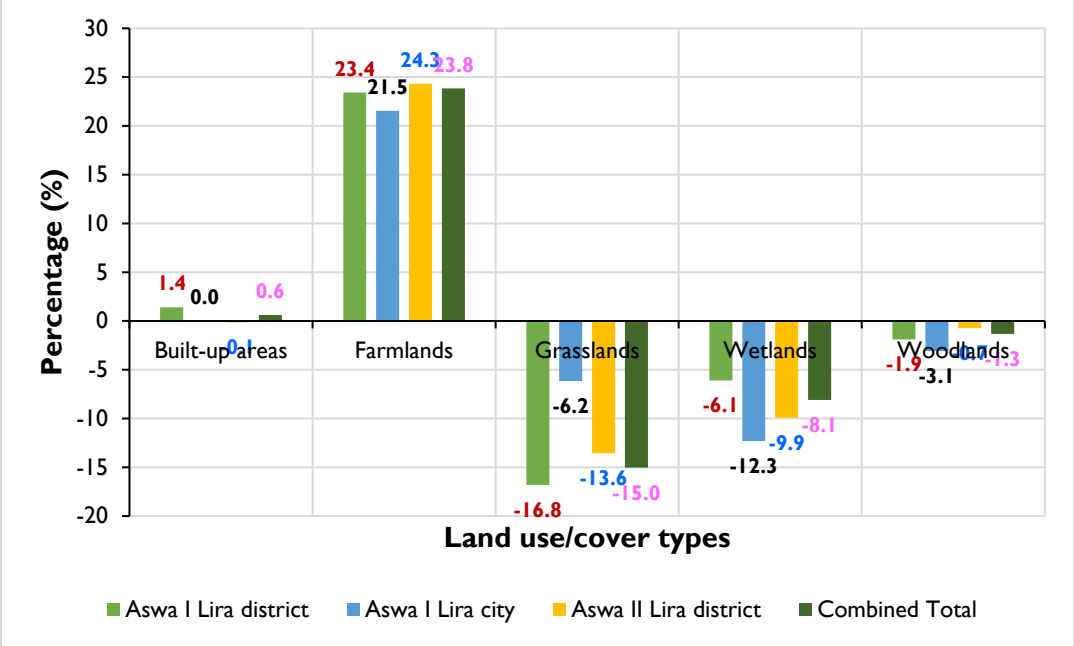


Figure 3-7: Land use/cover changes in Aswa I and Aswa II sub-catchments between 2014 and 2024

The changes in land use/cover in the sub-catchments have implications on water resources and they should therefore be monitored and regulated. LULC can increase surface runoff by reducing vegetation cover that normally absorbs and slows down rainfall. This also leads to more rapid runoff, resulting in increased soil erosion and sediment transport into water bodies such as rivers. High sediment loads can degrade water quality, impacting aquatic ecosystems and water treatment costs. LULC, such as intensive agricultural practices, urbanization, and deforestation, can lead to increased water demand and reduced groundwater recharge rates. This can result in groundwater depletion, lowering water tables and potentially causing land subsidence, with implications for both water and food or livelihood security. Groundwater depletion can also reduce base flows in rivers and streams, impacting freshwater ecosystems and water availability for human use.

The LULC types in Aswa I and Aswa II sub-catchments for 2014 and 2024 are presented in **Figure 3-8.**

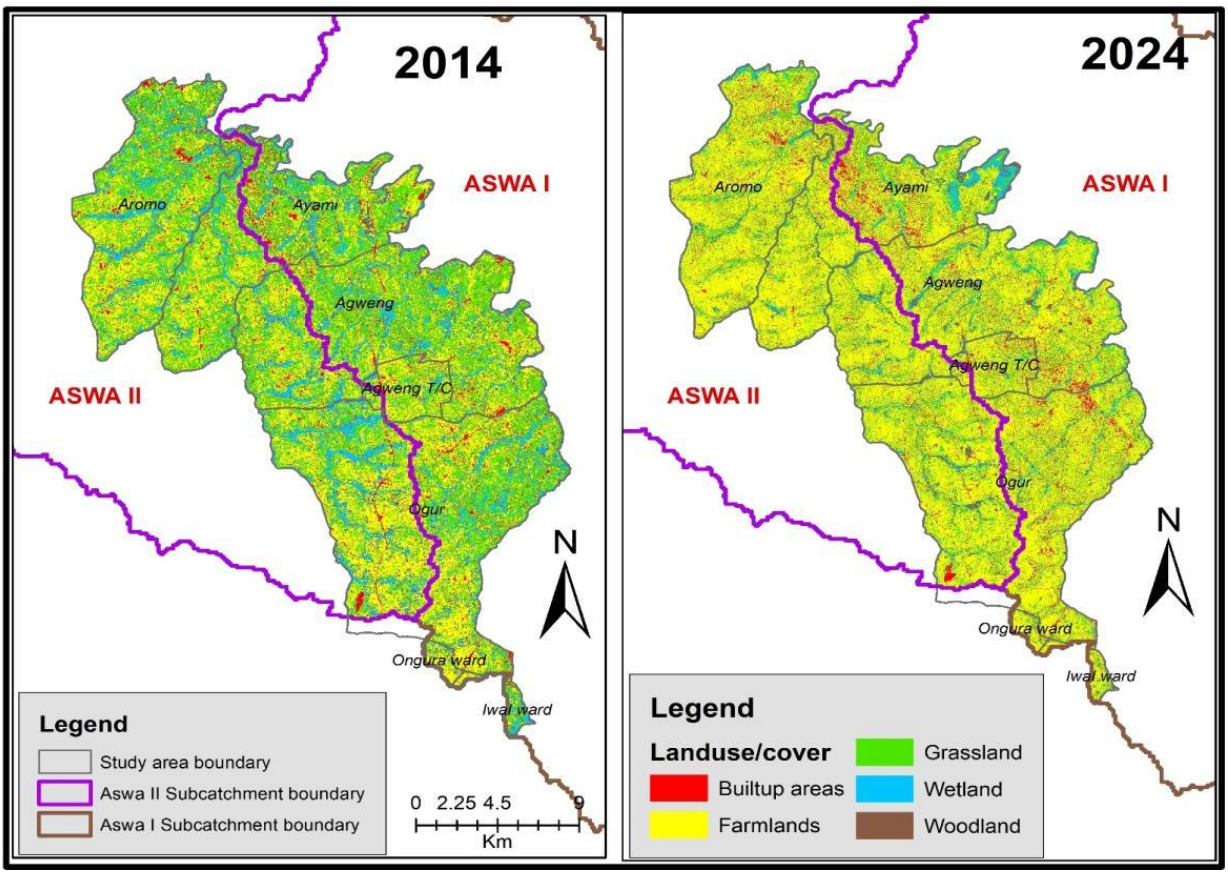


Figure 3-8: Land use/cover types in Aswa I and Aswa II sub-catchments for 2014 and 2024

Data source: Classification of satellite images

3.2. Environment risks

3.2.1. Drought risk

Drought is defined as a recurrent feature of climate that occurs when there is an extended period of abnormal deficiency in precipitation (relative to what is considered normal in a given area based on past referencing)[28]. The significant impacts of drought on water resources in the sub-catchment include reduced surface water availability in rivers and streams, reduced groundwater levels, and increased encroachment of wetland ecosystems[29]. The biggest part of the targeted area of the Aswa I sub-catchment experiences drought of moderate intensity (94.6%), especially in the Agweng and Ogur sub-counties. In the Aswa II sub-catchment, most of the targeted area is exposed to drought of high intensity



Plate 3-1: Maize Garden affected by drought in

[28] Haile, G. G., Tang, Q., Li, W., Liu, X., & Zhang, X. (2020). Drought: Progress in broadening its understanding. *Wiley Interdisciplinary Reviews: Water*, *7*(2), e1407.

[29] Lira district Multi-Hazard, Risk, and Vulnerability (HRV) profile, 2016.

(56.6%), especially in the Aromo and Ogur sub-counties. In July 2019, drought reduced the crop yields of farmers in Lira district and led to the drying of some water sources[30].

3.2.2. Flood risk

The most common natural disasters experienced in the catchment are floods and droughts. Major flooding events occur in both the lower and upper parts of the sub-catchment towards September-October. Both sub-catchments are prone to flooding because of intense storms, poor draining soils and low slopes. This has resulted in loss of property, reduced soil productivity and soil erosion. Upper parts of the catchment receive much less rainfall than the lower parts. These prolonged dry spells result in: total crop failure with far-reaching impacts on food security, leaving communities vulnerable to starvation; reduced water and pasture for livestock; disease outbreaks; loss of biodiversity and increased resource use conflicts. Floods occur when an overflow of water submerges land that is usually dry[31]. The significant impacts of floods in the sub-catchment include reduced water quality, displacement of people, destruction of croplands, infrastructure damage such as roads, and increased vulnerability to waterborne diseases. Floods contribute to reduced water quality through the introduction of contaminants (such as pesticides, fertilizers, heavy metals, oils, and waste) into water bodies. Most of the flooding occurs along River Aswa. Most of the target area experiences floods of high intensity (86.9%), and most of these hotspots are found in the Ayami and Agweng sub-counties in the Lira district. The target area of Lira City is not prone to flood hazards. In September 2020, however, the floods in the Lira district destroyed the infrastructure of the National Water and Sewerage Corporation along Lake Kwania and affected many villages[32]. In October 2019, the floods in the Lira sub-county submerged the Ogwal-Achonga road, cutting off business at the Omodo market[33]. The pupils also stopped attending schools as Omodo flooded swamp became impassable. The affected villages in the Lira sub-county included Anai Ober, Anai Okii, Ongica B, and Elwa villages.

3.2.3. Land degradation.

Increased human pressure on the land (partially resulting from population growth), weak environmental law enforcement, low level of awareness on environmental degradation and shortage of capacities and resources for monitoring and community-based natural resources management (e.g. for water and rangeland) has led to severe land degradation. Some of the activities include; Land use changes, deforestation and overgrazing, uncontrolled bush burning, wetlands, river banks and forest encroachment for cultivation and grazing of livestock, and, overgrazing exceeding carrying capacity of rangelands. This degradation results in higher overland runoff rates and thereby more frequent and intense droughts and floods. When controlled, bush burning is a critical means for transforming nutrients in the soil, with benefits to the quantity and

[30] https://www.independent.co.ug/130-drought-affected-farmers-benefit-from-crop-insurance/

[31] Viglione, A., & Rogger, M. (2015). Flood processes and hazards. In *Hydro-Meteorological Hazards, Risks and Disasters* (pp. 3-33). Elsevier.

[32] https://redpepper.co.ug/nwsc-rushes-to-assess-affected-systems-in-flood-ravaged-lira/104999/

[33] https://www.monitor.co.ug/uganda/news/national/communities-cut-off-after-heavy-downpour-causes-flooding-on-lira-access-road-1853696

quality of grass cover, and an important means to control tse- tse fly numbers. Within the sub-catchment, however, bush burning is a rampant practice because it is carried out without control. It often has disastrous consequences, such as loss of life and property, and damage to ecosystems, including forests and soil fertility. Areas around the open woodland are worst affected.

3.2.4. Soil erosion

Soil erosion is defined as the accelerated removal of topsoil from the land surface through water, wind, and tillage[34]. It can be exacerbated by climate change. Assessing soil erosion is essential for maintaining water quality, preserving water storage capacity, and ensuring the long-term sustainability of water resources. The findings show that soil erosion risk in the study area can be categorized as very slight (18.2%), slight (29.5%), moderate (27.4%), high (18.1%), severe (6.6%), and very severe (0.2%). In the Lira district of the Aswa I sub-catchment, the majority of the area has a slight coverage (28.5%) of soil erosion risk with minor patches of very severe soil erosion (0.1%) risk in the Ogur sub-county (Table 3-8). In Lira city, most of the area (36.2%) is exposed to high soil erosion risk, especially in the Iwal ward. In the Lira district of the Aswa II sub-catchment, the biggest area is exposed to slight soil erosion risk (30.7%) (**Table 3-8**).

Table 3-8: Coverage of soil erosion risk in Lira City and Lira District

Soil loss (t/ha/yr)	Erosion Risk Class	Aswa I (Lira District)		Aswa I (Lira City)		Aswa II (Lira District)		Total	
		Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%
< 2	Very slight	4,107.0	19.2	45.0	8.8	3,853.4	17.5	8,005.3	18.2
2 - 5	Slight	6,106.3	28.5	93.7	18.3	6,760.9	30.7	12,960.9	29.5
5 - 10	Moderate	5,755.5	26.8	115.1	22.5	6,186.0	28.1	12,056.6	27.4
10 - 50	High	3,863.7	18.0	185.5	36.2	3,923.3	17.8	7,972.5	18.1
50 - 100	Severe	1,589.7	7.4	72.7	14.2	1,225.5	5.6	2,887.9	6.6
100 - 500	Very severe	24.3	0.1	0.0	0.0	45.0	0.2	69.3	0.2
Total		**21,446.5**	**100**	**511.9**	**100**	**21,994.1**	**100**	**43,952.6**	**100**

The low soil erosion rates in the sub-catchments could be attributed to the relatively flat terrain which reduces the risk of soil erosion caused by runoff. Secondly, the area receives moderate rainfall (average annual rainfall of about 871 mm), which reduces the risk of soil erosion caused by heavy rainfall. Thirdly, the area is dominated by clay-loam soils, which are more resistant to soil erosion than sandy or silty soils. Lastly, some farmers have been educated about sustainable land management practices (such as mulching and agroforestry) by several stakeholders like Techno Serve, GIZ, IIRR, and MAAIF, among others.

3.2.5. Conflicts over use of Natural Resources

Encroachment of riverbeds has led to conflicts between farmers, pastoralists and sand miners. This is common along river banks in the wetlands of Duru, Anee, Abaala, Odongo Adaga around River Aswa in Lira district and Lira city adding extra pressure to the available water sources and environment.

[34] https://www.undrr.org/understanding-disaster-risk/terminology/hips/en0019

3.2.6. Mining

Artisanal mining is widely practiced within the catchment area, with sand and gold being the common minerals. This artisanal mining often has widespread negative socio-environmental impacts. These include the clearance of vegetation for mining activities, increase of silt deposits during the manning process, diversion of waterways to access the sand deposits on the riverbed was reported in the sub-catchment. Removal of the top soil due to the use of semi-mechanical techniques such as dredges, water pumps, have all contributed to increased land and riverbank degradation.

Despite the challenges, artisanal mining provides a livelihood for many people. It contributes significantly to Uganda's mining production and employs a large portion of the mining workforce.

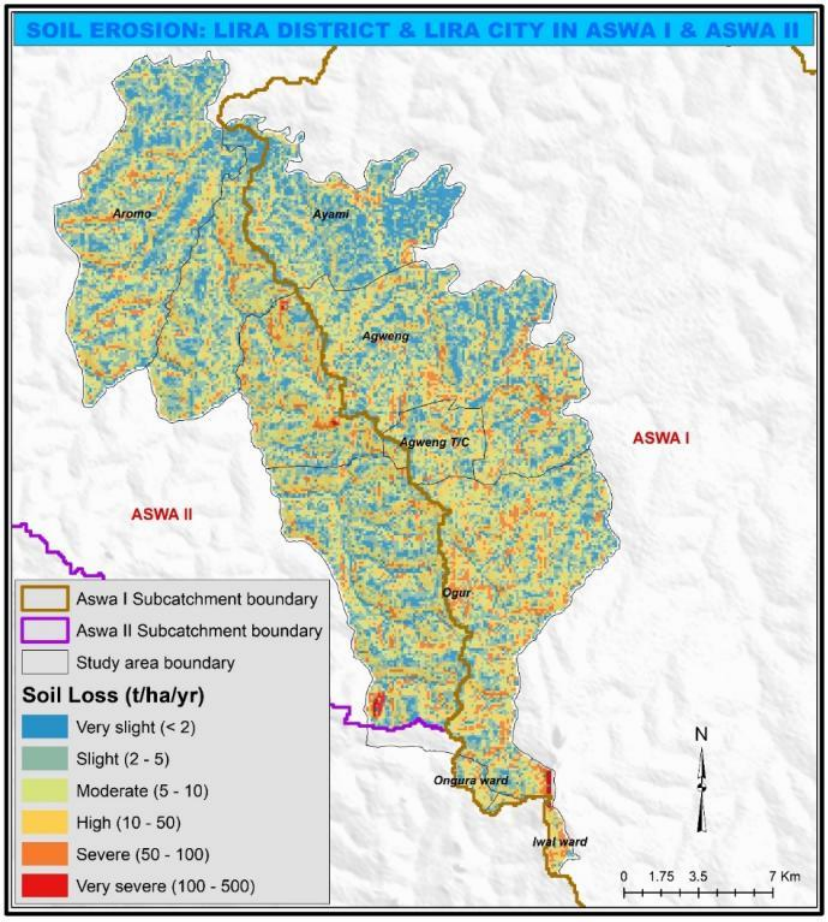


Figure 3-9: Soil erosion risk in Aswa I and Aswa II sub-catchments

Table 3-9: Summary of Key Social- Economic And Environmental Issues in the Aswa 1& 2 Sub-Catchment

Issue	Description of effect and likely effects
Land degradation and soil erosion	Increased human pressure on the land (partially resulting from population growth), weak environmental law enforcement, low level of awareness on environmental degradation and shortage of capacities and resources for monitoring and community-based natural resources management (e.g. for water and rangeland) has led to severe land degradation.

	Some of the activities include; Land use changes, deforestation and overgrazing, uncontrolled bush burning, wetlands, river banks and forest encroachment for cultivation and grazing of livestock, and, overgrazing exceeding carrying capacity of rangelands. This degradation results in higher overland runoff rates and thereby more frequent and intense droughts and floods.
Artisanal mining	Artisanal mining is widely practiced within the Sub-catchment area, with sand and clay being the common minerals. This artisanal mining often has widespread negative socio-environmental impacts. These include the clearance of vegetation for mining activities, increase of silt deposits during the mining process, diversion of waterways to access mineralized deposits on the riverbed. Artisanal miners often use simple tools like picks, shovels, and pans to extract minerals. This process is labor-intensive and involves digging, crushing, and washing the ore to extract the sand. Most artisanal mining activities are informal and not regulated by the government. This means that miners often work without proper safety equipment or environmental safeguards.
Uncontrolled bush burning	Vegetation Loss: Uncontrolled bush burning destroys vegetation cover, which is essential for protecting the soil and maintaining biodiversity. This loss of vegetation can lead to habitat destruction for many species. Soil Erosion: Without vegetation to hold the soil in place, the land becomes more susceptible to erosion by wind and water. This can lead to the loss of fertile topsoil, reducing the land's agricultural productivity and contributing to land degradation.
Soil erosion	Loss of Topsoil: The topsoil layer, which is rich in nutrients, is essential for plant growth. Its loss has reduced soil fertility and agricultural productivity. Sedimentation: Eroded soil particles are carried into rivers and streams, leading to sedimentation. This can clog waterways, reduce water quality, and harm aquatic habitats. Water Quality Degradation: Sediments can carry pollutants such as pesticides and heavy metals into water bodies, contaminating drinking water sources and affecting aquatic life. Increased Flooding: Erosion reduces the soil's ability to absorb water, leading to increased surface runoff and a higher risk of flooding.
Biodiversity	Reduced Resilience: Ecosystems with high biodiversity are generally more resilient to environmental changes. Loss of biodiversity can make watersheds more susceptible to the impacts of climate change and other stressors. Food Web Disruption: The loss of species can disrupt food webs, leading to overpopulation of some species and the decline of others, which can further destabilize the ecosystem. Ecosystem Functioning: Biodiversity is crucial for ecosystem services such as water purification, flood control, and nutrient cycling. Loss of species can disrupt

	these services, leading to poorer water quality and increased vulnerability to natural disasters

3.3. Water resources analysis

3.3.1. Hydrological analysis

The Aswa River is the major river in the Aswa Catchment. It originates from the hills of the north-western part of Katakwi District and flows through Lira District, forming the border between Pader and Gulu Districts. River Aswa has numerous main tributaries that flow into eight primary sub-catchments (Pager Aringa, Pager Kitgum, Aswa I, Aswa II, Aswa III, Agago, Nyimur and Pager Matidi). Specifically, in Aswa I Sub-catchment, there are 33 main tributaries which include Moroto, Adolo, Adungo, Adwari, Ageregere, Ajaki, Akidi, Amusus, Angaro, Apiyo, Apuch, Asudokino, Awelo, Ayago, Baya, Kai, Katabok, Kodokodoi, Obim, Ocet, Ochama, Oderokech, Odite, Ogwada, Okee, Okochiwa, Olim, Omanyanyang, Ongaro, Opot, Pilac, Pilach and Wadet.

In the Aswa II Sub-catchment, there are 14 main tributaries, which include Acake, Achake, Moroto, Agwar, Aleka, Angole, Chome, Laminakwet, Layeye, Odek, Olili, Opokopwac, Opwoo and Orapala. Notably, in the Lira District, six main tributaries form a boundary line between this district and the Pader, Otuke, and Alebtong Districts. These include Achake, Agwar, Aleka, Angole, Moroto and Obim. In Lira City, there are only two main tributaries, which include Ibur and Alunga (**Figure 3-10**). The rivers are the primary water source for domestic use, livestock, irrigation, industries, clay, and sand mining.

Aswa I and Aswa II sub-catchments have two (2) micro-catchments that intersect the target area in Lira District and Lira City, i.e., AS1d and AS1c in Aswa I Sub-catchment and AS2a and AS2b in Aswa II Sub-catchment (**Figure 3-10**).

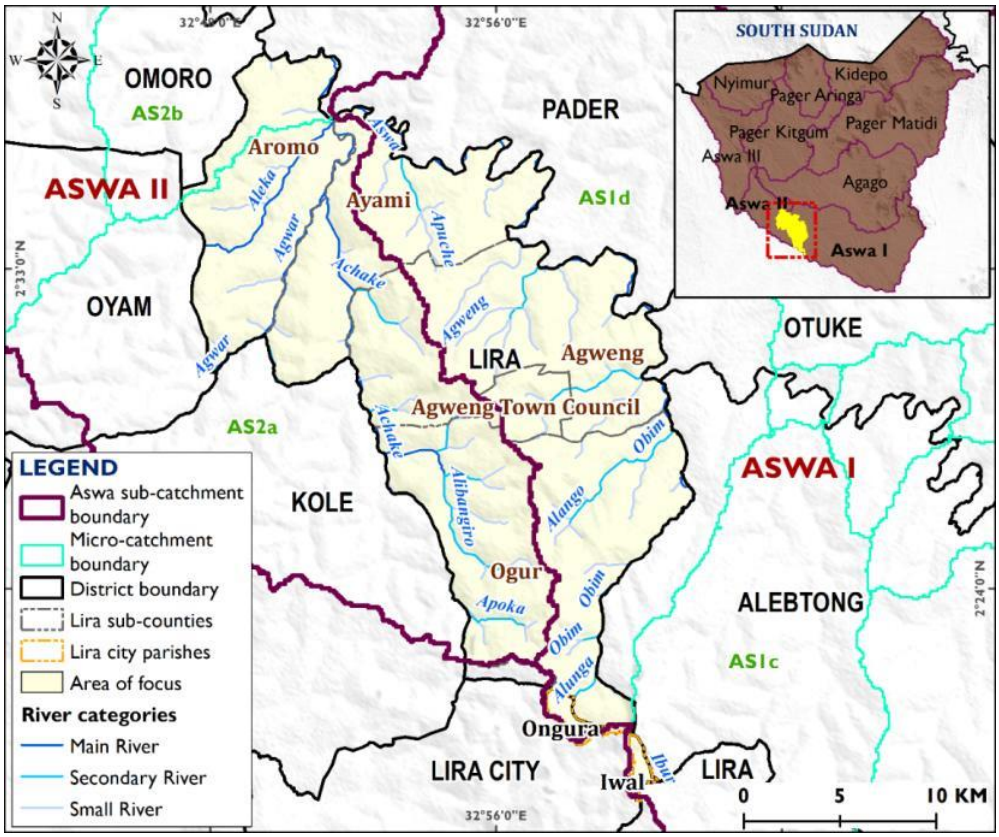


Figure 3-10: Rivers and micro-catchments in the focus area of Aswa I and Aswa II sub-catchments

Between 1997 and 2023, surface water available in Aswa I sub-catchment ranged from 1,672 m_3/year in 2005 to 29,791 m_3/year in 2020, with a mean of 7,688 m_3/year (*Figure 3-11*). On the other hand, surface water available in Aswa II sub-catchment ranged from 10 m_3/year in 2005 to 2,370 m_3/year in 2020, with an average of 678 m_3/year. The groundwater recharge in Aswa I sub-catchment ranged from 51,327 mm H_2O in 2005 to 362,872 mm H_2O in 2020, with a mean of 144,692 mm H_2O. In Aswa II sub-catchment, ground recharge between 1997 and 2023 ranged from 412 mm H_2O in 2005 to 83,036 mm H_2O in 2020, with an average of 28,779 mm H_2O. The comparison of surface and ground water between 1997 and 2023 shows that Aswa I sub-catchment has more surface and ground water than Aswa II sub-catchment (**Figure 3-11**).

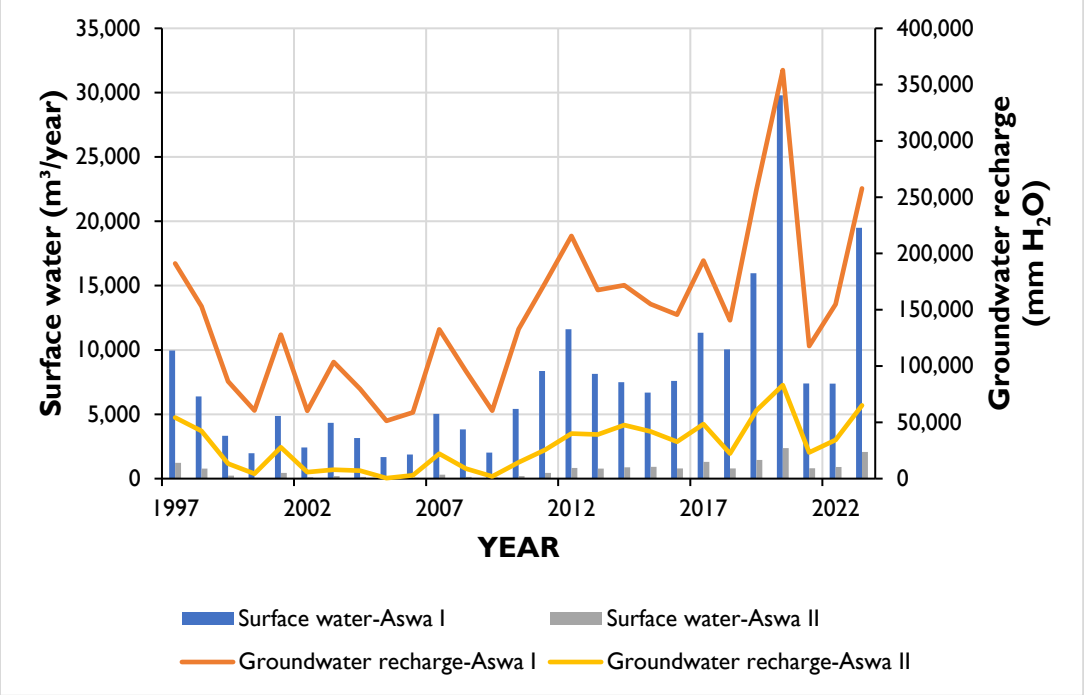


Figure 3-11: Comparison of surface water and groundwater recharge in Aswa I and Aswa II sub-catchments between 1997 and 2023 Source: SWAT modelling

Figure 3-12 and **Figure 3-13** show the monthly average of surface water and groundwater recharge in Aswa I and Aswa II sub-catchments. The results indicate that maximum surface water and groundwater recharge happen in the months of September, October, and November (SON), which is a typical rainy season in Lira City and Lira District.

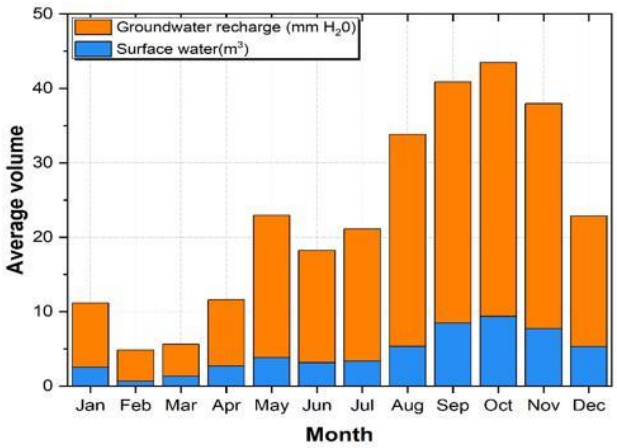


Figure 3-12: Monthly average surface water and groundwater recharge in Aswa I sub-catchment

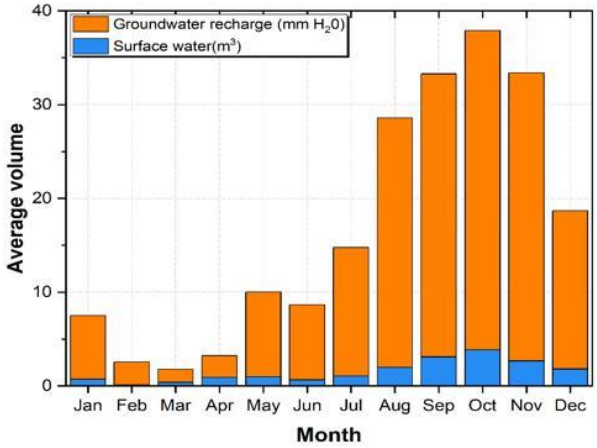


Figure 3-13: Monthly average surface water and groundwater recharge in Aswa II sub-catchment

3.3.2. Water resources and ecosystems

1) Overview

Lira District has 2,215 safe water sources, out of which 971 are protected springs, 639 are boreholes, and 605 are shallow wells[35]. The district also has 42 valley dams and 26 valley tanks for livestock. However, only 30% of the valley tanks and dams are fully utilised by the community members. Water coverage in Lira District is estimated at 64 per cent, and the functionality rate of all the water sources stands at 77.4%[36]. The non-functionality of some water sources in Lira District has been attributed to technical breakdown (30%), water quality issues (17%), vandalism (17%), non-functionality of the water source committee (13%), low yield (9%), alternative nearby areas (9%), and others (5%)[37].

In this assessment, a water sources dataset from the Ministry of Water and Environment (MWE), 2018 to was used to describe the spatial distribution of water sources in Lira City and Lira District. The target area of Lira District in the Aswa I sub-catchment has 48 deep boreholes (26.5%), 67 protected springs (37%), 6 public stand posts (3.3%), 10 rainwater harvest tanks (5.5%), and 50 shallow wells (27.6%) (***Table 3-10***). Most of the water sources in this section of the district are found in Ogur and Agweng sub-counties. The target parishes of Lira City in the Aswa I sub-catchment have 1 deep borehole (10%), 7 protected springs (70%), and 2 shallow wells (20%) (*Table 3-10*). Most of the water sources are located in Ongura Parish. The target area of Lira District in Aswa II sub-catchment has 60 deep boreholes (28.2%), 69 protected springs (32.4%), 9 public stand posts (4.2%), 6 rainwater harvest tanks (2.8%), and 69 shallow wells (32.4%) (***Table 3-10***). In this part of the district, Ogur and Aromo sub-counties have the most significant water sources.

Table 3-10: Distribution of water sources in Aswa I and Aswa II sub-catchments

Sub-catchment	District/city	Sub-county	Parish	Deep boreholes	Protected springs	Public stand posts	Rainwater harvest tanks	Shallow wells	Total
Aswa I	Lira	Agweng		11	14	4	6	16	51
		Agweng Town Council		15	7	2	0	1	25
		Ayami		12	6	0	0	9	27
		Ogur		10	40	0	4	24	78
		Sub-total		**48**	**67**	**6**	**10**	**50**	**181**
	Lira City	Ngetta division	Iwal	1	3	0	0	0	4
		Ngetta division	Ongura	0	4	0	0	2	6
		Sub-total		**1**	**7**	**0**	**0**	**2**	**10**
		Agweng		5	16	**0**	3	7	31

[35] https://liradistrict.com/water-and-sanitation/

[36] Lira district water database

[37] Uganda Water Supply Atlas http://wsdb.mwe.go.ug/index.php/reports/district/45#:~:text=The%20access%20rates%20in%20Lira,years%20and%20are%20considered%20abandoned.

Sub-catchment	District/city	Sub-county	Parish	Deep boreholes	Protected springs	Public stand posts	Rainwater harvest tanks	Shallow wells	Total
Aswa II	Lira	Agweng Town Council		0	1	**0**	0	0	1
		Aromo		20	14	**0**	0	18	52
		Ayami		11	12	**0**	0	20	43
		Ogur		24	26	9	3	24	86
		Sub-total		**60**	**69**	**9**	**6**	**69**	**213**
		Grand Total		**109**	**143**	**15**	**16**	**121**	**404**

Data source: Ministry of Water and Environment (MWE), 2018

The spatial distribution of water sources in Aswa I and Aswa II sub-catchments is presented in ***Figure 3-14***.

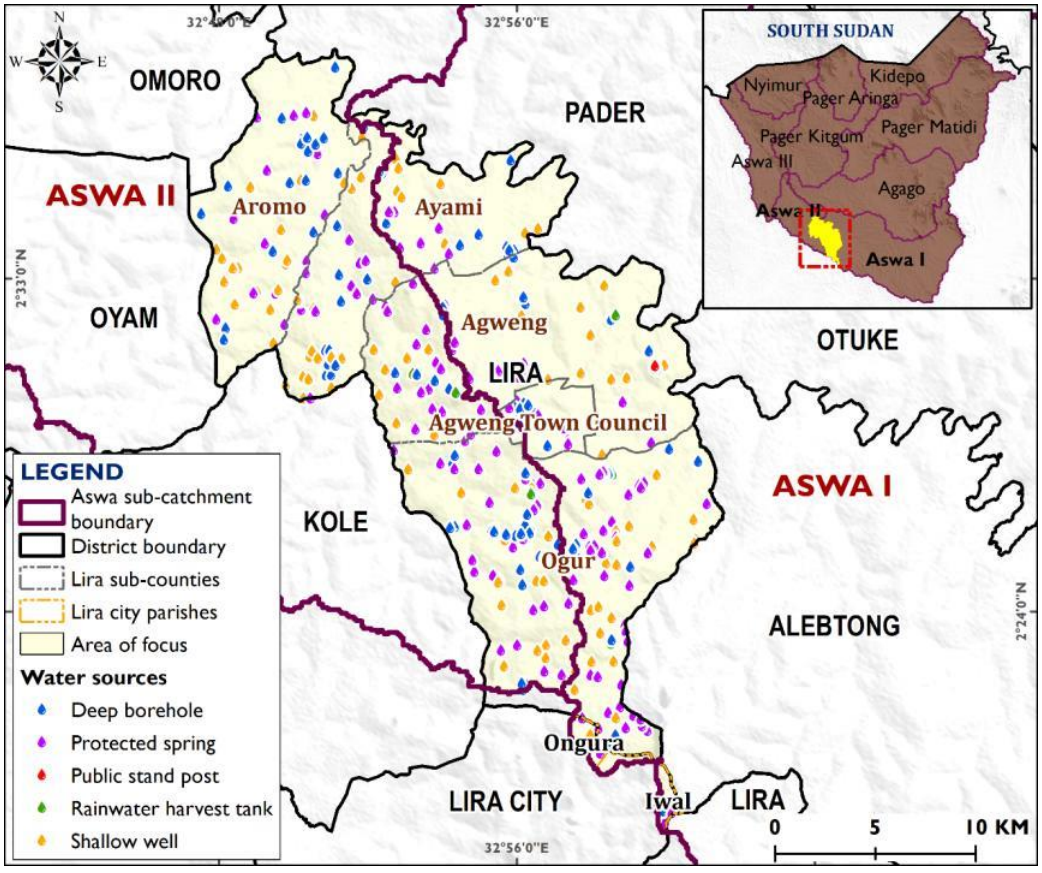


Figure 3-14: Water sources in Aswa I and Aswa II sub-catchments

Data source: Ministry of Water and Environment (MWE), 2018

2) Surface water resources

The primary sources of surface water resources in Aswa I and II sub-catchments are rivers, wetlands and ponds (**Plate 3-2**). Notably, River Aswa is the major river in the Aswa I and II sub-

catchments, which originates from the hills in the north-western part of Katakwi District and flows through Lira District and makes a borderline between Pader and Gulu districts where its two main tributaries, River Agago and River Pager flow into it.[38] However, these water sources are highly sensitive to drought which has rendered them seasonal.

The only available surface water in the Lira District is derived from the Moroto wetland system and the existing network of other temporary (seasonal) and permanent (perennial) wetlands or streams.[39] However, agricultural practices account for the rampant degradation or loss of wetlands as crops are grown in and at the edge of these wetlands (***Plate 3-2***). The crops grown include yams, maize, rice, and sugarcane. In addition, sand mining and livestock grazing take place in the wetlands, as shown (**Plate 3-3, Plate 3-4**). On the other hand, temporary (seasonal) and permanent (perennial) streams experience high sediment loads, reducing the water quality and causing siltation issues. This is mainly due to the crop cultivation and sand mining activities occurring at the edges of the streams.

In Lira City, wetlands have been lost due to urbanization, agricultural expansion, road construction, and the establishment of factories, which have reduced wetland coverage.[40] In some areas, wetlands have been used as waste disposal area because traditionally they are viewed as wasted land. This leads to the loss of aquatic life, flood control capability, and deterioration of water quality in wetlands.

Degraded wetlands in Lira District and City must be restored to provide their hydrological and ecosystem services. Sensitization of the communities about the benefits of wetlands and the risks of their degradation. Effective regulation and proper enforcement of environmental laws to protect wetlands are essential to reduce further degradation and encourage recovery.

[38] MWE, 2016. Aswa Catchment Management Plan.

[39] https://liradistrict.com/environmental-sector/

[40] https://gnna.co.ug/2024/04/lira-city-restores-65-of-its-depleted-wetlands/



Plate 3-2: Okole wetland in Lira city



Plate 3-3: Cultivation in wetlands



Plate 3-4: Temporary (seasonal) Obim streamflow (Left), Sand mining (Center) and crop production at the edges (Right) in Ogur Sub- County, Lira district.

3) Groundwater resources

Groundwater is the primary source of domestic and agricultural uses in Aswa I and II sub-catchments. This is due to high population growth and intensified irrigation; domestic and agricultural water demands are expected to increase. Groundwater responds more slowly to meteorological conditions than surface water, providing a natural buffer against climate change,

such as dry shocks and droughts. Therefore, characterizing groundwater resources provides vital information for proper management to reduce groundwater depletion and related water risks.

Aswa I and II sub-catchments are comprised of Precambrian rocks that are predominantly granulites and gneisses. These have a basement aquifer made of low to moderate productivity (0.5 to 2 L/s) but are noticeably variable. The groundwater storage is less than 1,000 mm. The piezometric levels vary between 1,050 and 2,230 m amsl.[5] Generally, groundwater drains towards the River Aswa and its main tributaries and drains west-to-northwest. The groundwater quality is usually good; however, some areas with high iron concentrations have been reported.[41]

According to Uganda's water supply atlas, the groundwater usage in Lira District stands as: shallow wells (36 %), deep boreholes (33 %), protected springs (30 %) and groundwater public taps (1 %), as shown (Figure 4).[42] On the contrary, most of the population in Lira City is connected to the national grid of National Water and Sewerage Corporation (NWSC). NWSC is Uganda's most significant urban water authority. It is crucial to provide potable water and sewerage services in more than 240 towns, with a customer base of more than 580,000 connections.[43]

In 2020, NWSC contracted a firm to construct a water plant at the Kachung mini-lake in the Agwata sub-county, Dokolo district, to address the increased water demand due to population growth in Lira City from 110,0000 to 256,000 people.[44] The Government of Uganda funded this project through the Ministry of Water and Environment, since the formation of Lira City in 2020, where four administrative units (Lira, Ngetta, Adekokwok and Iwal) have been amalgamated to form Lira City.



Plate 3-5: Groundwater public tap (Left), children pumping water from a borehole (Center) and women collecting water from a protected spring (Right) in Ogur sub-county, Lira district.

[41] MWE (2014). Consolidated Hydrological Year Book for Uganda 1978-2014

[42] Uganda water supply atlas (2024). http://wsdb.mwe.go.ug/index.php/reports/district/45

[43] https://www.nwsc.co.ug/wp-content/uploads/2023/03/Corporate-Plan-2018-2021_compressed.pdf

[44] https://gnna.co.ug/2024/01/sh3b-project-to-address-water-crisis-in-lira-city/

4) Threats to water sources and ecosystems

Environmental

A number of threats were identified for Aswa I and II sub-catchments that concern water for the environment: [1 & 45]

- Degradation of river banks due to uncontrolled livestock access, cultivation of crops and charcoal burning. In Aswa I and Aswa II sub-catchments, most of the sub-counties river banks are experiencing high degradation levels due to the cutting down of the riverine forests for charcoal and clearing of the land for farming. The cultivation of crops along the river banks and streams increases the risk of soil erosion. Therefore, the restoration of river banks needs to be considered a top priority.
- Uncontrolled cattle grazing is causing the collapse of river banks or streams and roadsides. The degradation of riverbanks is mainly due to uncontrolled livestock access to the riverbanks or streams. This is due to repeated trampling of river banks, causing soil erosion and, ultimately, the collapse of the river banks, as shown (**Plate 3-6**) below. In addition, sand mining was another human activity that contributed to the collapse of river banks or streams, as shown in (**Plate 3-6**) below.



Plate 3-6: Collapsing of river banks or streams mainly due to uncontrolled livestock access in Ogur sub-county, Lira district

- Agricultural expansion and cattle grazing leading to wetland degradation. In most areas of Aswa I and Aswa II sub-catchments, wetlands have been opened to cultivate numerous crops such as yams, maize, rice and sugarcanes, as shown in (Figure 2) above. Moreover, the communities adjacent to wetlands have often resorted to cultivating crops during prolonged dry spells due to their fertile soil and moisture. Consequently, this hampers wetlands from their ecological functions due to unstainable wetland utilization practices.

[45] MWE (2020). Integrated Water Management and Development Project (IWMDP). Terms of reference for lot 2: consultancy services for technical supervision of implementation of catchment management measures in Aswa II sub-catchment.

- Forest degradation and deforestation. Aswa I and Aswa II sub-catchments are experiencing rampant forest degradation and deforestation due to human activities such as bush burning, charcoal burning and clearing land for agricultural expansion. The adverse impact of these human activities is vividly demonstrated by the forest/land cover change trends between 2014 and 2024.
- Soil erosion due to poor farming practices. Almost 90% of the communities in the Aswa I and Aswa II sub-catchments are typically dependent on subsistence agriculture, whereby they apply poor farming methods that promote soil erosion. Furthermore, these poor farming methods manifest in a lack of soil and water conservation measures, overgrazing, digging along the slopes, overcrowding of crops and inappropriate application of pesticides. The lack of contour bands leads to uncontrolled surface runoff downward during the rainy season and increased sheet erosion. As a result, soil erosion has washed away the top fertile soil layers, leaving behind sandy soils. Eventually, some soil is washed into the wetlands or streams, leading to sedimentation and siltation, which also contributes to flooding in some areas.
- Water pollution is due to anthropogenic activities such as car washing inside wetlands and rivers, using fertilizers, pesticides, fungicides, insecticides, poor solid waste management, and industrial effluent discharge into wetlands and rivers. This has led to deteriorating water quality, negatively impacting both human and aquatic life. Due to car washing, the water is contaminated with oil, grease, dirt, and heavy metals residue from exhaust fumes and soap, which can harm fish and degrade the water quality, as observed in **Plate 3-7**). The water was black due to oil and grease contamination. Specifically, in Lira, car washing bays have become popular and lucrative among the youth as a source of livelihood due to low start-up requirements.



Plate 3-7: Car washing (Left) and fry observed in the oil and grease contaminated water in Okele wetland, Lira city.

Institutional

Key threats that affect the capacity of institutions to deliver on their mandates were assessed and include: [1 & 5]

- Understaffing at the Upper Nile Water Management Zone (UNWMZ) and district level.
- Poor institutional set-up and coordination. Typically, the structural setup determines how well-established and ready an institution is to deliver on its mandate. However, not all the required institutional arrangements are yet in place to effectively develop and manage

water resources, mainly at the WMZ level. Moreover, the stakeholder forums and the Catchment Management Committees (CMCs) do not yet exist for several catchments and sub-catchments.[5]

- Lack of enforcement of policies, laws and guidelines concerning water management
- The Ministry of Water and Environment (MWE) continues to license groundwater abstraction, yet the district perceives this could be excessive and damage the groundwater resources.
- Water and environment committees formed with local people shall not operate based on monetary compensation (as given by institutional bodies and NGOs) because this creates a wrong attitude
- Local officials contribute to degradation by accepting the illegal sale of land parcels within designated wetlands.
- Limited funding to critical departments such as the district environment and natural resources. This renders the departments non-functional.
- Lack of a harmonized integrated monitoring and evaluation strategy to help record information across all water and the environment sectors.

3.3.3. Water availability and balance

Water is vital and it is necessary to understand and quantify water availability using physical measurements and hydrological models with reliable data. This study assessed water resource availability using the SWAT model for surface water and groundwater resources in the Aswa I and II sub-catchments.

1) Surface water availability

Surface water availability is imperative to deciding water resource allocation as water resource management is becoming a crucial issue in the Aswa I and Aswa II sub-catchments. According to the intra-annual streamflow results, in the Aswa I Sub-catchment, the highest streamflow was recorded in October with a flow of 9.37 m^3/s, and the lowest stream flow was recorded in February with a flow of 0.68 m^3/s.

In the Aswa II Sub-catchment, the highest streamflow was recorded in October with a flow of 3.87 m^3/s, and the lowest stream flow was recorded in February with a flow of 0.12 m^3/s, as shown in (**Figure 3-15**). This result reveals that sub-catchments experience floods and high-water availability in the second rainy season (September-November); therefore, there is a need to increase storage capabilities able to meet the demands in the dry seasons (December to February).

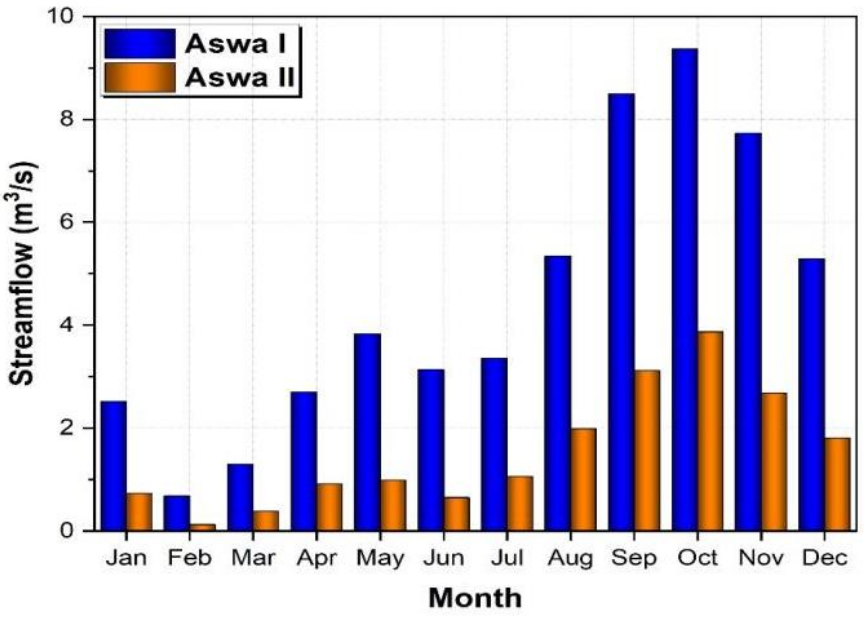


Figure 3-15: Intra-annual stream flow of River Aswa and its main tributaries in Aswa I and Aswa II sub-catchments from 1997 to 2023.

2) Groundwater availability

Groundwater represents an essential resource that augments surface water resources in addressing the water supply needs of people and the ecosystem. Both Aswa I and Aswa II sub-catchments lie in a semi-arid environment with erratic rainfall patterns; groundwater resources are often the preferred water source because of consistent supply in either the dry season or wet. Hence, this causes enormous pressure on the resource, diminishing groundwater resources in the area.

This will likely be exacerbated by climate change, population growth, and land use changes. Therefore, assessing groundwater availability in Aswa I and Aswa II sub-catchments is imperative for better resource planning and allocation.

Noticeably, in the Aswa I sub-catchment, groundwater has increased gradually during the 1997-2023 period. From 1997 to 2023, the annual groundwater recharge increased by 8.5 mm (34.9 %), as shown in (**Figure 3-16**). This increase could be associated with the restoration of 65% of degraded wetlands in Lira City and the Lira district.46 These wetlands help recharge groundwater. Similarly, in the Aswa II sub-catchment, annual groundwater recharge increased by 5.7 mm (20%), as indicated in **Figure 3-17**). In both Aswa I and II sub-catchments, groundwater is often the most preferred source of water due to its reliability and sustainability.

[46]https://gnna.co.ug/2024/04/lira-city-restores-65-of-its-depleted-wetlands/#:~:text=Leonard%20Otika%2C%20Lira%20City%20Environmental,the%20Environmental%20Police%20Protection%20Unit.

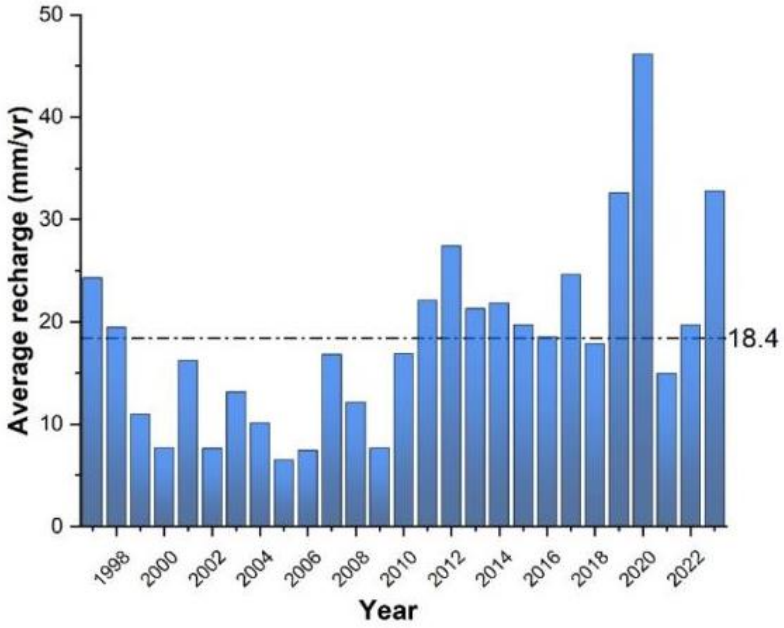


Figure 3-16: Inter-annual average groundwater recharge rate in Aswa I sub-catchment (1997-2023).

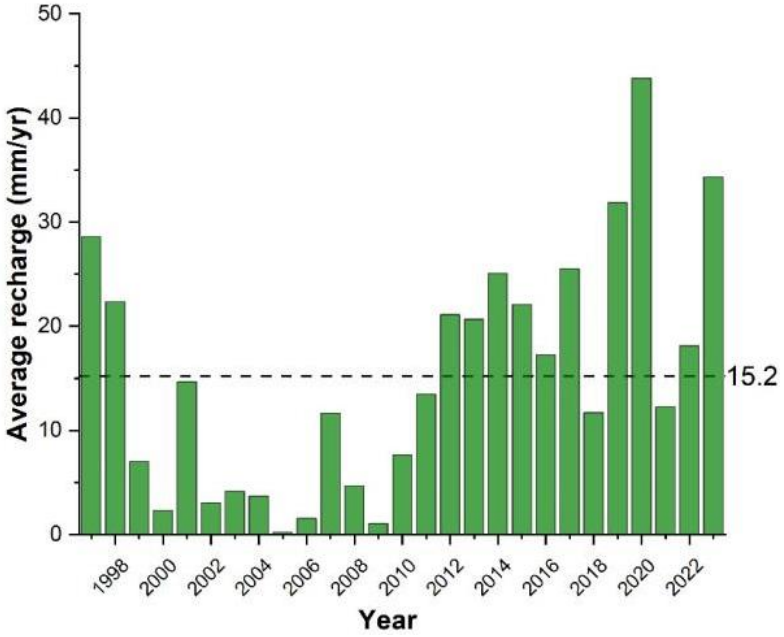


Figure 3-17:Inter-annual average groundwater recharge rate in Aswa II sub-catchment (1997-2023).

3) Water balance

Water balance refers to the distribution of water within a watershed, considering factors such as precipitation, evaporation, runoff, infiltration, groundwater recharge, and plant transpiration[47]. The water balance modelling conducted by the Ministry of Water and Environment in 2015 indicated

that the net precipitation and baseflow in Aswa I and Aswa II sub-catchments will decrease between 2015 and 2040 (**Table 3-11**). The actual evapotranspiration in Aswa I and Aswa II sub-catchments is expected to increase during the same period of assessment (***Table 3-11***). The water balance issues in the sub-catchment can be attributed to climate change and variability, population growth, agricultural expansion, deforestation, and land use/cover changes[48]. The water imbalance in the sub-catchments has resulted into water shortages especially in the dry season which has affected domestic, industrial, and agricultural water supply[49].

Table 3-11: Water balance in Aswa I and Aswa II sub-catchments

Water balance components	Year	Aswa I	Aswa II
Precipitation (mm)	2015	1,283	1,397
	2030	1,283	1,397
	2040	1,283	1,397
Actual Evapotranspiration (mm)	2015	1,183	1,186
	2030	1,201	1,212
	2040	1,208	1,222
Net Precipitation (mm)	2015	100	211
	2030	81	185
	2040	74	175
Baseflow (mm)	2015	30	74
	2030	24	65
	2040	22	61

Data source: Aswa Catchment Management Plan

3.3.4. Water access and demand

1) Water access

Access to safe water goes by the ratio of people served by a safe water point and piped water supply to the total population. Access to safe water in Lira District is estimated to be around 94%[50].

[50] Uganda water supply atlas. http://wsdb.mwe.go.ug/index.php/reports/district/45#:~:text=The%20access%20rates%20in%20Lira,years%20and%20are%20considered%20abandoned.

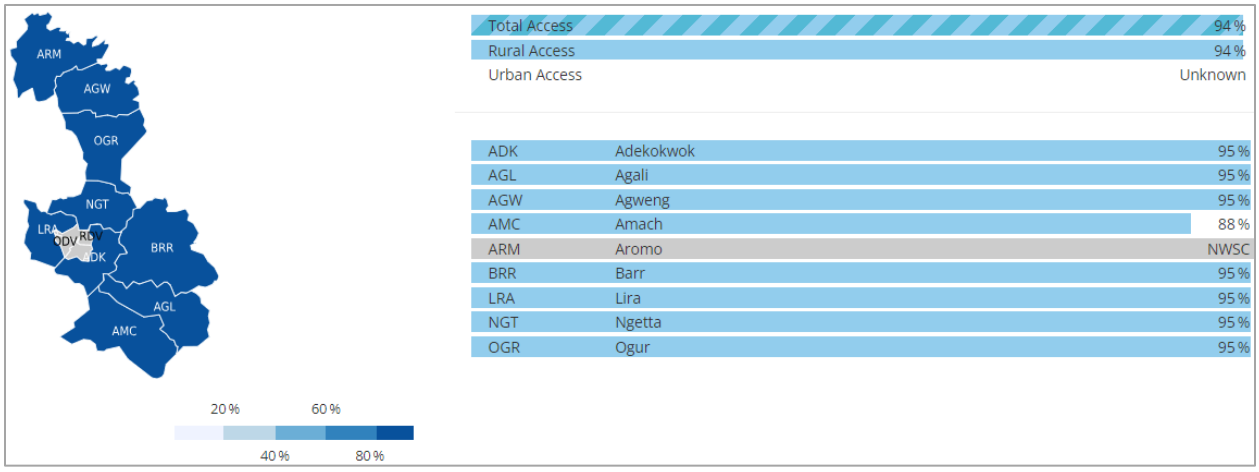


Figure 3-18: Access to safe water in Lira city and Lira district Source: Uganda Water Supply Atlas, 2024

The 2014 census indicated that 81.8% of the households in the Lira District had access to drinking water from improved sources. Ogur sub-county (86.9%) had the most significant number of households with access to safe drinking water. On the other hand, Aromo sub-county (21%) had the most considerable percentage of households with access to drinking water from an unsafe source (Figure 3-19).

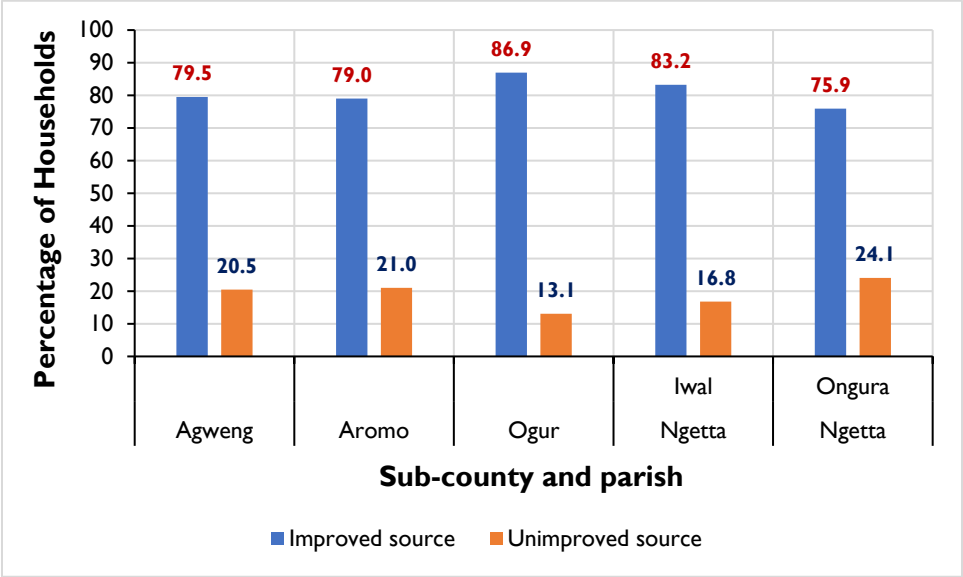


Figure 3-19: Access to improved and unimproved sources of drinking water in Lira district in 2014

Data source: UBOS Census, 2014

2) Water demand

Water demand refers to the amount of water required or desired by individuals, communities, industries, or ecosystems for various purposes.[51]. The water in Aswa I and Aswa II sub-catchments

[51] House-Peters, L. A., & Chang, H. (2011). Urban water demand modeling: Review of concepts, methods, and organizing principles. Water Resources Research, 47(5).

is used for domestic supply, environmental flow, industrial, crop and livestock production[52]. The environmental flow in Aswa I sub-catchment was estimated at 3% and 0.4% during the dry and wet semesters respectively[53]. On the other hand, the environmental flows in Aswa II sub-catchment range from 5% during the dry semester to 0.9% during the wet semester.

The ratio of water availability to water demand in Aswa catchment ranges between 42.9 in a mean hydrological year and 19.8 in a drought hydrological year[54]. The Ministry of Water and Environment defines the average/ year as the hydrological year with total rainfall closest to the annual mean[55]. Wet and dry years are hydrological years with maximum and minimum total rainfall, respectively. The water resources analysis indicate that Aswa catchment has sufficient water to meet the current demand. However, due to climate change, the water resources in Aswa catchment are projected to decrease by 356 MCM/Yr (17.3%) in 2030 and 490 MCM/Yr (23.8%) in 2040, amidst the increasing water demand (***Table 3-12***). Therefore, groundwater extraction should be increased to supplement surface water supplies, systems that recycle wastewater for non-potable uses should be implemented, communities should harvest and store rainwater from roofs and other surfaces, use efficient irrigation technologies to minimise water waste, optimize the operation of reservoirs to store more water during wet periods for use during dry periods, encourage the cultivation of drought-resistant crops or crops that require less water, and restore and preserve wetlands, which can act as natural water storage and filtration systems.

Table 3-12: Comparison of water availability and demand in Aswa catchment

Scenario	Resource (MCM/Yr)		Gross demand (MCM/Yr)			Net demand (MCM/Yr		
	Overall	Ground water recharge	from Surface water	from Ground water	Total	from Surface water	from Ground water	Total
Mean hydrological year	2,060	1,351	47	5.5	53	44	4	48
Drought hydrological year	1,012	678	51	5.5	56	47	4	51
Mean hydrological year - climate change 2030	1,704	1,124	1,299	21	1,320	503	15.2	518
Mean hydrological year - climate change 2040	1,570	1,037	1,958	44.7	2,002	903	32.6	935

Source: Aswa Catchment Management Plan

The water demand for people is highest in Aswa I Sub-catchment (specifically in ASIb and ASIc micro-catchments) (***Figure 3-20***). It is important to note that the focus areas in Lira City and Lira District have ASId, ASIc, AS2a, and AS2b. The primary supply of water in both Aswa I and Aswa II sub-catchments is groundwater (***Figure 3-20***).

[52] Aswa catchment management plan.

[53] Water Resources Development and Management Strategy and Action Plan. Ministry of Water and Environment (MWE), Directorate of Water Resources Management, Upper Nile Water Management Zone (UNWMZ). https://www.mwe.go.ug/sites/default/files/library/UNWMZ%20Strategy%20&%20Action%20Plan.pdf

[54] Revised Aswa Catchment Management Plan, 2020. https://www.mwe.go.ug/sites/default/files/library/ASWA%20CATCHMENT%20MANAGEMENT%20PLAN-REVISED%20VERSION%202020_0.pdf

[55] https://www.mwe.go.ug/sites/default/files/library/04_Chap%203%20Met-Hyd.pdf

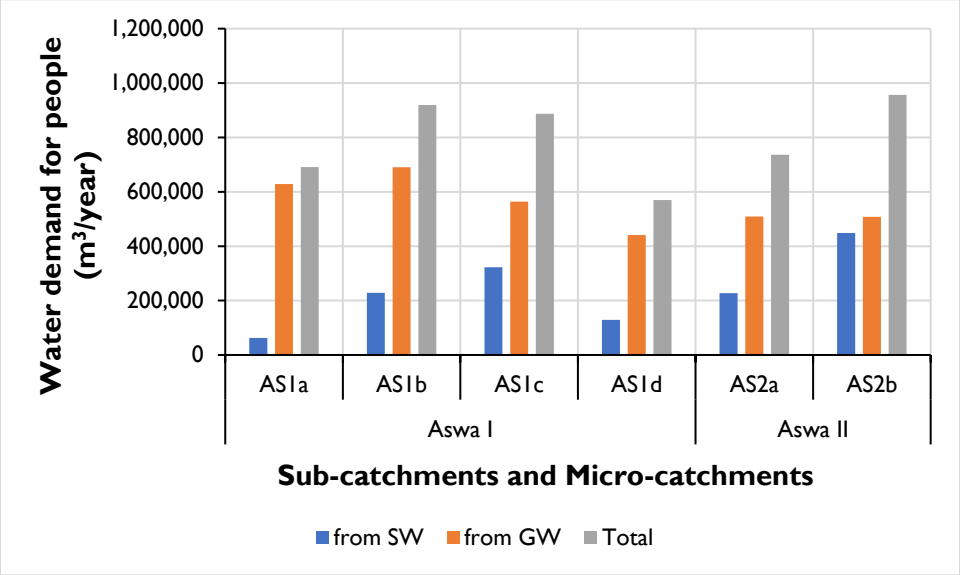


Figure 3-20: Water demand for people in Aswa I and Aswa II sub-catchments in 2023

The water demand for production activities is highest in Aswa I sub-catchments (specifically in ASIa and ASIb micro-catchments) (***Figure 3-21***). It is worth noting that the focus areas in Lira city and Lira district have ASId, ASIc, AS2a, and AS2b. In most micro-catchments, water for production is highly needed for crop irrigation; however, in ASIc and AS2b micro-catchments, livestock production has a higher water demand. There is a minimal water demand for water for production in industries and fisheries (***Figure 3-21***). In both Aswa I and Aswa II, surface water is the primary water supply for production.

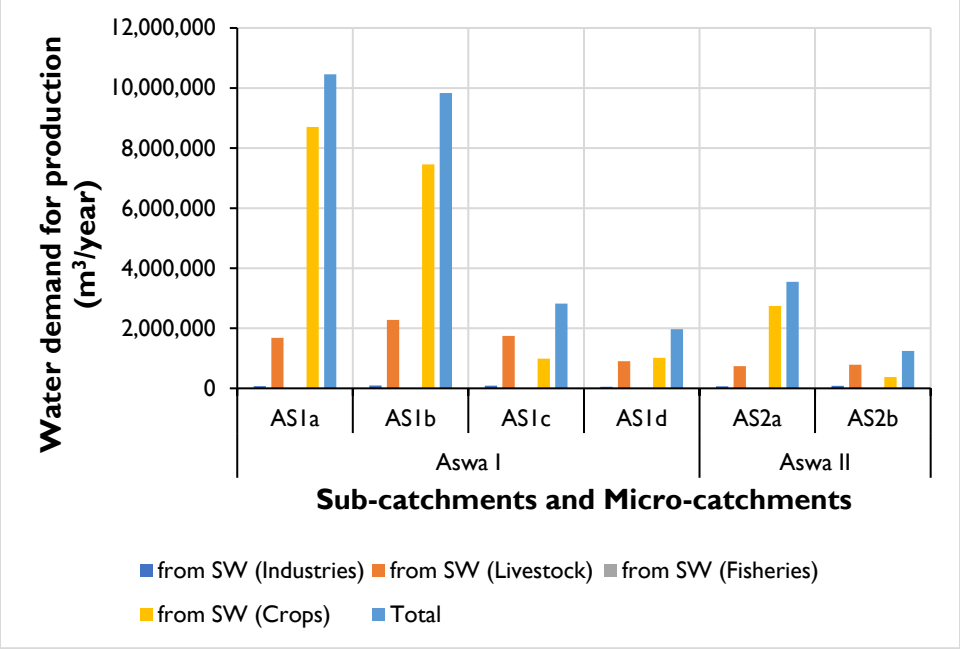


Figure 3-21: Water demand for production in Aswa I and Aswa II sub-catchments in 2023

Data source: Aswa Catchment Management Plan

3) Threats to future water access

The threats to water supply and demand highlighted in the Aswa catchment management plan include population growth, climate change, deforestation, wetland degradation, land use/cover changes, and urbanization. The area also experiences a high rate of evapotranspiration, which has significant implications for runoff, groundwater recharge, and dry season flows.

- Population growth: Between 2014 and 2024, the population in both Lira city and Lira district has increased by 87,649 people (19.9%)[56]. Population growth increases the water demand for domestic purposes. A growing population will increase water demand through intense irrigated agricultural practices needed to meet rising food demands.
- Land use/cover changes: Changes in land use/cover, mostly driven by population growth, also significantly impact water supply and hydrological processes through increased surface run-off, reduced groundwater recharge and baseflows in rivers, reduced water quality, and changes in streamflow patterns.
- Climate change: Climate change profoundly affects water supply systems, primarily through alterations in precipitation patterns, temperature regimes, and the frequency of extreme weather events such as drought.
- Deforestation: Most of the forests in Aswa I and Aswa II sub-catchments are encroached with farmlands and settlements. Deforestation can significantly impact water supply and hydrological cycles through reduced infiltration and groundwater recharge, increased surface runoff, and changes in streamflow patterns.
- Wetland degradation: About 57% of the wetlands in the target area of Aswa I and Aswa II sub-catchments are degraded. Wetland degradation can significantly impact water supply and the overall hydrological cycle through reduced water storage and availability during drought, poorer water quality, and reduced groundwater recharge.
- Urbanization: Urbanization, its subsequent surge in population, and the operationalization of Lira City in July 2020 also have implications for water supply and demand in the catchment. Urbanization increases the water demand for domestic, agricultural, and industrial purposes. The population may also affect resources such as wetlands and forests, impacting the water supply.

The challenges to water supply and demand in the Aswa I and Aswa II sub-catchments, are:

- Financial constraints: Implementing agencies such as the UNWMZ, Lira district local government, and Lira city council have limited financial resources to construct water infrastructure, desilt valley dams and tanks, and monitor water quality, hydrometeorology, and the groundwater network.
- Inadequate data: Limited, accurate data exist on water balance components (such as evapotranspiration, precipitation, and baseflow) for decision-making, planning, and policy development.
- Weak enforcement and compliance: Environmental and WRM regulations are reported to be weak, and there is limited compliance with existing standards. Operationalization of IWRM at the UNWMZ and the sub-catchments is also frail.

[56] Uganda Bureau of Statistics (UBOS), 2024

- Limited awareness of communities: Communities have low awareness about natural resource management. This has led to the degradation of riverbanks, wetlands, and forests, causing reduced water supply within the sub-catchments.

3.3.5. Water quality

According to the National Water and Sewerage Corporation (NWSC, 2024), water quality refers to water's physical, chemical, biological and radiological characteristics relative to the intended use. Water quality is often measured against specific World Health Organization guidelines and national standards. These stipulated guidelines provide a framework for defining safe drinking water from which individuals can make informed decisions.[57]

The water quality of water resources is mainly determined by natural factors and anthropogenic activities. The general information about water quality and pollution sources is reported in the National Water Resources Assessment (NWRA).[10] Based on various sources, pollutant loads were estimated, for instance, for households, livestock, industries, aquaculture, livestock, and land runoff. In Uganda, the economy is predominantly agricultural, so organic matter and nutrients are the key pollutants in the aquatic environment. Hence, the pollutant is considered to be primarily organic matter, which is measured through total nitrogen (TN), total phosphorous (TP), and biological oxygen demand (BOD).[1]

The parameters used to estimate nitrogen and phosphorus loads contained in the National Water Resources Assessment (NWRA) were the bedrock for the analysis. UBOS (2014) population census data was used to update estimations, and future scenarios were generated based on future population estimations and future water demand. The primary organic and nutrient pollution sources from anthropogenic activities include agriculture and livestock, human settlements, aquaculture, and industrial areas.

The results for the three scenarios, 2015 (baseline), 2030, and 2040, for the different sub-catchments, including Aswa I (AS1) and II (AS3) Table 1. BOD loads at source in t/year for each sub-catchment in 2015 (baseline), 2030, and 2040 (Figure 7). Total Nitrogen loads at source in t/year for each sub-catchment in 2015 (baseline), 2030, and 2040 (**Figure 3-22)**. Total Phosphorous loads at source in t/year for each sub-catchment in 2015 (current), 2030, and 2040 (**Figure 3-23**).[10] The results indicate that BOD, Total Nitrogen, and Total phosphorus loads will increase in the future (2030 and 2040) relative to the baseline (2015) in both Aswa I and II sub-catchments.

Table 3-13: Description of Name subC. ID as applied herein

Catchment	Sub-Catchment Name	Name SubC. ID
Albert Nile	Pakwach	AN1
	Panyango	AN2
	Ome	AN3
	Ora	AN4
	AN_up_Enyau	AN5
	Enyau	AN6
	AN_up_Kochi	AN7

[57] https://www.nwsc.co.ug/water-quality/

	Kochi	AN8
	Laropi	AN9
	Ayugi	AN10
	Unyama	AN11
Aswa	Aswa I	AS1
	Agago	AS2
	Aswa II	AS3
	Pager Matidi	AS4
	Pager Aringa	AS5
	Pager Kitgum	AS6
	Aswa III	AS7
	Nyimur	AS8
Kidepo	Kidepo	KI1

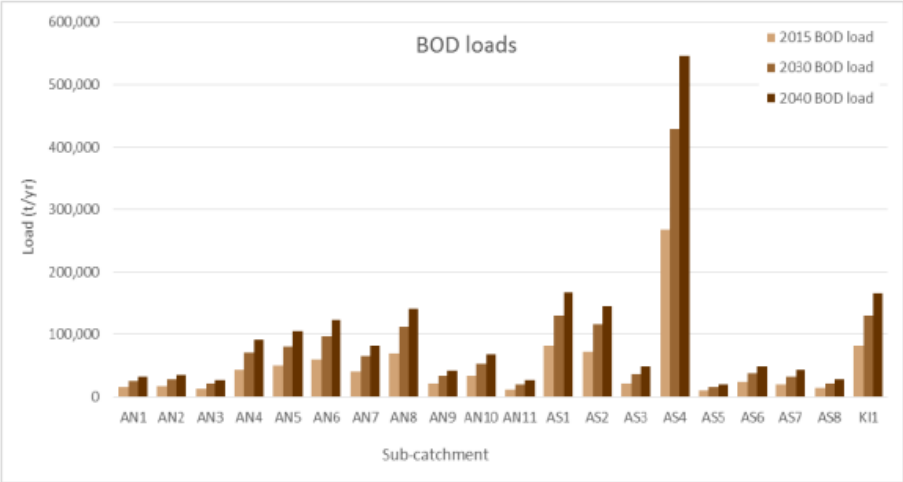


Figure 3-22: BOD loads at source in t/year for each sub-catchment in 2015, 2030 and 2040.

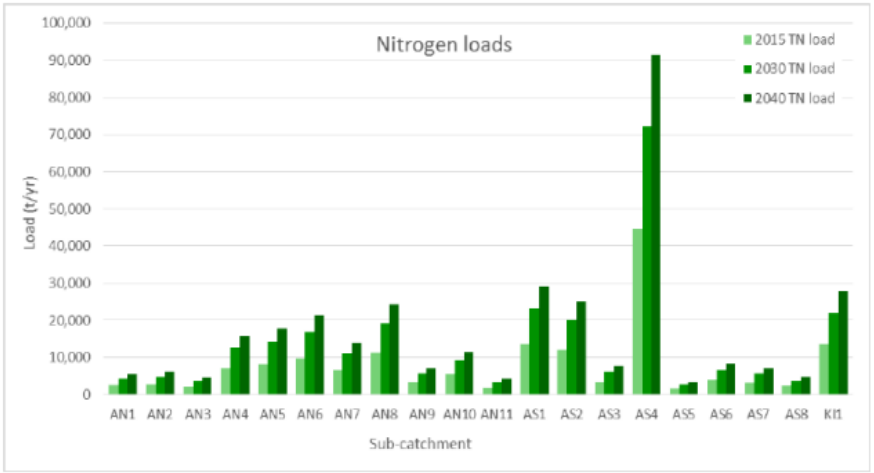


Figure 3-23: Total Nitrogen loads at source in t/year for each sub-catchment in 2015, 2030 and 2040.

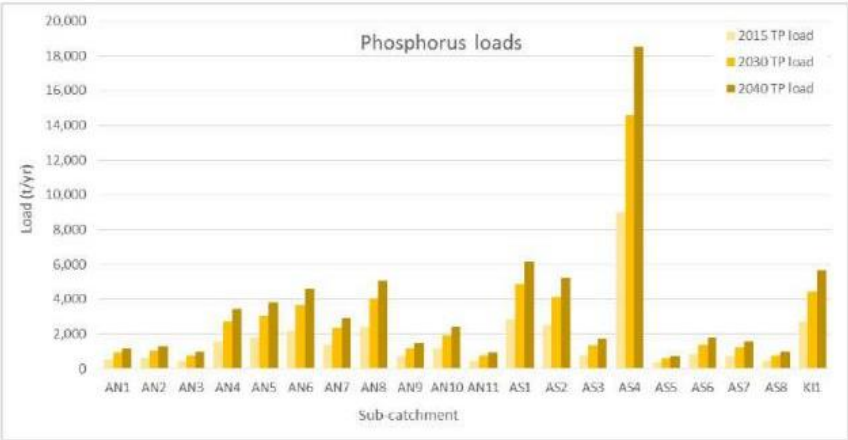


Figure 3-24: Total Phosphorous loads at source in t/year for each sub-catchment in 2015, 2030 and 2040.

In Lira District, water pollution is mainly attributed to anthropogenic activities such as sand mining and agriculture, which have increased wetland degradation, soil erosion and sediment loads in water. Subsequently, these activities have reduced the water quality, significantly affecting physical and chemical water parameters. Whereas, in Lira City, water pollution is from a variety of sources such as mobile sources (e.g. cars/trucks), industrial discharges (e.g. heavy metals, chemical oxygen demand, total nitrogen, total suspended solids, biological oxygen demand and total phosphorous), residential/commercial wastewater, trash, solid wastes and polluted stormwater runoff from upstream areas (**Plate 3-8**).

Despite increasing pollution of water sources, there is no water quality monitoring network in the Aswa I and Aswa II sub-catchments. The existing national water quality monitoring network of the Directorate of Water Resources Management (DWRM) has only one station for monitoring surface water resources in the Upper Nile Water Management Zone (UNWMZ), coded SWR017 (Upper Aswa). [10] Therefore, there is a need to establish more stations for monitoring both surface water and groundwater resources, specifically in the Aswa I and Aswa II sub-catchments.



Plate 3-8: Factory (Top-left), residential/commercial wastewater disposal site (Top-right), Aler compost plant for solid wastes (Bottom-left) and car/truck washing in Okole wetland (Bottom-right), Lira city

3.3.6. Challenges for water resources management

The challenges have been grouped three strategic areas, namely: Water for People, Water for Production, and Water for the Environment. The most critical sub-catchment challenges have been pointed out between Aswa I and Aswa sub-catchment.[5]

1) **Water for people**

- **Water insecurity:** Whenever the water demand exceeds available resources, conflicts arise among different users, causing severe water insecurity within Aswa I and II sub-catchments. This situation could be exacerbated due to the increase of extreme climatic events such as droughts.

- **Insufficient water storage:** Water storage will be crucial in Aswa I and II sub-catchments, whereby in 2040, the dry season projections of water demand will be much higher than those of available water resources. This implies that, even if there is no deficit annually, water shortages can occur during the dry season due to the various monthly hydrological conditions. Storage is critical to keep water during the wet season when it is abundant for use in the dry season. Notably, the lack of water storage is highly critical in Aswa I and II sub-catchments.
- **Inadequate water supply and irrigation infrastructure:** The limited water supply infrastructure has been considered critical in Aswa I and II sub-catchments where water supply access is low. Regarding the irrigation infrastructure, only one large irrigation scheme is being implemented in the entire Upper Nile Water Management Zone in Lamwo District.
- **Inadequate water supply infrastructure and services:** The lack of adequate water supply infrastructure has been assessed according to access to water supply in rural and urban areas. Eventually, the most critical area is the Aswa I sub-catchment, where the population density is high compared to the Aswa II sub-catchment.
- **Inadequate wastewater and sludge management**: This concerns inadequate sanitation facilities and areas with insufficient sludge management systems such as storage, collection, transportation, treatment, and disposal. The most critical area is the Aswa II sub-catchment compared to the Aswa I sub-catchment.

2) Water for Production

- **Pollution loads:** Pollution loads have been considered significant depending on the estimated potential pollution loads based on human activities in the Aswa I and II sub-catchments. The most critical area is the Aswa I sub-catchment compared to the Aswa II sub-catchment.

3) Water for Environment

- **Land degradation and erosion.** Land erosion risk is much higher in the Aswa I Sub-catchment than in the Aswa II sub-catchment.
- **Climate change and extreme climate events.** For Aswa I and II sub-catchments, extreme climate events experienced include flooding during wet periods and droughts during low rainfall periods.
- **Vulnerability to drought risk.** During drought, the general water resources decrease by 55% in the Aswa River basin. This reduction is much higher in the sub-catchments, where resource availability is lower in the mean year. This includes sub-catchments in the Aswa I and II.
- **Vulnerability to flood risk.** The flood events are higher in the Aswa I sub-catchment than in the Aswa II sub-catchment. This is mainly due to river bank overflow in the Aswa-Moroto River and main roads in lowland areas, mainly in the Alebtong District.
- **Pressure on water dependent ecosystems**. Pressure on water-dependent ecosystems has been considered critical due to the presence of potentially sensitive ecosystems. Different factors have been considered, including forest and rangeland areas, extension of wetlands, protected areas, wetland and forest management plans, and population density. High

population density and developed anthropogenic activities escalate pressure on ecosystems. This issue is more evident in the Aswa II sub-catchment than in the Aswa I sub-catchment.

3.3.7. Stakeholder Inventory

Below and in Table 3-14 **Error! Reference source not found.Error! Reference source not found.** are the primary, secondary and tertiary stakeholders in water resources management in the Aswa I and II sub-catchments:

1. **Primary stakeholders:** These are the stakeholders the project is likely to affect either positively or negatively. They include the local community (individuals such as farmers, sand miners, brick makers, charcoal producers, households and community-based organisations/groups, among others) and local government authorities: the sub-counties (Ogur, Ayami, Aromo, Agweng and Agweng Town Council in Lira District and East Division in Lira City), Lira District Local Government, Lira City Council. These stakeholders have low power but a high interest in water resources management.
2. **Secondary stakeholders:** These stakeholders are mandated to manage water resources; they are duty bearers with high to moderate power, particularly the Ministry of Water and Environment (MWE) represented by the UNWMZ, Aswa CMC, and the Ministry of Local Government.
3. **Tertiary stakeholders:** The tertiary stakeholders include the media (local radio stations and national radio/TV stations) and international or development partners in the study area.

Table 3-14: Primary, secondary and tertiary stakeholders for the Aswa 1 & 2 sub-catchments

Stakeholder	Power	Interest	Influence	Constraints	Opportunities/ Remarks
PRIMARY STAKEHOLDERS					
Citizens (including farmers, sand miners, brick makers, charcoal makers)	Low	High	Low		
Sub-county local governments	Low	High	Low	They lack the capacity to enforce the law and have no funds to undertake activities	Can mobilise in big numbers to stop encroachment.
Town Council	Low	Moderate	Low	They lack the capacity to enforce the law and have no funds to undertake activities.	Can mobilise in big numbers to stop encroachment.
Lira City Council	High	Moderate	High	Limited resources and limited coordination among actors.	The City Council has technical expertise and can mobilise in large numbers to stop encroachment.
Lira DLG	High	Moderate	High	Limited resources and limited coordination among actors.	The District Local Government has technical expertise and can mobilise in large numbers to stop encroachment.
SECONDARY STAKEHOLDERS					
NFA	Low	High	Low	Limited funding	The authority has CFRs within the study area: Ayami CFR, Ogur CFR, and Olia CFR
NEMA	High	High	High	Limited resources and limited coordination among actors.	The agency has technical expertise.
MAAIF	Low	High	Low	Limited resources	MAAIF is interested in increasing food security within the area
MoLG	Low	Low	Low	limited coordination among actors	MoLG, through the DLG and City Council, has structures with the technical expertise
MWE	High	High	High	Limited resources and limited coordination among actors.	The agency has technical expertise.

Stakeholder	Power	Interest	Influence	Constraints	Opportunities/ Remarks
UBOS	Low	Low	Low	No resources allocated towards water resources management	Mandated to coordinate, monitor and supervise Uganda's National Statistical System
UNWMZ	High	High	High	Limited resources and limited coordination among actors.	The agency has technical expertise.
RWRC-1	Low	High	Low	Limited resources	Mandated to extend water to rural areas, including part of the study area
Northern Umbrella Authority	Low	Low	Low	Limited capacity and resources	Mandated to operate water supply systems in rural areas, including part of the study area.
WSDF-N	Low	High	Low	Limited capacity and resources	Mandated to design and construct water supply systems in rural areas, including part of the study area
Land and Equity Movement in Uganda (LEMU)	High	Low	High	Limited resources for water resource management	Can support the implementation of some of the livelihood interventions
FAPAD (Facilitation for Peace and Development).	High	High	High	Limited resources for water resource management	Can support the implementation of some of the livelihood interventions
TERTIARY STAKEHOLDERS: INTERNATIONAL AND NATIONAL NON-GOVERNMENTAL ORGANIZATIONS					
UNHCR	Low	High	Moderate		Has the technical expertise and resources
IUCN	Low	High	Moderate		Has the technical expertise
World Bank Group	Low	High	Moderate	The capacity to allocate resources towards water management interventions	Has the technical expertise and resources
DANIDA	Low	High	Moderate	The capacity to allocate resources towards water management interventions	Has the technical expertise and resources
Austrian Development Cooperation	Low	High	Moderate	The capacity to allocate resources towards water management interventions	Has the technical expertise and resources

3.4. Socio-economic analysis

This section presents the findings from the literature review, in-field observations, household interviews, and stakeholder consultations through Key Informant Interviews, Focus Group Discussions, and workshops.

3.4.1. Demography

The Projected Lira District Population (Mid-year 2020) from the 2014 National Population and Housing Census (NPHC) is 474,200, of which 228,400 (48%) are male and 245,800 (52%) are female. This conforms to the country situation where there are more females than males. Most of the district population (356,507), representing 76%, live in rural areas, and the other population (117,692), representing 24%, are urban dwellers. The population density was 307 persons per square kilometer of land in 2014. Lira and Lira City combined have an average household size of 4.5, while the population growth rate between 2002 and 2012 was 2.88 (National Population and Housing Census 2014). Settlements are scattered with concentrations around productive agricultural areas, trading centers, and water sources (UNDP, 2014b; UNDP, 2014c). Regionally important hubs include Lira City and Agweng Town Council. Major roads connect Lira to Kitgum, Agago and Alebtong districts.

Table 3-15: Projected population in the study area of Aswa I and II

Sub-county	2015	2021	2030	2035	2040	2045
Agweng	24,100	28,300	34,500	39,995	46,365	53,750
Agweng- Town Council	5,100	6,000	7,300	8,463	9,811	11,373
Aromo	16,200	19,000	23,100	26,779	31,044	35,989
Ayami	17,000	19,900	24,300	28,170	32,657	37,859
Itek	22,400	26,400	32,100	37,213	43,140	50,011
Ogur	14,200	16,800	20,400	23,649	27,416	31,783
Total	**99,000**	**116,400**	**141,700**	**164,269**	**190,433**	**220,764**

Table 3-15 summarises the total population of the Aswa I and II sub-catchments as described in the Lira district and city development plans. As the two sub-catchments only partially overlap with the district and city, the estimates presented in the table could be higher than the actual.

3.4.2. Social-economic characteristics

Poverty levels are high in Lira; 71% of the population was living below the poverty line (hardcore poor) by 2002. This situation was worsened by the LRA war, which displaced people in IDP camps from late 2002 to December 2006, exacerbating the poverty levels, and the average household income declined from UGX 170,000= per annum in 2002 to UGX 110,000 per annum in 2008. The district's economy is mainly based on agriculture, with 81% of the population engaged in subsistence farming. Other pillars of the economy include commerce (15.9%) and agro-processing (3.1%).

Agriculture: Crop farming is the primary source of livelihood in the project area, cotton being the main cash crop. Other crops grown for food and sale are millet, sesame, cassava, groundnut, beans, pigeon peas, cowpeas, sorghum, sweet potatoes, rice, sunflower, soya beans, maize, and horticultural crops. Crop production is vital to the project area's development, providing food, cash income, employment, and raw materials for rural and urban industrialisation. Lira District is an important source of oil crops, cotton, vegetables, and pulses in the country due to the large hectares under crops despite the relatively low yields per unit area. Crop production is rain-fed and dominated by smallholder farmers. Many potential areas along wetlands and dams can be developed for small-scale irrigation. Livestock farming supplements crop farming. Cattle used to be a significant source of wealth, but this was eroded by cattle rustling and the LRA war from 1987-2006, depleting animal stock from 316,000 in 1987 to about 80,000 in 2002. However, with the improved security situation since 2006, the livestock population in the district has improved (Cattle 159,533, goats 161,711, sheep 12,749, pigs 28,631, and chickens 1,116,903).

***Commerce*:** Some residents of urban and semi-urban centers are involved in retail and wholesale merchandise, especially agricultural produce sales, food vending, animal and poultry trade, and non-agricultural trade activities.

***Agro-processing*:** Industrialisation is minimal, with most industries involved in agro-processing (such as edible oil production, bakery, maize and rice milling) and printeries in urban and peri-urban areas. The availability of electricity and raw materials has been a major factor in establishing these industries. Several small-scale artisanal factories, mainly in metal fabrication, woodwork, and brickmaking, are also located in (peri) urban areas.

The district and city's major revenue sources are central government transfers and donor funds. The major local revenue sources by category are property taxes, user charges, local service and hotel taxes, and miscellaneous sources. The district and city must explore other revenue sources to sustain their development needs.

3.4.3. Education

Most household heads in Agweng Sub-County and East Division stopped at the primary level (52%) of education. Most household heads in the Ayami sub-county (41%) do not have any formal education. With very low percentages of advanced education (3% with Advanced Level and 1% with Graduate degrees), there may be a shortage of technical expertise and advanced knowledge required for effective water resource management.

Most of the population (49% with Primary education) may have basic literacy and numeracy skills but might lack the technical knowledge needed for water resources management practices. Moreover, low levels of higher education and vocational skills training (3% with Higher Diploma and 1% with Vocational Skills) may limit the community's ability to implement and manage advanced water conservation techniques or understand complex water management issues. Programs to educate and train individuals on water management, hygiene, and conservation may be necessary to fill this gap.

3.4.4. Land tenure

The project area mostly has customary land ownership, where pieces of land belong to particular households, communities, or clans. Although customary land is owned in common, its use is not permanently assigned, and there is no proof of ownership, resulting in disputes over access and boundaries. In northern Uganda, land disputes are generally a serious issue, with 70 percent of all cases reported to court being directly related to land issues. Insecure land tenure rights discourage long-term investment in land improvement.

3.4.5. Summary of the socio-economic issues in the project area

The socio-economic issues related to the study area are summarised below;

- Heavy dependence on rain-fed agriculture has resulted in food insecurity (due to crop losses associated with drought), increasing poverty, and rural-urban migration. In addition, heavy reliance on rain-fed agriculture has escalated wetland encroachment for crop farming, as wetlands are the only places with sufficient soil moisture during the dry season.
- Urbanisation and the resultant population increase in (peri) urban areas have increased the demand for water and the destruction of forests and wetlands in favour of land for settlement.
- Land ownership and tenure issues have resulted in conflicts and disputes over land and water resources (e.g. wetlands), which hampers the management and protection of these natural resources.
- Prevalent high poverty levels have increased pressure on the environment and natural resources, as well as social conflicts and disputes.
- Low literacy levels limit the community's ability to implement and manage advanced water conservation techniques, while low percentages of advanced education create a shortage of technical expertise and advanced knowledge for effective water resource management.

3.5. Institutional and policy analysis

3.5.1. Legal framework for water resources management in Uganda

Over time, the Ugandan government has enacted laws (Act and Policies) and developed plans for managing the water sector. Although there exist gaps in relation to the management of water (and related) resources at the water catchment level, there are sufficient legal provisions to manage water resources sustainably. The Constitution of Uganda, Acts and Statutes establish the basis for protecting water sources sustainably, through environmental impact assessments, considering the environment when developing policies, regulating water abstraction and waste water discharge, ensuring stakeholder participation in water resources planning and management, among others. Also, several policies and strategies mention the need to 1) ensure universal access to safe water supply, 2) develop agriculture sustainably, 3) link water, sanitation and hygiene, 4) support self-help initiatives in communities and at household level, 5) promote community-based maintenance of rural water supply systems, among others. The legal instruments relevant to water resources management, and their gaps/challenges, are highlighted below:

The Constitution of the Republic of Uganda (1995) is the country's supreme law. It includes provisions for managing natural resources, with water being a critical component. The Constitution's National Objectives and Directive Principles of State Policy require the State to protect vital natural resources, including land, water, wetlands, fauna, and flora, on behalf of the people of Uganda. Moreover, the Constitution requires the government to take all practical measures to promote effective water management at all levels. The State is further enjoined in fulfilling the fundamental rights of all Ugandans to social justice and economic development. The Constitution asserts that every Ugandan has a right to a clean and healthy environment. Promoting sustainable development and raising public awareness about the balanced and sustainable management of land, air, and water resources for both present and future generations is a duty of the State under the Constitution. While the central government holds the primary responsibility for managing resources like water, district councils, and lower local government councils may exercise functions typically reserved for the central government, either at their request or when delegated by the central government.

The Water Act Cap 152 (1997) provides for the use, protection, and management of water resources and supply and facilitates the devolution of water supply and sewerage undertakings. Its objectives are inter alia:

1. To promote the rational management and use of the water resources of Uganda.
2. To promote the provision of a clean, safe and sufficient supply of water for domestic purposes.
3. To ensure appropriate development and use of water resources other than for domestic use, e.g. watering of stock, irrigation and agriculture, industrial, commercial and mining uses, generation of energy, navigation, fishing, preservation of flora and fauna and recreation in ways, which minimise damage to the environment.
4. To control pollution and promote the safe storage, treatment, discharge and disposal of waste, which may pollute water or otherwise harm the environment and human health.

The Act promotes the principles of IWRM and advocates for the involvement of all stakeholders in planning for the utilization, development and management of water resources. It addresses cross-sectoral interests in water resources and the (financial and technical) roles to be shared among stakeholders; the responsibilities to provide water services and to maintain facilities were devolved to local councils in districts and urban centres, while the role of the Central Government's Agencies is that of guiding and supporting as required. The Act is currently under review to provide for the de-concentration of water resources management from the center to regional entities.

The Local Governments Act, Cap. 243 (1997) provides the scope of service responsibilities for lower-level local councils, sub-counties and divisions. In particular, the local governments are mandated to provide and maintain water supply in liaison with the Ministry responsible for natural resources, which is the Ministry of Water and Environment, where applicable. The Act empowers the Local Governments to plan and implement development interventions according to local needs. The Act provides that two or more district councils may cooperate (following the Constitution) in

areas of culture and development by establishing and supporting joint institutions or trust funds and appointing joint committees on matters of common interest. Although district councils are responsible for assisting the government in preserving the environment by protecting wetlands, lake shores, and streams and preventing environmental degradation, the local governments have not been fully oriented and involved in water resources management issues.

The Land Act, Cap. 227 (1998) provides for the control of land use, specifically sections 44 (control of environmentally sensitive areas) and 45 (land use planning and zoning).

The National Forestry and Tree Planting Act (2003) regulates and controls forest management in Uganda by ensuring forest conservation, sustainable use, and enhancement of forests' productive capacity for the benefit of all Ugandans. The Act also promotes tree planting and the creation of forest reserves in which human activities are strictly controlled.

The National Environment Act Cap 181 gives everyone the duty to create, maintain and enhance the environment, including preventing pollution. The Act prescribes several principles of environmental management, including (i) encouraging the participation of stakeholders in the development of policies, plans and programmes for managing the environment, (ii) providing for equitable, gender responsive and sustainable use of the environment and natural resources, including cultural and natural heritage, for the benefit of both present and future generations, (iii) maintaining stable functioning relations between the living and non-living parts of the environment through conserving biological diversity and by use of prudent environment management measures, (iv) ensuring optimum sustainable yield in the use of renewable natural resources; (v) ensuring that activities relating to extractive processes of renewable and non-renewable natural resources are carried out in a sustainable manner, (vi) restoring lost or damaged ecosystems where possible and reversing the degradation of the environment and natural resources, (vii) ensuring that adequate environmental protection standards are established and that effective monitoring of change in environmental quality is undertaken.

National Water Policy (1999) provides an overall policy framework that defines the government's policy objective as "managing and developing water resources of Uganda in an integrated and sustainable manner, to secure and provide water of adequate quantity and quality for all social and economic needs sustainably, with the full participation of all stakeholders". Similar to the Act, the Policy is currently under review to provide for the de-concentration of water resources management from the centre to regional entities.

National Environment Management Policy (1994)'s primary goal is to support social and economic growth that maintains or enhances long-term environmental quality and resource productivity and meets the present generation's needs while ensuring future generations can meet their needs. In effect, NEMP's overall policy goal is to promote sustainable development. Regarding the water sector, the NEMP aims to control water pollution from domestic, industrial, and other emissions and discharges and promote environmentally sound management of wastes and hazardous materials.

National policy for the conservation and management of wetland resources (1995) aims to promote the conservation of Uganda's wetlands to sustain their ecological and socio-economic functions for the present and future well-being of the people. One of the policy goals is to maintain the functions and values of wetlands throughout Uganda and to promote the recognition and integration of wetlands functions in resource management and economic decision-making regarding sector policies and programs in other areas such as forestry, agriculture, and environmental management. One of the strategies of the policy is to ensure that there is no drainage of wetlands unless justified by the most important environmental management requirements.

Uganda National Land Policy (2013) provides a framework for articulating the role of land in national development, land ownership, distribution, utilisation, alienability, management and control. The Land Policy has a specific objective that seeks to ensure sustainable utilisation, protection and management of environmental, and natural and cultural resources on land for national socio-economic development. It seeks to ensure that all land use practices and plans conform to sound environmental management principles, including biodiversity, preservation, soil and water conservation and sustainable land management.

The National Environment Management Policy for Uganda (2014) seeks to address environmental issues in a holistic and integrated manner. It emphasises the following activities: a) prioritising watershed management to control, conserve, and regulate the water balance in the catchment regions; b) empowering lower levels of governance to systematically respond to local water challenges; and c) ensuring that water resources contribute to socio-economic development.

National Forestry Policy (2001) provides for the establishment, rehabilitation and conservation of watershed protection forests. It aims at promoting the rehabilitation and conservation of forests that protect the soil and water in Uganda's key watersheds and river systems.

The Uganda National Climate Change Policy (2015) recognises climate change monitoring, mitigation, and adaptation as integral to economic and social development. It seeks to elevate climate change issues within national and local policies, plans, and budgets and support stakeholders from all sectors in adopting actions that may promote climate resilience. The Policy lays out specific strategies relevant to the water sector including: promotion and encouragement of water harvesting and efficient water utilisation; (ii) ensuring availability of water for production in water dependent sectors, (iii) promotion and strengthening of the conservation and protection against degradation of watershed and catchment areas, (iv) promotion of integrated water resources management (including underground water resources), and (v) improving and strengthening trans-boundary cooperation.

The Uganda National Housing Policy (2016) aims to promote the efficient utilization of energy and other resources in housing and address issues of environmental conservation.

National Gender Policy (2007) is integral to national development policies. It is a framework policy for redressing gender imbalances and guiding all development practitioners. The aim of this policy is to guide all levels (including in the water sector) of planning, resource allocation and implementation of development programmes with a gender perspective. The emphasis on gender is based on recognizing that "gender" is a development concept useful in identifying and

understanding the social roles and relations of women and men of all ages and how this impact development. The Policy recognizes women and children as key stakeholders in water provision, use and resource sustainability.

Vision 2040 outlines Uganda's pathway to become an upper-middle-income country within 30 years (2010–2040). The Vision reinforces the government's commitment to achieving the Sustainable Development Goal for Water (SDG6) by increasing access to piped water and toilet facilities and developing water treatment systems. The Vision provides for the development of a 30-year plan implemented through: (i) three 10-year plans, (ii) six 5-year National Development Plans (NDP), (iii) sector-specific master and investment plans (SIPs), (iv) local government development plans, and (v) annual plans and budgets.

The third National Development Plan (NDP III) (2020 – 2025) recognises the effects of climate change caused by deforestation, land degradation, wetland degradation and encroachment. Program number five (5) of the NDP III (i.e. Climate Change, Natural Resources, Environment, and Water Management) aims at 1) assuring the availability of adequate and reliable quality freshwater resources for all uses; 2) increasing forest, tree and wetland coverage, restoring bare hills and protecting mountainous areas and rangelands; 3) maintaining and/or restoring a clean, healthy, and productive environment; 4) reducing climate change vulnerability and carbon footprint; 5) reducing human and economic loss from natural hazards and disasters; and 6) increasing incomes and employment through sustainable use and value addition to water, forests and other natural resources. Currently in preparation, NDP IV is expected to build on and continue NDP III's programs.

3.5.2. Institutional framework for water resources management in Uganda

Uganda's institutional framework for water resources management cascades from the national, regional, catchment, and district levels.

National level

The *Ministry of Water and Environment (MWE)* is the lead agency for all aspects of water resources management and development, setting the standards to manage and regulate all water resource developments and monitoring and evaluating all the sector development programs. MWE operates through three directorates:

1. The Directorate of Water Resources Management (DWRM) is responsible for developing, maintaining, and enforcing national water laws, policies, and regulations. DWRM manages, regulates, and monitors national water resources by issuing water use, abstraction, and wastewater discharge permits. DWRM is the lead in developing the agenda for catchment-based IWRM.
2. The Directorate of Water Development (DWD) is also responsible for developing water production infrastructure, including water supply and sanitation for urban and rural services.
3. The Directorate of Environmental Affairs (DEA) is the lead agency for environmental issues.

The MWE collaborates with several affiliated semi-autonomous bodies, including:

- **The *National Environment Management Authority (NEMA)*** is mandated to coordinate, monitor, regulate, and supervise environmental management in Uganda. NEMA leads in developing environmental policies, laws, regulations, standards and guidelines. It is the apex body for environmental law enforcement in Uganda, however, several functions have been delegated to other institutions as lead agencies in their respective fields. The responsibility for compliance control is placed on environmental inspectors distributed in several institutions and government agencies at central, regional, and district levels. An Environmental Police has been formed and trained at NEMA, whose functions include sensitisation, demarcation, control, issuing warnings, following up of cases, eviction, and prosecution of environmental offences.
- **The *Uganda National Meteorological Authority (UNMA)*** is mandated to offer weather and climate services, analyse scientific research findings and provide guidance on climate change.
- The *National Forestry Authority (NFA)* is mandated with managing the central forest reserves "on a sustainable basis and to supply high quality forestry-related products and services to government, local communities and the private sector". Recently, the cabinet of Uganda passed a resolution to disband NFA and return the functions to MWE, and the necessary legal and administrative steps are in advanced stages.
- **The *National Water and Sewerage Corporation (NWSC)*** is responsible for the operation of sewerage services and the provision of water in urban centres. It is to invest generated revenue surplus in infrastructure improvements, new investments, and since recently, water source protection.

Other ministries that have direct relevance for water resources management due to their mandates and operations are:

- **The *Ministry of Agriculture, Animal Industry and Fisheries*** is mandated to lead on water use and management of on-farm agricultural water facilities, while MWE is responsible for off-farm activities
- **The *Ministry of Tourism, Wildlife and Antiquities*** covers the water use and management of industries, commerce, wildlife and tourism
- **The *Ministry of Trade Industry and Cooperatives*** covers water use and management for industries and commerce
- **The *Ministry of Energy and Mineral Development*** oversees water use and management for hydropower generation and mining.
- **The *Ministry of Health*** ensures that everyone in Uganda has access to quality health services through primary health care, a process in which water plays a key role.
- **The *Ministry of Works and Transport*** oversees water use for navigation and management of water resources during road and bridge construction
- **The *Ministry of Local Government*** is responsible for establishing structures and frameworks for the governance of districts.

Regional level:

DWRM created four *Water Management Zones* (WMZ) and de-concentrated some water resources management functions to them. The WMZs correspond to the country's main hydrological basins and operate on a regional level, coordinating the activities of partners, facilitating the establishment

of Catchment Management Organisations (CMOs) and supporting them and Local Governments to implement relevant aspects of the de-concentrated functions and services of the DWRM. The four WMZs are Upper Nile WMZ (based in Lira), Victoria WMZ (based in Mbarara), Albert WMZ (based in Fort Portal), and Kyoga WMZ (based in Mbale).

DWD established the ***Water and Sanitation Development Facility*** **(WSDF)** model to promote a demand-responsive approach by supporting water supply and sanitation infrastructure for rural growth centres and small towns. WSDFs design and construct water supply and sanitation facilities, carry out related community mobilisation activities and set up operation and maintenance structures. Investment for water and sanitation in small towns, town boards and rural growth centres is funded through WSDFs. WSDFs currently operate through 4 branch offices in Lira (north), Mbarara (southwest), Mbale (east) and Wakiso (centre).

Further, DWD established six ***Rural Water Regional Centres*** **(RWRC),** formerly Technical Support Units (TSUs), to train district-based structures and offer them technical advice and support supervision to effectively implement their roles. The mandate also covers water for production. The RWRCs are located in Lira, Moroto, Mbale, Mbarara, Fort Portal, and Wakiso districts.

Water for Production Regional Centres (WFPRC) are responsible for promoting the development of water for production by through constructing valley tanks and dams and irrigation schemes. WFPRCs currently operate through three branch offices: Lira (north), Mbarara (west and centre), and Mbale (east)

Umbrella Authorities (UA) of Water and Sanitation, formerly Umbrella Organizations (UO), manage gazetted water and sanitation schemes. They operate through six offices in Lira (North), Moroto (Karamoja), Mbale (East), Wakiso (Central), Kyenjojo (Mid-West) and Kabale (South-West).

Further, the DEA has established *offices for the wetland department on the regional level.*

Catchment, District and Lower Local Government levels:

The WMZ establishes Catchment Management Organizations (CMO) comprising several bodies.

i. The ***Catchment Stakeholder Forum (CSF)*** brings together all stakeholders. It defines key issues related to water resources in the catchment that require consideration in order to effectively protect, manage, and develop water resources.
ii. The ***Catchment Management Committee (CMC*****)** is the executive board of the CMO. It comprises representatives of all relevant stakeholder groups (government, politicians, community-based organizations, NGOs, water users, media, academic institutions, and the private sector). The CMC collaborates with the WMZ during the formulation of a Catchment Management Plan and plays a steering role during its implementation. It endorses the CMP and presents it to the CSF for information purposes.
iii. The ***Catchment Management Secretariat (CMS)*** provides support to the Catchment Management Committee in coordinating the planning and implementation of activities in the catchment and following up on recommended actions by the stakeholders. The CMS is the administrative secretariat for the Catchment Management Committee and the Catchment Technical Committee.
iv. The ***Catchment Technical Committee (CTC)*** is the technical arm of the CMO and supports the CMC in their tasks. The CTC brings technical expertise and knowledge during the formulation of the Catchment Management Plan, puts into operation and sometimes

implements programmes and projects from the plan, and generally ensures that the different districts collaborate to implement the plan. It comprises technical people from the government, NGOs, the private sector, development agencies and other relevant organisations in the catchment.

v. ***Sub-catchment Management Committees*** **(SCMCs)** and ***Micro-catchment Management Committees*** **(MCMCs)** bring together stakeholders at the sub-county and parish/village levels, respectively. Their functions mirror those of the CMC at the respective levels.

vi. The Water Act provides for forming ***Water and Sanitation Committees***, ***Water User Groups***, **and** ***Water User Associations*** as community-level structures to ensure the sustainability of water supply and sanitation facilities through proper management, operation and maintenance by the user communities.

3.5.3. Legislative and institutional challenges

Literature review and consultations with stakeholders revealed the following policy challenges:

- ***Inadequate coordination****:* Considering its broad nature, some water resources management roles and responsibilities must be carried out across various institutions with overlapping mandates. This emphasises the need for collaboration and coordination among these institutions. However, with a few exceptions, central government institutions still plan and implement their work in silos. At the regional level, there is no established mechanism for collaboration between the different de-concentrated units of the MWE. At the district level, coordination between different committees is still challenging as the various committees plan and implement their activities in isolation. Further, due to limited capacity, CMOs cannot yet coordinate the water resources management activities of stakeholders (e.g., NGOs, private sector). Furthermore, inadequate information generation, sharing among relevant actors, and fragmentation of the generated data are important bottlenecks to coordination.
- ***Inadequate human resources***: Despite the advantages arising from de-concentrating the water sector services, inherent financial and human resources constraints at local levels still exist that hinder the effective implementation of water resources management. Capacity gaps refer to technical knowledge and expertise and the lack of staff, time, and obsolete infrastructure. Staff capacity is generally inadequate regarding numbers and seniority to effectively undertake water resources management activities at national, regional and catchment levels. In addition, CMO structures are not yet fully operationalised; for example, Catchment Management Secretariats and Catchment Technical Committees are not yet established for most catchments.
- ***Inadequate management instrument*****s**: Some of the management instruments for water resources management are not yet developed or fully operationalised. For instance, some CMPs, SCMPs, and MCMPs are not yet developed, finalised, or disseminated. In addition, stakeholders are concerned that investments within the CMPs are prepared to mainly be at a pre-feasibility level, which renders them weak in generating bankable projects that stakeholders can directly implement. Further, there is a lack of systematic and reliable data collection and management to support evidence-based decision-making and planning. Data and

information management procedures are not streamlined; this hinders access, usage and dissemination of data and information for decision-making and resource allocation.

- ***Inadequate water sector funding*** is another challenge that deserves mention. Generally, water resources management does not enjoy as much attention as "hardware infrastructure" interventions during budgetary allocation by the government (at the central and district levels), attributed largely to the difficulty in proving the contribution of WRM to livelihoods or, generally, the economy. Moreover, donor allocations to the water and environment sector are declining. Funding limitations result in *constraints in operations and logistics.* The availability of logistics and operational requirements affects the service delivery of any institution. Specifically, operations and logistics are handled at a zone level at the Upper Nile Water Management Zone, including fieldwork. However, some logistics are insufficient, such as field vehicles.
- ***Weak enforcement of laws***: While comprehensive laws and policies are in place, enforcement is often weak. This is due to limited resources, lack of capacity, and, sometimes, corruption and political interference.

3.6. Summary overview

Preliminary findings indicate several social, economic, environmental, policy, and institutional issues to address.

The major socio-economic threats that must be considered in the planning process and could inform potential interventions were identified. High population growth and density are the main drivers of socio-economic challenges, creating environmental pressures and intensifying competition for water resources. In fact, competition over natural resources (land and water resources) was identified as one of the main drivers of social conflicts in Northern Uganda. Poverty is another socio-economic dynamic that fuels environmental degradation as communities engage in unstainable activities (e.g. uncontrolled sand mining, cutting trees for charcoal production, etc.) in search of a means of survival. Also, there is a need to climate-proof the main source of livelihood in the project area (crop farming, which employs 81% of the population) while advancing sustainable water resources management.

The environmental situation in the study area indicates that there are several threats to water for the environment, mainly the degradation of river banks due to uncontrolled livestock access, the cultivation of crops, and charcoal burning. Most river banks are experiencing high degradation levels due to the cutting down of the riverine forests for charcoal and clearing of the land for farming. Crop cultivation along the river banks and streams increases the risk of soil erosion. Therefore, the restoration of river banks needs to be considered a top priority. The degradation of riverbanks is mainly due to uncontrolled livestock access to the riverbanks or streams. This is due to repeated trampling of river banks, causing soil erosion and, ultimately, the collapse of the river banks. In addition, sand mining is another human activity that contributed to the collapse of river banks or streams.

Regarding water resources, the challenges can be grouped into three strategic areas: Water for People, Water for Production, and Water for the Environment. The most critical sub-catchment challenges per strategic area are water for people (water insecurity, insufficient water storage, inadequate water supply and Irrigation infrastructure, inadequate water supply infrastructure and services), water for production (mainly pollution loads) and water for environment (land degradation, climate change and extreme climate events, vulnerability to drought risks, vulnerability to flood risks and pressure on water-dependent ecosystems).

Institutionally, although there exist gaps in the management of water (and related) resources at the water catchment level, sufficient legal provisions and structures are in place to manage water resources sustainably.

4. DEVELOPMENT OF PLANNING OBJECTIVES

4.1. Introduction

The planning of water resources development and management in the Aswa I and II Sub catchments is rooted in the Aswa Catchment Management Plan (CMP, 2017) and the Upper Nile Water Resources Development and Management Strategy, which was framed on the three guiding principles (Box 1):

Box 1: **Guiding Principles for Water Resources Management in Upper Nile WMZ**

Equity: social and institutional equity in allocating resources across different social and economic users and areas. The human right to safe water drives the prioritisation of water allocation among uses and sectors.

Sustainability: environmental, social and economic sustainability of water use and management. Water is a finite and irreplaceable resource fundamental to human well-being. It is only renewable if well managed and allocated in amounts such that the sources and sinks of water remain within their regenerative capacity.

Efficiency: wise and integrated management to promote technical efficiency, in the sense of increasing outputs of available water resources, as well as allocation efficiency of scarce water resources for social and economic development

(Source: Upper Nile Water Resources and Development Strategy)

4.2. Vision and strategic objectives

4.2.1. Vision

The stakeholders developed the following vision for the Aswa I and Aswa II sub-catchments, which aligns with the broader vision for the Upper Nile Water Management Zone/ Aswa CMP.

"A healthy and sustainably managed sub-catchment with an economically transformed population with guaranteed access to environmental resources and services by 2040"

4.2.2. Strategic Objectives

The stakeholders developed four strategic objectives for achieving the common vision.

1. To strengthen water governance and institutional coordination
2. To restore and conserve surface and groundwater-related natural resources
3. To support sustainable water resources-based livelihood options
4. To enhance communities' resilience and adaptation to extreme weather events and climate change

4.3. Action portfolio

Several options have been proposed to address the identified threats/ issues in the sub-catchment and achieve the desired vision at the sub-catchment level. The options include a) Institutional strengthening and capacity building b) Improving water and sanitation investments, c) implementing ecosystem restoration and management investments, d) governance investments and e) economic or livelihood improvement investments.

4.3.1. Overall recommendations

The following broad recommendations are made related to local water resources:

- Water balance modelling should be conducted using standard approaches to understand the state of water balance components such as net precipitation, baseflow, and evapotranspiration rates within the sub-catchments.
- Assess the current water demand and supply and water risk assessment for people and production in Lira city and district to support sustainable water management practices, plan for adequate water supply, and build climate resilience.
- The current spatial distribution of water sources within the sub-catchments should be established for effective water resource management. The current dataset of water sources can be requested from either the Ministry of Water and Environment or the district local governments.
- Restoration of forest and wetland ecosystems in the sub-catchments for improved water quality, flood mitigation, groundwater recharge, biodiversity support, water flow regulation, and climate regulation.
- Addressing these challenges requires a coordinated effort to streamline institutional roles, strengthen enforcement mechanisms, build local capacity, and secure adequate funding.

4.3.2. Specific recommendations

1) Water governance/institutional coordination

- Improve institutional and stakeholder partnerships, collaborations and linkages through technical and high-level political dialogues together with the operationalization of the inter-ministerial committees. A policy dialogue between the Ministry of Water and Environment and other sister Ministries, Departments and Agencies (MDAs) on harmonization of conflicting policy directions and mandates to ensure a collaborative and deliberate policy direction is taken to address the enormous environmental degradation in Aswa I and Aswa II sub-catchments.
- Effective enforcement of environmental laws by respective officers and institutions. Uganda has several laws and policies to conserve natural resources and the environment, particularly water resources. However, they continue to be infringed on.
- Address improper political interference. Political interference has hindered the smooth implementation of environmental laws. To reverse the current trends, there is a need for strong political will to handle the issue of wetland encroachers and river banks as stipulated in the Wetland Policy, Water Policy and National Environment Act 2019.

- Increase funding to the different agencies in charge of the environment and natural resources in Lira district and Lira city, such as the National Environment Management Authority (NEMA) and the Ministry of Water and Environment (MWE). These agencies operate on a limited budget, yet they have a large area to cover regarding monitoring and managing natural resources. In addition, there is also a need to procure more vehicles/motorcycles to ease the field monitoring of remote natural resources and office operations.
- The government, through NEMA and MWE, should stop issuing licenses or approving development plans in sensitive ecosystems such as wetlands. For example, factories have been established in the wetlands of Lira City.
- Information dissemination on the wise use of wetlands amongst the different stakeholders.
- Empower or strengthen local parish committees which manage and monitor these natural resources. In addition, these local parish committees ensure the sustainability of interventions. These committees comprise 7 to 8 members established in the different Lira district and Lira city parishes.

2) Water-based livelihood options

- Create alternative livelihood options such as beekeeping, fish ponds, and tree planting in all the sub-counties with water resources. At present, these projects have been established in a few sub-counties. For example, in the Ogur sub-county (Lira District), the International Union for Conservation of Nature (IUCN) is piloting a modern bee-keeping project whereby farmers adjacent to wetland ecosystems have been trained in the production of better-quality honey using an Akilo apiculture farm (**Plate 4-1**). The project has mobilised farmers along the buffer zones of wetlands into groups of 8 to 10 members. Farmers have been sensitised on beekeeping along wetlands to conserve the fragile ecosystem. Deliberate campaigns to plant fruit and other helpful tree species have also been initiated.
- Farmers have been taught soil and water conservation measures such as contour ploughing (Figure 12) but more is needed. Farmers have been trained to make bee hives and process and bulk honey. As a result, farmers' household income has increased from selling honey. The farm gate price for a 5-litre jerrican of honey costs 150,000/= Ugandan Shillings.
- This modern bee-keeping project has proved to satisfy the socio-economic demands and conserve and restore the ecosystem's integrity. In short, it can improve livelihoods while preserving ecosystems and restoring degraded areas by regenerating different plant species, as shown below (Figure 13). Therefore, it is a good candidate for scaling up and out in other Lira districts and city sub-counties.
- Train communities adjacent to wetlands on sustainable utilization of wetland plant species for craft production, especially the women who are believed to be the leading wetland degraders in the area. Ultimately, this initiative will supplement their household incomes.

3) Surface water conservation (for rivers and wetlands)

Rivers:

- Re-vegetate the river Aswa and its main tributary buffer zones with specific tree species that don't drain the water table to control soil erosion. This will improve the water quality of the Aswa River. Having natural vegetation on the riverbanks helps remove sediments and pollutants from the surface water. In this sense, the river buffer zone's vegetation serves as a filter/sieve for the runoff before it enters the river during the rainy season. Furthermore, re-vegetation helps in bank stabilisation as trees reduce the chances of bank collapse by holding the soil together.



Plate 4-1: Apiculture practiced is the study area

- Regulate the different land use practices in buffer zones of the river Aswa and its main tributaries, which could lead to the loss or collapse of land into the river. This causes the river to widen on either side, causing siltation downstream. Some of the land use practices include poor farming practices and overgrazing.
- Restore the banks of river Aswa and its main tributaries through eviction of encroachers.
- Conduct routine water quality assessment for water using parameters: Total nitrogen (TN), Total phosphorous (TP) and Biological Oxygen Demand (BOD) in Aswa I and II sub-catchments. This information will be paramount in ascertaining current water quality to plan and develop water resources.
- Develop catchment management plans for Aswa I and Aswa II sub-catchments, which could improve water resources management and restoration of degraded river banks.



Plate 4-2: Akilo Apiculture farm (Top-left, Top-right & Bottom-left) and soil and water conservation measures (bottom-right) in Ogur Sub- County

Wetlands:

- Restore and protect the degraded wetlands in the sub-catchments for improved water quality, flood mitigation, groundwater recharge, biodiversity support, and climate regulation. In addition, there is a need to restrict all the wetlands in all the sub-counties with concrete pillars, as shown below (**Plate 4-3**), instead of planting trees to act as boundaries. This will be essential in increasing the wetland coverage, which is also in line with National Development Plan III, which envisions that by the year 2025/26, wetland coverage shall have increased from a baseline of 8.5% to 9.8% and 12% by 2030.
- Design new sensitisation strategies about the dangers of wetland degradation and the benefits derived from wetlands. This will change the communities' mindset about ecosystems and their sustainable use and conservation. For example, FAPAD (Facility for Peace and Development), a non-government organisation in Lira South, pays participants who attend their sensitisation workshops, increasing community members' participation.
- A map of the current Lira district and city wetland inventory is needed. This information will be crucial in updating the database of all available wetland resources and their status and location for effective decision-making and targeted intervention measures.



Plate 4-3: Concrete pillars are mainly used for wetland

- Conduct routine water quality assessments for water using parameters: Total nitrogen (TN), Total phosphorous (TP) and Biological Oxygen Demand (BOD) in Aswa I and II sub-catchments. This information will be paramount in ascertaining current water quality to plan and develop water resources.
- Similarly, there is a need to develop catchment management plans for Aswa I and Aswa II sub-catchments, which could improve water resources management and restoration of degraded river banks.

4) Groundwater Access and Conservation

- Restore and protect the degraded wetlands in the sub-catchments since wetlands recharge groundwater as well.
- Conduct routine water quality assessment for water using parameters: Hardness (CaCo3), Iron total (Fe), Manganese (Mn), Chloride (Cl), Fluoride (Fe), Sulphate, Nitrate (NO_3), Nitrite (NO_2), Total Dissolved Solids (TDS), Turbidity, pH and E. Coli in Aswa I and II sub-catchments. This information will be essential in assessing whether the water meets the national rural water quality standards or World Health Organization guidelines to minimize human and livestock health risks.

- Monitor land use practices adjacent to groundwater resources since they alter groundwater recharge, increase water demand, and affect water quality. For example, planting eucalyptus trees near groundwater resources affects the depletion of the water table and hydrological cycle. In addition, there is a need to train farmers in better farming practices such as contour ploughing, mulching, and other agricultural practices that increase soil water retention and percolation in the underlying aquifer.
- Fence off areas around groundwater resources to prevent livestock from breaking up the ground around the borehole, as shown in the figure below
- Develop catchment management plans for Aswa I and Aswa II sub-catchments, which could improve water resources management and restoration of groundwater recharge.

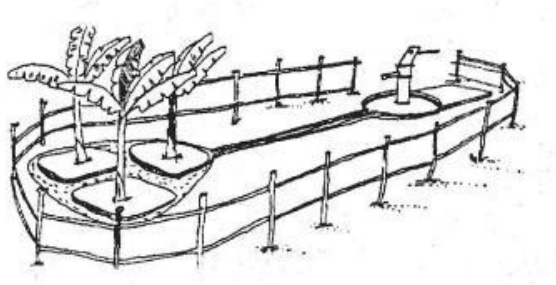


Figure 4-1: Demonstration of a fenced-off borehole

5) Extreme events (such as flooding/drought/winds/lightning) adaptation.

According to the Lira district hazard, risk, and vulnerability profile, the district is vulnerable to numerous dangers that frequently lead to disasters. These include animal vectors and diseases, invasive weed species, internal conflicts, crop pests and diseases, prolonged drought, environmental degradation, flooding, bushfires, human epidemics, and severe storms.[58] However, this study will focus only on disasters related to water resources, such as prolonged drought and flooding.

Prolonged drought:

- Water infrastructure development, including water supply, irrigation, and water storage systems within Aswa I and II sub-catchments. For example, in the Ogur sub-county, the government of Uganda, through the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), has established a micro-scale irrigation program where the government will help farmers pay for irrigation equipment through a cost-sharing arrangement as shown (**Plate 4-4).**

[58] Lira district hazard, risk and vulnerability profile (2016). https://www.necoc.opm.go.ug/HzNorthern/Lira%20District%20HRV%20Profile.pdf

The Government will pay between 25% and 75% of the total cost of the irrigation equipment but with a maximum contribution of 7.2 million Ugandan Shillings per acre. Irrigation is one of the major adaptation strategies to reduce the negative impacts of prolonged drought on crop yields in Lira district and Lira city. However, this micro-scale irrigation program is limited to several Lira districts and City sub-counties. Furthermore, there is a need to create awareness for this program amongst farmers.



Plate 4-4: micro scale irrigation program for a horticulture garden in Ogur sub-county, Lira district

- Farmers in Aswa I and Aswa II sub-catchments should be urged to increase the production of drought-tolerant crops such as millet, cassava, sorghum and sweet potato. This measure will contribute towards achieving Sustainable Development Goal 2, which aims at ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture. Farmers tend to cultivate crops in wetlands during drought since they contain fertile and moist soils throughout the year. Thus, this measure will reduce wetland degradation during prolonged drought.
- Construct valley dams and tanks to provide water for livestock watering and irrigation during drought periods.
- Establish Drought Early Warning Systems (DEWS) in Aswa I and Aswa II sub-catchments. DEWS are instrumental in drought mitigation because they provide drought-susceptible communities with information on mitigating and coping with drought.

Flooding:

- Construction of dams to reduce the impact of floods. Dams are primarily designed to store large water volumes. This capacity proves extremely useful when it comes to flood control. For instance, during a heavy downpour, dams store excess volume, preventing it from inundating downstream areas by regulating water flow through controlled releases. Thus, reducing the severity of floods.
- Frequent de-silting of river Aswa and its main tributaries to remove recent deposits of silt to the bed level of a river. Silt includes fine gravel or soils washed into rivers or streams from the surrounding land.

- Plant trees along the riverbanks of Aswa and its main tributaries. These trees intercept heavy rainfall by reducing the speed at which surface runoff reaches the river. In addition, trees can also absorb extra water and reduce flooding.
- Training and sensitization about flood risk and safety in flood-prone areas. This will help minimize the damage from flooding.
- Establish Early Warning Systems for floods in Aswa I and Aswa II sub-catchments. Early Warning Systems for floods will warn residents of the rising water levels in River Aswa and its main tributaries so residents can evacuate in time.

4.4. SWOT Analysis of Water Resources Management in the Aswa I and II Sub-catchments

The Table **4-1** below presents the Strengths, Weaknesses, Opportunities, and Threats to Water Resources Management in the two sub-catchments, providing a good basis for developing a responsive action plan.

Table 4-1: SWOT analysis for Aswa I and II sub-catchments

Strengths	Weaknesses	Opportunities	Threats
• Presence of protected areas (PAs) like the Ayami, Ogur and Olia CFRs. • The presence of wildlife creates the need for preservation of natural habitats. • The presence of wetlands provides diverse ecosystem services. • Presence of river networks and streams contributing to the Aswa River system. • Presence of policies and regulations governing	• Degraded natural resources. • Susceptibility to floods especially along River Moroto and River Olimi • High dependence on rain-fed agriculture. • Poor infrastructure like the roads. • Long-term dependency on natural resources. • Failure to enforce existing policies and regulations by the local authorities.	• Past and on-going efforts by other implementing partners (e.g. IUCN, World Vision and LEMU, see Table 4-2) laid the foundation to build on. • Small-scale irrigation agriculture. • Cash crop development. • Industrial development (processing). • Developing sustainable businesses around fish farming and animal health services, including livestock disease surveillance.	• Wetland and river banks encroachment. • PAs encroachment. • Increased water demand due to increased population growth. • Climate change variability and their implications such as droughts and floods. • Deforestation. • Poor sanitation facilities and open defecation. • Uncontrolled sand mining. • Poor solid waste management practices are present, especially in the East Division.

Strengths	Weaknesses	Opportunities	Threats
natural resources management.	• Lack of funding mechanisms	• Developing solid waste management centres within the urban areas (East Division).	

Key stakeholders undertaking similar interventions in the study area have also been analysed as part of the SWOT analysis. However, some of these Partners have left the areas since their projects ended. The **Table 4-2** below shows the different partners that have had interventions within the study area of Aswa I and II sub-catchments.

Table 4-2: Different Development Partners with similar Interventions in Aswa I and II

S/N	Partners	Area/Sub County	Activities undertaken	Status
01	International Union for Conservation of Nature (IUCN)	Ogur, Agweng S/c, Agweng T/C, Aromo, Ayami; all in Aswa II Sub Catchment	▪ Identified, mobilised, engaged and built capacity of stakeholders and communities in undertaking catchment-based and community-driven catchment management measures. ▪ Supported communities in restoring degraded hotspot wetlands and riverbanks in Aswa II sub catchment ▪ Supported communities in implementing soil and water conservation measures on priority hotspots in the sub-catchment. ▪ Supported communities to restore deforested and degraded land through community tree growing on individual farmers' land, public land and riverbanks ▪ Supported communities to establish and promote alternative income-generating activities for improved livelihoods.	In the final stages. The project will end in December 2024, and these project interventions will be handed over to the project district(s), including Lira District and Lira City Council
02	World Vision-Uganda	Ogur	▪ Mobilized community members and raised awareness of the advantages	Not active / exited the area

S/N	Partners	Area/Sub County	Activities undertaken	Status
			of controlling soil erosion/floods through the use of water harvesting. ▪ Undertook a community collective effort to avoid developing high soil and water runoff pathways and flood formation. ▪ Trained the community members in Nutrition and Health.	
03	Care-Uganda	Ogur	▪ Trained the community members in Nutrition and Health. ▪ Advanced nutrition outcomes by improving nutritious and safe food consumption for all people, especially the most vulnerable to malnutrition.	Not active / exited the area
04	Mecpa-Uganda (Local CBO)	Agweng S/C	▪ Trained women in sustainable vegetable growing and environmental conservation in the parishes of Abaala and Olit.	Not active / exited the area
05	Land and Equity Movement in Uganda (LEMU)	Lira City and Lira DLG	▪ LEMU supports vulnerable communities in Lira City and Lira DLG to secure their land rights under customary tenure and to achieve sustainable and productive land use	Still in the area but not specifically in the Aswa I and II sub-catchments

5. OPTIONS ANALYSIS

5.1. Introduction

Catchment management planning involves identifying options that address specific issues which have been identified during stakeholder consultations and field excursions while encompassing management and development solutions. To ensure alignment with the sub-catchment's vision and strategic objectives, derived options must prioritize sustainable development by protising interventions which can enhance people's economic status without compromising ecosystem health. A detailed cost estimation for each option was conducted by aggregating activity-specific costs, benchmarked against similar projects or market rates. Costs are presented in United States Dollars (USD) to mitigate inflation risks.

Table 5-1 and Table 5-2 shows the details of the proposed options and interventions for addressing the identified issues/ threats in Aswa I and II Sub catchments. The costing of interventions under specific options is presented in the action plan for implementing the plan.

Table 5-1: Proposed Options and Interventions for addressing issues/ threats related to Water Sanitation and Hygiene (WASH) across Aswa I & II Sub catchments

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
1. Population Growth	1.1. Rural urban Migration	1.1.1. Community sensitization and awareness creation	1.1.1.1 Undertake periodic radio talk shows.	a) Increased awareness on dangers of rural urban migration. b) Reduced Rural Urban Migration especially among the youths.
			1.1.1.2 Undertake periodic television adverts.	
			1.1.1.3 Prepare and distribute IEC (posters) materials in English and the local languages.	
			1.1.1.4 Design, supply and installation of billboards in English.	
			1.1.1.5 Undertake regular mobilization meetings for relevant partners at district level.	
		1.1.2. Train and support youths and women in sustainable agriculture Initiatives such as value addition	1.1.2.1 Mobilize Youths and women into groups at village level.	a) Increased Knowledge on sustainable agricultural production and value addition especially among the youths b) Improved knowledge on entrepreneurship skills especially among the Vulnerable groups
			1.1.2.2 Conduct Intensive training in sustainable agriculture initiatives and job creation.	
			1.1.2.3 Support the established groups with seed capital to start small scale value addition on agricultural products	
	1.2. High Fertility Rates	1.2.1. Community sensitization and	1.2.1.1 Promoting family planning education in schools	a) Increased awareness on family planning.

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
		awareness creation on family planning	1.2.1.4 Undertake media campaigns on radios, TVs and social media to target the youths	b) Increased extension services for service delivery especially in rural areas. b) Delays in early marriages especially in rural areas c) Increased adoption to family planning methods among the married couples. d) Improved accessibility and movements by extension workers
			1.2.1.5 Prepare and distribute IEC (posters) materials in English and the local languages.	
			1.2.1.6 Design, supply and installation of billboards in English with message on addressing high fertility rates.	
			1.2.1.7 Procurement of motorcycles to facilitate community mobilization.	
2. Poor access and low safe water coverage.	2.1 Limited safe water coverage and non-functionality of water supply systems.	2.1.1 Rehabilitate non-functional water supply systems.	2.1.1.1 Assess and repair non-functional point water sources.	a) Increased safe water coverage and accessibility by local people b) Increased coverage of deep boreholes for rural areas
			2.1.1.2 Siting, drilling and construction of deep boreholes.	
			2.1.2.2 Promote rainwater harvesting technologies at household level (Construct demonstration tanks in public places)	
		2.1.3 Increase the Coverage of Piped Water Supply	2.1.2.3 Feasibility studies, detailed design and construction of piped water systems.	a) Increased Piped water coverage to people at Household level
			2.1.2.4 Extend Piped Water Supply systems to reach areas without piped water systems	
	2.2 Unaffordability of water services by some users.	2.2.1 Pro-poor Public Stand Posts (PSPs).	2.2.1.1 Installation of pro-poor prepaid PSPs	a) Increased accessibility and affordability of safe

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
			2.2.1.2 Establishment of Water and Environment cooperatives.	water for all including the pro-poor. b) Improved efficiency of the water systems through management by water and environment cooperatives at local level
	2.3 Unregulated/ illegal water abstractions by investors	2.3.1 Improve regulation of water abstraction and effluent discharge.	2.3.1.1 Monitor the potential water abstractors to ensure they adhere to guidelines	a) Availability of data/ information on water abstractors. b) Reduced illegal water abstractions and effluent discharge
			2.3.1.2 Map all permissible water abstraction and effluent discharge locations.	
3. Poor access to sanitation facilities (latrines, water borne toilets, ecosan toilets, handwashing facilities, etc.)	3.1 Low access to improved sanitation facilities.	3.1.1 Increase the coverage for improved sanitation facilities.	3.1.1.1 Design and construction (review designs and supervise construction) of improved sanitation facilities e.g., water borne and ecosan toilets for public places.	a) Increased coverage of sanitation facilities such as water borne and ecosan toilets in public places. b) Reduced open defecation in public areas

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
		3.1.2 Sanitation and social marketing.	3.1.2.1 Undertake sanitation and social marketing campaigns.	a) Increased awareness on sanitation among households e.g., knowledge on toilet use. b) Increased toilet coverage at household level especially ecosan toilets and Water borne toilets. c) Reduced Open defecation in communities. d) Reduced incidences of water borne diseases such as diarrhea, dysentery, cholera etc.
	3.2 Inadequate knowledge and information on IWRM and WASH policies among the stakeholders	3.2.1 Strengthening the capacity of technical and political people of government structures in IWRM/WASH	3.2.1.1 Undertake periodic radio talk shows with focus on IWRM/WASH.	a) Improved knowledge on IWRM and WASH among the political and technical personnel.
			3.2.1.2 Organize trainings for catchment management structures and relevant authorities in existing policies and regulations on IWRM/ WASH	
		3.2.2 Sensitization of stakeholders on IWRM/WASH	3.2.2.1 Organize campaigns in communities and public places on IWRM/WASH	a) Improved awareness on IWRM/ WASH principles and practices by stakeholders within the sub catchments
			3.2.2.1 Organize annual events targeting youths e.g., WASH Boot Camps, conferences, school debates.	

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
		3.2.3 Promote research and Innovations for IWRM/WASH	3.2.3.1 Support research innovations related to WASH in tertiary institutions	a) Increase in research and innovations geared to addressing challenges in IWRM/WASH
			3.2.3.2 Organize WASH competitions and innovation prize among the youths and women	
		3.2.4 Enhance extension services related to WASH in communities	3.2.4.1 Procure Motorcycles to facilitate the movement of technical staff in promoting WASH in communities	a) Improved accessibility and service delivery by technical people. b) Improved reporting on the IWRM/ WASH status by the technical authorities.
			3.2.4.2 Conduct regular monitoring and give technical advice to local authorities and communities in IWRM/ WASH	
	3.3 Inadequate funds for financing IWRM/WASH services	3.3.1 Promote the economic contribution of IWRM/WASH services in social and national economic development to foster prioritization of funding for IWRM and WASH	3.3.1.1 Increased budget allocation towards IWRM/WASH at sub catchment level.	a) Improved service delivery especially in WASH
			3.3.1.2 Lobby funds for catchment management committees and environmental committees at district/ city or sub catchment level.	
4. Poor solid waste management.	4.1 Inadequate solid waste management systems.	4.1.1 Establishment of proper solid waste management systems.	4.1.1.1.Construction of waste bankers for public areas.	a) Improved Proper Solid waste management b) Improved sanitation and hygiene in the urban areas c) Enhancing economic value of wastes through value addition

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
		4.1.2 Installation of incinerators at Health Care Facilities (HCFs).	4.1.2.1. Installation of incinerators at HCFs.	
		4.1.4 Establishment of waste management centers.	4.1.4.1. Feasibility study and detailed design of waste management centers.	
			4.1.4.2. Design and implement green waste management innovations e.g., energy generation, making of compost manure, waste recycling etcetera	
			4.1.4.2. Procurement of Compression Garbage Compactor Truck.	
5. Poor liquid waste management leading to water pollution.	5.1 Inadequate treatment of effluent before discharge.	5.1.1 Enforcement of effluent discharge permits.	5.1.1.1 Sampling of effluent discharges and inspection/monitoring of discharging facilities.	a) improved liquid waste discharge and treatment within the sub catchments. b) Reduced risks of disease outbreak which may result from poor liquid waste management.
		5.1.2 Develop minimum standards for wastewater treatment facilities.	5.1.2.1 Development of minimum design standards for the treatment of wastewater.	
		5.1.3 Establishment of centralized WWTPs	5.1.3.1 Design and construction of wastewater/faecal sludge treatment facility	
			5.1.3.2 Procurement of vacutug and cesspool empties.	
		6.1.1 Enhance Monitoring and Planning	6.1.1.1 Installation of additional meteorological stations.	a) Increased availability of data related to IWRM/

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ outcomes
6. Inadequate Data on IWRM/ WASH Services.	6.1 Insufficient ground-based observations/data on water resources and climate	for Water services and Resources	6.1.1.2 Installation of river gauging stations and flood monitoring	WASH and climate b) Enhanced research and innovations from the available data. c) Improved weather prediction. d) Early preparedness to extreme weather events like natural disasters such as floods, droughts etc.
			6.1.1.3 Undertake regular surface water quality monitoring and reporting	
			6.1.1.4 Establish Early warning systems for floods	
			6.1.1.5 Establish sediment monitoring systems	
			6.1.1.4 Installation of groundwater monitoring stations	
	6.2 Limited capacity for some technical MWE and LG staff in IWRM/WASH Services.	6.2.1 Enhance capacity of designated MWE and LG staff in water resources assessment and management.	6.2.1.1 Undertake hands-on training of designated MWE staff in water resources assessment, planning and management.	a) Knowledge and capacities of MWE and Local Government staff enhanced in the area of IWRM/WASH
			6.2.1.2 Support extension services in communities focusing on IWRM/WASH services	
			6.2.1.2 Organise benchmarking/learning visits for designated MWE and LG staff	

Table 5-2: Proposed Options and Interventions for addressing issues/ threats related to Ecosystem Protection and Restoration across Aswa I & II Sub catchments

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
1. Riverbank encroachment leading to siltation, water pollution, floods, etc.	1.1. Low awareness and poor mindset.	1.1.1. Community sensitization and awareness creation	1.1.1.1 Undertake periodic radio talk shows.	a) Increased knowledge and understanding of the protection of river buffer zones by the local communities. b) Increased adoption to riverbank/ conservation of buffer zones by local communities.
			1.1.1.2 Undertake periodic television adverts.	
			1.1.1.3 Prepare and distribute IEC (posters) materials in English and the local languages.	
			1.1.1.4 Design, supply and installation of billboards in English.	
			1.1.1.5 Undertake regular mobilization meetings for relevant partners at district level.	
	1.2. Weak enforcement of applicable laws and regulations.	1.1.2. Strengthen the enforcement of the National Environment Act (2019), and the National Environment (Wetlands, Riverbanks, and Lakeshores Management) Regulations, 2000.	1.1.2.1 Hold annual capacity building workshops for local authorities (Technical and political staff).	a) Increased knowledge and understanding of the existing laws, policies and regulations for managing riverbanks.
			1.1.2.2 Mobilise funding to support/enhance Local Environment Committees (LEC) and environmental police to undertake monitoring and management.	b) Increased funds for supporting environmental committees and monitoring. c) Reduced environmental degradation around riverbanks.
			1.1.2.3 Eviction of encroachers and demolition of illegal structures.	d) Reduced encroachers and illegal/ degradation activities around riverbanks.

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
	1.2 Absence of visible riverbank boundary markers.	1.2.1 Demarcation of riverbanks using live markers	1.2.1.1 Mobilisation, awareness creation and training of community members.	a) Improved knowledge about river buffer zones conservation b) Reduced environmental degradation around riverbanks. c) Increased biodiversity within the buffer zones d) Reduced land conflicts between local authorities and the local people.
			1.2.1.2 Provide tools and materials for demarcation.	
			1.2.1.3 Demarcation of riverbanks using live markers planted at a distance of 100 meters from the highest water mark.	
			1.2.1.3 Revegetation and stabilization of degraded riverbanks.	
			1.2.1.4 Inspection and monitoring to ensure high survival rates after planting.	
		1.2.2 Demarcation using concrete pillars.	1.2.2.1 Provide tools and materials for demarcation.	
			1.2.2.1 Demarcation of riverbanks using concrete pillars installed at a distance of 100 meters from the highest water mark.	
	1.3.Increasing population leading to the demand for housing .	1.3.1. Community senstisation and awareness creation on family planning	1.3.1.1 Development of physical plans for Lower Local Governments.	a) Proper physical planning and reduced encroachment on riverbanks for housing.
	1.4 Absence of gazetted animal watering facilities.	1.4.1 Plan and gazette animal watering areas.	1.4.1.1 Construction of watering troughs using locally available materials.	a) Reduced riverbank degradation and sedimentation/ siltation. b) Improved health of the livestock c) Improved water quality

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
	1.5 Absence of properly planned and gazette car/cycle washing facilities.	1.5.1 Plan and gazette car/cycle washing areas.	1.5.1.1 Mobilisation, awareness creation and training of community members.	a) Reduced riverbank degradation and sedimentation/ siltation. b) Improved livelihood of the youths c) Improved water quality due to controlled pollution by engine oils and detergents.
			1.5.1.2 Provide tools and equipment.	
			1.5.1.2 Establishment of planned washing bays.	
	1.6 Livestock grazing.	1.6.1 Promote alternative sources of pasture.	1.6.1.1 Mobilise and train commercial pasture farmers.	a) Increased adoption to improved pasture agronomy by livestock farmers. b) Reduced disturbances and degradation of the river buffer zones through grazing. c) Improved livestock production for household economic enhancement.
			1.6.1.2 Provide pasture seeds for planting.	
2. Wetland encroachment and degradation leading to reduced water levels	Low awareness and poor mindset.	Sensitization through mass media.	Undertake periodic radio talk shows	
		Sensitization through local knowledge networks (Forestry Officers, CSOs, extension staff).	Hold periodic sensitization meetings for communities adjacent to wetland	
	2.1 Demand for settlement	2.1.1 Demarcation and restoration of degraded wetlands using live markers and concrete pillars	2.1.1.1 Mobilisation, awareness creation and training of community members.	a) Improved knowledge of wetland management by local communities and relevant authorities. b) Increase in wetland
			2.1.1.2 Provide tools and materials for demarcation.	

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
	2.2 Weak enforcement of applicable laws and regulations	2.2.1 Strengthen the enforcement of the National Environment Act (2019), and the National Environment (Wetlands, Riverbanks, and Lakeshores Management) Regulations, 2000.	2.2.1.1 Develop community-based wetland management plans (WMPs).	conservation and biodiversity. c) Increase in water quantity and quality within the sub catchments
			2.2.1.2 Eviction of encroachers and demolition of illegal structures.	
	2.3 Livelihood activities e.g., crop cultivation, livestock grazing/watering, Sand mining and brick-making.	2.3.1 Establish environmentally friendly livelihood support activities for wetland encroachers.	2.3.1.1 Installation of micro-irrigation systems	a) reduced encroachment on wetlands for livelihood activities b) Increase in wetland conservation and biodiversity. c) Increase in water quantity and quality within the sub catchments d) Enhanced income for wetland encroachers through implementing environmentally friendly livelihood activities
			2.3.1.2 Establishment of fish ponds and support of fish farmer groups.	
			2.3.1.3 Train women and youths to make handcrafts from wetland vegetation such as papyrus	
3. Soil erosion Leading to soil infertility, siltation of rivers.	3.1 Poor farming practices	3.1.1 Promote improved soil and water conservation (SWC).	3.1.1.1 Mobilise, sensitise and train farmers on SWC practices.	a) Improved knowledge on best farming practices such as soil and water conservation b) improve in soil productivity c) Improved water quality and natural resources management.
			3.1.1.2 Implement SWC practices (mulching, terracing, water trenches, Integrated farm planning, etc.).	
4. Water Pollution due to	4.1 Car washing inside wetlands and rivers	4.1.1 Plan and gazette car/cycle washing areas	4.1.1.1 Mobilisation, awareness creation and training of community members.	a) Reduced water pollution b) Improved water quality

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
anthropogenic activities			4.1.1.2 Provide tools and equipment.	c) Improved livelihoods of the youths.
			4.1.2.2 Establishment of planned washing bays.	
	4.2 Lack of appropriate farming skills and knowledge	4.2.1 Strengthen research-farmer and extension linkages.	4.2.1.1 Mobilisation, awareness creation and training of community members.	a) Increased knowledge on best farming practices. b) Improved knowledge on natural resources management c) Improved livelihoods of the youths.
			4.2.1.2 Establishment of Agroecology demonstration farms.	
5. Deforestation causing Land use and Cover Changes and climate change	5.1. Demand for settlement	5.1.1 Sensitization of communities about sustainable forestry practices.	5.1.1.1 Undertake periodic radio talk shows on forestry.	a) Improved knowledge on participatory forest management b) Reduced tree cutting
			5.1.1.2 Prepare and distribute IEC (posters) materials both in English and local languages.	
	5.2. Weak enforcement of applicable laws and regulations	5.2.1 Strengthen the enforcement of the applicable laws, regulations and guidelines.	5.2.1.1 Formulation and enforcement of physical plans.	a) Improved knowledge on the existing laws, policies and regulations b) Reduced tree cutting c) increase in tree cover d) Increased knowledge on forest management through community collaborative efforts
			5.2.1.2 Procurement of motorcycles to facilitate community mobilization.	
			5.2.1.3 Formulate and enforce bylaws and ordinances for addressing issues of deforestation	
			5.2.1.4 Establish collaborative forest management groups in communities around CFRs	

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
	5.3. Over-harvesting, charcoal burning, firewood, land clearing for agriculture.	5.3.1 Reforestation, afforestation and agroforestry (multipurpose tree species e.g., *Musizi, Khaya anthotheca, Mvule, Calliandr*a, etc.).	5.3.1.1 Mobilisation, sensitisation and training of HHs.	a) Improved knowledge on best practices of forestry b) Reduced tree cutting c) increase in tree cover
			5.3.1.2 Provide tools and materials for planting to the farmer groups.	
			5.3.1.3 Provide tree seedlings for planting.	
			5.3.1.5 Inspection and monitoring to ensure high survival rates.	
	5.4. Lack of affordable alternative energy solutions leading to overreliance of charcoal and firewood.	5.4.1 Promote energy efficient stoves.	5.4.1.1 Train selected households to construct energy efficient stoves e.g., Lorena stoves with locally available materials.	a) Improved knowledge on alternative energy technologies b) Reduced tree cutting c) increase in tree cover
		5.4.2 Promote other energy alternatives.	5.4.2.1 Promote subsidies for households and institutions that use Liquefied Petroleum Gas (LPG)/electricity as an energy source.	
			5.4.2.1 Support the establishment of local supply chains for alternative energy technologies.	
	5.5 Over-harvesting, charcoal burning, firewood, land clearing for agriculture.	5.5.1 Promote Apiculture	5.5.1.1 Mobilisation, sensitisation and training of HHs.	a) Improved knowledge on alternative income generating activities. b) Reduced tree cutting c) increase in tree cover d) Improved income of the people
			5.5.1.2 Establish farmer groups from each sub-counties adjacent to CFRs and provide each group support for an apiculture project.	

Identified Issue/ Threat	Drivers	Options	Identified Activities	Results/ Outcomes
		5.5.2 non-wood forest products.	5.5.2.1 Support enterprise development of non-wood forest products.	
	5.6 Low levels of affordable alternative energy technology adoption.	5.6.1 Enhance Adoption of alternative energy technologies.	5.6.1.1 Promote the production of briquettes.	a) new knowledge and innovations on alternatives to charcoal b) Knowledge on sustainable charcoal production. b) Reduced tree cutting c) increase in tree cover
			5.6.1.2 Promote sustainable charcoal production using improved kilns.	
			5.6.1.3 Plant trees for charcoal production.	
			5.6.1.4 Support enterprises for energy saving stoves.	

5.2. Description of Proposed Options and Interventions

The proposed options and interventions are geared to address two broad categories of threats identified and these include; a) options and interventions geared to address issues related to water and sanitation services, b) options and interventions geared to address issues related to ecosystem protection. The proposed options and interventions have been aligned to addressing these broad challenges/ threats within the Aswa I & II sub catchment. The implementation of these proposed options and interventions are described further in the sub sections below;

5.2.1. Addressing issues/ threats related to Water and Sanitation Services in Aswa I & II Sub catchments.

Access to reliable water and sanitation services is crucial for the health, well-being, and prosperity of communities within a catchment. A well-managed water and sanitation system ensures the sustainable use of water resources, protects aquatic ecosystems, and supports economic development. In a catchment, water and sanitation services play a vital role in maintaining water quality, preventing pollution, and mitigating the risks of water-borne diseases. The country aims to increase access to clean water, sanitation, and hygiene facilities, with a focus on achieving the United Nations' Sustainable Development Goal 6 (SDG 6), which seeks to ensure universal and equitable access to safe and affordable water and sanitation for all by 2030. On the other hand, the recommended options and actions/ interventions are looking at addressing issues related to Water, Sanitation and Hygiene services in Aswa I & II Sub catchments.

I. Rapid Population Growth

Rapid population growth was one of the issues identified by stakeholders in Aswa I & II sub catchments. This is majorly caused by; a) rural urban migration especially among the youths who live villages to look for jobs in the growing Lira City and town councils and b) high fertility rate especially among the teenagers/ youths who drop out from school at an early age. The high population of the area can cause pressure on existing natural resources but also demands for water and sanitation facilities all the time. To address this issue, possible options have been proposed and these include; a) Community sensitization and awareness creation through Undertaking periodic radio talk shows and TV adverts, information dissemination through use of IEC materials and bill boards translated into local languages, undertaking regular meetings with technocrats and politicians. b) Train and supporting youths and women in sustainable agriculture Initiatives such as value addition so that they can stay in the rural areas but do productive work. This can be achieved by mobilising the youths and women into groups and training them intensively in suitable agricultural production and other entrepreneur skills and supporting the youths and women with seed capital to startup businesses. The results or outcomes from these interventions shall ensure that there is increased awareness on dangers of rural urban migration especially among the youths, reduced rural urban migration, increased knowledge on sustainable agriculture and other potential business innovations, among others.

II. Poor access and low safe water coverage.

The drivers to poor access and low safe water coverage in Aswa I & II are; a) Limited safe water coverage and non-functionality of water supply systems, b) Unaffordability of water services by some users and c) Unregulated/ illegal water abstractions by investors. In order to address these, a number of options and interventions have been proposed and these include;

a) **Rehabilitate non-functional water supply systems:** This will be achieved through conducting an assessment on all non-functional water points such as deep boreholes, protected springs, shallow wells and repairing them. Siting, drilling and construction of deep boreholes in villages where there are no existing boreholes and Promoting rainwater harvesting technologies at household level to utilize the rain water.
b) **Increase the Coverage of Piped Water Supply:** This will be achieved through conducting the feasibility studies, detailed design and construction of piped water systems in areas where there are no piped water systems.
c) **Establishing Pro-poor Public Stand Posts (PSPs):** Installation of pro-poor prepaid Public stand posts to cater for the poor people who cannot afford installation of water systems within their homes.
d) **Establishment of Water and Environment cooperatives:** Water and Environmental cooperatives will be established at the sub county level/ town council in order to manage the water systems but also improve the livelihood of the people and conserving water resources.
e) **Improve regulation of water abstraction and effluent discharge:** This will be achieved through monitoring all the potential water abstractors to ensure they adhere to guidelines and mapping all permissible water abstraction and effluent discharge locations within the sub catchments.

The results for these options and interventions will aim at Increasing safe water coverage and accessibility by local people through increasing the water points in every village and at household level targeting both rural and urban areas within the sub catchments.

III. Poor access to sanitation facilities (latrines, water borne toilets, ecosan toilets, handwashing facilities, etc.)

Poor access to sanitation facilities leads to increased risk of diarrheal diseases, cholera, and typhoid fever. It also causes environmental pollution, contaminating water sources and soil. Additionally, inadequate sanitation infrastructure contributes to malnutrition, reduced cognitive development, and decreased economic productivity. Women and girls are disproportionately affected, facing dignity and safety issues, particularly during menstruation. The lack of proper handwashing facilities exacerbates the spread of infectious diseases, further burdening Uganda's healthcare system. The drivers to this threat include; a) Low access to improved sanitation facilities, b) Inadequate knowledge and information on IWRM and WASH policies among the stakeholders c) Inadequate funds for financing IWRM/WASH services. In order to address these, a number of options and interventions have been proposed and these include;

a) **Increase the coverage for improved sanitation facilities:** Design and construction (review designs and supervise construction) of improved sanitation facilities e.g., water borne and ecosan toilets for public places.
b) **Sanitation and social marketing:** Undertaking sanitation and social marketing campaigns in communities such as public places like markets, schools and religious institutions. The outcomes of this will be; a) Increased awareness on sanitation among households b) Increased toilet coverage at household level especially ecosan toilets and water borne toilets. c) Reduced Open defecation in communities, d) Reduced incidences of water borne diseases such as diarrhoea, dysentery, cholera etc.
c) **Strengthening the capacity of technical and political people of government structures in IWRM/WASH:** a) Undertake periodic radio talk shows with focus on IWRM/WASH, b) Organize trainings for catchment management structures and relevant authorities in existing policies and regulations on IWRM/ WASH.
d) **Sensitization of stakeholders on IWRM/WASH:** Organize campaigns in communities and public places on IWRM/WASH and Organize annual events targeting youths e.g., WASH Boot Camps, conferences, school debates.
e) **Promote research and Innovations for IWRM/WASH:** Support research innovations related to WASH in tertiary institutions and Organize WASH competitions and innovation prize among the youths and women.
f) **Enhance extension services related to WASH in communities:** this can be achieved through procuring Motorcycles to facilitate the movement of technical staff in promoting WASH in communities and conduct regular monitoring and give technical advice to local authorities and communities in IWRM/ WASH.
g) **Promote the economic contribution of IWRM/WASH services in social and national economic development to foster prioritization of funding for IWRM and WASH:** Increased budget allocation towards IWRM/WASH at sub catchment level and Lobbying funds for catchment management committees and environmental committees at district/ city or sub catchment level.

IV. Poor solid waste management.

The driver to poor solid waste management is Inadequate solid waste management systems within the sub catchments and this can be addressed by implementing the following options and interventions;

a) **Establishment of proper solid waste management systems:** Construction of waste bankers for public areas such as hospitals, schools, markets and religious institutions. Waste banks will be used for proper waste management where biodegradable and non-biodegradable wastes will be managed separately.
b) **Installation of incinerators at Health Care Facilities (HCFs):** Incinerators will be built in public institutions such as healthy centres and schools in order to manage hazardous wastes.
c) **Establishment of waste management centres:** Feasibility study and detailed design of waste management centres, Design and Implement green waste management innovations e.g., energy

generation, making of compost manure, waste recycling etcetera and Procurement of Compression Garbage Compactor Truck.

The implementation of these options and interventions will help to improved proper solid waste management, improve sanitation and hygiene in both rural and urban areas and enhancing economic value of wastes through value addition.

V. Poor liquid waste management leading to water pollution.

The driver to this issue is Inadequate treatment of effluent before discharge. Many factories discharge their waste into the environment with no or minimal treatment and this is very dangerous to aquatic and soil organisms. To address this, the following options and interventions/ actions will be implemented;

a) Enforcement of effluent discharge permits through Sampling of effluent discharges and inspection/monitoring of discharging facilities.
b) Developing minimum standards for wastewater treatment facilities.
c) Establishment of centralised WWTPs through; Designing and construction of wastewater/faecal sludge treatment facility and Procurement of vacutug and cesspool emptier.

VI. Inadequate Data on IWRM/ WASH Services.

The driver to this issue/ threat is Insufficient ground-based observations/data on water resources and climate and Limited capacity for some technical MWE and LG staff in IWRM/WASH Services. These drivers will be addressed through implementing the following options and interventions respectively.

a) **Enhance Monitoring and Planning for Water services and Resources:** Installation of additional meteorological stations, Installation of river gauging stations and flood monitoring, undertake regular surface water quality monitoring and reporting, Establish Early warning systems for floods, Establish sediment monitoring systems and Installation of groundwater monitoring stations.
b) Enhance capacity of designated MWE and LG staff in water resources assessment and management: Undertake hands-on training of designated MWE staff in water resources assessment, planning and management, Support extension services in communities focusing on IWRM/WASH services and Organising benchmarking/learning visits for designated MWE and LG staff.

5.2.2. Addressing issues/ threats related to Ecosystem Restoration and Protection in Aswa I & II Sub catchments.

The following issues/ threats related to ecosystem restoration and protection were identified in Aswa I & II sub catchments and these are caused by a number of drivers. Options and interventions have been proposed based on the type of issue/ threat and are described in details in the sub sections below;

(i) **Riverbank encroachment leading to siltation, water pollution, floods, etc.:** The drivers to this issue are a) Low awareness and poor mindset, b) Weak enforcement of applicable laws and regulations., Absence of visible riverbank boundary markers, Increasing population leading to the demand for housing, Absence of gazetted animal watering facilities, Absence of properly planned and gazetted car/cycle washing facilities and Livestock grazing. Based on these drivers, the following options and interventions have been proposed;

a) **Community sensitization and awareness creation:** This will be achieved through Undertaking periodic radio talk shows and TV adverts related to forestry, use of IEC materials such as posters and fliers, installation of billboards along major roads and undertaking regular mobilization meetings for relevant partners at district level to discuss about how to address the issues.

b) **Strengthening the enforcement of the National Environment Act (2019), and the National Environment (Wetlands, Riverbanks, and Lakeshores Management) Regulations, 2000:** This will be achieved through holding annual capacity building workshops for local authorities (Technical and political staff), mobilising funding to support/enhance Local Environment Committees (LEC) and environmental police to undertake monitoring and management and eviction of encroachers and demolition of illegal structures from the river buffer zones.

c) **Demarcation of riverbanks using live markers:** This will be achieved by Mobilising community member near the riverbanks and undertaking awareness creation and training on buffer zone management and demarcation process, Providing tools and materials for demarcation to the communities, demarcating of riverbanks using live markers and concrete pillars planted at a distance of 100 meters from the highest water mark, Revegetation and stabilization of degraded riverbanks and carrying out Inspections and monitoring to ensure high survival rates after planting of vegetation.

d) Community sensitization and awareness creation on family planning and developing of physical plans for Lower Local Governments.

e) Plan and gazette animal watering areas. Construction of watering troughs using locally available materials to reduce degradation and sedimentation/ siltation, improving health status of the livestock and improving water quality.

f) Plan and gazette car/cycle washing areas to help reduce water pollution from oil spills and erosion.

g) Promote alternative sources of pasture for livestock farmers who graze around the buffer zones. Farmers will be trained in improved pasture agronomy and provided with improved seeds for growing.

(ii) **Wetland encroachment and degradation leading to reduced water levels:** The following are the identified drivers a) Low awareness and poor mindset, b) Demand for settlement, c) Weak enforcement of applicable laws and regulations, d) Livelihood activities e.g., crop cultivation, livestock grazing/watering, Sand mining and brick-making. Based on these drivers, the following options and interventions have been proposed;

a) Sensitization through mass media and Sensitization through local knowledge networks (Forestry Officers, CSOs, extension staff). Similarly, to riverbanks radio talk shows and sensitization meetings for communities adjacent to wetland will be undertaken.
b) Demarcation and restoration of degraded wetlands using live markers and concrete pillars.
c) Establish environmentally friendly livelihood support activities for wetland encroachers and this will be achieved through Installing of micro-irrigation systems for wetland encroachers, Establishment of fish ponds and support of fish farmer groups and Training of women and youths to make handcrafts from wetland vegetation such as papyrus.

(iii) **Soil erosion Leading to soil infertility, siltation of rivers.** Soil erosion will be addressed through promoting improved soil and water conservation (SWC). Mobilise, sensitise and train farmers on SWC practices and implement SWC practices (mulching, terracing, water trenches, Integrated farm planning, etc.).

(iv) **Car washing inside wetlands and rivers:** Plan and gazette car/cycle washing areas, this will be achieved through conducting awareness creation and training of community members, providing tools and equipment to the youths' groups and establishing the planned washing bays in selected sites.

(v) **Lack of appropriate farming skills and knowledge:** Strengthen research-farmer and extension linkages: Through Mobilisation, awareness creation and training of community members and establishment of Agroecology demonstration farms.

(vi) **Weak enforcement of applicable laws and regulations:** Strengthen the enforcement of the applicable laws, regulations and guidelines: Formulation and enforcement of physical plans, Procurement of motorcycles to facilitate community mobilization, Formulate and enforce bylaws and ordinances for addressing issues of deforestation, Establish collaborative forest management groups in communities around CFRs.

(vii) **Over-harvesting, charcoal burning, firewood, land clearing for agriculture;** This will be addressed through implementing the following options and interventions;

a) **Promoting Reforestation, afforestation and agroforestry (multipurpose tree species e.g., Musizi, Khaya anthotheca, Mvule, Calliandra, etc.):** Mobilisation, sensitisation and training of HHs, Provide tools and materials for planting to the farmer groups, Provide tree seedlings for planting and Inspection and monitoring to ensure high survival rates.
b) **Promote energy efficient stoves:** Train selected households to construct energy efficient stoves e.g., Lorena stoves with locally available materials.
c) **Promote other energy alternatives:** Promote subsidies for households and institutions that use Liquefied Petroleum Gas (LPG)/electricity as an energy source and Support the establishment of local supply chains for alternative energy technologies.
d) **Promote Apiculture:** Mobilisation, sensitisation and training of households and Establishing farmer groups from each sub-counties adjacent to CFRs and provide each group support for an apiculture project.

e) **Promote the use of Non-wood forest products:** Support enterprise development of non-wood forest products.

6. CONCLUSIONS

From the study, there are clear challenges to the catchment, which are clearly affecting the status of the water resource, these include rapid population growth, high poverty, low literacy levels, land ownership which is not backed by formal documentation, poor access to basic services, weak enforcement of regulations on protection and conservation of water resources.

The area is also vulnerability to natural disaster, land degradation and soil erosion particularly around the riverbanks of the different rivers and streams within the study area.

Livelihood activities are resulting into environment degradation, these include bush burning for cultivation, deforestation due to agriculture and settlement. There are also conflicts over natural resources and activities such as artisanal mining are resulting in the clearance of vegetation and degradation of river banks.

These challenges however create opportunities for intervention in relation to water resources management and catchment protection. The already available knowledge base, and the finding of the study can help the stakeholders to identify priorities and an action portfolio for future interventions on protection and conservation of freshwater ecosystems and equitable access to water resource management in Lira District and Lira City.

Though there are a number of challenges related to water resources management and conservation, there are also opportunities to tap into for Improvement and sustainability. The work done previously by the different stakeholders provide lessons learnt and a platform on which future projects and programmes can be built. The existence of the bigger Aswa CMP, the Upper Nile Water Management Zone strategy, and the corresponding management structures provide a wider frame work in which implementation of the conservation measures in Aswa I and II can be anchored.

There are of course existing challenges ranging from Institutional and Financing gaps, but there is also appreciation of the problem of water resources protection from the various leadership of both Lira City and Lira District Local Government, as well as the National Level through the UNWMZ, and as such there exists willingness to mobilise resources for purposes implementing sustainable water resources management programmes.

7. APPENDICES

Appendix I: Topography of the focus area in Aswa I and Aswa II sub-catchments

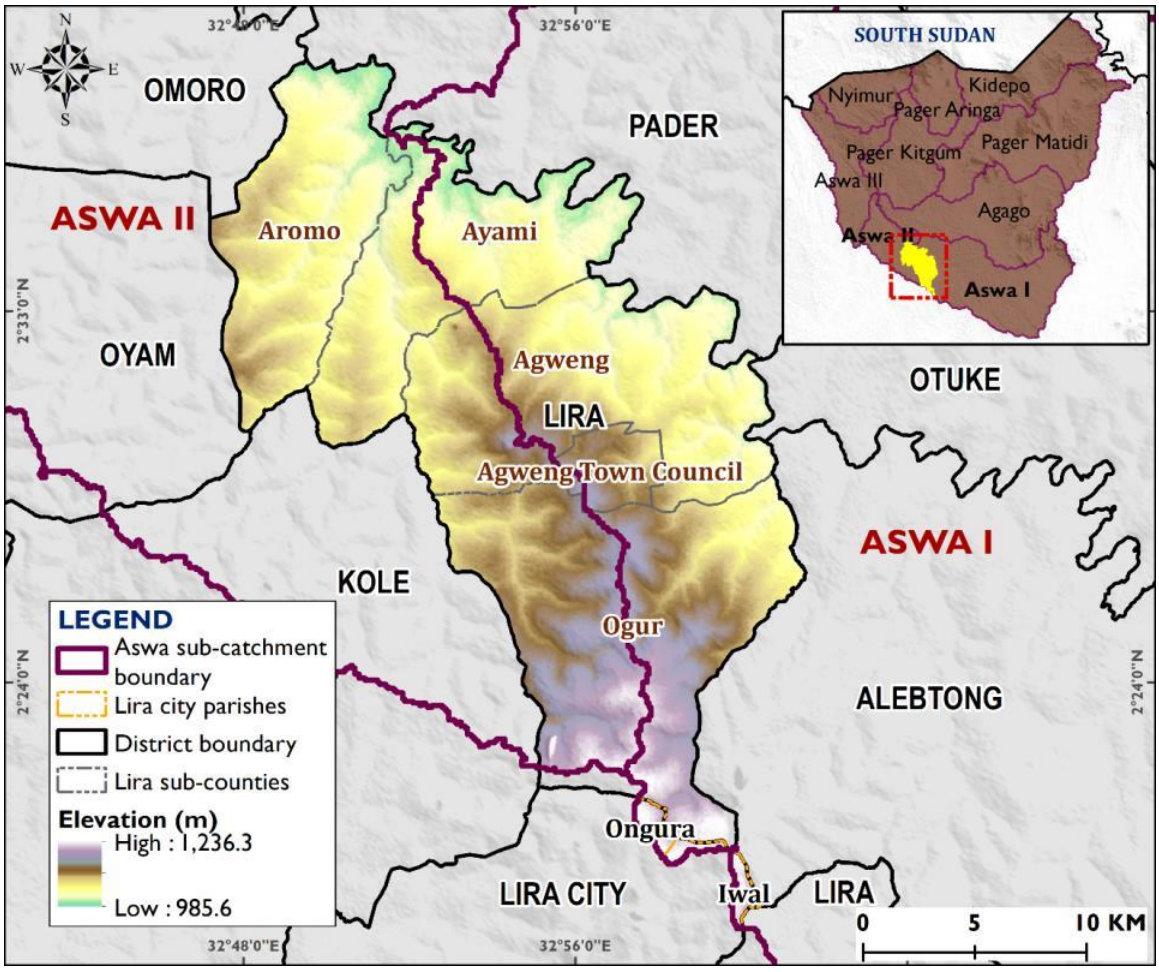


Figure 7-1: Topography of the focus area in Aswa I and Aswa II sub-catchments

Data source: SRTM DEM (30 meters)

Appendix II: Heat map of maximum temperatures in Lira City and Lira District

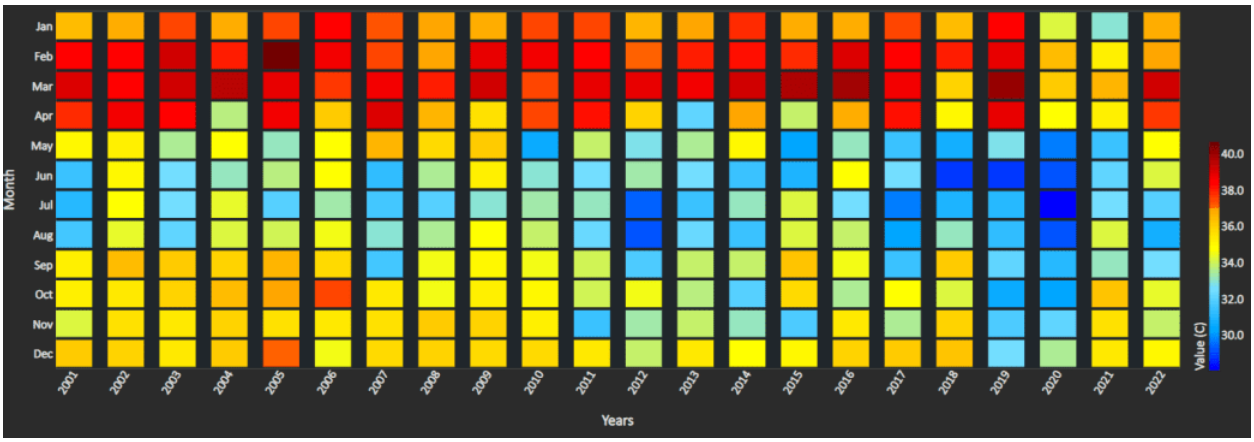


Figure 7-2: Heat map of maximum temperatures in Lira city and Lira district between 2001 and 2022

Appendix III: Geology in Lira City and Lira District

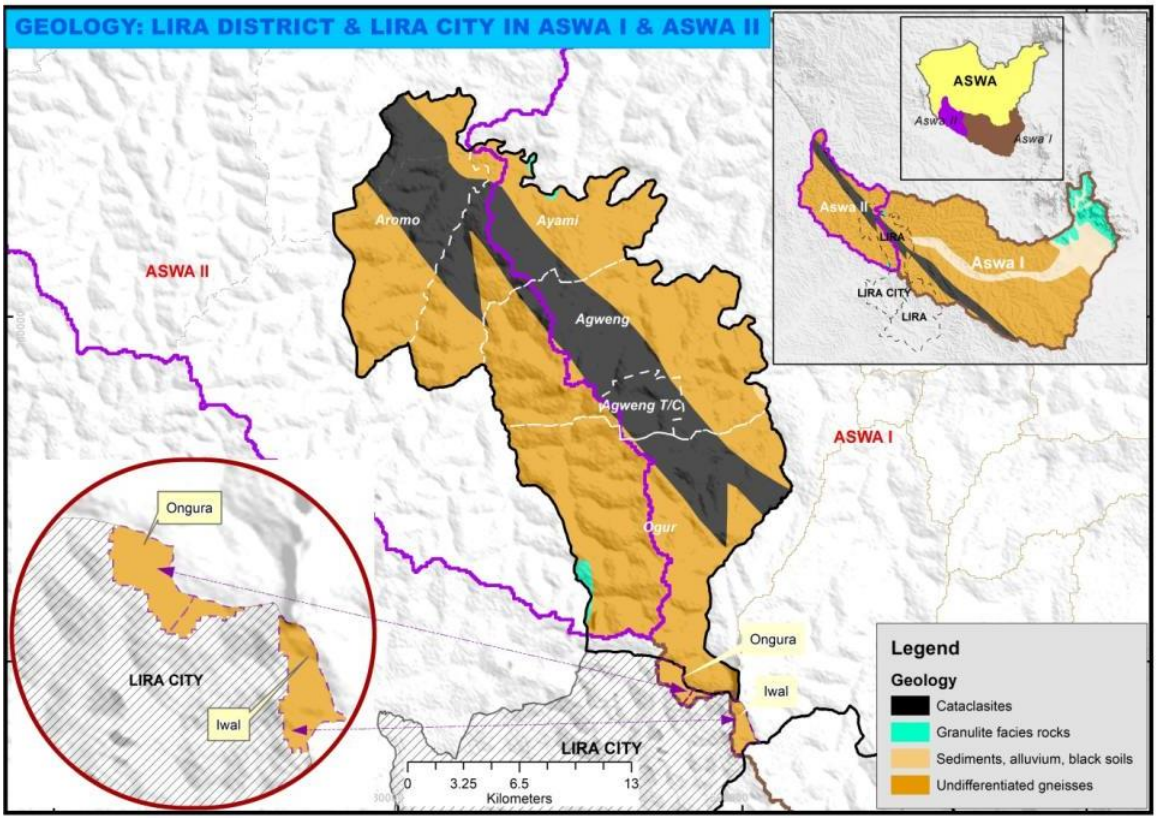


Figure 7-3: Geology of the study area in Aswa I and Aswa II sub-catchments

Data source: Directorate of Geological Survey and Mines,2022

Appendix IV: Distribution of soils in Aswa I and Aswa II sub-catchments

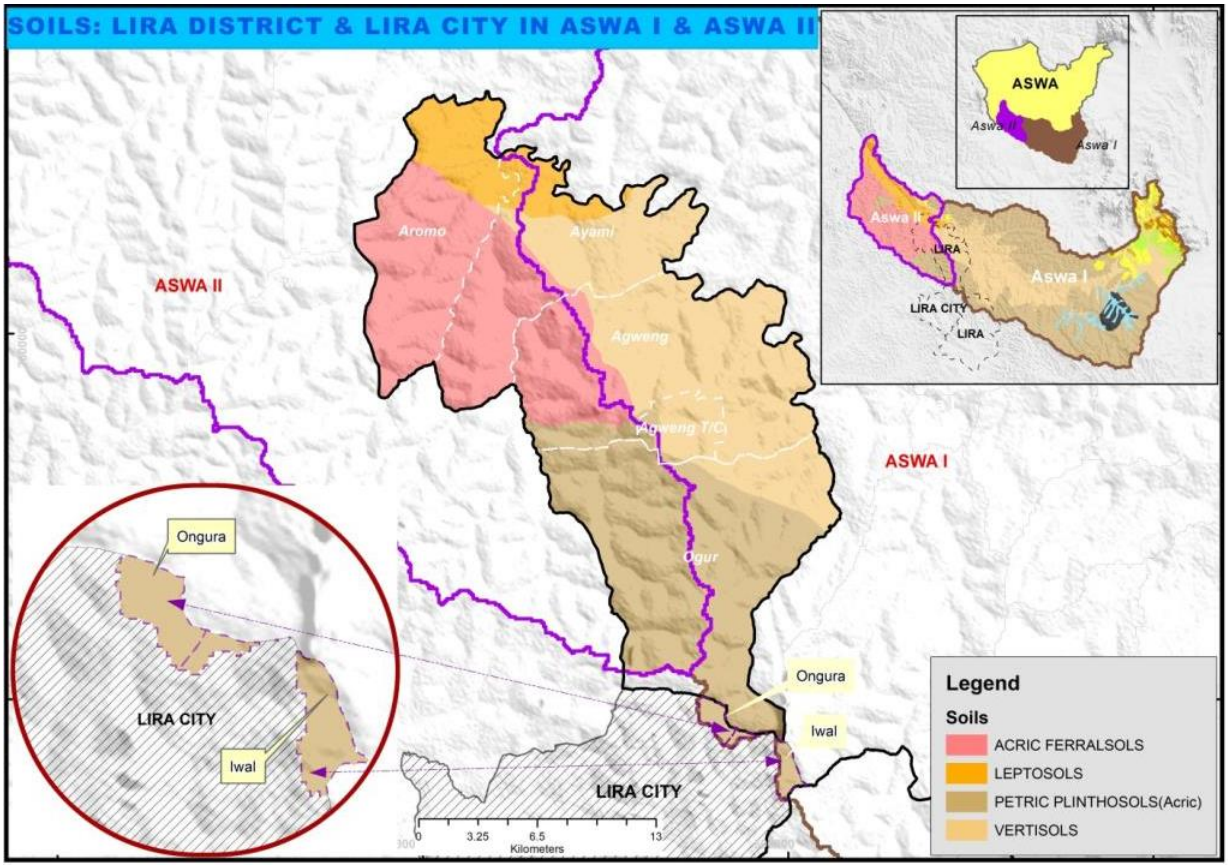


Figure 7-4: Distribution of soils in Aswa I and Aswa II sub-catchments

Data source: NARO, 2017

Appendix V: Original vegetation types in Lira City and Lira District (1964)

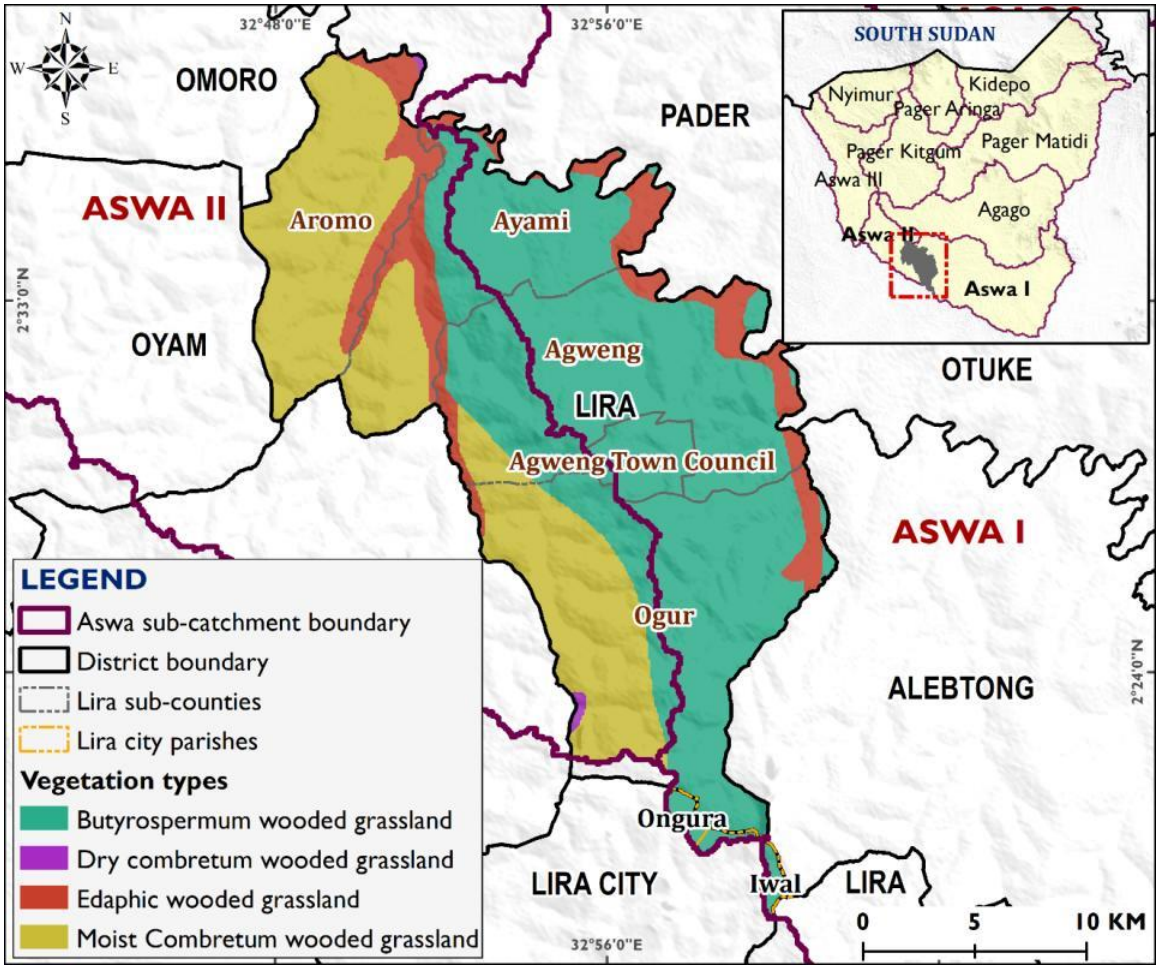


Figure 7-5: Original vegetation types in Lira city and Lira district in Aswa I and Aswa II sub-catchments

Data source: Langdale-Brown et al., 1964

Appendix VI: Wetland use/cover types and wetland status in Lira City and Lira District

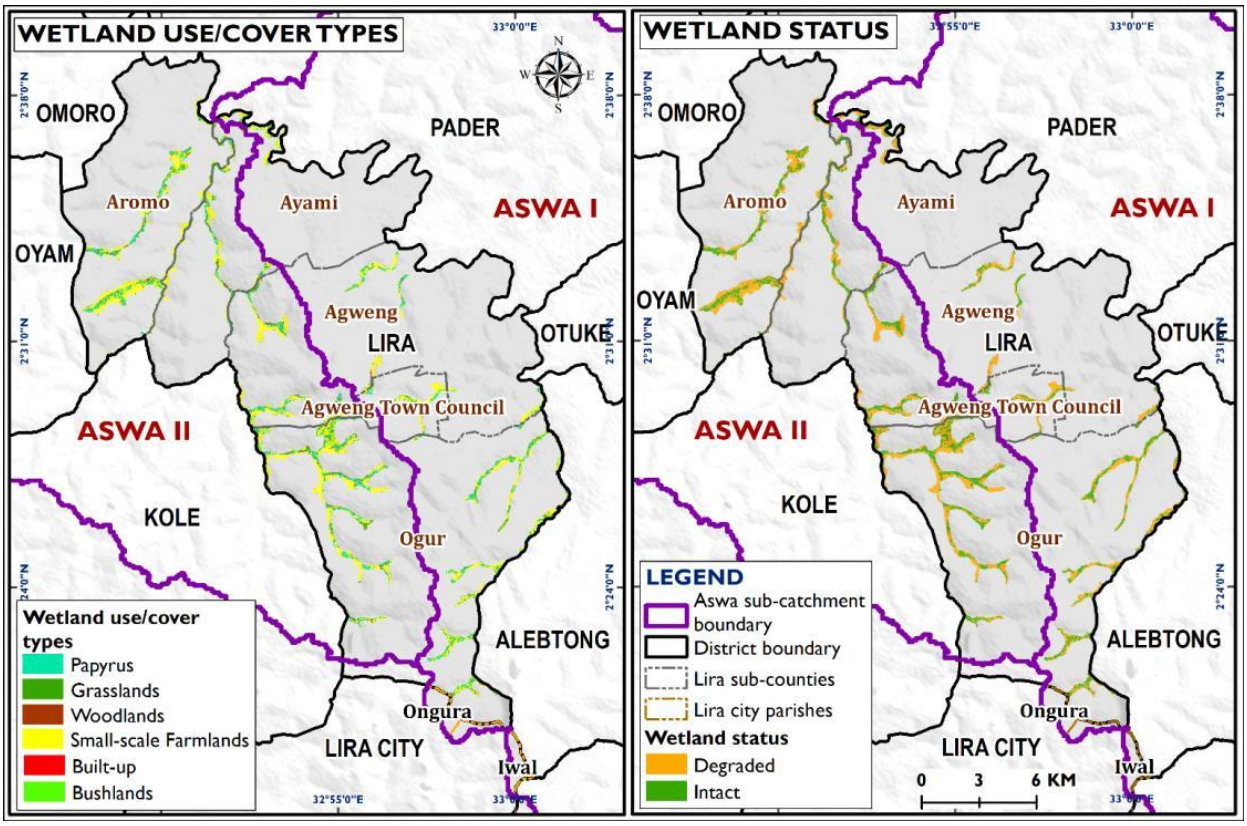


Figure 7-6: Wetland use/cover types and wetland status in Lira city and Lira district in Aswa I and Aswa II sub-catchments

Data source: Wetland Management Department (WMD), 2021

Appendix VII: Forest reserves in Lira district

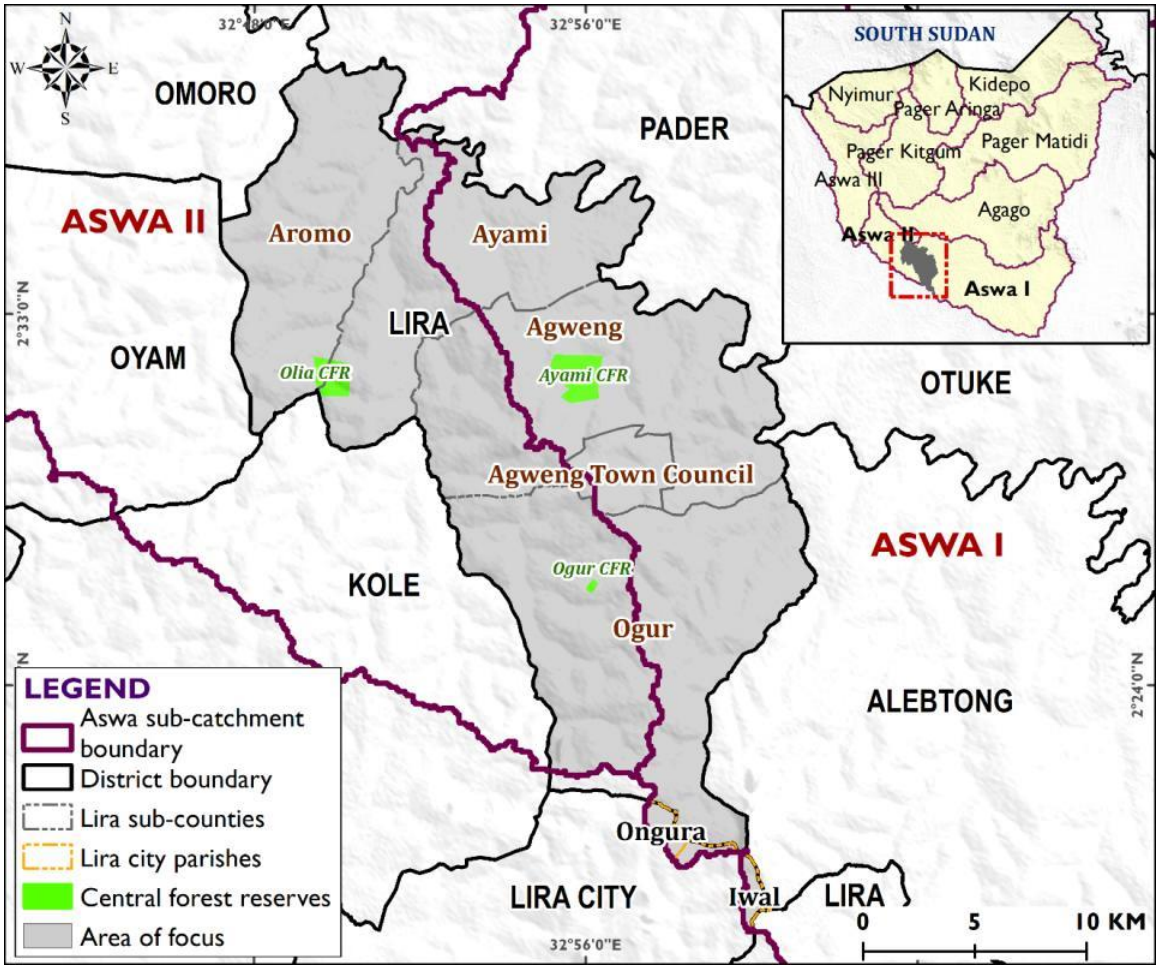


Figure 7-7: Forests in Lira district in Aswa I and Aswa II sub-catchments

Data source: National Forestry Authority (NFA)

Appendix VIII: Forest use/cover types and Forest Status of Ayami, Ogur, and Olia CFRs

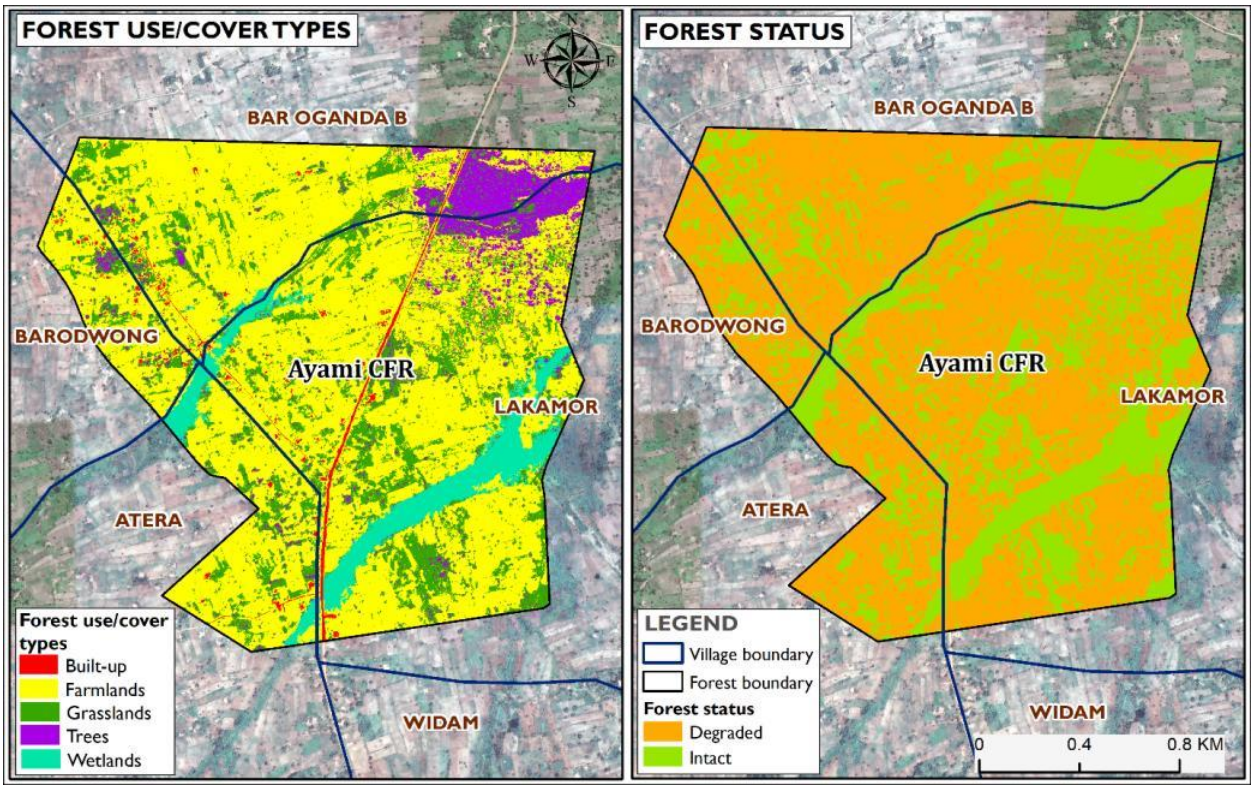


Figure 7-8: Forest use/cover types and forest status of Ayami CFR

Data source: National Forestry Authority (NFA), 2023

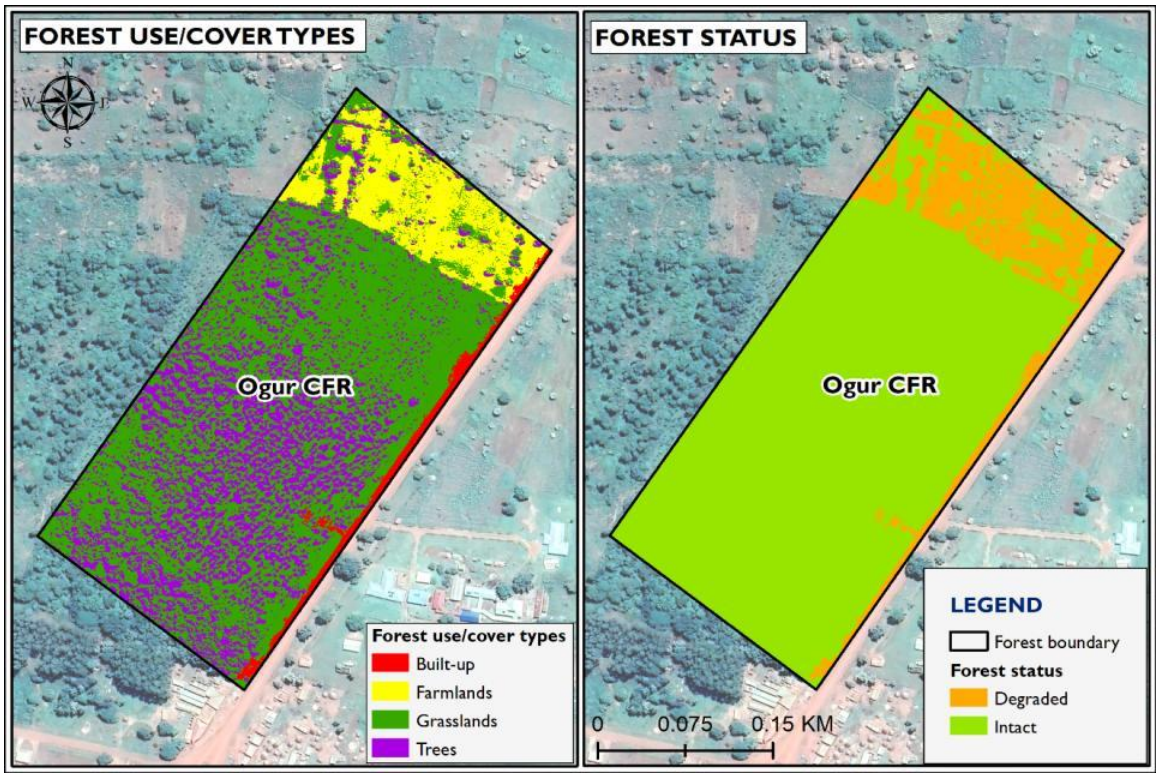


Figure 7-9: Forest use/cover types and forest status of Ogur CFR

Data source: National Forestry Authority (NFA), 2023

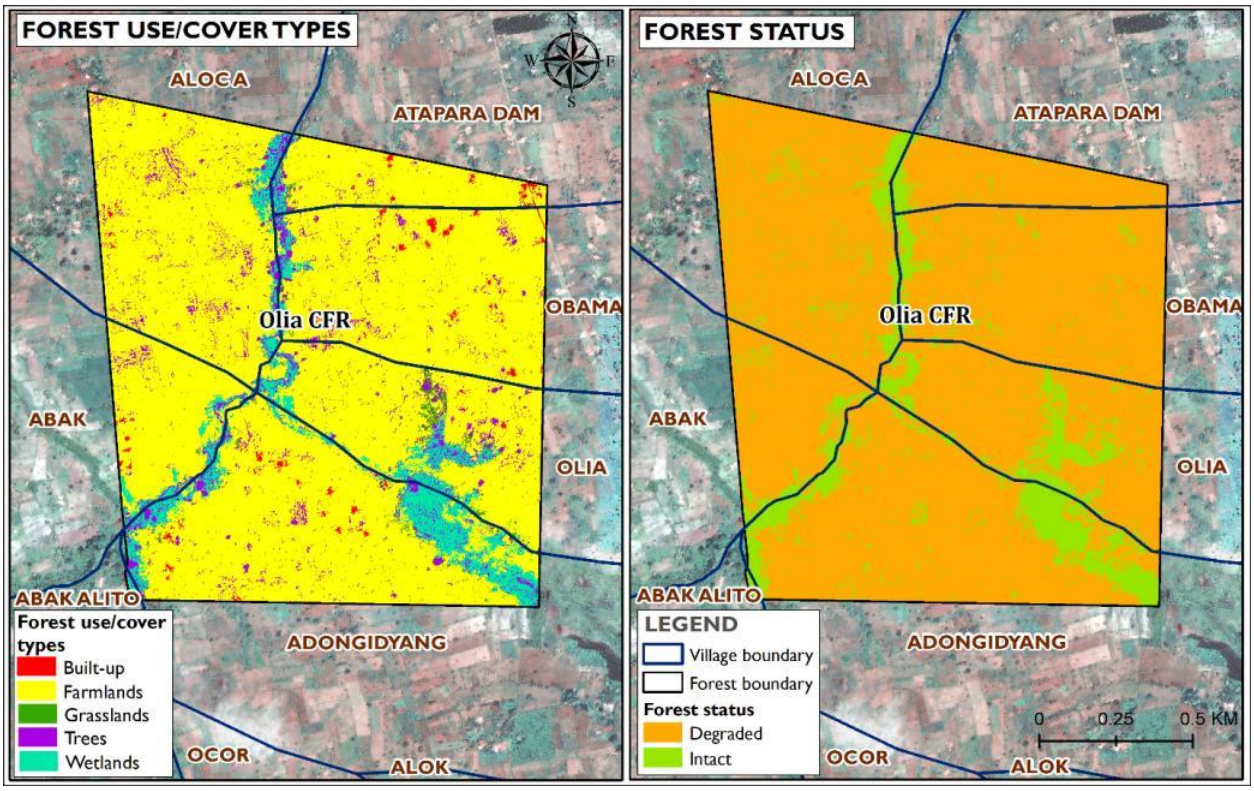


Figure 7-10: Forest use/cover types and forest status of Olia CFR

Data source: National Forestry Authority (NFA), 2023

Appendix IX: River categories in Aswa I and Aswa II sub-catchments

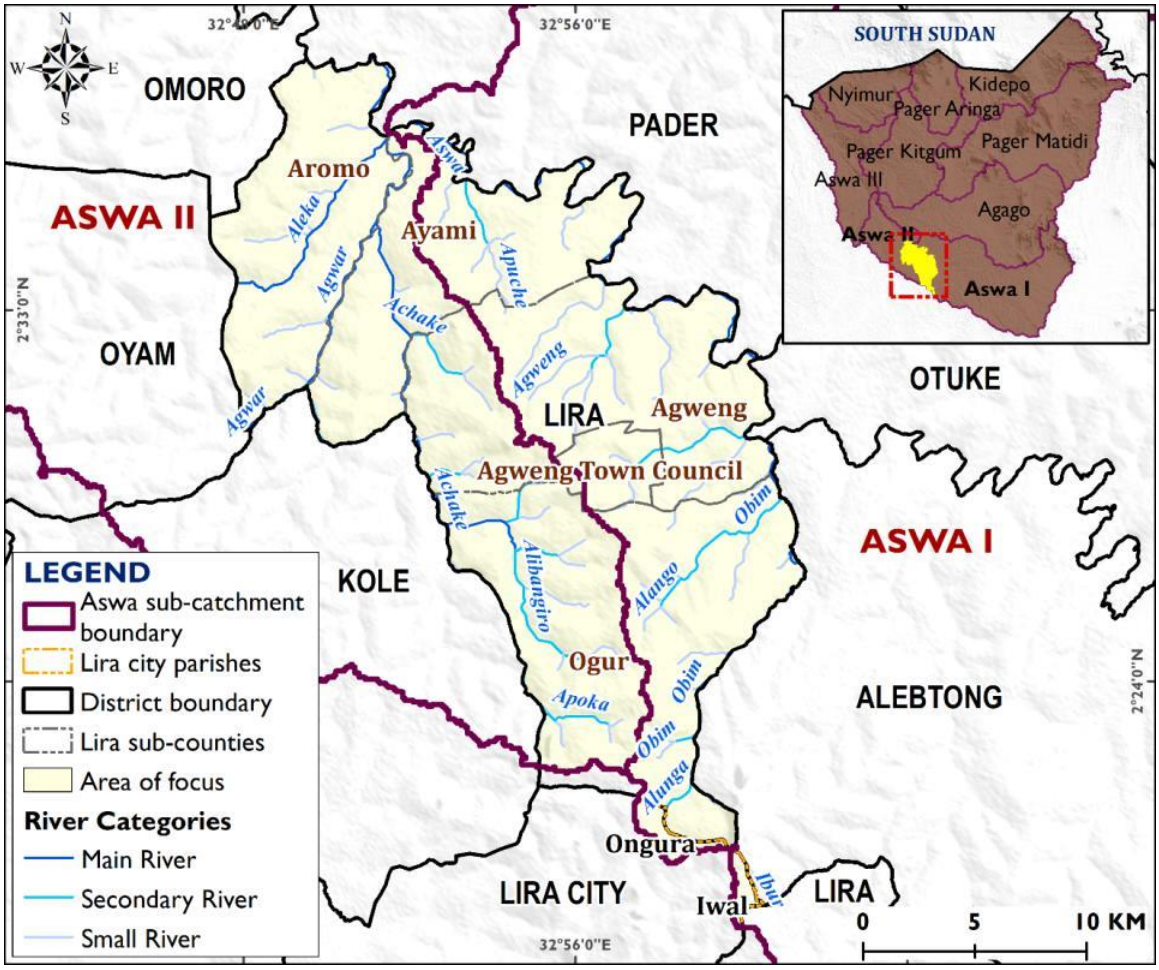


Figure 7-11: Rivers in Aswa I and Aswa II sub-catchments

Data source: Ministry of Water and Environment (MWE), 2022

Appendix X: Drought, floods, and soil erosion in Aswa I and Aswa II sub-catchments

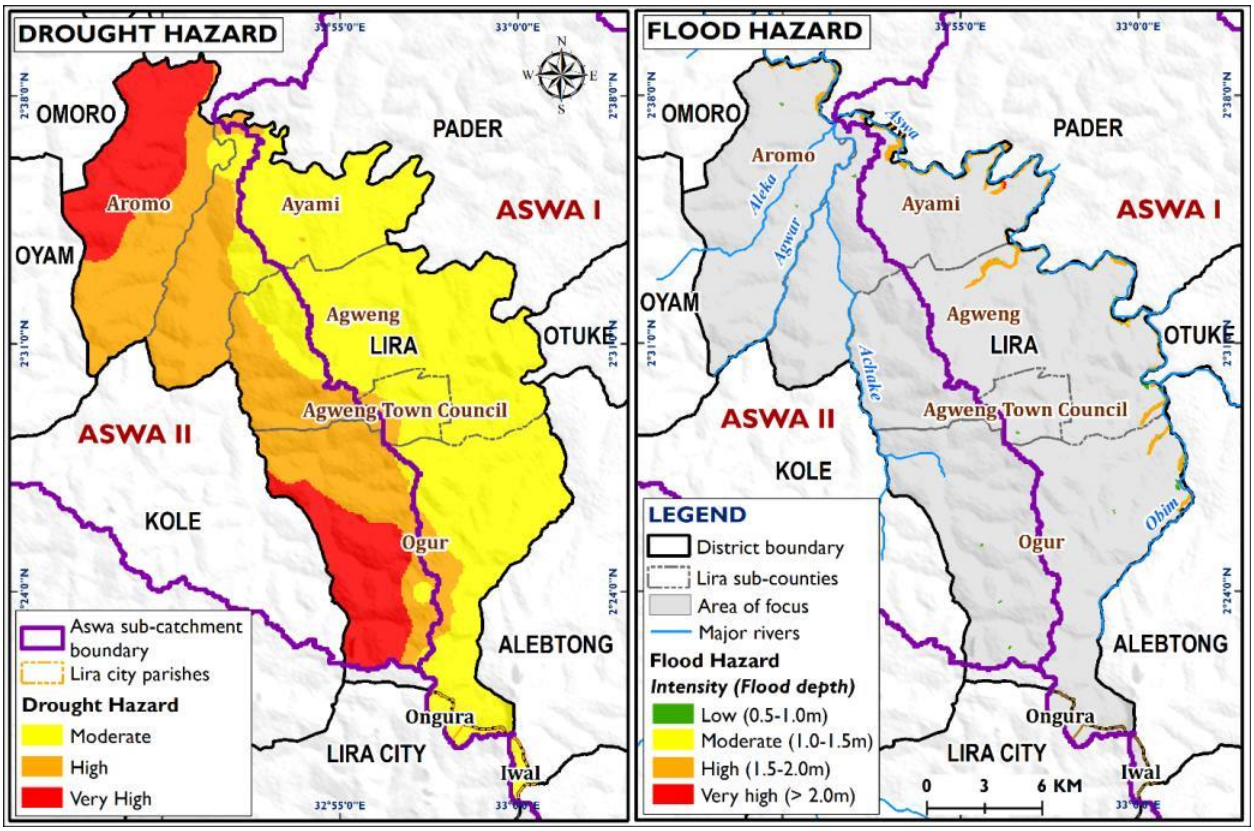


Figure 7-12: Drought and flood hazards in Lira district and Lira city

Data source: Department of Relief, Disaster Preparedness and Management, 2018

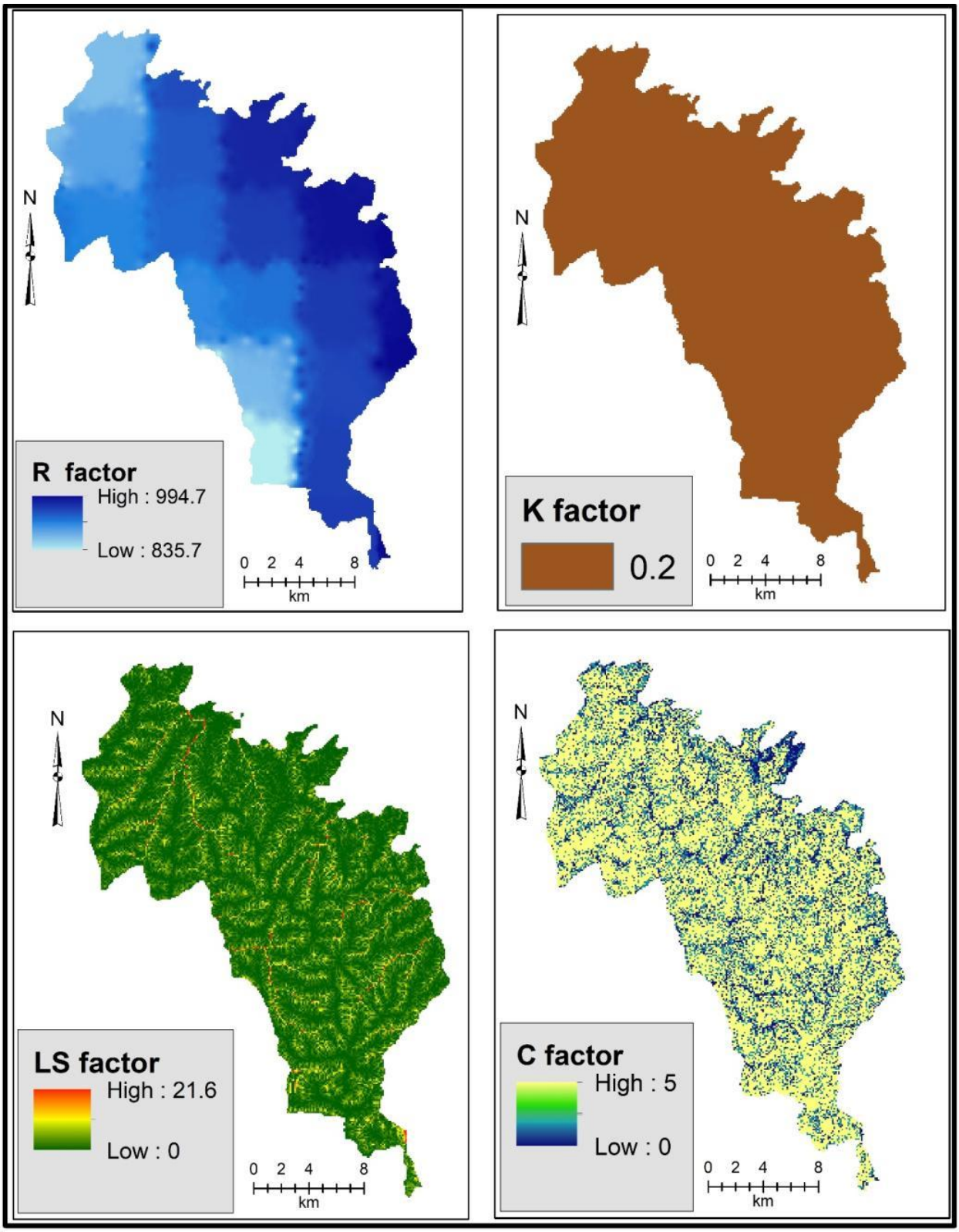


Figure 7-13: Factors used in the RUSLE model

Apendix XI. Data collection tools -Questionnaire

Household Questionnaire for Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa II Sub Catchment- Lira.

Hello Sir/Madam,

My name is ……and I am representing WSS Services (U) Ltd. We are conducting a household survey on behalf of the Join for Water in order to assess your social and economic wellbeing. The information gathered will support the development of plans for improving management of water and other natural resources in your area (under River Aswa Catchment). We identified you as one of the households within River Aswa Catchment area and would request you to respond to a few of our questions and the interview will take a short time.

SECTION A: GENERAL INFORMATION		
1	Would you be willing to participate in this survey?	⊙ Yes ⊙ No→19
2	Set start time	*Automatic*
3	Set date of interview	*Automatic*
4	Enter code name of enumerator	*Enter your code……*
5	Set GPS coordinates of property	*Automatic*
5.1	What district is your household situated?	*Choose district from list*
5.2	What sub county/division is your household situated?	*Enter name……..*
5.3	What parish/ward is your household situated?	*Enter name……..*
5.4	What village/cell is your household situated?	*Enter name……*
6	Name of respondent	*Enter name……*
6.1	Gender of respondent	⊙ Male ⊙ Female
6.2	Position of respondent	⊙ Household head →6.3 ⊙ Spouse →6.3 ⊙ Daughter →6.3 ⊙ Son →6.3 ⊙ Caretaker →6.3 ⊙ Other
6.2.1	Please specify other position	*Enter position……..*
6.3	Is your household a female-headed one?	⊙ Yes ⊙ No
6.4	What is the highest level of education of household head?	⊙ No formal education→7 ⊙ Nursery→7 ⊙ Primary→7 ⊙ Ordinary Level→7 ⊙ Advanced Level→7 ⊙ Ordinary Diploma→7 ⊙ Higher Diploma→7 ⊙ Vocational Skills Training→7

		⊙ Graduate→7 ⊙ Other
6.4.1	Please specify other level of education	*Enter other……*
7	Ownership of household	⊙ Owned→7.1 ⊙ Rented→7.1 ⊙ Leased→7.1 ⊙ Caretaking→7.1 ⊙ Other
7.0	Please specify other ownership	*Enter other……*
7.1	What material is your roof made of? (Observe)	⊙ Iron sheets ⊙ Clay or concrete tiles ⊙ Thatch
7.1.1	What material are your walls made of? (Observe)	⊙ Bricks ⊙ Mud and poles
7.1.2	What material is your floor made of? (Observe)	⊙ Cemented ⊙ Mud
7.2	How many people usually live in your household?	*Enter number……*
7.3	How many females (children included) live in your household?	*Enter number……*
7.4	How many children below the age of 18 years live in your household?	*Enter number……*
7.5	How many people above the age of 65 years live in your household?	*Enter number……*
7.6	Are there persons with disabilities living in your household?	*Enter number……*
7.7	What is your household's primary source of livelihood?	⊙ Crop farming→7.8 ⊙ Animal farming→7.10 ⊙ Fish farming ⊙ Fishing ⊙ Lumbering ⊙ Stone mining ⊙ Sand mining ⊙ Retailing (goods) ⊙ Petty trading (vending, hawking) ⊙ Transport service (boda-boda, taxi, etc.) ⊙ Casual labor ⊙ Salary/Wages ⊙ Other
7.7.1	Please specify other source of livelihood	*Enter other……*→8
7.8	What is the major crop grown by your household? (1) Wet Season (2) Dry Season	⊙ Matooke→7.8.2 ⊙ Cassava→7.8.2 ⊙ Sweet potato→7.8.2 ⊙ Maize→7.8.2 ⊙ Groundnuts→7.8.2 ⊙ Soya beans→7.8.2 ⊙ Simsim→7.8.2 ⊙ Sorghum→7.8.2 ⊙ Millet→7.8.2 ⊙ Irish potatoes→7.8.2 ⊙ Coffee→7.8.2 ⊙ Sugarcane→7.8.2

		⊙ Tea→7.8.2 ⊙ Other
7.8.1	Please specify another major crop	*Enter other……*
7.8.2	Which month of the year do you start planting?	⊙ January ⊙ February ⊙ March ⊙ April ⊙ May ⊙ June ⊙ July ⊙ August ⊙ September ⊙ October ⊙ November ⊙ December
7.8.2.1	Which week of the month do you start planting?	⊙ First ⊙ Second ⊙ Third ⊙ Fourth
7.8.3	Which month of the year do you start harvesting?	⊙ January ⊙ February ⊙ March ⊙ April ⊙ May ⊙ June ⊙ July ⊙ August ⊙ September ⊙ October ⊙ November ⊙ December
7.8.3.1	Which week of the month do you start harvesting?	⊙ First ⊙ Second ⊙ Third ⊙ Fourth
7.8.4	What is the main use for your major crop?	⊙ Subsistence→7.9 ⊙ Commercial ⊙ Subsistence and commercial
7.8.5	What is the unit price of your produce at the farm?	*Enter amount……*
7.9	What are the main 4 challenges you face in crop farming?	☐ Limited access to markets→7.9.2 ☐ Low yields→7.9.2 ☐ Limited value addition→7.9.2 ☐ Post-harvest losses→7.9.2 ☐ Poor quality produce→7.9.2 ☐ Low prices→7.9.2 ☐ Drought→7.9.2 ☐ Other
7.9.1	Please specify other challenge faced	*Enter other……*
7.9.2	What soil and water conservation techniques do you use?	☐ Mulching→7.12 ☐ Cover crops→7.12 ☐ Terracing→7.12 ☐ Contour bunds→7.12

		☐ Water retention ditches→7.12 ☐ None→7.12 ☐ Other
7.9.2.1	Please specify other.	*Enter other……*
7.10	What is the major animal reared by your household?	⊙ Cows→7.10.2 ⊙ Goats→7.10.2 ⊙ Sheep→7.10.2 ⊙ Chicken→7.10.2 ⊙ Pigs→7.10.2 ⊙ Other
7.10.1	Please specify other animal reared	*Enter other……*
7.10.2	How many of these (major) animals do you rear?	*Enter number……*
7.11	What challenges do you face in rearing your animals?	☐ Lack of pastures→7.12 ☐ Water scarcity→7.12 ☐ Poor breeds→7.12 ☐ Diseases→7.12 ☐ Limited access to markets→7.12 ☐ Other
7.11.1	Please specify other challenge faced	*Enter other……*
7.12	Approximately how much land do you own here (acres)?	⊙ 0-0.25 acres ⊙ 0.25-0.50 acres ⊙ 0.50-0.75 acres ⊙ 0.75-1 acres ⊙ >1acre
7.12.1	What are you mainly utilizing this land for?	☐ Crop farming→8 ☐ Animal rearing→8 ☐ Residential purpose→8 ☐ Other
7.12.1.1	Please specify other purpose	*Enter other……*
8	What is your primary source of drinking water supply?	⊙ Piped water→8.1 ⊙ Borehole→8.1 ⊙ Protected Spring→8.1 ⊙ Water vendor→8.1 ⊙ Open source (unprotected spring, pond, stream, etc.) →8.1 ⊙ Rainwater→8.1 ⊙ Other
8.0	Please specify other source	*Enter other……*
8.1	Approximately how far (in meters) is your primary water source?	⊙ 0-250 meters ⊙ 250-500 meters ⊙ 500-1,000 meters ⊙ >1,000 meters
8.2	How many litres of water does your household use per day?	*Enter number……*
8.3	Do you pay for your water?	⊙ No→8.4 ⊙ Always ⊙ Sometimes
8.3.1	How much do you spend on water per month?	*Enter amount……*
8.4	How do you rate the quality of your water?	⊙ Poor ⊙ Fair→8.5 ⊙ Good→8.5

8.4.1	Why do you rate your water quality poor?	☐ It has a bad taste ☐ It has a bad smell ☐ It is coloured ☐ It is hard
8.5	How reliable is your water source?	⊙ Water is always available ⊙ Water is sometimes available ⊙ Water is scarce
8.6	Is the available water sufficient for your domestic needs?	⊙ Yes ⊙ No
8.7	Which measures do you put in place to conserve your water?	☐ We harvest rainwater ☐ We take short showers/baths ☐ We fix leakages ☐ We utilize only what is sufficient for each need ☐ None of the above
9	What is your main source of energy for cooking? (Observe)	⊙ Electricity→10 ⊙ Charcoal ⊙ Gas→10 ⊙ Firewood ⊙ Kerosene→10
9.1	If you use firewood or charcoal, where do you get it from?	⊙ Vendor/market ⊙ Private forest ⊙ CFR
9.1.1	Which technology does your household mainly use for cooking?	⊙ 3-stone fire ⊙ Energy-saving stove ⊙ Charcoal stove
10	What is your main source of energy for lighting?	⊙ HEP ⊙ Solar ⊙ Kerosene lump(s) ⊙ Candles ⊙ Torch ⊙ None of the above
11	What type of toilet facility do you use? (Observe)	⊙ No toilet→13 ⊙ Simple pit latrine→11.2 ⊙ Lined pit latrine→11.2 ⊙ Flush toilet connected to a septic tank→11.2 ⊙ Compost/ecosan toilet→11.2 ⊙ Other
11.1	Please specify other toilet type	*Enter other……*
11.2	Do you share the toilet facility with other households?	⊙ Yes ⊙ No
12	Is there a hand washing facility near the toilet? (Observe and ask)	⊙ Yes ⊙ No
13	Has any member of your HH suffered from any of the following illnesses in the last 3 months?	☐ Malaria ☐ Typhoid ☐ Diarrhoea ☐ Hepatitis A ☐ Cough ☐ Flu ☐ Cholera ☐ Dysentery
14	How do you dispose-off your solid waste?	☐ Composting ☐ Burying ☐ Burning

		☐ Waste skip ☐ Illegal dumping ☐ Collected by service provider
15	Do your premises flood when it rains?	⊙ Never ⊙ Moderately ⊙ Severely
16	Does your household own a radio?	⊙ Yes ⊙ No
16.1	Does your household own a television?	⊙ Yes ⊙ No
16.2	Does any member of your household own a mobile phone?	⊙ Yes ⊙ No
16.3	Does your HH own any of the following transport modes?	☐ Bicycle ☐ Motor cycle ☐ Vehicle ☐ None of the above
16.4	Do you belong to any SACCO or village savings group?	⊙ Yes ⊙ No
17	What is your household's average monthly expenditure?	*Enter amount……*
18	What are the 3 main challenges faced by your community?	☐ Water scarcity ☐ Lack of electricity ☐ Waste management ☐ Deforestation ☐ Wetland encroachment ☐ Floods ☐ Drought ☐ Hunger ☐ Other
18.1	Please specify other problem	*Enter other……*
19	Record the end time	*Automatic*

This is the end of the interview and thank you very much for your time. Do you have any questions you would like me/us to respond to?

Annex XII: Interview Guide (KIIS)

Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa1& II Sub Catchment- Lira.

Consent

Hello, my name is _____ working as Sociologist, on this study commissioned by Join for water to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa1 & II Sub Catchment- Lira." We are at this stage assessing socio-economic and democratic situation. I would like to request you to participate in this stakeholder interview and provide genuine opinions regarding this study. Your views will be vital in guiding decision-making, and laying the groundwork for sustainable water management in the Aswa 1& 11 Sub – Catchment. Your participation is voluntary but your views are very much important to both you the stakeholder and the entire communities that directly or indirectly. Be assured that any information that you will provide will be kept strictly confidential. You are free to ask me any questions that you have about this assessment before you decide whether to participate.

Guiding Questions.

Stakeholder position……..

District…….…….

Subcounty……

PART ONE: ADMINISTRATIVE STRUCTURE AND DEMOGRAPHY (District Planner)

Qn 01: What is the current district administrative structure (Also, Probe for administrators responsible for championing environmental protection)?

Qn 02: Population data of the district.

Qn 03: Gender disaggregated Data of the district.

Qn 04: Data on housing conditions.

Q 05: How has the planning department been involved in planning for Ntuaral resources management at district level?

Q06: What are some of the issues (you have observed recently) facing water and other natural resources within the district/ sub counties city etc

PART TW0: LAND TENURE SYSTEMS AND ECONOMIC ACTIVITIES (District Natural Resources/Water Officer/Environment Officer)

1. How do you perceive the current state of the environment, water and other Natural resources in your area? What are the primary causes of degradadation?
2. What are the main livelihood activities mostly done by the people?
3. Can you describe the environmental / natural resources protection measures currently practiced in your district/ city/community?
4. What are some of the economic activities affecting the water resources in the communities?

5. What are the major barriers to implementing effective water ecosystems / Natural resources protection strategies?
6. How does natural resources degradation impact food security and livelihoods in your district/city?
7. What community-led initiatives have been successful in promoting environmental/ natural resources management sustainability?
8. What role do local and national governments play in conservation of Natural resources in your area?
9. How are young people and women involved in natural resources protection and conservation efforts?
10. What is the status of land ownership in the district?
11. What training or resources are available to community members regarding environmental / Natural resources conservation?
12. In what ways could environmental/ natural resources conservation/ protection measures be integrated with economic development initiatives?
13. What are your recommendations for improving natural resources protection and promoting sustainable practices among the community?
14. What are some of the institutional challenges related to water resources management at district level.
15. Are there any by-laws enacted to protect the water resources?
16. How effective is the enforcement of those by-laws (if any)?

PART THREE: COMMUNITY FEATURES (DCDO)

1. What is the social structure of this community?
2. Describe the current state of psychosocial wellbeing among the community members in your area.
3. How are community members involved in the planning for natural resources management in your location
4. What is the community perception of natural resources conservation in your location
5. Are there any human – environmental conflics within this location
6. What causes them (if they do exist)
7. Describe the Gender aspects in this implementation of district plans.
8. Who are considered vulnerable group (and state how)?
9. Comment on Gender related aspects (Probe in relation to environmental encroachment).
10. Comment on culture and archeological heritage in the district?
11. What livelihoods do people derive from the water resources?
12. What is the mail source of community livelihoods in your location
13. How are women involved in water resource management?

KII GUIDE OF OTHER, NWSC, UNWMZ, NFAand other NGOs

Qn 01: In your view, what are the main water resources -related challenges in the Aswa1 & II sub catchment?

Qn 02: What is your organization doing towards water resources management in the area?

Qn 03: As UNWMZ, what is your organisation's integrated vision for the Aswa1& II sub-catchment?

Qn 04: How can you pool synergies with other players to achieve the above vision?

Qn 05: Who are the key stakeholders in the water resources management and use in this sub-catchment?

Qn 06: Are there any potential challenges in bringing different stakeholders together for a more coordinated water resource management effort?

Qn 07:What are some of the institutional challenges related to water resources management within the Aswa 1 & 11.

Annex XIII: Focus Group Discussion (FGD) Guide

Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa II Sub Catchment- Lira.

Consent

Hello, my name is_____ Working as Sociologist, on a "**Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa 1 & II Sub Catchment- Lira.**" We are at this stage assessing socio-economic and democratic situational analysis. I would like to request you to participate in this stakeholder interview and provide genuine opinions regarding this study. Your views will be vital in in the designing appropriate interventions in this community. Your participation is voluntary but your views are very much important to both you the stakeholder and the entire communities that directly or indirectly. Be assured that any information that you will provide will be kept strictly confidential. You are free to ask me any questions that you have about this assessment before you decide whether to participate.

Guiding Questions.

i) Stakeholder position……..
ii) District…….…….
iii) Subcounty……

FOCUS GROUP DISCUSSION GUIDE

1. What are some of the water resources within your area?
2. What are the water resources -related challenges being faced in your area?
3. What are the possible causes of those challenges?
4. Where are the hotspots (severely affected areas) and why?
5. What livelihood do you derive from the water resources in your community?
6. What are the alternatives to these livelihoods?
7. Are there any laws to protect the environment?
8. What can be done to improve the environment and the water source in particular?
9. What is the role of the community in water resources management?
10. What is the possible role of women, elderly and religious leaders in championing sustainable water resources management?

Annex XIV: Observation Checklist

Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa Sub Catchment- Lira.

Consent

Hello, my name is _____ working as a Sociologist, on "**Scoping Study to assess the current Socio-Economic, Environmental, And Institutional Issues Related to Water Resource Protection and Management in the Aswa Sub Catchment- Lira.**" We are at this stage assessing socio-economic and democratic situational analysis. I would like to request you to participate in this stakeholder interview and provide genuine opinions regarding this study. Your views will be vital in in the designing appropriate interventions in this community. Your participation is voluntary but your views are very much important to both you the stakeholder and the entire communities that directly or indirectly. Be assured that any information that you will provide will be kept strictly confidential. You are free to ask me any questions that you have about this assessment before you decide whether to participate.

Guiding Questions.

iv) Stakeholder position……..….
v) District…….……..
vi) Sub-county……

OBSERVATION CHECKLIST

Category	Main check Item	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
Land use land changes	1. What type land uses and activities are present in the catchment	
Crops	2. What are some of the crops grown within the sub catchments	
Animlas	3. What are some of the animals reared within the sub catchments	
River encroachment	1.Are there signs of River encroachment within the sub catchments? Where exactly?	

What proportion of land is covered by vegetation	4. What are the types of the vegetation cover?	
Erosion	1. Are signs of erosion and degradation visible in the landscape 2. What is the extent of gullying, soil scouring and land-slipping in steep areas in the catchment	
Ongoing infrastructural development	3. What are some of the ongoing infrastuructural development within the area	
Other Economic activities	4. What are some of the other economic activities being carried out within the sub catchments:	
Hotspots/Threats	5. What are some of the threats/hotspots within the sub catchments	

Apendix XV. - Stakeholder Assessment and Engagement report

Join For Water

SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL, AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA 11 SUB-CATCHMENT



Stakeholder Engagement Report

WSS SERVICES (U) LIMITED
Plot 17 Kakungulu Road, Ministers' Village
Ntinda Kampala
P.O. Box 27755 Kampala, Uganda
Tel: +256 (0) 702254042/+256 (0) 782-519315
Email: wss@wssservices.co.ug;
byamukamad@yahoo.co.uk

©September 2024

1. Introduction

This report outlines the engagement with stakeholders for the scoping study aimed at assessing socio-economic, environmental, and institutional issues related to water resource protection and management in the Aswa 11 Sub-Catchment. Effective stakeholder engagement is crucial to understanding and addressing the diverse needs and perspectives related to water resources in the region.

2. Objectives

- To identify key stakeholders involved or affected by water resource management in the Aswa 11 Sub-Catchment.
- To gather input on socio-economic, environmental, and institutional challenges and opportunities.
- To establish a collaborative framework for ongoing dialogue and cooperation.

3. Stakeholder Identification

The following stakeholders were identified for engagement based on their roles, interests, and impacts on water resource management:

Local Communities: Residents, farmers, and community groups within the Aswa 11 Sub-Catchment. Commnities engaged were; Ogur sub county, Agwng Sub county, Agweng Town Council, Ayami Sub County, Aromo Sub County of Lira District and East Division of Lira City.

Local Government Authorities: District and municipal offices responsible for water management and environmental protection. In this regard, key Informants included LC3 chair persons of different Sub Counties, District Environmental Officer, Senior Sociologist UNWMZ, DCDO, Community development Officers, Town Clerks, Mayors, Parish Chiefs,CAO of Lira.

Non-Governmental Organizations (NGOs): Organizations working on environmental conservation, water management, and community development.

Private Sector: Businesses and industries utilizing water resources, including agricultural enterprises and manufacturing units. Farmers were engaged

Government Agencies: National and regional bodies involved in water resource policy and regulation.UNWMZ was engaged.

Traditional Leaders: Community elders and local leaders with influence over land and water use practices. These were part of the community engagements.

4. Engagement Activities

4.1. Initial Consultation Meetings(2)

Purpose: To introduce the scoping study, outline objectives, and gather preliminary feedback.

Participants: Representatives from local communities, government authorities, NGOs, and academic institutions.

Outcomes: Identification of key issues, concerns, and expectations regarding water resource management.

4.2. Focus Group Discussions

Purpose: To delve deeper into specific socio-economic, environmental, and institutional issues.

Participants: Separate groups for farmers, local business owners, community leaders, and environmental activists.

Outcomes: Detailed insights into challenges faced by each group and potential solutions.

4.3. Surveys and Questionnaires

Purpose: To collect quantitative data on stakeholder perceptions and experiences.

Participants: A broad cross-section of the population, including both rural and urban residents.

Outcomes: Statistical data on stakeholder attitudes towards water resource management and protection.

4.4. Key Informant Interviews

Purpose:

Identify Key Issues. Key informant interviews helped identify critical issues affecting water resource management in the Aswa Sub-catchment. This included understanding the socio-economic pressures, environmental challenges, and institutional gaps.

Gather Expert Insights: These interviews provided expert opinions and insights on the current state of water resources, existing policies, and practices. They helped capture nuanced and in-depth information that may not have been available through other methods.

Assess Institutional Capacity: The interviews assessed the capacity and effectiveness of local institutions and governance structures in managing water resources and enforcing relevant policies and regulations.

Understand Stakeholder Perspectives: They helped understand the perspectives and needs of various stakeholders, including community members, local leaders, and government officials.

Inform Recommendations: The insights gathered were used to develop recommendations for improving water resource management, policy formulation, and implementation strategies.

Participants

1. **Local Government Officials**: These included District and City Technical and political leaders, sub-county chiefs and LC 111s, and Municipal officials who oversee water resource management and environmental protection.
2. **Community Leaders**: Including traditional leaders, village elders, and local council members who understand local customs, practices, and challenges related to water resources.
3. **Environmental and Water Resource Experts**: Professionals working in environmental conservation, water management, and related fields who can provide technical insights and data.
4. **Local Businesses and Farmers**: Individuals whose activities directly impact water resources, such as those involved in agriculture, fishing, and sand mining.

Outcomes

1. **Comprehensive Issue Identification**: Key informant interviews provided a detailed understanding of the socio-economic, environmental, and institutional issues impacting water resource management. This included identifying specific problems like wetland degradation, over-extraction, and pollution.
2. **Insight into Institutional Challenges**: They revealed strengths and weaknesses in the existing institutional frameworks, such as gaps in policy enforcement, lack of resources, or inadequate community involvement.
3. **Stakeholder Needs and Perspectives**: The interviews captured diverse stakeholder needs and concerns, helping to tailor interventions and recommendations to be more effective and relevant.
4. **Data for Policy Formulation**: The information collected informed the development of evidence-based policies and strategies to improve water resource management and protection.
5. **Awareness and Capacity Building**: Insights from key informants highlighted areas where awareness and capacity building are needed, both within communities and among local institutions.
6. **Recommendations for Action**: Based on the findings, actionable recommendations are developed for improving water resource management practices, enhancing institutional frameworks, and addressing socio-economic and environmental challenges.
7. **Baseline for Future Studies**: The data and insights serve as a baseline for future studies and monitoring, helping to track progress and measure the impact of implemented interventions over time.

5. Key Findings

5.1. Socio-Economic Issues

Access to Water: Variability in water access between urban and rural areas; concerns about equitable distribution.

Economic Dependence: High reliance on agriculture for livelihoods; water scarcity impacting crop yields and income.

Infrastructure Needs: Lack of adequate water storage and irrigation infrastructure; need for improved water supply systems.

5.2. Environmental Issues

Water Quality: Pollution from agricultural runoff; need for better waste management practices.

Ecosystem Health: Degradation of wetlands and riparian zones; impact on biodiversity and natural water filtration.

Climate Change: Increased frequency of droughts and floods affecting water availability and quality.

5.3. Institutional Issues

Coordination: Fragmented management across different levels of government and sectors; need for integrated water resource management.

Capacity Building: Limited technical and financial resources for effective water management; need for training and capacity development.

Policy Gaps: Inadequate or outdated policies and regulations; need for updated legislation and enforcement mechanisms.

5.4 Findings specific to Sub Counties and Town Councils engaged

1. Focus Group Discussion at Ogur Sub-County Headquarters

Key Issues Raised:

- **Environmental Concerns:** Interference with wetlands especially due to over cultivation, absence of water banks i.e. need for demarcation of buffer zones, land encroachment due to population pressure, and climate change impacting water resources.
- **Institutional Issues:** Existing by-laws need strengthening, land is customarily owned, and there's a need for local water management committees.
- **Community Needs:** Need for alternative sources of water like boreholes and piped water systems, awareness on soil conservation, energy-saving technologies, and support for alternative livelihoods like beekeeping.

Recommendations:

- Provide the community with alternative water sources like boreholes, piped water, water harvesting technology
- Over cultivation of wetlands is a result of drought on the upper lands. There is need for provision of water for production

- Increase awareness and support for alternative livelihoods and environmental conservation.
- Set up community water management committees.
- Implement pillar demarcation and use of environmental police.

2. Community Engagement at Akor Parish, Ogur Sub-county

Challenges:

- Lack of clean water sources and inadequate water for home use.
- Overpopulation leading to wetland encroachment for cultivation.
- Climate change- drought has forced the community members to cultivate in swamps because upper lands are dry and can't support growth of some crops like rice, deforestation, sand mining, poor water quality, and loss of aquatic life.

Recommendations:

- Develop irrigation systems and alternative water sources.
- Support fish farming, tree planting, and VSLA.
- Enhance sensitization on wetland conservation.

3. Focus Group Discussion at Agweng Sub-county

Key Issues Raised:

- **Challenges:** Wetland degradation, soil erosion, sand mining, over-cultivation, and deforestation.

Recommendations:

- Support irrigation, alternative water sources, alternative sources of livelihoods
- Tree planting
- VSLA schemes.
- Promote income-generating skills for women.
- Formulate and support environmental by-laws.

4. Community Engagement at Agweng Sub-county

Challenges:

- Drought, Increased population putting pressure on existing water resources hence depletion, Over-cultivation, sand mining, deforestation, soil erosion and water pollution.

Recommendations:

- Support irrigation, alternative water sources, alternative sources of livelihoods
- Demarcate wetlands and riverbanks.

- Enhance community awareness and support environmental protection bylaws.

5. Focus Group Discussion at Agweng Town Council

Key Issues Raised:

- **Challenges:** Wetland degradation, encroachment, and poor water quality.

Recommendations:

- Support irrigation, alternative water sources, alternative sources of livelihoods
- Promote income-generating skills and improve farming methods.
- Support tree planting, irrigation, and VSLA schemes.

6. Focus Group Discussion at Aromo Sub-county

Key Issues Raised:

- **Challenges:** Dirty water, over grazing in wet lands, land conflict, deforestation, and climate change.

Recommendations:

- Support irrigation, alternative water sources, alternative sources of livelihoods
- Change mindset on resource use.
- Support alternative livelihoods and demarcate wetlands.
- Support by-law formulation and implementation.

7. Community Engagement at Aromo Sub-county

Challenges:

- Over-cultivation, deforestation, soil erosion, and water pollution.
- Decline in water quality and quantity

Recommendations:

- Develop irrigation systems and alternative water sources.
- Demarcate wetland boundaries.
- Support alternative livelihoods and improve farming practices.

8. Focus Group Discussion at Ayami Sub-county

Key Issues Raised:

- **Challenges:** Lack of safe water for home use, Soil erosion, climate change, Population pressure, deforestation, and loss of aquatic life.

Recommendations:

- Develop irrigation systems and alternative water sources.
- Train communities in energy-saving technologies and better cultivation methods.
- Continue demarcation and support for alternative livelihoods.

9. Focus Group Discussion at Iwal Ward, Lira City East Division

Challenges:

- Lack of clean water for home use, Drought, Deforestation, soil erosion, and over-cultivation.

Recommendations:

- Enforce by-laws and provide alternative water sources.
- Sensitization, mindset change, and collective responsibility.
- Support projects like tree planting and beekeeping.

10. Community Engagement at Iwal Ward, Lira City East Division

Challenges:

- Encroachment, pollution, and deforestation.
- Drought, soil erosion, land conflicts, No enough water sources
- Degradation of water resources

Recommendations:

- Provision of irrigation, awareness creation, and support for alternative livelihoods.

6. General Recommendations

Enhanced Coordination: Foster collaboration between government agencies, local authorities, and other stakeholders through regular meetings and joint initiatives.

Infrastructure Investment: Prioritize investments in water provision and storage, irrigation systems, and waste management to improve water access and quality.

Community Engagement: Strengthen involvement of local communities in decision-making processes and implementation of water management strategies.

Policy Reform: Review and update water resource policies to address current challenges and incorporate best practices.

7. Conclusion

The stakeholder engagement process has provided valuable insights into the socio-economic, environmental, and institutional issues related to water resource management in the Aswa 11 Sub-Catchment. Addressing these issues requires a collaborative approach, combining efforts from all stakeholders to ensure sustainable water management and protection.

8. Next Steps

- **Action Plan Development**: Create a detailed action plan based on stakeholder feedback and recommendations. This gap especially in infrasructure development can be filled by JFW. The communities need clean safe water in short distances from their homes. There is need for irrigation.
- **Monitoring and Evaluation**: Establish mechanisms for ongoing monitoring and evaluation of water resource management practices and stakeholder engagement.
- **Continued Engagement**: Maintain regular communication with stakeholders to ensure continued collaboration and address emerging issues.

9. Appendices

- **Appendix A**: Stakeholder Engagement notes

SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL, AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA SUBCATCHMENT-LIRA.

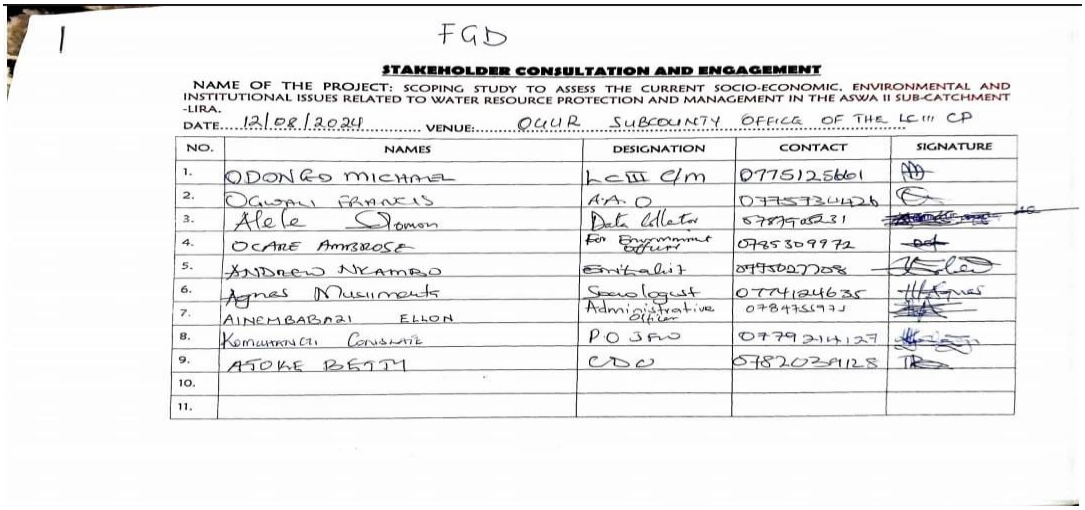
FOCUS GROUP DISCUSSION AT OGUR SUB- COUNTY HEAD QUARTERS ON 12/08/2024



KEY ISSUES RAISED;

- Ogur's population is around Forty-two thousand. Youth being the highest number, followed by children, then women and lastly men.
- Ogur has fish ponds
- People are interfering with wetlands. There is need for demarcation.
- No more water banks. They have been used up to the shores
- Population pressure has forced people to encroach on land
- Climate change is a contributing factor to the deteriorating water resources
- Some by-laws have been drafted.
- Land is customarily owned
- Need for energy saving stones, Support for bee keeping
- Sensitization and awareness on soil conservation is needed
- Need to set committees within the community to manage water resources
- Use of Environmental police
- Alternative sources of livelihoods to those using swamps
- Need for pillar demarcation
- Leaders are part of those breaking the law
- Mindset change on sustainabiity

Attendance



FGD

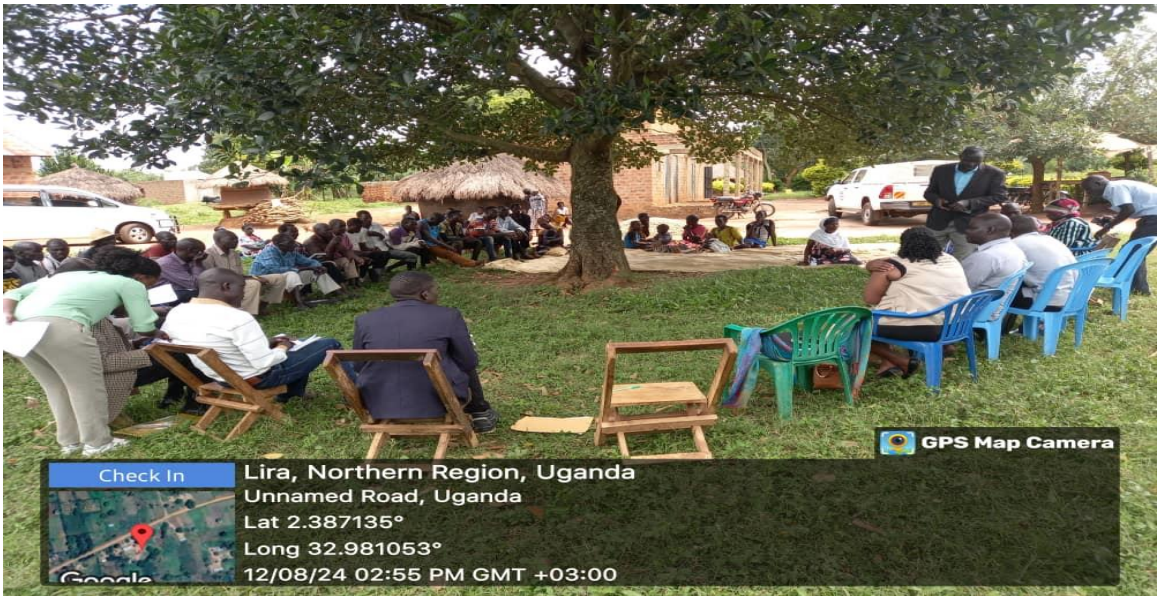
STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 12/08/2024 VENUE: OGUR SUBCOUNTY OFFICE OF THE LC III CP

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ODONGO MICHAEL	LC III C/m	0775125661	
2.	OGWALI FRANCIS	A.A.O	0775734426	
3.	Alele Solomon	Data Collator	0787705231	
4.	OCAKE AMBROSE	For Environment Officer	0785309972	
5.	ANDREW NKAMBO	Entomologist	0785007708	
6.	Agnes Musimenta	Sociologist	0774124635	
7.	AINEMBABAZI ELLON	Administrative Officer	0784756975	
8.	KOMUHANGI CONSTATE	P.O JFLO	0779214127	
9.	AJOKE BETTY	CDO	0782075128	
10.				
11.				

COMMUNITY ENGAGEMENT AT AKOR PARISH OGUR SUB- COUNTY ON 12/08/2024



1. **List of water resources**
   - Aswa River and wetland
   - Omwonyo lao wetland and river
   - Obim wetland and river
2. **Water Resources Challenges**
   - Over population forcing people to use wetlands to cultivate
   - Bad weather. Drought. Climate change
   - Deforestation
   - Sand mining
   - Pests and diseases
   - Occasional floods
   - Poor water quality
   - Limited Sensitization
   - Loss of aquatic life
3. **Livelihood derived from the wetlands**
   - Fishing
   - Agriculture
   - Sand mining
   - Timber and charcoal
   - Brick laying
   - Cattle rearing
4. **Alternative sources of livelihood**
   - Beekeeping
   - Fish farming
   - Tree planting
   - Irrigation for farming upstream

- Energy saving technologies
- Village Savings and Loan Associations (VSLA Scheme)

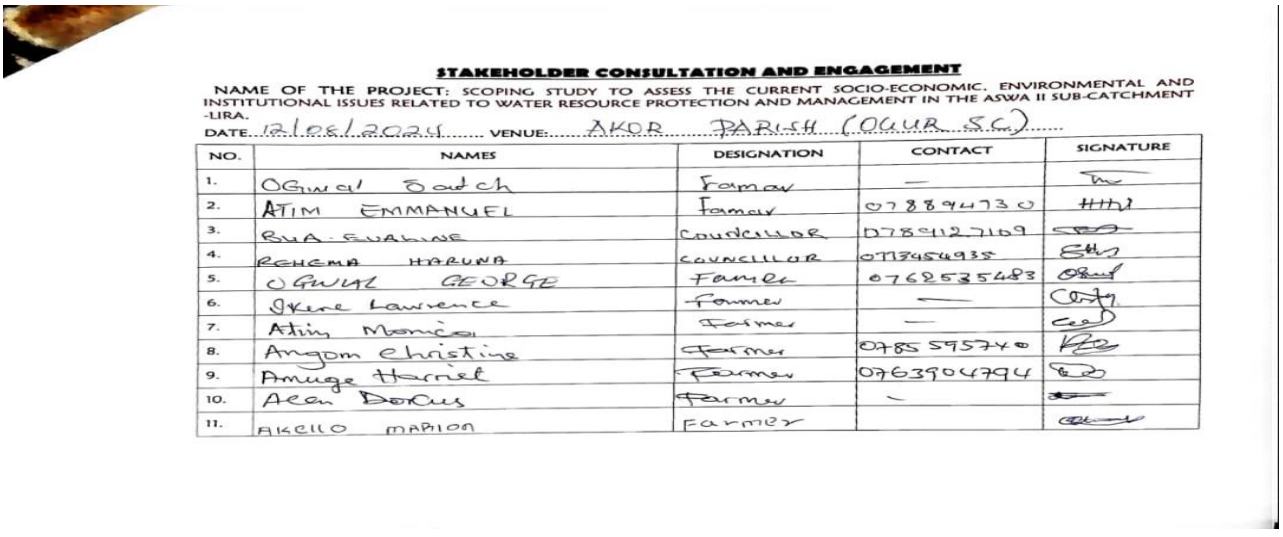
5. **Bye-laws**
   - Not yet in place
   - Need to support the process of formulation
6. **Recommendations**

- Irrigation (Water for production)
- Alternative water sources for safe clean home use water like boreholes and springs
- Fish farming
- Tree planting
- Poultry farming
- Sensitization on wet land conservation
- Support to groups on VSLA
- Support for bee keeping
- Support for pig keeping
- Provision of energy saving technology
- Energy cooking stoves

Social Economic and Historical Trend of the water resources in Ogur sub-county in the last 20 years

- The wet lands were more conserved than today. More fish, big trees, enough water. Today, water has been drained and no bigger fish. Trees have been cut.

Attendance;



STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 12/06/2024 VENUE: AKOR PARISH (OGUR S.C)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OGwal Enoch	Famar	—	
2.	ATIM EMMANUEL	Famar	0788947730	
3.	BUA EVALINE	COUNCILLOR	0785127109	
4.	REHEMA HARUNA	COUNCILLOR	0778454935	
5.	OGWAL GEORGE	Famer	0762535483	
6.	Okere Lawrence	Farmer	—	
7.	Atim Monica	Farmer	—	
8.	Angom christine	Farmer	0785 595744	
9.	Amuge Harriet	Farmer	0763904794	
10.	Acan Dorcus	Farmer	—	
11.	AKELLO MARION	Farmer		



STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE..12/08/2024 VENUE: AKOR PARISH (OGUR SC)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	EMUR GEOFFREY	PESAN FARMER	0787169121	
2.	OCEN WILSON	FARMER	0771913206	
3.	OBUA ROLAND	L C I AKANGA	0786172475	
4.	LEE PATRICK	FARMER	0778811692	
5.	Odwa Patrick Ojul ALebtan	Farmar	0770440719	
6.	Olunga Ronald	mashron	0785299857	
7.	Bua Denish	Fan farmer	0770778838	
8.	OLEA EMMANUEL	farmer	-	
9.	OOBUA SUEMA	MEMBER		
10.	OGWAL DENISH	Farmer	0765836706	
11.	OLET TOM L C II	AKANGA	0778858582	

COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE..12/08/2024 VENUE: AKOR PARISH (OGUR SUB COUNTY)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	EDOKA MARTINE	COUNCILLOR AKOR PARISH	0754-800320	
2.	EDOKA DAVID	Opinion leader	0772499653	
3.	ONGOM TOMMY	Chairman LC1 AKOR Parish	0774602015	
4.	GWENG YUBU	ELDER	0778372-5002 AKOR PARISH	
5.	Obua Richard	MEMBER	0779710043	
6.	OGWOK JACKSON DUNCAN	farmer	0765434623	
7.	KASULE SOKO MON	FARMER	0775630654	
8.	OKELLO FRANCIS	member	0776039942	
9.	ORUTE DENISH	farmer	0779832947	
10.	OGWANG TOM	Council		
11.	ATIM - SILVESTO	FARMER	0779471184	

COMMUNITY ENGAGEMENT

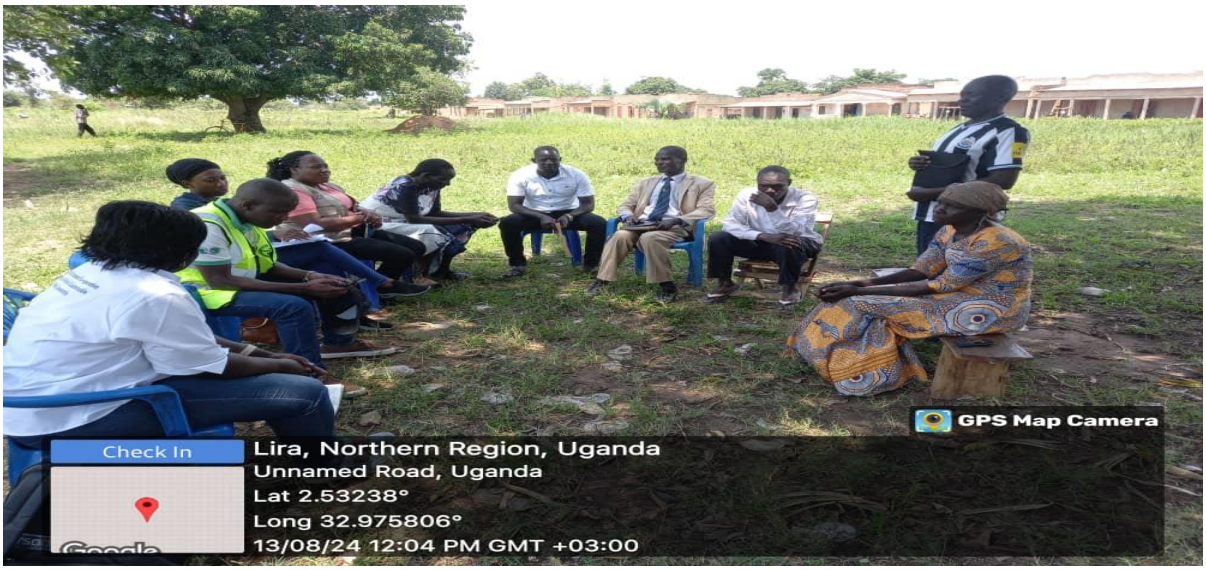
STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE..12/08/2024 VENUE: AKOR PARISH (OGUR SC)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AWAL TOM	FAMER		
2.	Edun Martin	FAMER		
3.	AGWA LEO	FARMER		
4.	OGWANG BRIAN	FARMER		
5.	OGUR RONALD	FARMER	0778250751	
6.	AKECH GLORIA	FARMER		
7.	Akol Joyce	FARMER		
8.	APIO ESTER	FARMER		
9.	Ayo Richard	FARMER	0765254165	
10.	ANYAK THOMAS	FARMER	0772941245	
11.	OKWIR DENISH	FARMER	0773185551	

FOCUS GROUP DISCUSSION AT AGWENG SUB- COUNTY ON 13/08/2024



KEY ISSUES RAISED;

- Challenges include;
- Wetland degradation
- Wetland encroachment
- Soil erosion
- Sand mining
- Over cultivation
- Deforestation-charcoal burning and for firewood
- Settlement
- Use of chemicals hence water pollution
- Poor farming technologies
- Population pressure
- Agweng has 7 parishes
- Water resources include; R. Aswa, Abara swamp, Acace wetland, Ayami swamp
- Crops grown include; rice, tomatoes, sugarcane
- Recommendations include income generating skills to women, Irrigation, planting trees, Demarcation, Bee keeping, energy saving stoves, VSLA

Attendance:

FGD

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 13/08/2024 VENUE: AGWENG SC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AWOR JENNIFER HARRIET	C.D.O AGWENG	0 774547158	
2.	ABALI TONNY	Fmr SAS Acholi	0772002780	
3.	OYENA TOMSON	LC III C/P AGWENG	0779313860	
4.	OKAO LAWRANCE	Councilors	0775053666	
5.	EMING GEOFFREY	L C I	0392838625	
6.	ACENG CICILIA	L C II	0780791694	
7.	ENGOLA SAM	Fmr L.C I	076110381	
8.	Ajari Patrick	ALP	0772097029	
9.	OJOK C/	C Leader.	0780603989	
10.	Ayo Richard	C. leader	0767211450	
11.	Ruth David	Chairs. Agweng	0785191924	

COMMUNITY ENGAGEMENT AT AGWENG SUB- COUNTY ON 13/08/2024



1. List of water resources

- River Aswa
- Abala wetland in Abala parish
- Acake wetland in Te-Adwong and Te-Ogur parishes
- Ayitunga wetland in Ayitunga village
- Ayami stream in Baroganda parish
- Kulu Atugu Stream in Teoburu parish
- Apopong stream in Orit parish
- Kulu Akello Abwor in Acelela parish

2. Water Resources Challenges

- Over cultivation of the riverbank, buffer zones and wetlands. Major crops grown include; soyabeans, Sugarcane, tomatoes, rice, etc
- Sand mining
- Deforestation
- Charcoal burning
- Reclamation of the wetland for settlement
- Poor farming technologies along the wetland
- Water pollution through spraying the garden during land clearance

3. Livelihood derived from the wetlands

- Fishing
- Agriculture

- Sand mining
- Deforestation for timber and charcoal

NB: To generate income for survival.

4. Alternative sources of livelihood

- **Beekeeping**
- Fish farming
- Tree planting
- Irrigation for farming upstream
- Energy saving technologies
- Village Savings and Loan Associations (VSLA Scheme)

5. Bye-laws

- Not yet in place
- Need to support the process of formulation

6. Recommendations

- Demarcation of all the wetlands and riverbanks with live markers
- Tree planting
- Provision of energy saving technology
- Awareness creation
- Strengthening the capacity of the community structure like wetland management committees
- Supporting the formulation of environmental protection byelaws
- Encouraging voluntary evacuation of the wetland protected zones

Social Economic and Historical Trend of the water resources in Agweng sub-county in the last 20 years

Status of Abala wetland 20 years ago

- Animals used to graze freely in the wetland without conflict
- Abundant clean water
- Vast vegetation with wild fruits and animals
- Timely rainfall 1st rain in Feb
- Abundant fish of high quality

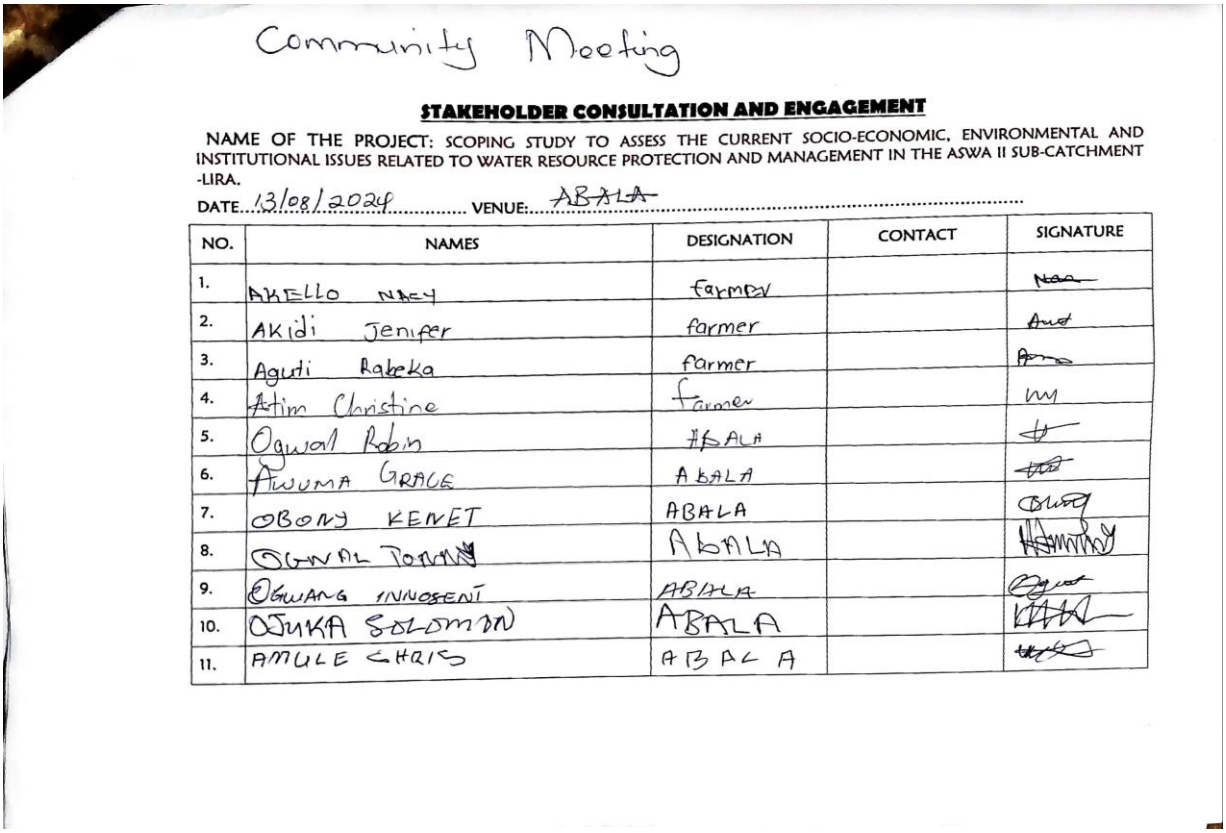
Current Status

- Reduction of water in quantity due to water diversion into farms for cultivation
- Water pollution due to soil erosion
- Loss of vegetation due to high rate of deforestation
- Land wrangles attributed to wetland ownership
- Reduction of the wetland coverage
- Loss of wild fruits
- Loss of aquatic animals

- Loss of papyrus
- Late rains – 1st rain begins in April/May

General observation: Both the political and technical leadership embraced the scoping study and pledged for unwavering support towards the exercise

Attendance:



Community Meeting

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 13/08/2024 VENUE: ABALA

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AKELLO NANCY	farmer		
2.	Akidi Jenifer	farmer		
3.	Aguti Rabeka	farmer		
4.	Atim Christine	farmer		
5.	Ogwal Robin	ABALA		
6.	Awuma Grace	ABALA		
7.	OBONY KENET	ABALA		
8.	OGWAL TONNY	ABALA		
9.	OGWANG INNOSENT	ABALA		
10.	OJUKA SOLOMON	ABALA		
11.	AMULE CHRIS	ABALA		

Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 13/08/2024 VENUE: ABALA

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ARINGO BRENDA	Farmer	0766039285	
2.	AKELLO IBEITY	Farmer	—	
3.	AKITE ROSELINE	Farmer	—	
4.	AKELLO SANTA	Farmer	—	
5.	APIO SUSMAN	Farmer	0773307719	
6.	AKAC MILLY	Farmer	0773087381	
7.	ACAN ELISABETH	Farmer		
8.	Aboya Colline	Farmer		
9.	Achola Fiona	Farmer	0762318816	
10.	ODONGO ISAAC	Farmer	0776717272	
11.	OTIM MARTIN	FARMER	0784271835	

Community Meeting

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 13/08/2024 VENUE: ABALA

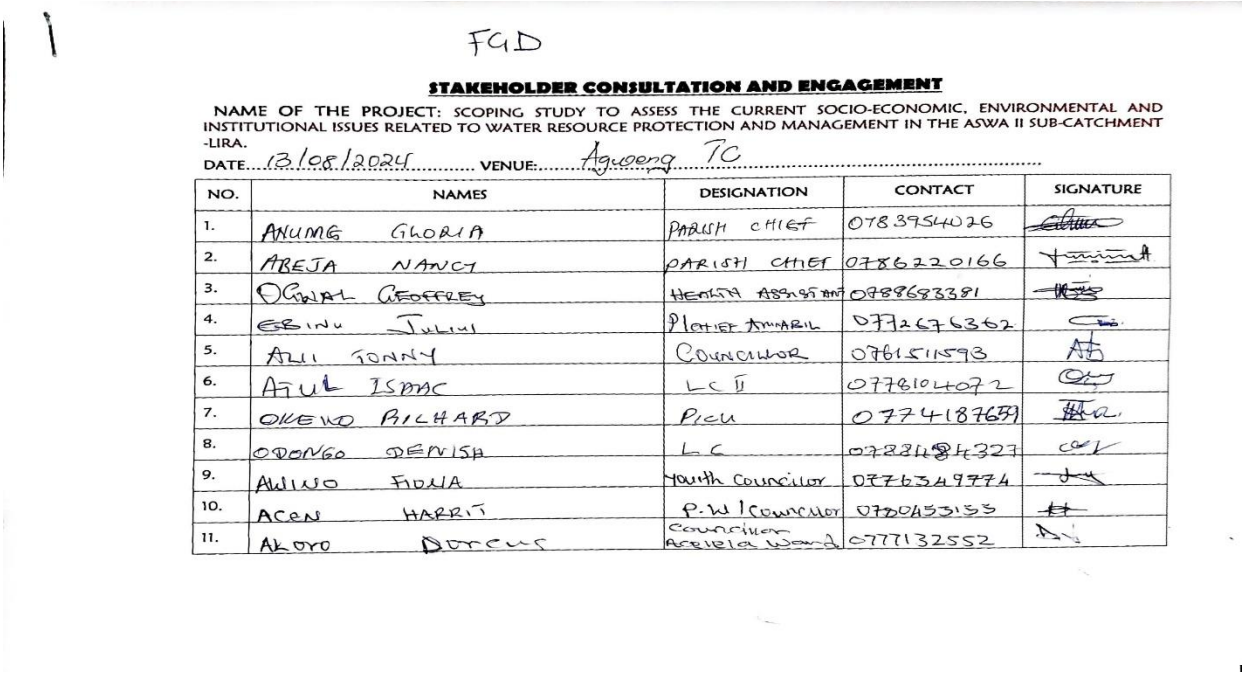
NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AMULE FRED	[illegible]	0773401159	
2.	LAKER CHRISTIN	APUR		
3.	OKAL AUGUSTINO	C/Person LC1	0783646561	
4.	OCEN BOSCO	DEFANCE SECURITY LC II	0772028297	
5.	AMULE SCOVIA	Abala - councillor	0781463448	
6.	ALENY CELESTINO	Abala	0783645169	
7.	AKELLO BETTY	Abala	0772600752	
8.	Otale Michael	Abala	0773214124	
9.	OPITO WILBERT	Abala	0765560488	
10.	ALII MOSES	Abala	0773054752	
11.	APORO ALEX	LC	0785086741	

FOCUS GROUP DISCUSSION AT AGWENG TOWN COUNCIL ON 13/08/2024.

KEY ISSUES RAISED;

- Challenges include;
- Wetland degradation
- Wetland encroachment
- Soil erosion
- Sand mining
- Over cultivation
- Deforestation-charcoal burning and for firewood
- Settlement
- Use of chemicals hence water pollution
- Poor farming technologies
- Population pressure
- Agweng has 7 parishes
- Water resources include; R. Aswa, Abara swamp, Acace wetland, Ayami swamp
- Crops grown include; rice, tomatoes, sugarcane
- Recommendations include income generating skills to women, Irrigation, planting trees, Demarcation, Bee keeping, energy saving stoves, VSLA

Attendance



FGD

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 13/08/2024 VENUE: Agweng TC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ANUMG GLORIA	PARISH CHIEF	0783954026	
2.	AREJA NANCY	PARISH CHIEF	0786220166	
3.	OGWAL GEOFFREY	HEALTH ASSISTANT	0789683381	
4.	ESINU JULIUS	Plotter Attendant	0772676362	
5.	ALLI JONNY	COUNCILLOR	0761511593	
6.	ATUK ISAAC	LC II	0778104072	
7.	OKENO RICHARD	PWD	0774187679	
8.	ODONGO DENISH	LC	0782184327	
9.	AWINO FIONA	Youth Councillor	0776349774	
10.	ACEN HARRIT	P.W.D Councillor	0780453153	
11.	AKORO DUNCAN	Councillor Acekela Ward	0777132552	

COMMUNITY MEETING AT AGWENG TOWN COUNCIL ON 13/08/2024.



1. **Water Resources at Agweng Town Council**
   - Alela Aduni Stream originates from the rock at Acelela parish
   - Awela Abiro stream
   - Amia Abil wetland in Amia Abil parish
   - Nyim Olot Elia wetland in Acelela Parish prone to floods annually
   - Okori Akoch wetland
   - Kulu Oluk stream
   - Anyadem stream
   - Atin acel wetland
   - Acami stream
   - Alongo stream
   - Odyek mer wetland
   - Forest Reserve
2. **The most degraded water resources in order of degradation**
   (i) Odyek mer wetland
   (ii) Kulu Oluk Stream associated with land wrangles, deforestation, etc
   (iii) Amia Abil wetland dries off during dry season
   (iv) Nyim Olot Elia
   (v) Anyadem Stream experiences issues of soil eroision, water pollution, etc
3. **Historical Trend of the water resources in Agweng Town Council 15 years ago and current status**

Aduni stream 15 years ago

- Had clean and abundant water
- Abundant fish of big quality and of various species like tilapia, cat fish
- Thick vegetation
- Used for swimming and bathing
- Wild vegetables and fruits
- Indigenous trees like 'Odugu', Olam'
- Open grazing land without conflict
- Source of papyrus and palm trees for making mats, bags, hats and other crafts

Current status of Aduni stream

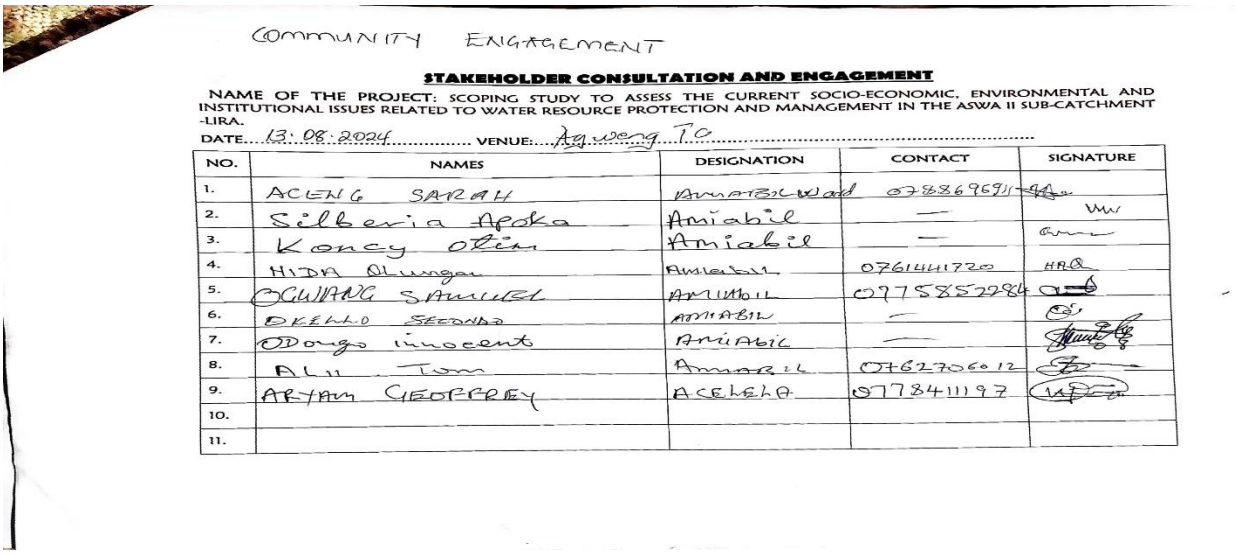
- Water pollution due to soil erosion washing away top fertile soil from the farm depositing to the river
- Fish is hardly seen due to high rate of fish depletion
- Deforestation for timber, fire wood, charcoal, settlement, space for farming
- Limited grazing space. Communities have personalized the wetland
- Destruction of wetland resources like papyrus
- Grazing land associated with land wrangles
- Digging of water ways for vegetable growing

–

4. **Water resources challenges in Agweng Town Council**
    - Cultivation of the wetlands for livelihoods
    - High rate of tree cutting for charcoal
    - River dries off in dry season
    - Grazing Land conflict
    - Soil erosion causing siltation of the river
    - Water pollution due to farming along the river buffers
    - Poor farming technology like use of traditional tools, unimproved seeds
5. **Alternative Livelihoods**
    - Small scale Irrigation system
    - Tree planting through provision of tree seedlings like pine, teak, gravella, etc
    - Fish farming
    - Apiary
    - Establishment of Credit schemes through provision of cash as capital to Village Savings and Loan Associations
6. **Recommendations**
    - Mass awareness on the need to conserve water resources
    - Demarcation of the wetland and riverbank boundaries with teak trees
    - Tree planting
    - Support formulation of byelaws to regulate wetland utilization
    - Introduce better farming methods like irrigation scheme, improved seeds,
    - Promote soil and water conservation measures

- Introduce energy saving technologies through training communities in improved cookstoves

Attendances



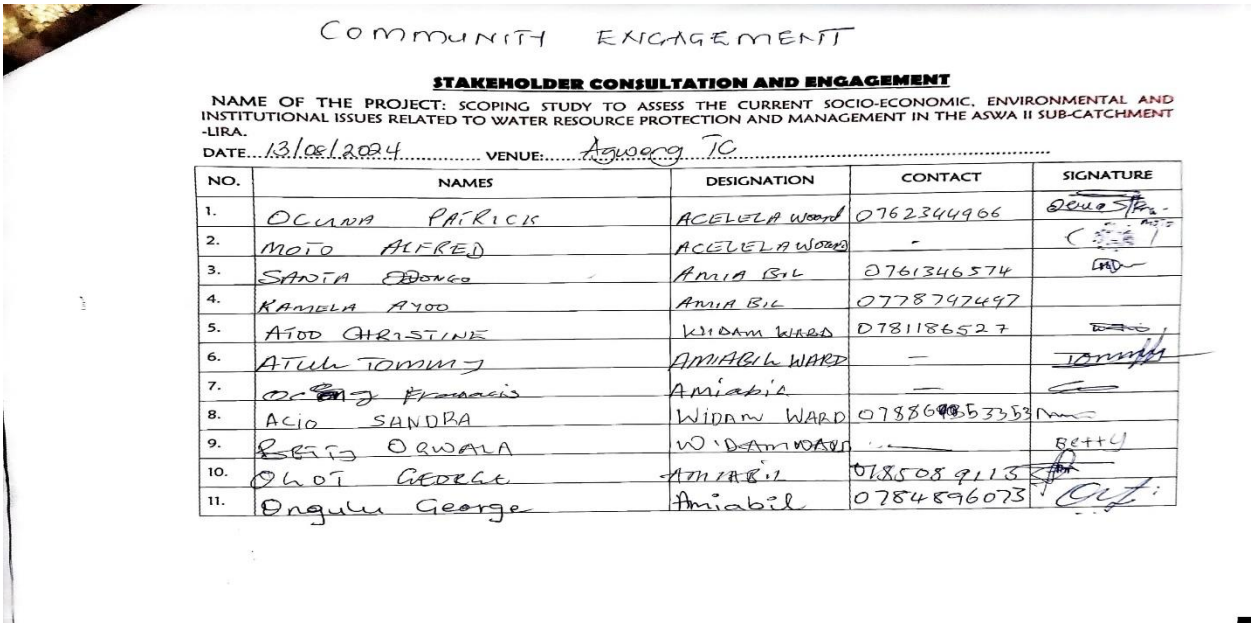
COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 13:08:2024 VENUE: Agwong TC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ACENG SARAH	AMIABIL Ward	0783696911	
2.	Silberia Apoka	Amiabil	—	
3.	Koney Otim	Amiabil	—	
4.	HIDA Alungat	Amiabil	0761441720	
5.	OGWANG SAMUEL	AMIABIL	0775852284	
6.	OKELLO SEEDAD	AMIABIL	—	
7.	ODongo innocent	AMIABIC	—	
8.	ALU Tom	Amiabil	0762706012	
9.	ARYAM GEOFFREY	ACELELA	0778411197	
10.				
11.				



COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 13/08/2024 VENUE: Agwong TC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OCUNA PATRICK	ACELELA Ward	0762344966	
2.	MOTO ALFRED	ACELELA Ward	-	
3.	SANIA EDONGO	AMIA BIL	0761346574	
4.	KAMELA AYOO	AMIA BIL	0778747497	
5.	AYOO CHRISTINE	WIDAM WARD	0781186527	
6.	ATUK TOMMY	AMIABIL WARD	—	
7.	OC[illegible] Francis	Amiabil	—	
8.	ACIO SANDRA	WIDAM WARD	0788[illegible]5335[illegible]	
9.	BETTY OWALA	WIDAM WARD	—	
10.	OKOT GEORGE	AMIABIL	0785089113	
11.	Onguku George	Amiabil	0784896073	

COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 13.08.2024 VENUE: Aguoeng TC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ABINGO COLLINE	ACELELA WARD ICIKA SELL	0778565706	
2.	ONYOYO TONNY	ACELELA ICIKA COM	0787414617	
3.	OGWANG SAM	AMAABILCELL	0775005791	
4.	ALWEDO MOLLY	Aguoeng SCDO TIC	0742267825	
5.	OKELLO STEVEN	COUNCILLOR	0788502365	
6.	ENNUGE FRANCIS	FISHERIES OFFICER	0775755438	
7.	ONGOM RONALD LAMECK	MA-IDR	D773394798	
8.	AROKO HADIET	Town Clerk	0782553332	
9.				
10.				
11.				

FOCUS GROUP DISCUSSION AT AROMO SUB-COUNTY ON 14/08/2024



KEY ISSUES RAISED;

Some of the challenges identified included:

- Dirty water polluted by running water due to bare buffer zone
- Grazing land conflict since the wetland is fragmented into plots
- Frequent floods due to river siltation and blockage of water ways damaging the crops
- Deforestation for charcoal and firewood
- Limited awareness on riverbank boundaries
- Soil erosion due to bare agricultural land
- Long drought
- Shortage of clean drinking water due to limited number of deep boreholes

Most degraded water resources

- Aloc wetland is dry reclaimed for agriculture
- Otwil wetland dominated by rice, soya, vegetables cultivations, high rate f deforestation for charcoal
- Lela Adoro wetland- heavily cultivated with rice, greens, cabbage, tomatoes and egg plants
- River Aswa- the buffer zones are dominated with rice and maize cultivations
- Aromo swamp
- Okim River

Recommendations Included:

- Positive mindset change
- Alternative sources of livelihoods like bee keeping, Poultry
- Tree Planting
- Water for production- Irrigation
- Demarcating the wetland and streams
- Support on making of bi-laws

Attendance

FDG

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/8/24 VENUE: AROMO SC (ALOC B VILLAGE)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ACENG THEOPISTA	CDO	0772868423	
2.	Agalo Evelyne	SAS ODOCHO	0774096697	
3.	OKELLO NELSON	LC II	0776177293	
4.	OJOK RICHARD	L.C.I Aloc.B.	0778303872	
5.	Rev Nelson Okello	Pastor	0765709929	
6.	Ogwal Alex Kwach	Lcp clan leader	0774446090	
7.	OGWAL Tommy	GISO	0773222137	
8.	OWINY GEORGE	Youth Councillor Aromo	0761-721634	
9.	ABUA Docuse	Aloc B. WCP Pacu	0779833161	
10.	Agnes Musiimenta	WSS(sociologist)	0774 124635	
11.	Andrew Ntambu	LIS	0755227785	

COMMUNITY ENGAGEMENT AT AROMO SUB-COUNTY ON 14/08/2024



1. **List of Water Resources**

- River Aswa that flows through Barpii and Otara parishes in Aromo sub-county,
- Aleka river tributary of River Aswa flowing through Odocha and Bar pii parishes
- Agwar river flowing through Odoro, Akua, Bar pii to River Aswa
- Acake river in Bar pii parish
- Aloc wetland in Odoro parish
- Odocha wetland Odoro parish

- Aromo wetland bordering Odek and Aromo sub-county passes through Otara parish
- Otara wetland in Otara parish
- Otwil wetland in Otara parish
- Lela Adoro wetland in Otara parish
- Okim river

2. Historical trend of water resources 20 years ago

- River used to flow with clean water
- No river diversion for farming
- Abundant water throughout the year
- Abundant cat fish
- Children used to swim in clean water
- River Agwa was a source of clean drinking water
- The depth of the river used to be at least 5 feet deep
- The buffer zones had thick vegetations full of wild fruits
- The wetlands were full of papyrus

3. Current Status

- The river dries during long drought
- Reclaimed for farming due to limited land and long dry spell
- Siltation of the river caused by cultivation along the buffer zone
- Destruction of wetland species like papyrus
- Fish heavily depleted with poor fishing technology
- Water pollution from soil erosion
- The depth of the river reduced from 5 to 2 feet deep
- Reduced water levels due to digging of waterways for growing vegetables
- Heavy cultivation of rice for survival and payment f school fees
- High rate of deforestation for charcoal sale

4. Water resources Challenges

- Cultivation of the buffer zone causing siltation of the river and affecting the flow of water due to water diversion for farming
- Poor farming technology that exposes the soil fertility to erosion
- Broken boreholes which require major repairs beyond community capacity
- Open wells contaminated, shared with animals
- Aloc B village lacks safe water source, only one shallow well shared by the entire village
- Poor enforcement of byelaws

5. Drivers of encroachment

- Over population
- Climate change interms of long dry spell driving people to wetland
- Source of income for survival
- Limited knowledge in upstream farming

6. Recommendations

- Demarcation of the riverbank and wetland boundaries to stop encroachment

- Massive sensitization
- Provide alternative sources of income such as Apiary, poultry, tree planting, irrigation schemes, Support VISLAs with Cash as capital for micro-credits
- Train farmers in mulching technology
- Provide a dam for watering animals and fishing through-out the year
- Strengthen enforcement committees
- Train communities in energy saving technology to address deforestation for firewood
- Provide clean water supply

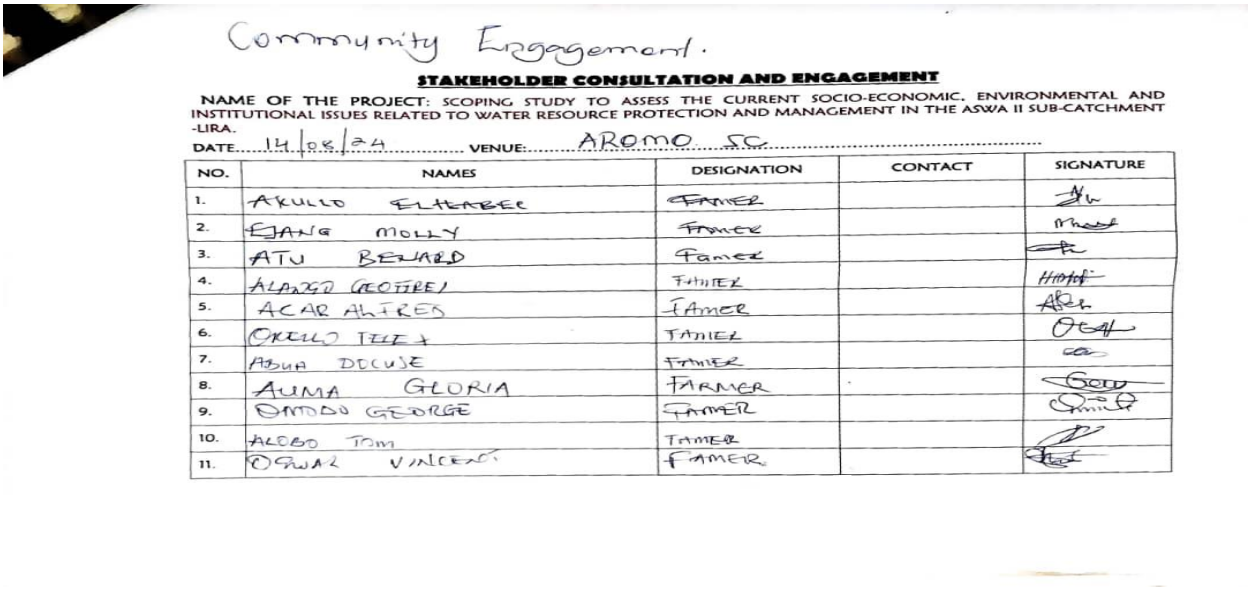
Word from Sub- County NRM Chairperson

- President issued a directive to ensure that all the wetlands in this country are protected
- Called upon members to respect this directive

LCIII Chairperson

- Protection of water resources is key due to high rate of degradation
- Appreciated the plan initiated to conserve water resources and pledged for support
- Need to invest in alternative livelihood that can support communities to voluntarily leave the wetland

Attendance



Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 14/08/24 VENUE: AROMO SC.

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AKULLO ELIZABETH	FARMER		
2.	EJANG MOLLY	FARMER		
3.	ATU BERNARD	Famer		
4.	ALAZIA GEOFREY	FARMER		
5.	ACAR AGNES	FARMER		
6.	OKELLO ISAAC	FARMER		
7.	ABUA DICUSE	FARMER		
8.	AUMA GLORIA	FARMER		
9.	OMODO GEORGE	FARMER		
10.	ALOBO TOM	FARMER		
11.	OGWAL VINCENT	FARMER		

COMMUNITY MEETING

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/08/24 VENUE: AROMO SC (ALOC B Village)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ATIM MILLY	Councillor	0785321560	
2.	OJOK RICHARD	LC1	0778303872	
3.	OCHAN LAWRENCE	CDO SEC	0791019871	
4.	Acuti DAVID	Famer	0785544432	
5.	OJUKA SAMUEL	Famer	0773941649	
6.	OWINY Laurentino	LC1 Aloc A	0772719846	
7.	OMARA NELSON-Opio	LC1 OKELOKUC	0766849815	
8.	OCAN SAM	Famer	0777326654	
9.	OJOK ISAAC PHILLIP	COUNCILLOR Production	0779516290	
10.	Aceng Grace	Farmer	0766629439	
11.	OBANG ANDREW	COUNCILOR	0782990583	

COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/08/2024 VENUE: AROMO SC (ALOC VILLAGE)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OGWAL ALEX	Famer	0780964541	
2.	ERIMA KAIEGAYA ANDREW	Famer	0782711895	
3.	NAM SOLOMON	Famer	0781784277	
4.	EGWAL DENISH	FARMER	0783648314	
5.	OPOK JIMMY	Famer	0777353733	
6.	OROCHI ALFRED	Famer		
7.	OBUNG GEOFFREY	FARMER	0778295727	
8.	ORYE MOSES	FARMER	0778295727	
9.	AOL JENIPAR	FARMER	0779622915	
10.	ALUM FICKAL	FARMER		
11.				

FOCUS GROUP DISCUSSION IN AYAMI SUB-COUNTY ON 14/08/2024



Participants include;

- District Environment Officer
- Sub-county Chief
- Sub-county Chairperson
- Animal Husbandry Officer
- CDO
- Parish Chief
- Parish Councilors
- LCII and LC1 Chairpersons

Discussion

- After the insurgence, there was rapid population growth
- Due to population pressure, people are forced to go use the swamps for farming and this led to degradation of these wet lands
- Deforestation in search of firewood is a challenge.
- There has been increased loss of aquatic lives
- Some demarcation has been done in Akole at least 4kms have been covered on around 30kms
- Flooding along Aswa river cos of its reduced size
- No more papyrus and no big trees along river banks

Recommendations included;

- Train women on energy saving technologies to avoid deforestation
- Demarcating the wetlands and streams
- Support on formulation of by-laws
- Train people on better alternative ways of living like bee keeping

- Train people on better ways of cultivation
- Provide tree seedlings to people both for wetlands and farm land or upland

Attendance

FGD

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 14/08/2024 VENUE: AYAMI SUB COUNTY (ABOLONENO VIHAGE)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OBIA GEORGE	SAS/SCC	0774 190680	
2.	OBUR TOM THOMAS	LC III CIP	0711449750	
3.	OCAN AMBROSE	For Environment officer	0785309972	
4.	OMARA DICKSON	LC II AGUTKUMU PARIS	0392643300	
5.	OKELLO JOHN BOSCO	CDO - AYAMI SC	0774055273	
6.	OKELLO BOSCO FELIX	Pl Chief Asst	0773325033	
7.	AKUMA ROBERT	AAHO	0778216287	
8.	OKELLO PATRICK	LC I	0789515444	
9.				
10.				
11.				

COMMUNITY ENGAGEMENT IN AYAMI SUB-COUNTY ON 14/08/2024



Villages

- Wekboke A
- Adyere central
- Aboloneno
- Akwoyo

1. **Water Resources**

- Aswa river passing through Apuce and Acutkumu parishes
- Apuce Stream which is a tributary of Aswa river
- Agwar river
- Acake river
- Akore wetland- district demarcated about 4kms due to community demand driven by grazing land conflict since a few sections of the community had gained ownership of the wetland and had blocked access to the entire community

2. **Historical trend of the wetland status 20 years ago in comparison with the current status**

Previous status

- The river had clean water used for domestic purposes like drinking, cooking, swimming and watering animals
- Abundant fish of all species
- Free grazing land, the animals would be driven to the wetland to graze freely without anyone watching and they would be picked late in the evening
- Source of aquatic animals such as frogs. The elders believed that presence of the frogs used to ensure timely rainfall
- The wetland used to be bushy with thickets
- Abundant wild fruits like passion fruits, berries and abundant wild animals
- Timely rainfall in March

Current Status

- Water pollution due to buffer zone cultivation
- Soil erosion due to bare deforested land
- High rate of deforestation for firewood and charcoal
- Fish depletion using poor fishing method
- Grazing land conflict due to limited land driven by population pressure and poverty
- Late rainfall; 1st rain now received in May
- Destruction of wetland resources and aquatic animals
- No more wild fruits and animals

3. **Challenges of water resources**

- Over cultivation up to the river banks and wetland reclamation for farming
- Limited space for grazing since the grazing land has been fragmented and owned for farming
- River diversion; digging water ways into the vegetable gardens in dry season has caused reduction in water levels
- Land conflict; only 5 people in charge of wetland, the rest have been denied access
- Untimely rainfall
- Over destruction of wetland resources like papyrus and spear grass for roofing
- Frequent occurrence of floods due to siltation of the riverbed caused by farming along the buffer zone
- Reduced number of wild animals due to destruction of thickets for firewood

- No more morning mist as it used to occur due to destruction of trees and reclamation of the water bodies
- Spraying the garden with chemicals as one of the methods for clearing land has led to land and water pollution
- Byelaws are available but experience challenges of weak enforcement

–

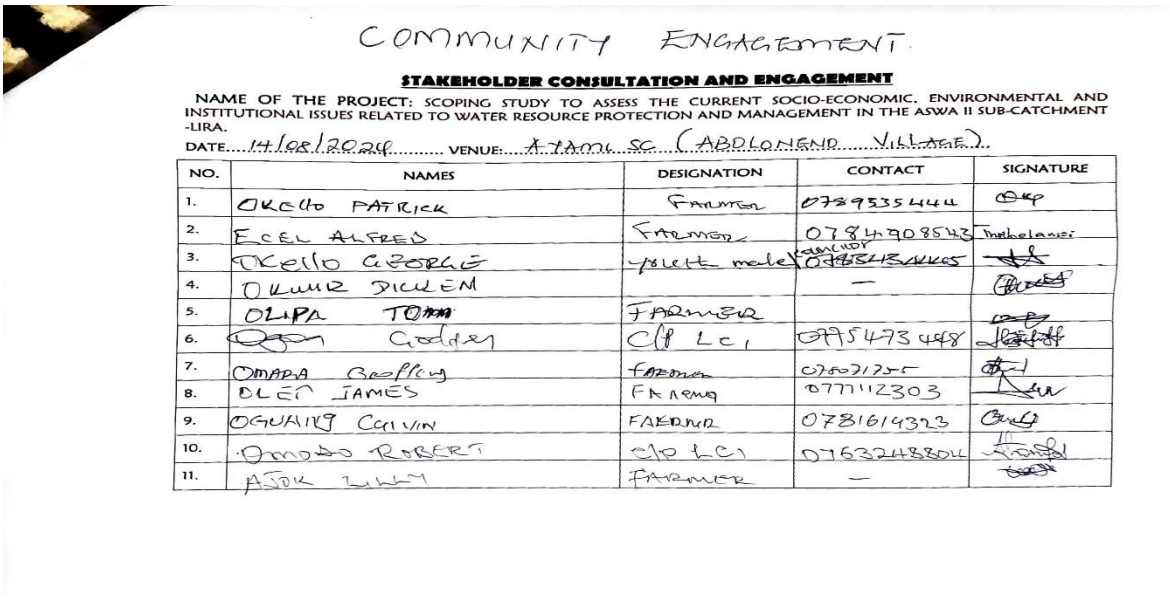
4. **Recommendations**

- Demarcation of the wetland boundaries and riverbanks with live markers such as teak trees
- Physical planning of the buffer zones where animal paths and watering points should be gazzetted
- Awareness creation on wetland conservation
- Tree planting
- Support Enforcement of byelaws

5. **Alternative Sources of Livelihood**
    - Fish farming
    - Better farming technology
    - Apiary
    - Upland rice seeds provision
    - Tree planting
    - Small scale irrigation
    - Revolving fund in a VSLA

NOTE: The sub-county leadership embraced the programme and pledged for unwavering support although they guided that it will be prudent to invest heavily in alternative livelihoods which have driven people into wetland encroachment

Attendance



COMMUNITY ENGAGEMENT

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/08/2024 VENUE: AYAMO SC (ABOLONENO VILLAGE).

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OKECHO PATRICK	FARMER	0739535444	
2.	ECEL ALFRED	FARMER	0784790854	
3.	OKELLO GEORGE			
4.	OKWIR JICKEM		—	
5.	OLIPA TOM	FARMER		
6.		C/P LC1	0775473448	
7.	OMARA GEOFFREY	FARMER	0760717355	
8.	OLEC JAMES	FARMER	0777112303	
9.	OGWANG CALVIN	FARMER	0781614323	
10.	OMODO ROBERT	C/P LC1	0763248804	
11.	AJOK [illegible]	FARMER	—	

Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/8/2024 VENUE: AYAMI SC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	APIO MARIAMO	FARMER	—	
2.	AMULE NANCY	FARMER	0778996309	
3.	APIO KETTY	FARMER	—	
4.	ATIM JOAN	farmer	-	
5.	AYAA ROWENCE	farmer	0772522273	
6.	AJOK JENIFFER	Farmer	0776707439	
7.	ADUL AIDA	Farmer	0775090505	
8.	AWINO Semmy	F	—	
9.	ALUM BETTY	F	—	
10.	ABELO JENEET	F	—	
11.	ABULU JENET			

Community Engagement

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 14/08/2024 VENUE: AYAMI

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AYO TONNY	ABOLOGOOO-AGU	0765029829	
2.	JENET OLOBO WOMEN COUNCILOR	OMOLO	0778505025	
3.	IMAT BETTY AWIO GEOFFREY	WARDRIKE A	—	
4.	AYO GEOFFREY BOB	WARDRIKE A	0777018383	
5.	OMARA KENNETH	WARDRIKE C	-	
6.	IMAT CILLA	ABOLIMUMO	-	
7.	IMAT HELLEN AJENIA	WARDRIKE B	—	
8.	IMAT PASKA UGAT	ABINTEK	—	
9.	IMAT JUSTINA OMARA	WARDRIKE C	—	
10.	IMAT HADDA OMODU	ABOLOMUMO	-	
11.	IMAT MOLLY EBONG	ABILOMUMO	-	

FOCUS GROUP DISCUSSION AT IWAL WARD IN LIRA CITY EAST DIVISION ON 15/08/2024



Water Resources

- Olap swamps
- Abany Swamps
- Agweng Swamps
- Agao Swamps
- Itek Swamps
- Agwaa Swamps
- Te-tugu Swamps
- Ogada Swamps
- Awar Swamps
- Alela Swamps
- Bur kwoyo Swamps

Economic activities in water resources

- Rearing of animals
- Growing of crops
- Sand mining
- Pottery

- Fishing
- Brick laying
- Charcoal burning
- Cutting of papyrus for crafts and grass for thatching houses

Challenges Faced by Water resources

- Deforestation
- Soil Erosion
- Drought
- Poor water quality
- Over caltivation
- Conflicts
- Loss of aquatic life

Recommendations

- Adequate sensitization on soil preservation
- Mindset change
- Collective Responsibility
- Projects like tree planting, bee keeping, poultry
- Education on environmental safety
- Need alternative water sources for clean water
- Demarcation of buffer Zones
- Eviction from wetlands for those who have constructed houses there
- Formation of By-laws to protect water resources
- Irrigation

Attendance

FGD

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE..15/08/2024.. VENUE: Iwal ward.

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OKORI ALFRED IBRAHIM	Person fulling Party NRM	0779110169	
2.	OMARA MOSES	c/p LcII	0779512693	
3.	AKULLO SILVIA	WOMEN COUNCIL	0780276116	AKULLU
4.	OKELLO AKERA NOAH	ELDERLY	0783445546	
5.	ODONGO JOSEPH	C/P LCI OKERE PE WORD	0783250676	
6.	Ogwal Kasimiro	Councillor	0772073934	
7.	Omona Robin	LC1 C/P	0775060325	
8.	AYO RICHARD	PWD REP	0755259630	
9.	EMUR John	Komiti/C.1	0778326114	
10.	ODONGO GEORGE	A CONCERN CITIZEN	0783126297	
11.	OGWANG TONNY	L C I	0751801166	

COMMUNITY ENGAGEMENT AT IWAL WARD IN LIRA CITY EAST DIVISION ON 16/08/2024



1. **Cells**

- Wilela, Okere Pekok B, Okere Pekok A. Abadmunu, Abany, Akwoyo and Iwal

2. Water Resources

- Agweng stream in Iwal cell
- Olap stream in Okere pekok cell
- Abany river in Abany cell
- Burkwoyo stream
- Ogada river in Akwoyo bordering Aduru
- Itek river in Abadmunu cell
- Obangkwon – Olap stream
- Alela stream in Abany cell

–

3. Water resources Challenges

- Cultivation of sugarcane, tomatoes, rice and Eucalyptus growing along the buffer zones
- Reclamations of the wetland for settlement
- Cases of individuals fragmenting wetland for sale reported several times and not yet addressed
- Bricks burning has polluted the water but also created barrow pits in the wetland
- Deforestation for Timber, Charcoal, firewood for bricks burning
- Sand quarrying has polluted water and created barrow pits
- River diversion for farming
- Fish depletion
- No more grazing land, community practices zero grazing due to lack of space for grazing animals. Wetland fragmented into plots and owned for farming and settlement
- Environmental by-laws available but lacks enforcement due to fear of hatred

–

4. Historical Trend

- The water source used to produce water vapor in the atmosphere that eventually form the clouds resulting into rain. The area used to receive timely 1st and 2nd rains but degradation of the water sources is deteriorating the rainfall pattern in the area
- Thick vegetation with wild fruits and wild animal but currently the forests have been destroyed in search of wood for bricks burning. Cooking and charcoal

–

5. Drivers of water resources encroachment

- Rapid population pressure
- High rate of poverty
- In search of food
- Limited level of awareness on wetland conservation
- Long dry spell
- Poor farming technology
- Unemployment of the youths

6. Alternative livelihood sources

- Support to VSLA in terms of revolving fund that individuals can borrow and invest in other ventures to generate household income other than cultivating the wetland
- Provision of upland rice seeds and introduction of small-scale irrigation
- Piggery
- Poultry
- Tree planting
- Introduction of better farming technology
- Apiary
- Fish farming
- Goats rearing

–

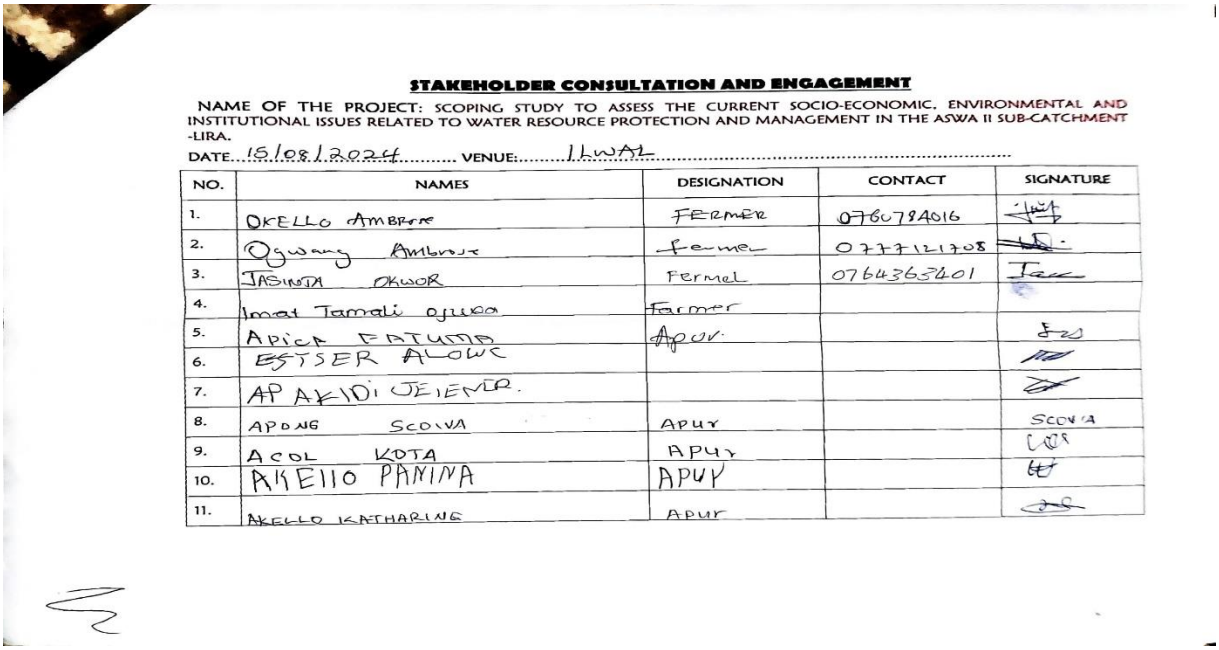
7. General recommendation

- Provision of irrigation farming
- Awareness creation on wetland conservation
- Demarcation of the wetland boundaries
- Introduction of the specialized environmental court at the local level
- Support the youth with vocational skills to be empowered to engage in vocational ventures other than bricks burning

NOTE: Community at inception was trying to relate the scoping study to the previous intervention of an NGO known as Land and Equity Movement in Uganda (LEMU) that operated in the area in 2016 to demarcate the communal land with a vision of *making land work for all.*

This caused a lot of negative reactions but after thorough explanation, they understood and the engagement was successfully accomplished.

Attendance



STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 15/08/2024 VENUE: ILWAL

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OKELLO AMBROSE	FERMER	0760784016	
2.	Ogwang Ambrose	Fermer	0777121708	
3.	JASINTA OKWOR	Fermel	0764363601	
4.	Imat Tamali ojuka	Farmer		
5.	APICA FATUMA	Apur		
6.	ESTSER ALOWO			
7.	AP AKIDI JEJEMER.			
8.	APONG SCOVIA	APUR		SCOVIA
9.	ACOL KOTA	APUR		
10.	AKELLO PAMINA	APUY		
11.	AKELLO KATHARINE	APUR		

COMMUNITY MEETING

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE. 15.08.24 VENUE: ILWAL

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ODOGR MORISH	LC1	0777114586	
2.	MARY EPILIA	APUR	0789127480	
3.	AIWANG RACEL	APUR		
4.	NUME MARY	APUR	0775228051	
5.	OWELLO ALEX EKODA	LC1	0783948391	
6.	OTENG GOLIA	APUR	0785785105	
7.	Owiti Denis	Town Agent	0392991472	
8.	OBII Edward	APUR	0784708869	
9.	OKWOR JULIUS	APUR	0784363401	
10.	OGWAL QUINTO	CIP LC1	0779664734	
11.				

Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE. 15/08/2024 VENUE: LIRA ~~DISTRICT~~ CITY. EAST DIVISION (ILWAL)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OTIM MARTIN	APUR	0774643892	
2.	OBONG MATHAM	APUR	0783679854	
3.	OWACH JAMES	APUR	0761226175	
4.	AJALLA RABECCA	FAMER		RABECCA
5.	APIO SANTA	APUR		
6.	AKORI MARRION	FARMER	0780898864	
7.	AMONY SANDRA	FARMER	0765682629	
8.	Amongi JENIFER	FARMER		
9.	KETT U ADONG			
10.	Amongi Sekandina.	Apur	0773595328	Sekandina
11.	KIA Magret	APUR	0771910540	

COMMUNITY ENGAGEMENT AT ONGURA WARD IN LIRA CITY EAST DIVISION ON 16/08/2024







1. **Cells**
- Okii,
- Atira
- Ongura A.
- Ongura B.
- Tedam
- Akwaka A and
- Akwaka B

2. **Water resources**

- Agweng stream in Okii cell
- Odongoneri wetland in Okii and Atira cells
- Aburobiti stream in Okii cell
- Olunga Joe stream in Okii cell
- Alinyang stream in Okii cell
- Odida stream in Atira cell
- Olongkole stream in Ongura A cell
- Aba Okello stream in Ongura A cell
- Oluma stream
- Alaratong stream
- Ical wetland
- Aler wetland
- Anyakedi wetland
- Lela Alunga wetland

–

3. Water resources Challenges

- Reduced water quantity due to diversion of the water for farming
- Destruction of indigenous trees for hard charcoal
- Broken spring wells and shallow wells beyond capacity of the community to repair
- Siltation of the river due to soil erosion
- Sharing water from open wells with animals leading to outbreak of disease
- Reclamations of wetland for settlement
- Construction of pit latrines at the buffer zones leading to water source contamination
- Open defecation near the open wells contaminating water sources
- Water pollution due to cultivation at the buffer zones
- Bricks burning at the wetland causing floods
- Digging of water ways for farming
- Eucalyptus tree planting in the wetland draining the water
- Damage of water sources by animals due to limited space for grazing

–

4. Drivers of encroachment

- Limited land
- High rate of population growth
- Low household income
- Unemployment
- Some crops need water source like cabbage, sugarcane, yams, etc

–

5. Recommendations

- Awareness creation
- Provision of alternative livelihood sources like fish farming, Apiary, Dairy farming, Micro-credit schemes through VSLA
- Tree planting
- Increase the coverage of water supply
- Repair the broken wells and protect the open wells

- Demarcation of the wetland boundaries with live markers
- Construction of animal drinking points and paths to the grazing site
- Installation of the signposts near all the wetlands indicating that the water resource should not be encroached
- Introduction of improved cooking stoves as energy saving technology
- Create off shoots along the road to curb issues of floods damaging the roads
-

Attendance

-

STAKEHOLDERS ENGAGEMENT AT OGUR SUB COUNTY-ADEKNINO/ADWOA AND ADUU/OGUR PARISH ON 16/08/2024



1. Water resources

- Abebeng wetland
- Angokoremo
- Wang Tula wetland
- Anee wetland
- Anyak
- Ogingo wetland
- Obolokome wetland
- Aded river
- Ajusu Mary river
- Odongo Adaga wetland
- Aboloneno wetland
- Kagera river
- Olimi

2. Water resources Challenges

- Reduced water quantity due to diversion of the water for farming
- Destruction of big trees for hard charcoal
- soil erosion
- Sharing water from open wells with animals leading to outbreak of disease
- Reclamations of wetland for settlement
- Water pollution due to cultivation at the buffer zones
- Eucalyptus tree planting in the wetland draining the water
- Damage of water sources by animals due to limited space for grazing
-

3. Drivers of encroachment

- Limited land
- High rate of population growth
- Low household income
- Unemployment
-

4. Recommendations

- Mindset change and awareness
- Provision of alternative livelihood sources like fish farming, bee keeping, poultry, Micro-credit schemes through VSLA
- Tree planting
- Construct other water sources
- Repair the broken wells and protect the open wells
- Demarcation of the wetland boundaries with live markers
- Construction of animal drinking points and paths to the grazing site
- Installation of the signposts near all the wetlands indicating that the water resource should not be encroached
- Introduction of improved cook stoves as energy saving technology
-

Attendance

11

Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 16/08/2024 VENUE: ADEKNINO VILLAGE ADWOA PARISH OGUR S/C

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	Otim Patrick	Adeknino	0783644994	
2.	ATYANG PAUL	Adeknino	0776150002	
3.	Banya Tom	Adeknino	0783453521	
4.	Ereng Vincent	Adeknino	0779443120	
5.	Opio Ruksi	Adeknino	0775855052	
6.	OGWENG DAVID	ADEKNINO	0773154727	
7.	AYO LAWRENCE	ADUKU	0774915310	
8.	IMAT BETT	ADUKU	—	
9.	AYO PATRICK	ADEKNINO	0761263296	
10.	AJOK VICKY	ADUKU	—	
11.	ATOO ROSE	ADUKU	—	

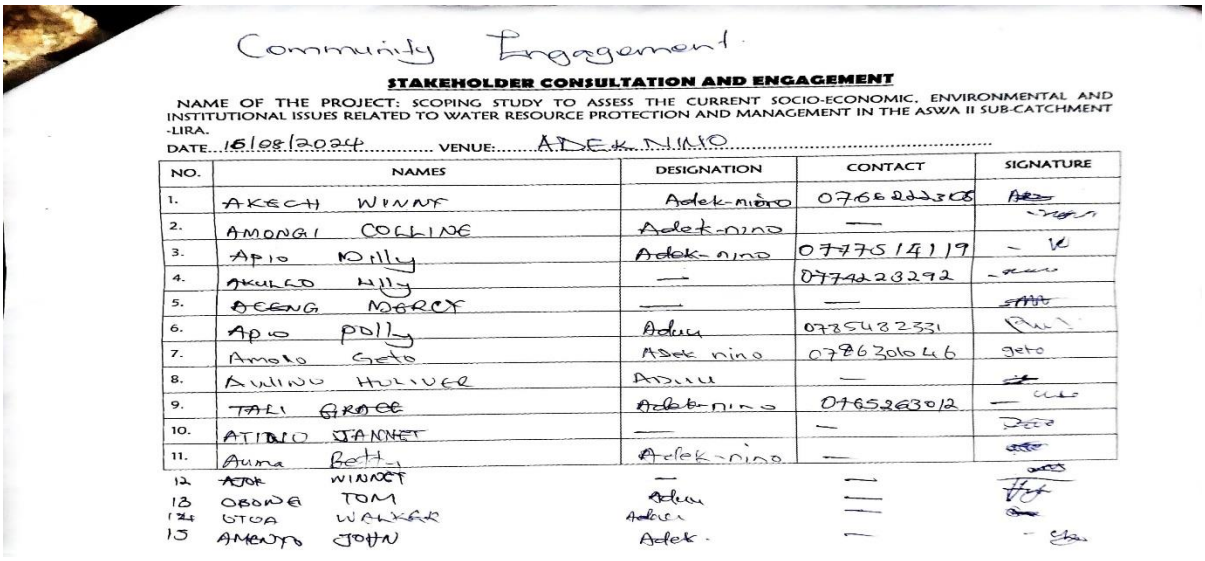
Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 16/08/2024 VENUE: ADEKNINO VILLAGE ADWOA PARISH OGUR SC

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	OLUM NORMAN	ADUKU	0781475134	
2.	OLET DENISH	ADUKU	0771883277	
3.	ATYANG ISAAC	ADEK-NINO	0766839324	
4.	OPIO PETER	ADEKNINO	0776376652	
5.	Bucnya Daniel	ADEKNINO	—	
6.	OGWENG JOSEPHER	ADEKNINO	0789127854	
7.	OGWENG JIMMY	ADEK-NINO	—	
8.	OKELLO MORISH	Aduku	0788333795	
9.	OPIO FRANCO	ADEKNINO	0778073459	
10.	OCEN MARTINE	ADEK-NINO	—	
11.	OBONGO JAMES	ADEKNINO	0781264634	



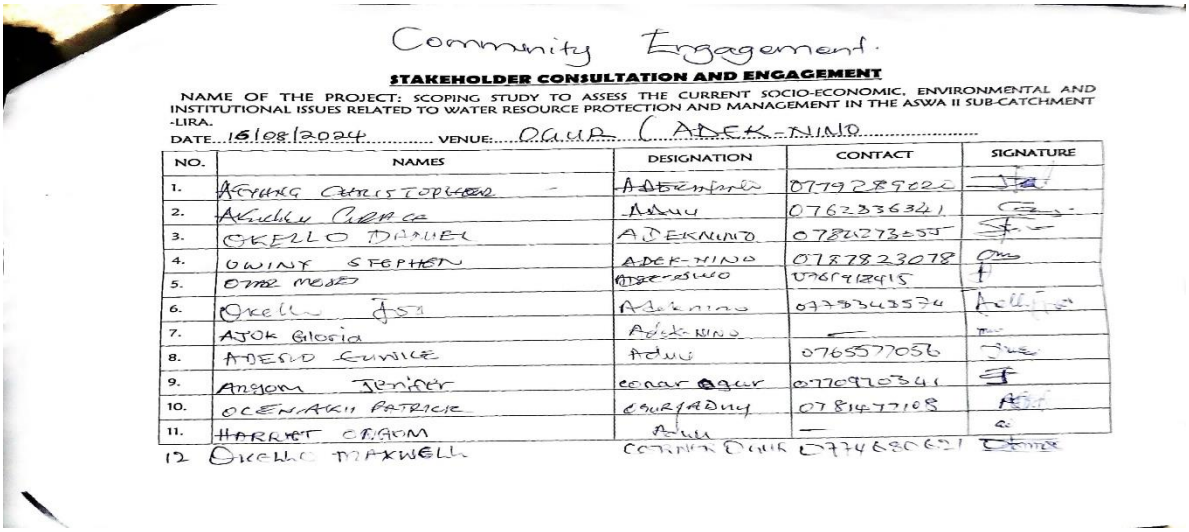
Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 15/08/2024 VENUE: ADEK NINO

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AKECH WINNY	Adek-nino	07662223[illegible]	
2.	AMONGI COLLINE	Adek-nino	—	
3.	Apio Milly	Adek-nino	0777514119	
4.	AKULLO Milly	—	0774223292	
5.	ACENG MARCY	—	—	
6.	Apio POLLY	Adek	0785432331	
7.	Amolo Geto	Adek nino	0786306046	Geto
8.	AWINO HULIVER	Adek	—	
9.	TALI GRACE	Adek-nino	0765263012	—
10.	ATIENO JANNET	—	—	
11.	Auma Beth	Adek-nino	—	
12	AJOK WINNET	—	—	
13	OBONG TOM	Adek	—	
14	OTOA WALKER	Adek	—	
15	AMENYO JOHN	Adek	—	



Community Engagement.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE: 15/08/2024 VENUE: OGWA (ADEK-NINO

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	AGWANG CHRISTOPHER	ADEK-NINO	0779289020	
2.	AKULLO CLARA	ADEK-NINO	0762336341	
3.	OKELLO DANIEL	ADEK-NINO	0782273655	
4.	OWINY STEPHEN	ADEK-NINO	0787823078	
5.	OTIM MOSES	ADEK-NINO	0765912415	
6.	Okello JOY	Adek-nino	0779343574	
7.	AJOK Gloria	Adek-NINO	—	
8.	ADERO EUNICE	ADEK	0765577056	
9.	Angom Jenifer	ADEK-NINO	0770970341	
10.	OCEN AKII PATRICK	ADEK-NINO	0781477108	
11.	HARRIET OTAOM	Adek	—	
12	OKELLO MAXWELL	ADEK-NINO	0774680621	

KEY ISSUES RAISED DURING KEY INFORMANT INTERVIEWS

S/N	NAME/DESIGNATION	ISSUE RAISED
1	DEO- LIRA DISTRICT	▪ Erut North and South are the most degraded due to over cultivation ▪ Rivers include; Aswa, moroto, okole, olweny ▪ There is too much political interference in water resource management and protection. Government should look for a way to control political interference ▪ Natural Resources department has no car and hence there are transport challenges to

		do monitoring and other water resource management activities ▪ Some progress in cash inflow as the conditional grant was increased for 2024 and more works could be done in protection of water resources ▪ Mind sets of some rural people is a big challenge in wetland management. Locals are not receptive to change and consider it a 'war' against them when told to preserve wet lands and stop bad practices. Locals think its only applicable in northern Uganda and not in other parts of the country. Recommends awareness and sensitization workshops at village level ▪ Information dissemination should be priotised ▪ Local governments should not approve developments that causes degradation in wetlands ▪ There should be a platform for institutional coordination to predict trends especially regarding climate change ▪ Avail alternative sources of livelihoods ▪ Land tenure system is basically customary in Lira district and in particular Aswa catchment ▪ FAPAD has done water resource mapping before. Document to be shared digitally
2	LC111 CHAIRPERSON OGUR SUBCOUNTY	▪ Big hotspot in adeknino village ▪ Ogur subcounty is majorly water thirsty ▪ Some by-laws to protect wet lands have been drafted but yet to be passed ▪ The youth form a big percentage of the Ogur sub-county population ▪ There is a high level of degradation of water resources. The communities need a lot of awareness and sensitization ▪ Wetlands have been encroached on. ▪ Climate change has forced people into use of swamps for cultivation ▪ Demarcation of buffer zones should be done as soon as possible

		▪ Provision of alternative water sources for people and animals would ease on the effects on wetlands due to human activities
3	DEPUTY CAO- LIRA	▪ Welcomed the team doing the assessment to Lira District ▪ Urged the consultants to go and get information from the grass root people ▪ Mentioned that its critical to share findings
4	COMMUNITY DEVELOPMENT OFFICER- OGUR	▪ Communities need to be engaged thoroughly. ▪ There is need for mindset change as their perceptions of the enforcement of the law is still negative and inequality is at the back of their minds ▪ Sensitisation and awareness about water resource protection should take Centre stage ▪ People have no alternative sources of livelihoods. Bee keeping, livestock farming would work for them ▪ Irrigation is also important since our people are running to cultivate swamps where there is still some water and the upper lands are dry.
5	CDO-AGWENG SUB-COUNTY	▪ Agweng has 7 parishes. ▪ R.Aswa passes through the subcounty in Bar Parish ▪ Abara swamp is most degraded ▪ People have encroached on wetlands for farming and looking for other sources of livelihoods. Alternatives would help the wetlands recover from too much degradation. ▪ Planting of trees would help with conserving the environment. ▪ People are using chemicals in their gardens which have an impact on the water quality. Alternative sources of water would solve this challenge of poor quality water
5	Agricultural Officer-LIRA CITY	▪ Farming in wetlands is the biggest degrading factor.

		▪ People are using poor technology for farming and yields are little. They don't have any other land to till. ▪ Populations are growing by the day and population pressure has led people to search for survival in water resources
6	DTC-LCED	▪ Requested that a bigger part of the city be considered for water is scarce everywhere and the city is struggling to provide people with clean safe water ▪ City status has complicated many administrative structures and power to impact change is in the hands of politicians. Sometimes our hands are tied. ▪ Wetlands are encroached on by even leaders
7	CDO-AROMO SUB-COUNTY	▪ People are encroaching on wetland because of population increase, lack of knowledge, climate change ▪ Women are the biggest actors in the degradation of wetlands. They are the ones that do the farming while men are in trading centers ▪ Only one borehole and it's also broken down. Need help repairing it ▪ Other sources of livelihood would keep the community members off the water resources like wetlands ▪ Restoration activities like planting of trees can help on preventing soil erosion ▪ Providing other water sources would reduce pressure on wetlands

KII

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 15/08/24 VENUE: LIRA CITY (EAST DIVISION)

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	ANGOLE JIMMY	DTC LCED	0780229376	
2.	ATOIKE BETTY	CDO	0782039128	
3.	ODONGO MICHAEL	LC III Chairman	0775125661	
4.	OGWANG FRANCIS	A.D	0775734426	
5.				
6.				
7.				
8.				
9.				
10.				
11.				

KEY INFORMANTS.

STAKEHOLDER CONSULTATION AND ENGAGEMENT

NAME OF THE PROJECT: SCOPING STUDY TO ASSESS THE CURRENT SOCIO-ECONOMIC, ENVIRONMENTAL AND INSTITUTIONAL ISSUES RELATED TO WATER RESOURCE PROTECTION AND MANAGEMENT IN THE ASWA II SUB-CATCHMENT -LIRA.

DATE 12/08/2024 VENUE: District Offices

NO.	NAMES	DESIGNATION	CONTACT	SIGNATURE
1.	Otim Dennis Otto	DCAO	0777930411	
2.	OCEN WALTER	Environment Officer	0772678409	
3.	OCAKE AMBROSE	Forest Ranger	0785309772	
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				

Appendix XVI: Household Survey Raw Data